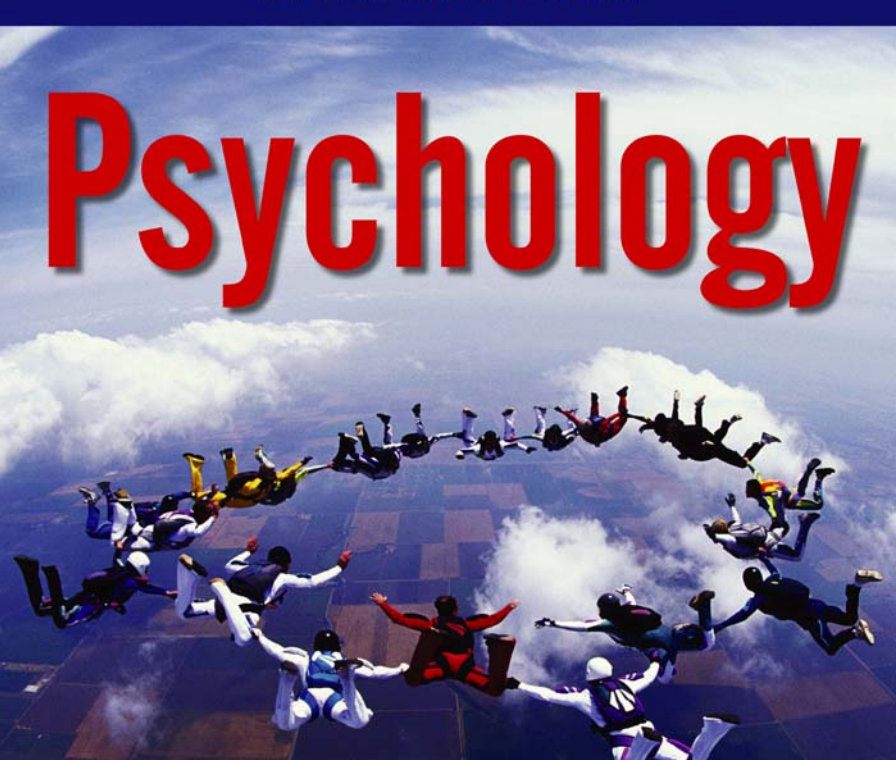
Miles Hewstone, Frank D. Fincham
and Jonathan Foster

Psychology



BPS TEXTBOOKS IN PSYCHOLOGY

BPS Blackwell

Psychology

To our children

Rebecca and William Hewstone
&
Alex, Camilla and Jess Fincham
&
George and Hallam Foster

Psychology

Miles Hewstone, Frank D. Fincham
and Jonathan Foster

BPS Blackwell

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WHAT INSTRUCTORS ARE SAYING ABOUT *PSYCHOLOGY*:

'This is the best introductory psychology text I have seen. The text is well written and comprehensive and, unlike some other introductory texts, it treats topics with the intellectual rigour they deserve. I would not hesitate to recommend this book to anyone teaching introductory level courses in Psychology.' *Dr Simon Davies, University of Hull, UK*

'This is an extraordinarily comprehensive text. I have not seen anything to equal it in terms of sheer depth and breadth of coverage. Fortunately, the logic of the structure and the clarity of presentation permit this mountain of information to be easily navigated by the student.' *Dr Jeff Coney, Murdoch University, Australia*

'Comprehensive, engaging and incisive – this is an outstanding text that students will be sure to welcome.' *Professor Michael Siegal, University of Sheffield, UK*

'Preparing an introductory psychology text requires difficult decisions about the desirable range of subject matter and depth of treatment. Hewstone, Fincham and Foster have assembled a number of authors, all of whom are experts in their fields, to assist with this task, and have used a framework which makes the material accessible and coherent.' *Dr Robert Jamieson, La Trobe University, Australia*

'This book does a great job in providing a comprehensive, integrated, state-of-the-art coverage of the field of psychology – it really brings the field alive. The chapters are clearly structured, written in a highly accessible style and full of fascinating information. Each chapter is authored by a leading expert on the respective area. The authors succeed in conveying their fascination with their fields to their readers. The book is a pleasure to read. Students will not only profit greatly from reading it, they will enjoy doing so.' *Professor Wolfgang Stroebe, Utrecht University, The Netherlands*

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Brief Contents

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Contents

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PSYCHOLOGY

Each chapter is written by a world authority in the field, in association with our editorial team.

EDITORIAL TEAM

Miles Hewstone is Professor of Social Psychology at Oxford University, and a Fellow of New College. He has published widely in the area of social psychology. He is co-founding editor of the *European Review of Social Psychology*, and a former editor of the *British Journal of Social Psychology*. His books include *Causal Attribution*, *Stereotypes and Stereotyping* and *Introduction to Social Psychology*. He is a Fellow of the British Academy and an Honorary Fellow of the British Psychological Society and past recipient of The British Psychological Society's Spearman Medal and Presidents' Award for 'distinguished contributions to psychological knowledge'.

Frank D. Fincham trained as a Rhodes Scholar at Oxford University after obtaining his undergraduate and master's degrees in South Africa. He is currently Eminent Scholar and Director, Florida State University Family Institute, and also an Associate Scientist at the Research Institute on Addictions. He is a Fellow of the British Psychological Society, the American Psychological Association and the National Council for Family Relations. His work on relationships has been recognized by numerous awards, including the prestigious Presidents' Award from the British Psychological Society for 'distinguished contributions to psychological knowledge'.

Jonathan Foster obtained a first class honours degree in psychology and a doctorate in behavioural neuroscience from the University of Oxford. He was subsequently awarded an international fellowship in neuropsychology, held at the Rotman Institute, University of Toronto. He has taught and practised psychology in three continents and has consulted on psychological topics for industrial, legal and commercial organizations. His particular area of expertise is cognitive neuroscience (especially related to disorders of memory), on which he has spoken and published widely. He is currently Senior Research Fellow in Cognitive Neuroscience at Edith Cowan University and an Associate Professor in Cognitive Neuroscience and Neuropsychology at the University of Western Australia.

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Please see inside back cover for biographies.

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Preface

It is, to say the least, unfortunate that the classic history of psychology was written by someone called Boring (*A History of Experimental Psychology*, 1950 [1929]). Nothing could be less true of this still-young discipline, which is bursting at the seams with discoveries and ideas as we race into the 21st century.

Consider the following questions:

1. How on earth do London taxi drivers (who have to pass a difficult test called 'The Knowledge') manage to remember all those complicated streets, one-way systems and even alternative routes for the rush hour? Do they have larger brains? (see chapter 3, p. 68)
2. Why do you sometimes feel stuffed after a main course, but still manage to squeeze in a pudding? And how might this help to explain rising levels of obesity in Western societies? (see chapter 5, pp. 97, 100, 104)
3. Why are people's names so difficult to remember? (see chapter 11, pp. 236–7)
4. Why do we sometimes find ourselves with a word stuck 'on the tip of the tongue', and what does this tell us about everyday language and thinking? (see chapter 12, p. 257)
5. How do so-called *savants* have IQs in the mentally retarded range, but display a single and exceptional cognitive skill, such as being able to calculate the day of the week for any calendar date? (see chapter 13, pp. 282–3)
6. How important is culture in the rise of obesity and eating disorders? And given the evidence for genetic transmission, what actually is inherited? (see chapter 15, pp. 329–30)

You can answer all these questions by simply looking up the page numbers given. But understanding the background, and what it takes to answer these and related questions, makes for a far more interesting read. So read the whole chapter . . . and you'll soon find yourself wanting to read the whole book!

Reading this book will give you the answers to many fascinating questions about yourself (how you learn, perceive, remember, think, develop and behave) and others (why does your friend who is depressed seem to focus so much on negative events? why are people so bad at making decisions under some circumstances?). It will also demonstrate some of the most important ways in which psychological knowledge can be successfully applied (e.g. to understanding psychological disorders, to the treatment of stress, to making organizations function more effectively, and to explaining and reducing crime).

Our task in this book is to present this vibrant field to you – whether you are an instructor or a student of introductory psychology – in a way that faithfully represents the discipline and reflects its diversity and distinctiveness, but is also clear, compelling and suited to your level and needs. It is no easy task in a subject that now ranges across a broad spectrum of issues, approaches and techniques.

We have structured the book in a way that seems most natural. We reveal the coherence of psychology through its origins and methods, while giving full rein to its enormous breadth and variety. Throughout, we have sought to present the key developments in enough detail so that you can understand them *from this volume alone*. Of course, we refer you to plentiful sources for further reading, but we recognize the demands on your time and appreciate that, to convey both theory and methods, we must give you sufficient details about why and how things were done. We hope you will find the 'Research close-ups' especially useful in this respect – these are a new learning device, whereby we summarize the background, methods, findings and implications of key studies in each chapter.

We begin our voyage of learning and discovery by discussing what psychology is and how it developed (chapter 1). We then consider what the 'glue' is that holds psychology together as a discipline, and decide that it is the commitment to the empirical approach (i.e. data-gathering on the basis of a prior theory). We consider why it is crucial to collect data, what the strengths and weaknesses of available methods are, and how to handle the data once collected (chapter 2). This matters because, for example, it allows us to conduct a powerful test of the effectiveness of different therapies for psychological disorders such as depression.

We continue our journey with some of the essential 'building blocks' for understanding many of the complex problems that psychology tries to tackle. We have to understand the intricacies of the brain (chapter 3), how we learn (chapter 4), and the importance of basic motivational states such as hunger and thirst (chapter 5). We also need to know why emotions are central to our lives (chapter 6), and how we 'sense' information about our environment and use it to perceive and make sense of our world (chapters 7 and 8; check out the optical illusions).

Next we cut a swathe through human development, from infancy (using ingenious methods) through childhood and adolescence to adulthood (chapters 9 and 10), and the controversies concerning the study of intelligence and personality (chapters 13 and 14). We then move from normal to abnormal psychology, looking at the main psychological disorders, their causes and treatment (chapters 15 and 16), and the ways in which our behaviour as individuals can be altered by the actual, or imagined, presence of other people (chapters 17 and 18).

The book ends in the domain of applied psychology. We show how psychology has contributed to a better understanding of illness and health (chapter 19), how it is used by many organizations in the selection and training of employees (chapter 20), and how forensic psychology tackles areas such as eyewitness testimony, obtaining confessions and reducing crime (chapter 21).

Must you learn about psychology 'in this order'? No, of course you can also 'dip into' any chapter at any time, and we think you will benefit from this curiosity-driven learning too. However, many of the complex problems of psychology demand a multi-level approach, and there are real strengths in using basic building blocks as a foundation, before adding further complexity.

A few examples will illustrate how the different areas of psychology are sometimes recruited to understand a phenomenon better .

1. To understand complex abnormal phenomena such as panic disorders, we need to have some understanding of how neurotransmitters and learning come together with work on psychosocial conditions (see chapters 3, 4, 16 and 17).
2. One of the core dimensions of personality, introversion–extraversion, is best understood in terms of arousal theory and the physiological background of the Ascending Reticular Activating System (see chapters 3 and 14).
3. Diagnosis and treatment of a patient with an eating disorder may require investigation of dysfunction in the hypothalamus, clinical and personality assessment, and the study of social norms relevant to the situation (see chapters 5, 14, 15, 16 and 18).

Another aspect worth noting is that chapters often deal with the same issue in rather different ways, and so a deeper understanding of psychology emerges from reading across chapters. For example, you will find Freud's ideas discussed in various chapters (e.g. 14, 15 and 16), ethical issues raised in several places (e.g. chapters 1, 2 and 16) and aspects of stress covered in discussions of personality, health and organizations (see chapters 14, 19 and 20). The detailed indexes help you to pick up these links and overlaps, and we have taken great care to cross-reference between chapters too.

Special features of this book

A great deal of planning and care has gone into writing and presenting these chapters, and designing the book as a whole. We wish to emphasize the following special features:

- It is a fully comprehensive introductory text for students starting their study of psychology. It has been specifically designed for introductory students of psychology in the following geographical areas: the United Kingdom, Europe, Australia, New Zealand and other countries of the Commonwealth using English as their language of study.
- It is published in association with the British Psychological Society.
- It is written with style and authority by leading psychologists from the UK and Australasia, known for their own outstanding research records and broad knowledge of their respective fields. You can read their research biographies in the inside back cover.
- It contains comprehensive and integrated coverage of all the major topics in first-year undergraduate psychology.
- It supplements coverage of basic areas of psychology with extensive treatment of cutting-edge applied areas such as health, organizational and forensic psychology.
- Each chapter contains a number of pedagogical aids (explained in more detail in the following pages), which help students to understand psychology on their own terms.
- The book is accompanied by an interactive website providing full support for both lecturers and students (www.bpsblackwell.co.uk/hewstone).

A final word, of thanks

This book has been a mammoth undertaking. Had we known what would be involved, we are honestly not sure we would have undertaken it! We have been supported, however, by a superb group of people.

First, of course, is our team of contributing authors. It has been a privilege to learn more about their fields of expertise through working with them. It has reopened our eyes (somewhat closed since our own undergraduate days) to the richness of the field of psychology, and reminded us why we set out to study this huge and fascinating subject some 30 years ago.

Second, we are grateful to a number of reviewers and consultants who, at various stages, worked constructively with us to help improve the product: Bob Snowden, Brian Parkinson, Caroline Green, Cath Hartigan, Christiaan Hamaker, Clare O'Malley, Claudine Crane, Fiona Jones, Giovanni Carnibella, Graham Davies, Herbert Biggs, Jasper von Grumbkow, Jeff Coney, Jeff Ward, Jeroen Jansz, Jim Barnes, John Beech, John Dixon, Kate Nation, Ken Gilhooly, Lusia Stopa, Maggie Snowling, Martin Elton, Martyn Barrett, Michael Siegal, Morag MacLean, Nancy Franklin, Pam Maras, Philip Corr, Rhiannon Turner, Robert Jamieson, Simon Davies, Tom Smulders, Tony Gale, Val Wynn and Wakefield Carter.

Third, we were lucky to collaborate with Jane Hammond Foster, who worked tirelessly and efficiently to copy-edit the book.

Fourth and finally, we owe the greatest thanks to Sarah Bird of Blackwell, whose faith in this project never died, who encouraged us from blueprint to product, and did far more than we could ever reasonably have hoped to produce and promote this book. In its last stages she was ably assisted by Will Maddox, and we sincerely hope he has not been too badly burned by his baptism of fire as a publisher.

We hope all those who read the book will not only learn from it but have their enthusiasm fired too. We are always keen to receive feedback, which can be sent via email to intro.psych@oxon.blackwellpublishing.com.

Miles Hewstone, Oxford University, UK
Frank D. Fincham, Florida State University, USA
Jonathan Foster, Edith Cowan University, Australia

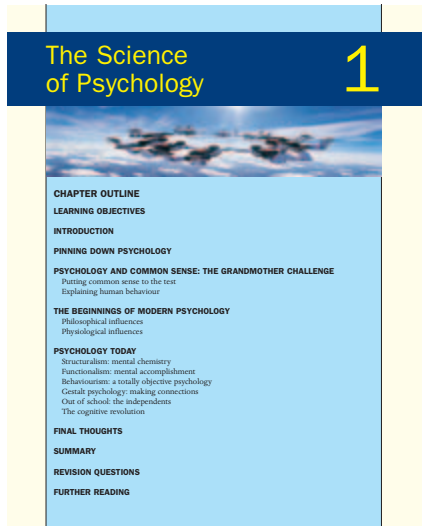
Learning Features

Psychology comes complete with a full array of pedagogical features to enhance the content and make it easier to absorb. As this is the most comprehensive introductory psychology textbook on the market, there is a great deal of information here – our pedagogical features make this information more accessible, giving you the freedom and ability to go into as little or as much depth as you want, when you want.

From the **Chapter outline** and **Learning objectives** at the start of each chapter to the **Summary** and **Revision questions** at the end, all the features are interlinked to give you, the reader, the best possible understanding of psychological science. The book also presents two brand new features to help you appreciate how research is done (**Research close-ups**) and see how the concepts you learn about relate to matters of everyday life (**Everyday psychology**).

Chapter outline

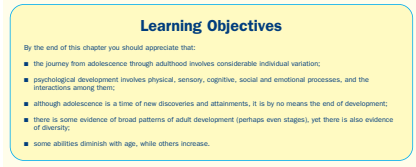
Each chapter is organized around a series of key ideas. These ideas are listed in a clear 'road map' at the start of each chapter, outlining the principles covered in the chapter and giving you a sense of what is to come.


The Science of Psychology 1

CHAPTER OUTLINE
LEARNING OBJECTIVES
INTRODUCTION
PINNING DOWN PSYCHOLOGY
PSYCHOLOGY AND COMMON SENSE: THE GRANDMOTHER CHALLENGE
Putting common sense to the test
Explaining human behaviour
THE BEGINNINGS OF MODERN PSYCHOLOGY
Philosophical influences
Physiological influences
PSYCHOLOGY TODAY
Structuralism: mental chemistry
Functionalism: mental accomplishment
Behaviourism: a totally objective psychology
Gestalt psychology: making connections
Out of school: the independents
The cognitive revolution
FINAL THOUGHTS
SUMMARY
REVISION QUESTIONS
FURTHER READING

Learning objectives

Tied in closely with the end-of-chapter **Summary**, the **Learning objectives** isolate the key areas in the chapter, around which all of its content revolves. By referring to these objectives both before and after reading the chapter, you can gauge your level of understanding. If you are not sure you have achieved one of the objectives, return to the relevant part of the chapter and read it again until you are ready to move on.

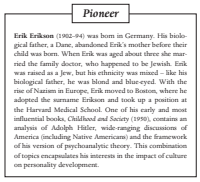

Learning Objectives

By the end of this chapter you should appreciate that:

- the journey from adolescence through adulthood involves considerable individual variation;
- psychological development involves physical, sensory, cognitive, social and emotional processes, and the interactions among them;
- although adolescence is a time of new discoveries and attainments, it is by no means the end of development;
- there is some evidence of broad patterns of adult development (perhaps even stages), yet there is also evidence of diversity;
- some abilities diminish with age, while others increase.

Pioneers

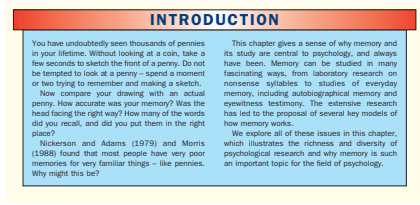
Many outstanding individuals have made, and continue to make, huge contributions to psychological science. In each chapter, we present short biographies of some of the most influential players in the scientific study of human behaviour. Some were active as long as 150 years ago, many are still alive and researching today, and new 'pioneers' are emerging all the time, as the field continues to move forward.


Pioneer

Erik Erikson (1902–94) was born in Germany. His biological father, a Dane, abandoned Erik's mother before their child was born. When Erik was aged about three she married the family doctor, who happened to be Jewish. Erik was raised as a Jew, but his ethnicity was mixed – like his biological father, he was blond and blue-eyed. With the rise of Nazism in Europe, Erik moved to Boston, where he adopted the surname Erikson and took up a position at the Harvard Medical School. One of his early and most influential books, *Childhood and Society* (1950), contains an analysis of Adolph Hitler, wide-ranging discussions of America (including Native Americans) and the framework of his version of psychoanalytic theory. This combination of topics encapsulates his interests in the impact of culture on personality development.

Introduction

Psychology is made up of a wide range of sub-disciplines, and switching between them can often be difficult. To help you progress from chapter to chapter as seamlessly and effortlessly as possible, each one begins with a short, scene-setting introduction to the new topic that proves an invaluable entry point.


INTRODUCTION

You have undoubtedly seen thousands of pennies in your lifetime. Without looking at a coin, take a few seconds to sketch the front of a penny. Do not be tempted to look at a penny – spend a moment or two trying to remember and making a sketch.

Now compare your drawing with an actual penny. How accurate was your memory? Was the head facing the right way? How many of the words did you recall, and did you put them in the right place?

Nickerson and Adams (1979) and Morris (1988) found that most people have very poor memories for very familiar things – like pennies. Why might this be?

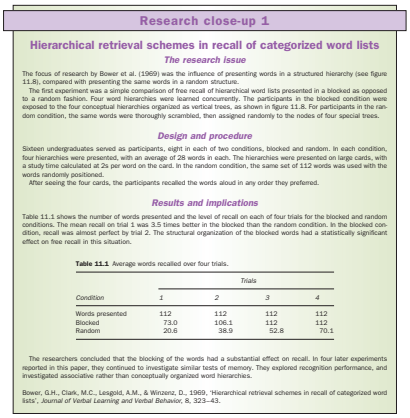
This chapter gives a sense of why memory and its study are central to psychology, and always have been. Memory can be studied in many fascinating ways, from laboratory research on nonsense syllables to studies of everyday memory, including autobiographical memory and eyewitness testimony. The extensive research has led to the proposal of several key models of how memory works.

We explore all of these issues in this chapter, which illustrates the richness and diversity of psychological research and why memory is such an important topic for the field of psychology.

Key terms

As with any new subject, from time to time you will encounter new terms that you need to understand and retain. To help you to learn these key terms and what they mean, each one is accompanied by a short definition in the margin at its first significant appearance in the text. You may find it helpful to skim through these terms on your final revision of a chapter before exams. All the key terms are also listed alphabetically in a full **Glossary** at the end of the book, so if a previously mentioned term appears in the text again, you can easily remind yourself of its meaning.

Dream Levinson's term for an individual's vision of his life goals, formed around 17 to 22 years of age and contributing to the motivation for subsequent personal development



Research close-up 1

Hierarchical retrieval schemes in recall of categorized word lists

The research issue

The focus of research by Bower et al. (1969) was the influence of presenting words in a structured hierarchy (see figure 11.8), compared with presenting the same words in a random structure.

The first experiment was a simple comparison of free recall of hierarchical word lists presented in a blocked as opposed to a random fashion. Four word hierarchies were learned concurrently. The participants in the blocked condition were exposed to the four conceptual hierarchies organized as vertical trees, as shown in figure 11.8. For participants in the random condition, the same words were thoroughly scrambled, then assigned randomly to the nodes of four special trees.

Design and procedure

Sixteen undergraduates served as participants, eight in each of two conditions, blocked and random. In each condition, four hierarchies were presented, with an average of 28 words in each. The hierarchies were presented on large cards, with a study time calculated at 2s per word on the card. In the random condition, the same set of 112 words was used with the words randomly positioned.

After seeing the four cards, the participants recalled the words aloud in any order they preferred.

Results and implications

Table 11.1 shows the number of words presented and the level of recall on each of four trials for the blocked and random conditions. The mean recall on trial 1 was 3.5 times better in the blocked than the random condition. In the blocked condition, recall was almost perfect by trial 2. The structural organization of the blocked words had a statistically significant effect on free recall in this situation.

Table 11.1 Average words recalled over four trials.

	Trials			
Condition	1	2	3	4
Words presented	112	112	112	112
Blocked	73.0	106.1	112	112
Random	20.6	38.9	52.8	70.1

The researchers concluded that the blocking of the words had a substantial effect on recall. In four later experiments reported in this paper, they continued to investigate similar tests of memory. They explored recognition performance, and investigated associative rather than conceptually organized word hierarchies.

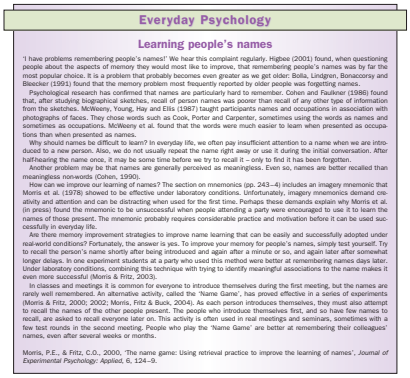
Bower, G.H., Clark, M.C., Lesgold, A.M., & Winzenz, D., 1969, 'Hierarchical retrieval schemes in recall of categorized word lists', *Journal of Verbal Learning and Verbal Behavior*, 8, 323–43.

Research close-ups

This is our most innovative and exciting feature. Research is the lifeblood of psychological science, and all the material in this book has been discovered as a result of years of painstaking research. A student coming to psychology for the first time can, however, find research inaccessible and daunting. Our **Research close-ups** use snapshot case studies to report key studies and bring the research to life. Each one is reported under three main headings: 'The research issue' (why the research was initiated), 'Design and procedure' (how it was carried out) and 'Results and implications' (what the findings were). References at the end of each **Research close-up** provide the leads to go elsewhere and find out more.

Everyday psychology

Psychology is present in every aspect of human behaviour. It is everywhere you look and an intrinsic part of everything you do. While each chapter is full of everyday examples to bring the subject matter into your world, it is in our **Everyday psychology** boxes that the material really comes alive. Applying the basic principles to real-life contexts, these features see the subject through your eyes, providing a clear insight into an extended everyday example of one or more of the main chapter topics.



Everyday Psychology

Learning people's names

'I have problems remembering people's names!' We hear this complaint regularly. Higbee (2001) found, when questioning people about the aspects of memory they would most like to improve, that remembering people's names was by far the most popular choice. It is a problem that probably becomes even greater as we get older: Bolla, Lindgren, Bonaccorsy and Bleecker (1991) found that the memory problem most frequently reported by older people was forgetting names.

Psychological research has confirmed that names are particularly hard to remember. Cohen and Faulkner (1986) found that, after studying biographical sketches, recall of person names was poorer than recall of any other type of information from the sketches. McWeeny, Young, Hay and Ellis (1987) taught participants names and occupations in association with photographs of faces. They chose words such as Cook, Porter and Carpenter, sometimes using the words as names and sometimes as occupations. McWeeny et al. found that the words were much easier to learn when presented as occupations than when presented as names.

Why should names be difficult to learn? In everyday life, we often pay insufficient attention to a name when we are introduced to a new person. Also, we do not usually repeat the name right away or use it during the initial conversation. After half-hearing the name once, it may be some time before we try to recall it – only to find it has been forgotten.

Another problem may be that names are generally perceived as meaningless. Even so, names are better recalled than meaningless non-words (Cohen, 1990).

How can we improve our learning of names? The section on mnemonics (pp. 243–4) includes an imagery mnemonic that Morris et al. (1978) showed to be effective under laboratory conditions. Unfortunately, imagery mnemonics demand creativity and attention and can be distracting when used for the first time. Perhaps these demands explain why Morris et al. (in press) found the mnemonic to be unsuccessful when people attending a party were encouraged to use it to learn the names of those present. The mnemonic probably requires considerable practice and motivation before it can be used successfully in everyday life.

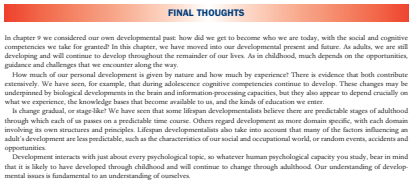
Are there memory improvement strategies to improve name learning that can be easily and successfully adopted under real-world conditions? Fortunately, the answer is yes. To improve your memory for people's names, simply test yourself. Try to recall the person's name shortly after being introduced and again after a minute or so, and again later after somewhat longer delays. In one experiment students at a party who used this method were better at remembering names days later. Under laboratory conditions, combining this technique with trying to identify meaningful associations to the name makes it even more successful (Morris & Fritz, 2003).

In classes and meetings it is common for everyone to introduce themselves during the first meeting, but the names are rarely well remembered. An alternative activity, called the 'Name Game', has proved effective in a series of experiments (Morris & Fritz, 2000; 2002; Morris, Fritz & Buck, 2004). As each person introduces themselves, they must also attempt to recall the names of the other people present. The people who introduce themselves first, and so have few names to recall, are asked to recall everyone later on. This activity is often used in real meetings and seminars, sometimes with a few test rounds in the second meeting. People who play the 'Name Game' are better at remembering their colleagues' names, even after several weeks or months.

Morris, P.E., & Fritz, C.O., 2000, 'The name game: Using retrieval practice to improve the learning of names', *Journal of Experimental Psychology: Applied*, 6, 124–9.

Final thoughts

Each chapter has been written by a world authority in the field, in association with our editorial team. In the **Final thoughts** section of each chapter, these leading lights provide some final words of wisdom for those exploring their area for the first time.



FINAL THOUGHTS

In chapter 9 we considered our own developmental past: how did we get to become who we are today, with the social and cognitive competencies we take for granted? In this chapter, we have moved into our developmental present and future. As adults, we are still developing and will continue to develop throughout the remainder of our lives. As in childhood, much depends on the opportunities, guidance and challenges that we encounter along the way.

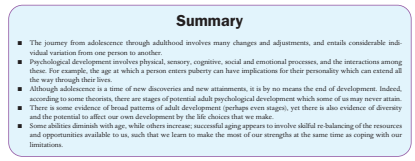
How much of our personal development is given by nature and how much by experience? There is evidence that both contribute extensively. We have seen, for example, that during adolescence cognitive competencies continue to develop. These changes may be underpinned by biological developments in the brain and information-processing capacities, but they also appear to depend crucially on what we experience, the knowledge bases that become available to us, and the kinds of education we enter.

Is change gradual, or stage-like? We have seen that some lifespan developmentalists believe there are predictable stages of adulthood through which each of us passes on a predictable time course. Others regard development as more domain specific, with each domain involving its own structures and principles. Lifespan developmentalists also take into account that many of the factors influencing an adult's development are less predictable, such as the characteristics of our social and occupational world, or random events, accidents and opportunities.

Development interacts with just about every psychological topic, so whatever human psychological capacity you study, bear in mind that it is likely to have developed through childhood and will continue to change through adulthood. Our understanding of developmental issues is fundamental to an understanding of ourselves.

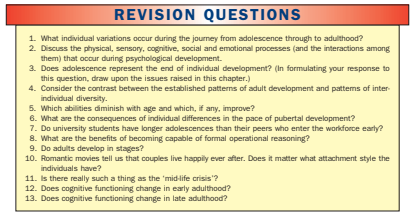
Summary

Tied in closely with the **Learning objectives** listed at the start of the chapter, the end-of-chapter **Summary** provides a clear list of bullet points reviewing the key areas in the chapter and elaborating on the main themes referred to in the **Learning objectives**. You will also find this quick-fire list useful to refer to at revision time, for a quick jog of the memory.



Summary

- The journey from adolescence through adulthood involves many changes and adjustments, and entails considerable individual variation from one person to another.
- Psychological development involves physical, sensory, cognitive, social and emotional processes, and the interactions among these. For example, the age at which a person enters puberty can have implications for their personality which can extend all the way through their lives.
- Although adolescence is a time of new discoveries and new attainments, it is by no means the end of development. Indeed, according to some theorists, there are stages of potential adult psychological development which some of us may never attain.
- There is some evidence of broad patterns of adult development (perhaps even stages), yet there is also evidence of diversity and the potential to affect our own development by the life choices that we make.
- Some abilities diminish with age, while others increase; successful aging appears to involve skilful re-balancing of the resources and opportunities available to us, such that we learn to make the most of our strengths at the same time as coping with our limitations.



REVISION QUESTIONS

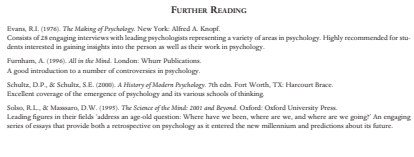
1. What individual variations occur during the journey from adolescence through to adulthood?
2. Discuss the physical, sensory, cognitive, social and emotional processes (and the interactions among them) that occur during psychological development.
3. Does adolescence represent the end of individual development? (In formulating your response to this question, draw upon the issues raised in this chapter.)
4. Consider the contrast between the established patterns of adult development and patterns of inter-individual diversity.
5. Which abilities diminish with age and which, if any, improve?
6. What are the consequences of individual differences in the pace of pubertal development?
7. Do university students have longer adolescences than their peers who enter the workforce early?
8. What are the benefits of becoming capable of formal operational reasoning?
9. Do adults develop in stages?
10. Romantic movies tell us that couples live happily ever after. Does it matter what attachment style the individuals have?
11. Is there really such a thing as the 'mid-life crisis'?
12. Does cognitive functioning change in early adulthood?
13. Does cognitive functioning change in late adulthood?

Revision questions

Our **Revision questions** are an opportunity to test your learning of the core concepts, as well as to use the subject matter as a spring-board for considering more far-reaching issues. Carefully written to pull together the main aspects of the chapter, these questions will improve and intensify your grasp of each sub-discipline.

Further reading

This textbook should not be treated as the be-all and end-all of your psychology education. To this end, as well as a consolidated list of **References** at the back of the book and relevant references after each **Research close-up** and **Everyday psychology** box, each chapter provides a short list of books for those who wish to pursue a particular area that bit further. A short description of each one enables you to decide, at a glance, which best suits your needs.



FURTHER READING

Evans, R.I. (1976). *The Making of Psychology*. New York: Alfred A. Knopf.
Consists of 26 engaging interviews with leading psychologists representing a variety of areas in psychology. Highly recommended for students interested in gaining insights into the person as well as their work in psychology.

Furnham, A. (1994). *All in the Mind*. London: Whurr Publications.
A good introduction to a number of controversies in psychology.

Schultz, D.P., & Schultz, S.E. (2000). *A History of Modern Psychology*. 7th edn. Fort Worth, TX: Harcourt Brace.
Excellent coverage of the emergence of psychology and its various schools of thinking.

Solso, R.L., & Massaro, D.W. (1995). *The Science of the Mind: 2001 and Beyond*. Oxford: Oxford University Press.
Leading figures in their fields 'address an age-old question: Where have we been, where are we, and where are we going?' An engaging series of essays that provide both a retrospective on psychology as it entered the new millennium and predictions about its future.

Web Ancillaries

www.bpsblackwell.co.uk/hewstone

Psychology is accompanied by an interactive website providing full, free support for both instructors and students. In-depth market research has helped us to identify the ancillary features that really matter to both lecturers and students, and our website provides something for everyone. Divided into two areas – one for lecturers to save them time and energy on course-planning and let them get on with teaching, and one for students to practise their learning in their own time – the site offers a testbank of multiple-choice, fill-in-the-blank and essay questions, downloadable figures and tables, and course-planning ideas.

Students' area

Psychology's general-access **Student's area** is concerned with helping you, the student, to consolidate your learning by self-testing and quick access to in-text features. It is well worth spending some time there.

- The **Student's area** brings with it a large bank of **self-test questions** for you to test your learning of the content of the textbook. For each chapter we provide:
  - an interactive *multiple-choice* test – choose from four possible answers for each question and wait for your marks to be tallied up on-screen;
  - an interactive *fill-in-the-blanks* test – insert the missing word in the gap for each question, and the electronic marker will do the rest; and
  - *essay questions* – write an essay or formulate some thoughts based on the essay questions provided; a list of points that should be covered allows you to see if you are on the right lines.
- **Chapters** are provided in electronic form on the website, allowing you to search easily for specific terms and themes in the book.
- **Drop-down contents lists** allow you to switch from short lists to extremely detailed ones within seconds. Links to related titles and further reading suggestions from the book can also be accessed from here within a click or two.
- An **online glossary** enables you to find definitions of all the key terms in the textbook at a glance.

Instructors' area

For instructors who feel they spend too much time formulating and producing material for classes and exams and not enough time teaching, *Psychology*'s password-protected **Instructor's area** is a boon.

- A large **testbank of multiple-choice questions** has been designed for use either in informal class tests or in more formal exams. The smaller number of multiple-choice questions in the **Student's area** complements, rather than overlaps with, the content of the instructor's testbank.
- The **fill-in-the-blank and essay questions** provided in the **Student's area** can also be covered as part of a class exercise.
- **All the figures and tables** in the book are available in PowerPoint format: simple to download and use as required in your own lecture presentations.
- We also offer you more general **lecture assistance**:
  - a series of PowerPoint slides, containing a list of the main points to be covered in each lecture; and
  - a rough guide suggesting how to put all the above resources (bullet points, figures and tables) together to make a lecture.

Simply visit the website, complete the short registration form and, upon approval, a unique password will be e-mailed to you.

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The Science of Psychology

1

CHAPTER OUTLINE

Learning Objectives

By the end of this chapter you should appreciate that:

- psychology is much more than 'common sense';
- psychological knowledge can be usefully applied in many different professions and walks of life;
- psychology emerged as a distinct discipline around 150 years ago, from its roots in physiology, physics and philosophy;
- there are fundamental differences between different schools of thought in psychology;
- psychology is the science of mental life and behaviour, and different schools of thought within psychology place differing degrees of emphasis on understanding these different elements of psychology;
- most academic departments in the English-speaking world focus on the teaching of experimental psychology, in which scientific evidence about the structure and function of the mind and behaviour accumulates through the execution of empirical investigations;
- in the history of psychology many different metaphors have been used for thinking about the workings of the human mind, and since the Second World War the most influential of these metaphors has been another complex information-processing device – the computer.

INTRODUCTION

Psychology is often defined as 'the science of behaviour'. Certainly, psychologists invest a considerable amount of time and effort in observing and measuring behaviour. But they are also interested in what people say about their experiences. Rather than studying a person's behaviour in isolation, they use the behaviour to find out about mental and biological processes, motives and personality traits. Therefore a definition of psychology as 'the science of behaviour' is inadequate.

So, what is psychology? One way to answer this question is to start with the word itself. 'Psychology' literally means 'science of the mind' (*psycho* meaning 'mind', or 'mental', and *-logy* meaning 'science'). A better definition of psychology might be 'the science of behaviour and mental processes', and indeed this is the definition offered in most introductory psychology textbooks.

But does this expanded definition cover the wide range of phenomena studied by psychologists – including topics you might not expect to find in a psychology textbook, like thirst, vision and hearing (chapters 5, 7 and 8)?

Ask yourself: 'Who am I?' You might mention many aspects of yourself when you answer this question, including your personality, your experiences, your sexual preferences, age, physical characteristics, aspirations, attitudes, social contacts and so on. All of these are of interest to psychologists (see chapters 10, 14 and 17). As if this were not enough, they would also be interested in things that you are unlikely to mention, like your physiology (especially processes in your nervous system), genetic make-up, and mental processes that are outside your conscious awareness (see chapters 3, 5 and 7).

Here is a selection of the many activities that psychologists engage in and the settings in which they do so:

- Teaching and developing training programmes (universities, colleges, hospitals, industry, government)
- Scientific research (universities, private and government research institutes, industry)
- Diagnosis and treatment of emotional and behavioural problems (hospitals, community service agencies, private practice)
- Personality testing, vocational testing and test development (personnel departments of organizations, consulting firms)
- Advising government on policies (all levels of government)
- Diagnosis and treatment of learning difficulties, emotional and behavioural problems that impair education (nurseries, schools, special education units, universities)
- Designing machines, computers, systems (e.g. assembly lines), traffic signs etc. that are optimal for human use (industry, government)
- Providing expertise to the legal system (prisons, courts, consulting firms)
- Developing advertising and marketing strategies (business)
- Helping athletes improve performance (professional sports teams, government sports institutes)

Figure 1.1

Psychologists engage in a wide range of activities, including helping athletes to improve their performance.

Given this diversity of activities it should be no surprise that it is impossible to identify a common set of characteristics (or even a single characteristic) that sets psychologists apart from sociologists, anthropologists, biologists and so on. What does this mean for you, as you begin your study of psychology? It means that the subject you have chosen to explore is more complex than it might appear at first sight – which makes it all the more fascinating.

PINNING DOWN PSYCHOLOGY

developmental psychology the study of age-related changes across the life span

clinical psychology focuses on the causes and treatment of psychological disorders and adjustment problems such as depression and phobias

physiological psychology investigates the association between the brain and behaviour

To begin with, psychology is not a single enterprise. Rather, it is a coalition of specialities, each identified by the adjective that precedes the word 'psychology'. So, for example, *developmental psychology* encompasses age-related changes across the lifespan, *clinical psychology* focuses on the causes and treatment of psychological disorders and adjustment problems, *physiological psychology* investigates the association between physiology and behaviour/mind, *cognitive psychology* looks at basic mental processes, and so on. Here is a list of the many subfields of psychology:

cognitive psychology examines fundamental mental processes such as perception, thinking, memory, language

Abnormal psychology: Nature and development of abnormal behaviour, thoughts, feelings associated with distress or impaired functioning that is not a culturally expected response to an event (see chapter 15)

Behaviour genetics: Impact of heredity on animal and human behaviour (see chapter 13)

Clinical psychology: Diagnosis, treatment, and prevention of mental disorders and disabilities (see chapters 14, 15 and 16)

Cognitive neuroscience: Neuronal basis of mental processes (see chapter 3)

Cognitive psychology: Study of the processes by which sensory information is transformed, reduced, elaborated, stored, retrieved and used (see chapters 8, 11 and 12)

Community psychology: Person–environment interactions and the ways society impacts upon individual and community functioning. Focuses on social issues, social institutions, and other settings that influence individuals, groups, and organizations. Emphasizes changing social systems to prevent psychological problems (see chapters 17, 18 and 19)

Comparative psychology: The study of behaviour in different species (see chapters 3, 4 and 5)

Consumer psychology: The effects of advertising, marketing, packaging, and display on the behaviour of purchasers (see chapter 17)

Counselling psychology: Traditionally associated with the field of education, counselling psychology may include vocational guidance as well as helping persons resolve problems or role issues related to work or school or family matters (see chapter 16)

Cross-cultural psychology: Impact of culture on human behaviour (see chapters 13 and 18)

Developmental psychology: Change in behavioural and mental processes over the life span (see chapters 9 and 10)

Developmental psychopathology: The origins and course of individual patterns of behavioural maladaptation whatever the age of onset, causes or transformations in behavioural manifestation (see chapter 15)

Educational psychology (also called school psychology): Diagnosis and treatment of educational, emotional, and behavioural problems in children and teenagers (see chapters 9 and 10)

Environmental psychology: Relationships between human behaviour and the physical environment (see chapters 7, 8 and 19)

Ergonomic psychology (also called human factors and engineering psychology): Design of tasks, equipment, and work places to maximize performance and well-being and to minimize fatigue, boredom and accidents (see chapter 20)

Evolutionary psychology: Applies an evolutionary perspective to understanding human behaviour and mental processes (see chapters 4 and 5)

Family psychology: Study of the family as a system, and of relationships within the system (see chapter 16)

Forensic and criminological psychology: Psychological aspects of legal processes and crimes (see chapter 21)

Health psychology: Lifestyle and physical health, the identification of psychological causes and correlates of health and illness, psychological aspects of health promotion and the prevention and treatment of illness (see chapter 19)

Mathematical/quantitative psychology: Development of mathematical models of behaviour and derivation of statistical methods for analysing data collected by psychologists (see chapter 2)

Medical psychology (also referred to as behavioural medicine): Psychological aspects of medical practice, the doctor–patient relationship, reactions to medical advice, improving treatment compliance. Psychological issues that arise in medical treatment of children and adolescents have given rise to the field of pediatric psychology (see chapters 3 and 19)

Neuropsychology: Study of the impact of disorders of the nervous system (especially the brain) on behaviour (see chapters 3, 5 and 7)

Organizational psychology: Study of structures and functions of organizations and the activities of the people within them. Included in its remit are job satisfaction, employee attitudes and motivation, and their effects on absenteeism, labour turnover, and organizational productivity and efficiency (see chapter 20)

Personality psychology/Individual Differences: Study of characteristics that make each person unique (see chapter 14)

Social psychology: Investigation of the reciprocal influence of the individual and his or her social context (see chapters 17, 18 and 20)

Sport/exercise psychology: Reciprocal effects of psychological factors on sports/exercise

The numerous specialities make psychology a wide-reaching subject with rather fuzzy boundaries. So, you may well ask, 'What is the glue that holds psychology together as a discipline?'

If there is any one thing, it is psychology's reliance on a philosophical view known as *empiricism*. Empiricists believe that knowledge comes from observation and experience (the Greek *empeiria* literally means 'experience'). This viewpoint tells us that all hypotheses about human functioning should have an observable consequence, which can be confirmed or refuted by data collection and statistical testing (see chapter 2).

empiricism the belief that knowledge comes from observation and experience, and sensory experience is the source of all knowledge

Psychologists are therefore united by their commitment to empirical research as a means of achieving their shared goal of understanding, predicting and changing human behaviour. To this end, they study not only humans but numerous other species too, including fruit flies, cockroaches, rats, cats, dogs, horses and our closest relative, the chimpanzee. Some psychologists use a laboratory, and others study creatures in their natural habitat.

Another way to address our question is to look for overlap in the content of various psychology textbooks. A psychologist called J.D. Matarazzo did this, and found a consensus on 'the core content in every generation since 1890' (1987, p. 895), despite dramatic increases in knowledge base. Four major content areas were represented over this 100-year period:

1. biological bases of behaviour,
2. cognitive and affective processes,
3. developmental processes, and
4. social bases of behaviour.

However, several studies also found that consensus on a core vocabulary is lacking (Landrum, 1993; Quereshi, 1993; Zechmeister & Zechmeister, 2000). It appears that our diversity has resulted in a number of different dialects rather than a single common language.

Why the difficulty in pinning down psychology? And why the diversity in vocabulary used to discuss the various aspects? Is the

language we use simply a smoke screen to turn psychology into a science, when it is really little more than common sense?

PSYCHOLOGY AND COMMON SENSE: THE GRANDMOTHER CHALLENGE

Everyone engages, to a greater or lesser degree, in the task of understanding human behaviour. Does that mean everyone is a psychologist?

Yes, in the sense that everyone has ideas about what lies behind the behaviours he or she encounters in the world. Sometimes these ideas are easily expressed, but sometimes they are implicit and beyond conscious awareness. Implicit personality theories, for example, describe the unarticulated expectations we have about relationships between traits. If you see John as daring, you are likely to assume that he is also fearless and confident, as these traits are closely related in our implicit theories of personality (Rosenberg, Nelson & Vivekananthan, 1968; see also chapter 14).

So, can scientific psychology tell us more than our own grandmother, who has spent many years observing human behaviour? Surely scientific psychology is just common sense? The fact is that 'all sciences arise as refinement, corrections and adaptations of common sense' (Oppenheimer, 1956, p. 128), and common sense 'is the datum from which it [science] starts and to which it must recur' (Whitehead, 1949, p. 110). In this regard, psychology is no different from any other science. One of the pioneers of modern social psychology, Fritz Heider, viewed the task of psychology as the systematization of common sense. But does it offer us anything more?

Perhaps it is because psychology includes the study of obvious, everyday phenomena, that we are tempted to infer that it offers us little more than common sense. But common sense, or intuitive psychology, offers us an understanding of human behaviour that can be incoherent and is often contradictory. Consider these proverbs, which embody our collective wisdom about human behaviour: 'too many cooks spoil the broth' vs. 'many hands make light work'; 'out of sight, out of mind' vs. 'absence makes the heart grow fonder', and so on. It is not that each proverb does not offer an insight. The issue is to determine systematically the conditions under which each insight holds true.

PUTTING COMMON SENSE TO THE TEST

Would you administer a lethal shock?

Let us put our common sense to the test. Answer the following questions simply on the basis of common sense:

1. Happily married spouses are characterized by their tendency to reciprocate positive partnering behaviours towards each other.
   (a) True
   (b) False
2. What percentage of people would administer a potentially lethal shock to another person when instructed to do so by an authority figure?
   (a) 80–90 per cent
   (b) 50–60 per cent
   (c) 20–30 per cent
   (d) 1–2 per cent
3. Animals process information in the same way that people do.
   (a) True
   (b) False
4. Schizophrenics suffer from a split personality.
   (a) True most of the time
   (b) True some of the time
   (c) True none of the time
   (d) True only when the schizophrenic is undergoing treatment
5. The principles of learning that apply to fish also apply to:
   (a) humans
   (b) birds
   (c) neither (a) nor (b)
   (d) both (a) and (b)
6. If you need help from a bystander, you are more likely to receive it if there are only one or two people nearby.
   (a) True
   (b) False
7. If you want a person to perform some action at a very high rate, you should reward the action every time it occurs.
   (a) True
   (b) False

Now check the answers on p. 23.

Let us look in more detail at perhaps the most dramatic question – concerning the administration of a potentially lethal shock to another person. Psychiatrists, middle-class adults and university students alike estimated that only one or two people in 1000 would administer a potentially lethal shock.

In one of the best known psychology studies, Milgram (1963; 1977; see also chapter 18) devised a series of experiments on obedience to authority in which pairs of participants were divided into 'teachers' and 'learners'. In reality, the learner was always a confederate – someone who works in collusion with the experimenter. The teacher – who knew nothing of the collusion – was asked to administer an electric shock to the learner whenever he or she made a mistake in the learning task. Initial mistakes resulted in low levels of shock, but as incorrect responses increased, so did the intensity of the shock.

By the time a 270 volt shock was administered, the learner was screaming, supposedly in agony, and at 300 volts was pounding on the wall in protest and refusing to answer questions. The teacher was instructed that silence should be considered an incorrect response and to administer the shock. When told to administer a potentially lethal shock (450 volts), about half the

Figure 1.2

Human participants were obedient to the point of being murderous in Milgram's controversial experiment.

participants (in one study it was as high as 68 per cent) obeyed. In other words, there was a 250- to 500-fold difference between the common sense answer and the evidence of psychological research.

Human behaviour is complex

If you felt uneasy reading about what Milgram did to participants in his studies, you are not alone. In addition to what it tells us about obedience to authority, Milgram's research was an important stimulus for developing clearer guidelines regarding the ethical treatment of participants in psychological research. The role of ethics is discussed in chapter 2.

Although the studies demonstrate the power of social norms (in this case the norm of obedience to authority), they attracted, and rightly, severe ethical criticism (Baumrind, 1964). Milgram (1964; 1977) responded by arguing that participants were carefully and sensitively *debriefed* – in other words, after the experiment, they were told about its true nature. He reported that his 'teachers' were greatly relieved, rather than upset, and believed that the research had been worthwhile. In a follow-up several months later, 84 per cent reported feeling positive about their participation, 15 per cent reported neutral feelings, and 1 per cent described negative feelings.

Milgram's critics questioned this response, arguing that the debriefing might have eroded the participants' trust of others and that learning they were capable of committing such harm may have damaged their self-esteem (Schlenker & Forsyth, 1977).

This exercise ought to have convinced you that psychology has more to offer than your grandmother when it comes to understanding the complexities of human behaviour. Even so, at times you may find yourself unimpressed by some of the findings reported in this book. You may feel you knew all along that this was the way humans behaved. Such a response may reflect a cognitive heuristic called the *hindsight bias*. According to this bias, we sometimes falsely overestimate the probability with which we would have predicted an outcome (see also chapter 12).

hindsight bias falsely overestimating the probability with which we would have predicted an outcome after we know it has already occurred

In a well known study, Fischhoff and Beyth (1975) had people predict the likelihood of various outcomes when President Nixon visited China and the Soviet Union. After the trip, they were asked to again make the same predictions but to ignore what had actually happened. People estimated the probability of outcomes that actually occurred as higher than they did before the trip. Even when they were told about this hindsight bias and urged to avoid it, the bias remained.

The hindsight bias has implications for forensic psychology, which involves the 'examination and presentation of evidence for judicial purposes' (Blackburn, 1996; see also chapter 21). How effective is it when a judge – as judges are prone to do – tells a jury to ignore certain evidence, after they have heard it, when reaching a verdict?

Once you accept that psychology has more to offer than your grandmother when it comes to understanding human behaviour, you might legitimately ask, 'How do psychologists – as opposed to my grandmother – explain human behaviour?'

EXPLAINING HUMAN BEHAVIOUR

Imagine you are a psychologist interested in understanding a particular kind of behaviour, such as human aggression. What would you look at to advance your understanding? Brain cells and hormones? Inherited characteristics? Socialization by parents? The stimuli that precede aggressive behaviour?

Psychologists pursue all these avenues in their attempt to explain human behaviour. Some look inside the person for causes of behaviour, focusing on physical events such as physiological functioning. As a result, we now know that compulsive violence is associated with tumours and damage in a particular region of the brain – the temporal lobe (Elliot, 1988). Others look for causes of aggression in hypothetical mental activity. From this approach, we have learned that aggressive behaviour is more likely to occur when the person producing the aggressive behaviour infers that they have experienced something negative due to a volitional act of another person (Weiner, 1986).

Yet other psychologists will look to the environment for causal explanations. They may focus on events or stimuli that precede an aggressive act or on a general environmental state. From them we have learned that children acquire aggressive behaviour by observing it in models (see figure 1.3) and that high ambient temperature is associated with naturally occurring aggression. Hotter regions of the world witness more aggression than cooler regions, and hotter years, seasons and days, in comparison to

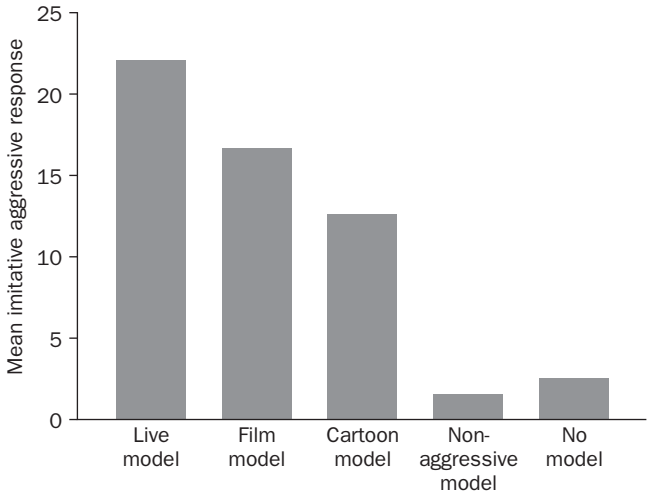

Figure 1.3

Mean imitative aggressive responses by children who were exposed to aggressive models, non-aggressive models or no models. Source: Hewstone and Stroebe (2001), based on Bandura (1973).

cooler ones, are more likely to produce assaults, murders, rapes, riots and spouse abuse (Anderson, 1987).

It should now be apparent that there is no single explanation for aggressive behaviour. Confusion can be avoided if we accept that each explanation is useful in its own way. The variety of approaches that psychologists have taken in explaining behaviour is illustrated in the next section, which briefly outlines the evolution of psychology from philosophy to a behavioural science.

There are two reasons why you should be familiar with the history of your subject:

1. Ignorance of psychology's past leaves you unable to evaluate the significance of new developments and perhaps even to mistake old facts and viewpoints as new.
2. The vastness of psychology can be both intimidating and confusing as you try to draw connections between various concepts and approaches. Seemingly unrelated topics may be intricately bound together through their historical development, so an appreciation of psychology's past can help you to integrate the many different areas and subspecialities that make up modern psychology.

Research close-up 1

The bystander effect

The research issue

Emergencies happen every day all around the world. The most publicized emergency ever seen erupted in New York City on September 11, 2001. The Red Cross, Salvation Army, paramedics and many other humanitarian groups rushed to help the sick and injured while the 9/11 attacks were still taking place.

One might reasonably suppose that the nature of humans is to help others when they are in trouble. Unfortunately, this is not always the case. 'Bystander apathy' occurs when people witness an emergency and take no action.

In the Kitty Genovese murder in the United States in 1964, 38 neighbours apparently watched and listened but did not act to help or call police. Although shocking, these neighbours' reactions were not unusual. Why do people who are willing to help in non-emergency situations not do so in an emergency?

First, there are few potentially positive rewards in an emergency situation. Life is threatened for the victims and the helpers. Second, emergencies usually come without warning and place the potential helper under a great deal of stress. People's reactions are typically untrained and unrehearsed.

A potential intervener must make a series of decisions. She must notice the event and interpret it as an emergency. She must then decide if she has a responsibility to act and, if so, how. Should she help directly or call the police? Finally, she must decide how to implement the action.

Of course, in a real emergency a person is highly unlikely to be so rational. Furthermore, while the victim may gain the status of a hero, the person who comes to his aid risks being a failure, getting sued, or even being attacked or wounded herself.

Here are just two experiments that have examined the bystander effect.

Experiment 1
Design and procedure

Latané and Darley (1969) had participants fill out questionnaires in a room to which smoke was added. In condition 1 the participant was alone. In condition 2, three naive participants were in the room. In condition 3, confederates purposely noticed, but then ignored, the smoke.

Results and implications

In condition 1, 75 per cent of participants calmly noticed the smoke and left the room to report it. But in condition 2 only 10 per cent reported the smoke. In condition 3, 38 per cent reported the smoke.

Most participants had similar reactions. Those who did not report the smoke all concluded that it was not dangerous or was part of the experiment. No one attributed their inactivity to the presence of others in the room.

Other related research studies have shown that togetherness reduces perception of fear even when the actual danger is not reduced. It may be that people in groups are less afraid and less likely to act. On the other hand, they may be simply inhibited from showing fear in a group situation.

From post-experimental interviews, it became clear that participants did not act because they concluded the situation was not threatening.

Experiment 2
Design and procedure

This experiment tested what people would do if they witnessed an emergency knowing that others are present but not being able to see or hear them, and *vice versa*.

The researchers placed a naive student participant in a room and told them that they were to talk to others via an intercom about normal personal problems. Participants were told that there were other student participants who were similarly located in isolated rooms (to preserve anonymity). One of the other students (a confederate of the experimenter) becomes a 'victim' who suffers a seizure and calls out audibly for help. The key question was whether the participant would leave his or her cubicle to assist the victim.

The researchers varied the perceived number of people, with participants talking in groups of two, three or six people. They also varied the two-person discussion group by changing the characteristics of the other bystander (female, male, or a medical student with emergency training).

Finally, two more conditions were set up: one with the participant and a real friend as bystanders, and one where the six participants had had prior contact and a brief 'encounter' with the perceived victim.

Results and implications

Ninety-five per cent of all participants responded within the first 3 minutes, 85 per cent of participants who perceived themselves to be alone left their cubicle before the victim finished calling for help, but only 31 per cent who thought there were four other bystanders acted so quickly.

Overall, 100 per cent of participants in the two-real-person condition acted to deal with the emergency, but only 62 per cent of participants in the six-person condition took action.

The gender and medical competence of bystanders had no effect on the results. But being in the presence of a friend significantly increased the speed of response. It seems that personal responsibility diffuses across strangers but does not diffuse across friends. In addition, people who had briefly met the victim previously were significantly more likely to respond more quickly to their pleas.

Even those who did not respond to the emergency showed signs of genuine concern. They were often nervous and trembling, and seemed to be in a state of indecision about responding.

Taken together, these experiments show there are strong situational factors that can inhibit people from acting in emergencies. These findings have important implications for predicting, understanding and perhaps even controlling how people behave in social situations.

Latané, B., & Darley, J., 1969, 'Bystander "apathy"', *American Scientist*, 57, 244–68.

THE BEGINNINGS OF MODERN PSYCHOLOGY

Where does the history of psychology begin? Humans have long been intrigued by their own behaviour, and attempts to understand human functioning can be traced to early Greek philosophers. But until the last quarter of the nineteenth century, this endeavour was pursued through speculation, intuition and generalizations made on the basis of an individual's experience.

A major breakthrough occurred when the tools of science (carefully controlled observation and experimentation) were applied to the study of humans, and psychology began to emerge as a distinct entity.

Philosophical influences

The notion that the methods of science could be applied to mental phenomena emerged from sixteenth and seventeenth century European philosophy.

The relationship between body and mind

The work of French philosopher and mathematician René Descartes (1596–1650) led to many of the later trends in psychology. Reflecting the spirit of his times, Descartes subscribed to the idea of mechanism – an image of the universe as a machine and physical entities as mechanical devices. Descartes applied this view to animals, including humans, setting humans apart from animals only by their possession of a 'mind'.

Since Plato, most philosophers had viewed the body and the mind (or soul or spirit) as fundamentally different in nature. Descartes accepted this *dualism*. But prior to Descartes, the mind was believed to influence the body, rather than the other way around. Descartes developed what became known as *cartesian dualism*, which asserts a relationship of mutual interaction. Also, by limiting the mind to one function – thought – Descartes ascribed to the body attributes that had previously been associated with the mind (e.g. reproduction). He was the first to offer a strictly physical–psychological dualism. The way was paved for a change from metaphysical analysis of the soul to observation of the mind and its operations.

dualism the view that the body and the mind (or soul or spirit) are fundamentally different in nature

cartesian dualism a framework offered by Descartes, which asserts a relationship of mutual interaction (see **dualism**)

As it became increasingly clear that sensations travel to the brain and that bodily movements originate in the brain, Descartes looked for a point of interaction between mind and body in the brain. He settled on the pineal gland, or conarium, at the top of the brain stem and described the interaction in mechanical terms. For example, the mind makes an impression on the conarium (in a manner never specified), which, by tilting in the right direction, causes animal spirits to flow to the appropriate muscles, producing movement. Descartes ultimately concluded that the interaction between the physical and non-material worlds (body and mind) was miraculous.

One of Descartes' conclusions was that: 'The existence of God is demonstrated, a posteriori, from this alone, that his idea is in us' (1977, p. 234). This points to another important legacy of his philosophy, namely that some ideas (e.g. ideas of God) are innate. This notion influenced later psychological theories, especially in Gestalt psychology.

The mind as a collection of experiences

After Descartes, another French philosopher, Auguste Comte, developed a new philosophical idea that had a profound impact on psychology. Comte coined the term *positivism* to describe a way of thinking that recognized only positive facts and observable phenomena. He believed that social life is governed by laws and principles that we can discover through the methods used in the physical sciences. It was only a matter of time before the methods of science were applied to the study of mental phenomena conceived of in mechanistic terms.

positivism a term coined by Comte to describe a way of thinking that recognizes only positive facts and observable phenomena, as practised in the physical sciences

A third important philosophical tradition, this time rooted in England, facilitated this application. Empiricism, as we noted earlier, sees sensory experience as the source of all knowledge and provided psychology with both method and theory. The method was observation and, to a lesser extent, experimentation. The theory concerned the growth of the mind, which was seen to occur through the accumulation of sensory experience.

John Locke (1632–1704), whose *Essay on Human Understanding* (1690) marked the formal beginning of British empiricism, rejected the notion of innate ideas, arguing that a new-born child has no knowledge whatsoever. He admitted that some ideas might appear to be innate (such as the idea of God) but argued that this was only because they are so constantly taught that no student could remember a time when he or she was not aware of it. Instead, Locke argued, each infant is born with a mind like a blank slate, a *tabula rasa*, upon which experience is written. For Locke, all knowledge is empirically derived, with complex ideas consisting of numerous interlinked simple ideas.

tabula rasa the empiricist Locke argued that each infant is born with a mind like a blank slate, a tabula rasa, upon which experience is written

Scottish philosopher David Hume (1711–76) developed this notion of the association of ideas, and made it more explicit. He outlined three laws of association, which he saw as the mental counterpart of the laws governing the physical universe:

1. resemblance or similarity
2. contiguity in time or place
3. causality (linking effects to causes)

So *materialism* (the view that all things, including mental phenomena, can be described in physical terms), positivism and especially empiricism were the three philosophical pillars on which modern psychology was built. But psychology has equally important roots in physiology. In fact it was four German physiologists who were primarily responsible for the emergence of the new science of psychology.

materialism the view that all things, including mental phenomena, can be described in physical terms and understood in terms of matter and energy

Physiological influences

Physiology shaped the form of early psychology and imbued it with the experimental method.

Measuring mental processes

The legacy began with Hermann von Helmholtz (1821–94), who investigated the speed of neural impulses. His work suggests that thought and movement do not occur instantaneously as previously believed, but that thought occurs first, followed by movement. This paved the way for others to investigate the psychological significance of time taken to react to a stimulus (reaction time or response latency) – an approach that remains important in modern psychology (see chapter 13). Helmholtz made significant contributions to sensory psychology, especially audition and vision (you will still find his colour theory of vision in psychology textbooks), but he saw psychology as closely related to metaphysics and never considered himself a psychologist.

Unlike Helmholtz, Ernst Weber (1795–1878) saw psychology as akin to a natural science and applied strict experimental methods. Weber found that the smallest difference between two stimuli that could be discriminated (the *just noticeable difference, or JND*) depends not on the absolute difference, but on the relative difference between the stimuli. For example, he established that the JND between two weights is a constant fraction of 1/40 (40g is noticeably different from 41g, 80g is noticeably different from 82g etc.) and that the constant varies for different senses.

just noticeable difference (JND) the smallest difference between two stimuli that can be discriminated

Weber achieved a major breakthrough by showing how to investigate the relation between stimulus (body) and sensation (mind). But like Helmholtz, his concern was with physiological processes, and he failed to appreciate the significance of his work for psychology.

Gustav Fechner (1801–87) built on and went way beyond Weber's work in attempting to document exactly 'the functionally dependent relations . . . of the material and the mental, of the physical and psychological worlds' (1966, p. 7). Developing a programme of research on what he called *psychophysics*, Fechner devised methods that, with minor modifications, are still in use today.

psychophysics the systematic attempt to relate changes in the physical world to differences in our psychological perceptions

For example, the idea of average error assumes that we cannot obtain a 'true' measure of sensation. So when a person is asked to adjust a variable stimulus (such as light intensity) to match it to a constant, standard stimulus, average error is the average difference between the variable stimulus and the standard stimulus over a number of trials. This technique – useful in measuring reaction time – is basic to modern psychology. In fact, Fechner, more than any other single person, prepared the way for the research on perception described in chapter 8.

The first psychology textbook

Although philosophy had paved the way for the application of scientific methods to the study of mental phenomena, it was through the work of physiologists like Helmholtz, Weber and Fechner that this potential was fully realized. Yet, despite their influence, none of these men has been credited with founding modern psychology. That honour has been bestowed on a fourth physiologist, Wilhelm Wundt (1832–1920), who published

Pioneer

Figure 1.4

Wilhelm Wundt is generally considered the founder of modern psychology.

Wilhelm Wundt (1832–1920) was a physiologist and psychophysicist who established the world's first psychology laboratory and wrote the first psychology textbook, *Principles of Physiological Psychology* (1874). Wundt (along with Edward Titchener, who helped establish psychology in the USA) developed the first systematic position, or school of thought, in psychology – structuralism, so called because it focuses on the structure of the mind. Wundt put students through an arduous training in the method of introspection (looking inward) to single out those who could describe the elementary sensations of experience – colours, tones, tastes and so on. But by the early twentieth century, introspection had been labelled 'superstitious' by John Watson, the founder of behaviourism.

Principles of Physiological Psychology (1874) – widely considered the first psychology textbook.

In the preface Wundt wrote, 'The work I here present to the public is an attempt to mark a new domain of science.' Unlike his predecessors, Wundt called himself a psychologist and took a number of actions to promote this new domain of science.

PSYCHOLOGY TODAY

The birth date of psychology is most often given as 1879. It was in this year that Wilhelm Wundt is said to have established the first formal psychology research laboratory at the University of Leipzeig in Germany, and the first psychology journal followed two years later. Together they heralded the beginning of modern psychology.

STRUCTURALISM: MENTAL CHEMISTRY

Wilhelm Wundt (along with one of his English students, Edward Titchener, who helped establish psychology in the USA) developed the first systematic position, or school of thought, in psychology – *structuralism*. According to Wundt, psychology is the science of immediate experience, unbiased by any interpretation.

structuralism a theory derived from the use of psychophysical methods, so called because it focuses on the structure of the mind

Look at figure 1.5. Did you see a blue fish? According to Wundt, this will not do, as you are showing greater interest in the object (fish) than in the sensation of experiencing blue. In other words, this is a mediated, or interpreted, experience. Wundt put students through an arduous training in the method of *introspection* (looking inward) to single out those who could describe the elements of experience – colours, tones, tastes and so on. In our example, a good introspectionist would describe only the intensity and clarity of the sensations that occur in viewing the image, such as its blueness.

introspection literally, looking inward, this is an observational method used to describe the elements of experience (colours, tones, tastes and so on)

Figure 1.5

Blue fish.

Table 1.1 Titchener's (1910) 'periodic table' of the mind.

Elementary sensations	*Number*
Colour	About 35,000
White to black range	600 to 700
Tones	About 11,000
Tastes	Just 4 (sweet, sour, bitter, and salty)
From the skin	Just 4 (pressure, pain, warmth, and cold)
From the internal organs	Just 4 (pressure, pain, warmth, and cold)
Smells	9 classes seem likely, but there might be thousands of elements
Total elementary sensations	46,708 plus an indeterminate variety of smells

Like chemistry, psychology consists of analysis – discovering the basic elements of conscious thought – and synthesis – discovering connections between elements and the laws governing these connections. To qualify as an element, an experience has to be irreducibly simple. Titchener even dared to number the elements of consciousness and offered what one might view as a 'periodic table' of the mind (see table 1.1). Elementary sensations had to be combined because, as Wundt recognized, we experience conscious thought as a unity, not as a series of varied sensations of brightness, hue, shape etc. Wundt's doctrine of apperception describes a process of 'creative synthesis' by which elementary experiences are organized into a whole. And his law of psychic resultants posits that psychic compounds have new properties that are 'by no means the mere sum of the characteristics of the elements' (1896, p. 375).

Wundt was profoundly influential, not to mention prolific – if you read his works at the rate of 60 pages a day, it would take two and a half years to finish them. But the method of introspection did not stand the test of time and by the early twentieth century had even been labelled 'superstitious' by an American behaviourist, John Watson. In fact, vehement reaction against the limitations of structuralism defined much of what subsequently happened in psychology for many years.

FUNCTIONALISM: MENTAL ACCOMPLISHMENT

Preoccupation with the structure of the mind was replaced by a second major system of thought in psychology, which focused on function. *Functionalism* addressed the very

functionalism addresses the very practical question of what functions the mind, or mental processes, accomplish

practical question of what the mind, or mental processes, accomplish. The precept 'thinking is for doing' is the hallmark of functionalism. Although it arose in the USA and was the first uniquely American system of psychology, it owed much to the Englishman Charles Darwin.

The notion of function is central to Darwin's theory of evolution, as the physical characteristics of a species evolve to meet its requirements for survival. The idea that behaviour might also reflect adaptation to the environment soon followed. Darwin's seminal work, *On the Origin of Species by Means of Natural Selection* (1859), also raised the possibility of continuity in behaviour and mental functioning between animals and humans, prompting the laboratory study of mental functioning in animals. Finally, Darwin's observation of variation among members of the same species focused attention on individual differences in psychology.

The most important exponent of functionalism was William James (1842–1910), who argued that: 'No one ever had a simple sensation by itself' (James, 1890, p. 224). Instead, he proposed, the most important thing about consciousness is its continual flow, and he coined the famous phrase 'stream of consciousness' to emphasize this fact. He was interested in the process of conscious activity (e.g. perceiving and learning) and viewed the attempt to divide consciousness into distinct elements as misguided. From James' perspective, the function of consciousness is to guide behaviour that will help the organism adapt to the environment. He felt that consciousness must have some biological use or else it would not have survived. Not surprisingly, James saw psychology as a biological science.

Unlike Wundt, James never set out to found anything (he started a laboratory at Harvard University in 1875 but did not carry out any laboratory research). Yet his impact on psychology was equally profound. In *Principles of Psychology*, published in 1890, James offered a vision that is closer to modern psychology than anyone else at that time. Indeed, the two volumes, with chapters on such topics as reasoning, habit, emotion, instinct, will, the self, attention and hypnotism, remain useful reading for psychologists today (see chapters 6, 12 and 16).

With the publication of this work, James felt that he had said all he knew about psychology and devoted the rest of his life to philosophy. But it was enough to pave the way for comparative psychology and the study of individual differences to become part of the mainstream of psychology.

After James, functionalism was developed more formally as a 'school' by John Dewey (1859–1952) and James Angell (1869–1949). Functionalism shifted attention away from the exclusive focus on private experience (consciousness) to include the study of objective, observable behaviour. Unlike structuralism, functionalism was not supplanted but provided a bridge for the emergence of the polar opposite of structuralism – a psychology that focused on behaviour and eschewed study of the mind.

Pioneer

William James (1842–1910) was the most important exponent of functionalism. James argued that the most important thing about consciousness is its continual flow, coining the famous phrase 'stream of consciousness'. Unlike Wundt, he viewed the attempt to divide consciousness into distinct elements as misguided. From James' perspective, the function of consciousness is to guide behaviour that will help the organism adapt to the environment. In *Principles of Psychology* (1890) James offered a vision that is closer to modern psychology than that of anyone else at that time. With the publication of this work, James felt that he had said all he knew about psychology and devoted the rest of his life to philosophy. But it was enough to pave the way for comparative psychology and the study of individual differences to become part of the mainstream of psychology.

Behaviourism: a totally objective psychology

The emergence of functionalism had been evolutionary rather than revolutionary, with structuralism maintaining a strong but not exclusive hold on psychology as it entered the second decade of the twentieth century. But a student of Angell's, John Watson, changed this with the publication of a broad, cutting attack on existing systems in psychology. 'Psychology as the behaviorist views it' (1913) served as the manifesto for a revolution in psychology:

> Psychology as the behaviorist views it is a purely objective experimental branch of natural science. Its theoretical goal is the prediction and control of behavior . . . The behaviorist, in his efforts to get a unitary scheme of animal response, recognizes no dividing line between man and brute. The behavior of man, with all of its refinement and complexity, forms only a part of the behaviorist's scheme of investigation.
>
> **(p. 158)**

Like Wundt, Watson set out to promote something new – a totally objective psychology, whose subject matter was observable behaviour. Stimulus–response units were seen to be the basic building blocks of complex behaviour. So, even in rejecting structuralism, Watson shared with it an analytic and atomistic point of view. Because Watson was more interested in working with animals than humans, it is not surprising that he viewed *behaviourism* as 'a direct outgrowth of studies in animal behavior' (1929, p. 327).

behaviourism a totally objective psychology, whose subject matter is observable behaviour

By the turn of the century the study of animal behaviour had become widespread, and experimental animal psychology was growing rapidly. Edward Thorndike (1874–1949) – one of the most important figures in the development of animal psychology – is credited with introducing the experimental investigation of animal behaviour. To study 'animal intelligence', he put cats in a

Figure 1.6

John Watson treated all functioning in terms of stimulus–response.

cage, placed food outside the cage door and timed how long it took the cat to learn how to escape.

In the process of trial-and-error learning, Thorndike observed that responses were 'stamped in' or 'stamped out', depending on their consequences. He formalized this observation in his famous *law of effect*: 'Any act which in a given situation produces satisfaction becomes associated with that situation, so that when the situation recurs the act is more likely to recur also. Conversely, any act which in a given situation produces discomfort becomes dissociated from that situation, so that when the situation recurs the act is less likely than before to recur' (1905, p. 203). In building on Thorndike's work, Watson purged it of mentalistic ideas like 'satisfaction'.

law of effect articulates two central experimental findings: 1) any act that produces satisfaction is more likely to recur; and 2) any act that produces discomfort is less likely to recur

Watson also profited from the work of the Russian physiologist, Ivan Pavlov (1849–1936). In his Nobel Prize-winning work on digestion, Pavlov discovered that hungry dogs would salivate at the sight of the person who brought them their food. At first, he considered this 'psychic secretion' a nuisance, but soon he realized that it revealed a very basic form of learning. He went on to show that dogs could be trained, or conditioned, to salivate at the onset of an arbitrary stimulus (e.g. the sound of a bell) if it was immediately followed by food. Without intending to do so, Pavlov had provided psychology with a basic element, the stimulus–response association – also used by Watson as the foundation of behaviourism.

Watson had argued that, with the appropriate stimuli, an organism can learn to behave (respond) in specific ways, much like Pavlov's dogs. Along with his student, Rosalie Rayner, he showed – through an experiment that raised obvious ethical

Everyday Psychology

Saving lives

Some people find the methods used in behaviourism research unpalatable. Pigeons and rats? Cages and electric shocks? What possible good can this contribute to improving the quality of human existence? What follows is perhaps the simplest yet strongest answer – life itself.

Rumination – the voluntary regurgitation of food without nausea or retching – is common among infants. Prolonged rumination can produce death rates as high as 20 per cent due to malnutrition and decreased immune function. One particular nine-month-old infant was literally starving to death after four months of rumination. Several unsuccessful attempts were made to stop the rumination by using physical restraints, antiemetic drugs, and even a course of counselling for his mother.

Two behaviourally oriented psychologists were brought in to try a treatment of last resort. Peter Lang and Barbara Melamed (1969) used electromyographic recording to isolate the entire vomiting sequence – and they managed to stop it without affecting important behaviours such as sucking and swallowing.

Their treatment consisted of a brief, intense electric shock to the child's leg at the first sign of vomiting, repeated at one-second intervals until all signs of vomiting stopped. The first treatment proved successful, and five subsequent trials were administered. Within two weeks of the first treatment the child's body weight increased 20 per cent. He appeared to be well, both physiologically and psychologically, when followed up at six months, twelve months and two years.

Although successful, it would be a mistake to conclude that electric shock is a standard treatment for ruminative vomiting. Most punishment-based treatments or aversion therapies are generally restricted to situations where no other alternatives are feasible. In this case, the child's life was in danger and an immediate intervention was needed to prevent starvation. There simply wasn't time to try other behavioural techniques.

Since then, other cases of rumination have been successfully treated by less dramatic means. One successful treatment was to squirt lemon juice into the child's mouth at the first sign of rumination (Sajwaj et al., 1974) and another entailed withdrawing attention from the child when she vomited (Wright et al., 1978).

Lang, P.J., & Melamed, B.G., 1969, 'Case report: Avoidance conditioning therapy of an infant with chronic ruminative vomiting', *Journal of Abnormal Psychology*, 74, 1–8.

concerns – how fear could be learned. Little Albert, an 11-month-old child, was shown a white rat that he was not afraid of. Each time he was shown the rat, the experimenter made a loud noise, eliciting a startle reaction (Watson & Rayner, 1920). After just seven trials, the rat alone, without the accompanying noise, produced fear (crying) (see chapter 4, *Everyday Psychology*).

In the same year, Watson's formal career as a psychologist ended prematurely and abruptly in the midst of highly publicized divorce proceedings, but his legacy lived on. Behaviourism thrived well into the 1960s, especially in the USA, where it evolved under the direction of arguably the most influential psychologist of the twentieth century, Burrhus Fredrick Skinner (1904–90) and became known as radical behaviourism.

Radical behaviourism

What is 'radical' about radical behaviourism? First, it is 'radical' because Skinner completely accepted private life as *behaviour*. Second, a mental state is treated as a sub-category of the environment – so each of us is affected by both the external environment and our own internal environment. Third, the same principles apply equally well to both environments. Fourth, radical behaviourists focus only on behaviour and the variables that control it. They look in only two places for these variables: the conditions that immediately precede the behaviour and the conditions that immediately follow it.

Imagine you are playing table tennis. As you hit the ball, you say to yourself, 'Stay focused.' You notice that the ball lands on the table more frequently when you do this. So this outcome (ball on the table) keeps you saying that phrase to yourself as you hit the ball. Consider what would happen if you said the phrase but the ball hit the net as often as it landed in play. Eventually you would stop saying the phrase to yourself.

There are two points to notice here:

1. It is the functional relationship between the outcome and the phrase that determines the likelihood that you will repeat the phrase.
2. The phrase itself has no power over the behaviour (it does not directly 'cause' the behaviour).

Radical behaviourism is sometimes viewed as simplistic, but Skinner's approach was far from simple. In *Science and Human Behavior* he notes that behaviour is very complex and difficult to study: 'Since it is a process, rather than a thing, it cannot be easily held for observation. It is changing, fluid, and evanescent, and for this reason it makes great technical demands upon the ingenuity and energy of the scientist' (1953, p. 15).

Skinner focused on establishing laws of behaviour (empirical relationships between environmental events and behaviour) based on intensive observation of a single subject under carefully controlled experimental conditions. His approach, the *experimental analysis of behaviour*, investigated 'operant' behaviours – so-called because they 'operate' on the subject's environment. Skinner viewed this approach as more representative of real-life learning. Operant behaviours are distinguished from the kind studied by Pavlov – 'respondent' behaviours, which are a response to a known stimulus (see chapter 4).

experimental analysis of behaviour a term used by Skinner and his associates to describe the investigation of operant behaviour (those behaviours that are not prompted by any observable stimulus)

Figure 1.7

Skinner demonstrates the box named after him.

Skinner's classic work involved the study of bar pressing (or pecking) by rats (or pigeons) in a 'Skinner box' that was constructed to eliminate all extraneous stimuli (see figure 1.7). A hungry animal was placed in the box and allowed to explore it. Sooner or later the animal would accidentally press a lever that released a food pellet. The food acted as a reinforcing stimulus (or reinforcer) for the bar-pressing behaviour, increasing the probability of its future occurrence. In other words, the animal 'worked' (pressed the bar) because there was a 'payoff' (food). This is an example of *operant conditioning*.

The manner in which the payoff occurred – the *schedule of reinforcement* – influenced bar pressing. Schedules of reinforcement could vary according to time *interval* schedules (in human terms, this might be the weekly pay check), or work ratio schedules (a pay cheque based, for example, on number of items sold). Ratio schedules produce greater rates of behaviour, or faster learning. Schedules can also vary in terms of whether they are fixed or

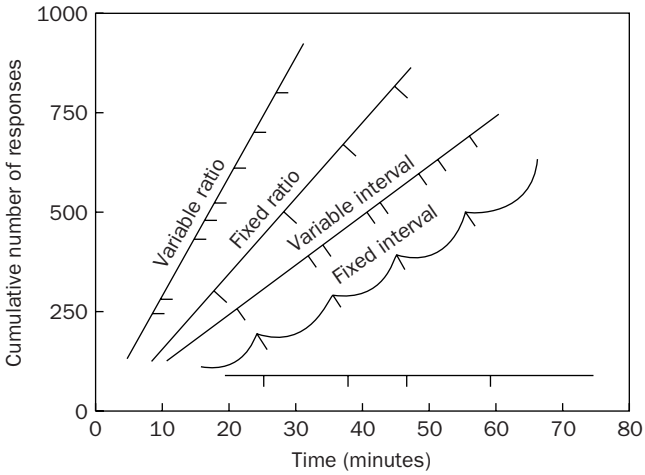

Figure 1.8

Performance curves produced by the four representative schedules of reinforcement. The steeper the slope of the curve, the faster the response. Each pause indicated by a small horizontal line signifies a period of reinforcement. Source: Skinner (1961).

Figure 1.9

Arguably the most influential psychologist of the twentieth century, Burrhus Fredrick Skinner was prominent in the birth of radical behaviourism.

variable. Interestingly, a variable ratio schedule, in which the rate of reinforcement of the rat varies somewhat according to the number of bar presses it makes, produces the highest rate of responding (see figure 1.8).

Skinner went on to show that operant conditioning can take several forms, as shown in table 1.2. One of its first applications to human behaviour occurred in 1948 when it was used to treat an institutionalized, profoundly retarded person (Fuller, 1949). Systematic research to make the experimental analysis of behaviour useful in addressing human problems soon followed, giving rise to the widespread use of teaching machines ('programmed learning'), behaviour modification in educational settings, and treatments for emotional and behavioural disorders.

The application of operant procedures to address socially important behaviours became known as applied behaviour analysis in the 1960s. Like Watson, who envisioned behavourism giving rise to 'saner living', Skinner saw his laboratory research as also providing a technology of behaviour that could improve society. In his novel *Walden Two* (1948), Skinner outlines in detail the mechanics of a society based on behavioural principles.

Most modern behaviourists no longer adhere strictly to the behaviourism espoused by Watson or Skinner. But even psychologists who reject behaviourism in all its forms are indebted to it. The objective approach to understanding behaviour has its roots in structuralism and evolved though functionalism to reach its zenith in behaviourism. This is the hallmark of modern psychology.

Gestalt psychology: making connections

While functionalism followed structuralism in the USA, and behaviourism arose in opposition to both, a different kind of opposition to structuralism emerged in Germany – Gestalt psychology.

The Gestalt attack on structuralism in Europe was independent of the opposition that had developed in the USA. It arose out of a simple observation by its founder, Max Wertheimer

Table 1.2 Four ways in which operant conditioning can occur.

	Response – outcome contingency	*Example (developing appropriate child behaviour)*	*Effect on behaviour*
Positive reinforcement (reward)	Correct response is followed by reinforcer	Parent praises child when he shares toy	Strengthens desired response
Negative reinforcement (avoidance)	Correct response is followed by withdrawal of aversive stimulus	Parent stops nagging child when he shares toy	Strengthens desired response
Punishment (positive punishment)	Undesired behaviour is followed by aversive stimulus	Parent physically rebukes child when he snatches toy from friend	Weakens undesirable response
Omission (negative punishment)	Undesired behaviour is followed by withholding of reinforcer	Parent takes away child's candy when he snatches toy from friend	Weakens undesirable response

(1880–1943), whose paper 'Experimental studies of the perception of movement' marks the beginning of Gestalt psychology.

Wertheimer notes that we can see motion or movement even when no actual movement takes place. For example, when two lights flash in quick succession, we see what appears to be movement from one to the other and back again. Wertheimer called this the 'phi phenomenon'.

It was impossible to explain the phi phenomenon in structuralist terms by describing each elementary sensation (any more than we can explain a melody by describing each individual note). So how did Wertheimer explain it? He did not. He saw no need for explanation, for, he argued, apparent movement could not be reduced to anything simpler. From the Gestalt perspective, the perception forms a whole (in German, *Gestalt* means 'form' or 'entire figure'), or unity (the movement), that is greater than the sum of its parts (the two lights). Gestalt psychology therefore challenged the associationist views that prevailed at the time.

Gestalt psychology is based on the principles that complex mental experience exists on its own, and that perception is composed not of elements but of structured forms. Perhaps the best known Gestalt psychologist, Wolfgang Kohler (1887–1967), reminds us that 'the concept "Gestalt" may be applied far beyond the limits of sensory experience' (1947, p. 178).

Kohler studied apes and observed that they solved problems (e.g. by joining two short sticks to retrieve a banana) by 'insight', or by spontaneously seeing relationships (in this case, between two sticks). This contrasted with the work of behaviourists, whom he criticized for structuring animal problem-solving tasks in such a way that they allowed only trial and error behaviour. For example, an animal in a maze cannot see the overall design of the maze, only the alley it is in, and it is therefore limited to using trial and error.

Although it did not survive as a distinct school of psychology much beyond the 1950s, Gestalt principles were incorporated into other areas of psychology, particularly thinking and learning. It even influenced early social psychology.

Out of school: the independents

Many important developments in the emergence of psychology took place outside the context of the 'schools'. The first began within a few years of the establishment of Wundt's laboratory at Leipzeig.

Memory: Hermann Ebbinghaus

Shortly after Wundt stated that it was not possible to investigate higher mental processes experimentally, a compatriot, Hermann Ebbinghaus (1850–1909), devised ingenious experimental methods for studying memory (the process of learning and forgetting) using only himself as the subject.

One experimental technique involved learning nonsense syllables – syllables that have no meaning and therefore no connections to anything in a subject's experience. Ebbinghaus formed the syllables by using all possible combinations of consonants separated by a vowel (e.g. nim, mur), generating a pool of 2,300 syllables, from which he drew lists for his experiments. To learn the lists, Ebbinghaus went though a stack of cards, each of which contained one syllable. He controlled the exposure to each card by using the ticking of a watch to regulate their rate of presentation. After reading the card set, he paused a fixed amount of time before reading the cards again.

Ebbinghaus reasoned that learning and forgetting could be studied using two techniques:

1. complete mastery, or counting the trials needed to memorize a list of nonsense syllables so that he could recall it at least once without error; and
2. savings, or the difference in the number of trials needed to relearn a list, compared to the number of trials required for original learning.

To be sure about the accuracy of his results, Ebbinghaus would repeat the same task several times using different lists. This allowed him to eliminate variable errors due to random fluctuations caused by things like mood and different environmental conditions. In his attempt to be systematic, he even regulated his daily habits, always learning material at the same time each day.

Using these methods, Ebbinghaus documented the influence of various conditions on learning and memory, including the passage of time on forgetting. The famous Ebbinghaus *forgetting curve* (see figure 1.10) shows that forgetting occurs rapidly in the first few hours after learning and then proceeds more slowly.

Ebbinghaus limited himself to gathering facts about memory through systematic, careful observation and did not offer any theory about how memory works. He did not found a school of psychology, had no disciples and worked alone. And yet he had a profound impact on psychology (see chapter 11). His painstaking work, reported in his brilliant book *On Memory* (1885), stood

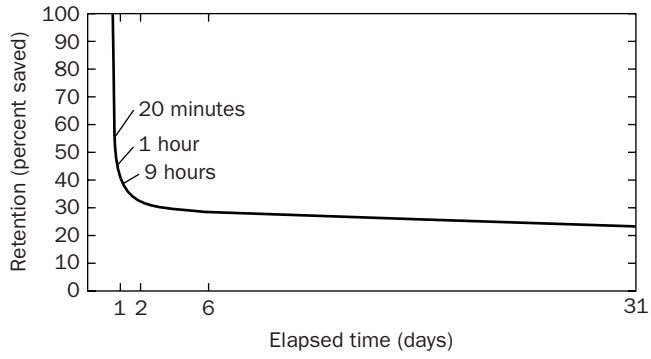

Figure 1.10

Ebbinghaus's 'forgetting curve'. This figure shows retention of nonsense syllables measured by saving in relearning (the percentage decrease in the number of trials required to relearn the list). For example, 50 per cent saving means that half as many trials are needed to relearn the list as it took to learn it initially. Retention clearly decreases as the retention interval (the time between initial learning and the retention time) increases, but the rate of forgetting slows down. Source: Based on Ebbinghaus (1885; 1913 translation).

the test of time as his findings were later replicated by others and many remain valid today. According to Roediger (1999), Ebbinghaus solved three important problems faced by psychologists in their work:

1. converting unobservable mental processes into observable behaviour;
2. measuring the behaviour reliably; and
3. showing how relevant variables affect the behaviour.

In doing so, he started a whole new field of study that remains vital today and set the stage for later study of many aspects of cognition.

Individual differences: Francis Galton

In addition to his remarkable work on memory, Ebbinghaus was the first to publish on intelligence testing in children. He developed a test, still included in test batteries today, which anticipated *psychometrics*, the theory and measurement of psychological variables. It was not until 1905, however, that Alfred Binet (1857–1911), along with fellow French researcher Théodore Simon, produced the first successful test of general intelligence.

psychometrics the theory and measurement of psychological variables such as IQ (intelligence quotient)

These efforts all rested on the earlier work of the Englishman Sir Francis Galton (1822–1910), who initiated the whole idea of 'mental tests'. He assumed that intelligence could be measured in terms of sensory abilities, reasoning that the more the senses perceive differences – for example, the ease with which weights can be discriminated – the larger the field upon which our judgement and intelligence are able to act (Galton, 1928).

Galton was also interested in the inheritance of mental abilities. Inspired by the work of his cousin, Charles Darwin, he did much to introduce the spirit of evolution to psychology.

Pioneer

Francis Galton (1822–1910) was instrumental in developing psychometrics – the theory and measurement of psychological variables. He reasoned that the more the senses perceive differences (for example, the ease with which weights can be discriminated), the larger the field upon which our judgement and intelligence are able to act. Inspired by the work of his cousin, Charles Darwin, Galton introduced the spirit of evolution to psychology. His first influential work, *Hereditary Genius* (1869), applies statistical ideas to the problem of heredity, documenting the genealogy of 997 eminent men. Galton's interest in documenting human differences led him to develop statistical methods, perhaps the most famous being 'co-relation' – or correlation – between two variables.

His first influential work was *Hereditary Genius* (1869), which applies statistical ideas to the problem of heredity and documents the genealogy of 997 eminent men. Galton calculated that the chance (statistically) of members of this group having an eminent relative was less than 1 per cent. What he found was that 33 per cent had eminent relatives. His conclusion that genius is inherited would not be justified by today's research standards. These would require his findings to be compared to those for a group of non-eminent men, and would require closer examination of an alternative hypothesis – namely, that relatives might share similar environments and not just genes.

Galton's interest in documenting human differences led him to develop statistical methods, perhaps the most famous of which is the correlation or 'co-relation' (Galton's term) between two variables. (See chapter 2 for a more detailed description of correlation.) Indeed, Galton's pioneering work gave rise to a number of statistical tools that psychologists still use today.

Two further, and better known, developments took place outside the mainstream of psychology – Sigmund Freud's psychoanalysis and Jean Piaget's genetic epistemology. Neither had an immediate impact on the subject, but over the course of time their influence was profound.

Psychoanalysis: Sigmund Freud

Sigmund Freud (1856–1939), a Viennese physician, formulated a revolutionary theory of human behaviour. Although familiar with the experimental psychology movement, Freud's data was not obtained from controlled experiments but by listening to patients who were not suffering from any familiar disease. He applied his own idiosyncratic interpretation of data to formulate theories. By the mid 1890s, he had become convinced that traumatic sexual experiences in childhood were responsible for many of his patients' symptoms. These painful memories were pushed out of consciousness ('repressed') and the task of Freud's 'talking cure' – *psychoanalysis* – was to bring such memories into conscious awareness.

psychoanalysis Freud's 'talking cure', which aimed to bring pathological memories into conscious awareness and was used by Freud as the foundation for developing a theory of personality

Over the course of his career, Freud used psychoanalysis as the foundation for developing a theory of personality that included a number of mental structures – the id, ego and superego. These structures were fundamentally different from those investigated by Wundt. The id, together with portions of the ego and superego, were considered to be unconscious and therefore could not be analysed by introspection, and, unlike Wundt, Freud was also interested in the function of these structures. His theory is described in more detail in chapter 14.

There were no points of contact between psychology and psychoanalysis. Each had a different approach, and psychologists were particularly critical of Freud's methods, including the conditions under which he collected his data, the unstated process by which he moved from data to conclusions, vagueness of terms, and the difficulty of deriving empirically testable hypotheses.

Figure 1.11

Sigmund Freud ignored his critics and developed his own idiosyncratic theories of human behaviour.

Figure 1.12

Jean Piaget's integration of logic and observation offered new insights into developmental psychology.

Freud, for his part, simply stated that his work was 'based on an incalculable number of observations, and only someone who has repeated those observations on himself and on others is in a position to arrive at a judgment of his own upon it' (1938, p. 144). But because no one knew how Freud reached his judgements, they could not be repeated. Eventually even his own disciples grew frustrated and split from him.

Subsequent attempts to describe the dynamics of the mind that build on psychoanalytic thinking are generally referred to as psychodynamic theories. Although psychoanalysis never became a 'school' in psychology (its home always was and remains in free-standing psychoanalytic institutes outside academia), many of his concepts came to have a profound influence on psychology, and on twentieth century civilization in general.

Genetic epistemology: Jean Piaget

How do we come to know something? This is the question addressed by the branch of philosophy concerned with the study of knowledge – epistemology. Instead of using only logical arguments to address this question, a Swiss biologist, Jean Piaget (1896–1980), studied developmental changes in knowing and the nature of knowledge (see chapters 9 and 10).

genetic epistemology the study of the origin of knowledge in child development, as practised by Jean Piaget

Piaget did not identify himself as a psychologist, instead labelling his work as *genetic epistemology*, the study of the origin of knowledge in child development. Drawing on his work with fresh water molluscs, his greatest insight was simply that knowledge is a relationship between the knower and the known. The knower always provides a framework for the acquisition of knowledge, which simultaneously influences (assimilates) and is influenced by (accommodates) what is known. As the knower changes, so does what is known.

Piaget argued that a child understands an object by acting on it either physically or mentally and thereby constructs knowledge. Infants develop cognitive structures or schemes, which are organized patterns of actions that reflect a particular way of interacting with the environment. Cognitive structures of older children, from about seven years on, reflect abstract mental operations. These operations, or internalized actions that are organized structures, allow older children to realize that

Research close-up 2

Conservation of liquid

The research issue

Central to Piaget's theory is the concept of mental operation. We can most easily see a mental operation at work in his famous conservation task.

Conservation gives stability to the physical world, and is achieved in relation to a number of physical properties such as number, length weight, area, and so on.

Design and procedure

A child is shown two glasses of the same physical dimensions with equal amounts of juice in them and asked, 'Which one has more?' The child correctly states, 'They both have the same.' Then, in front of the child the juice from one glass is poured into taller, narrower glass and the empty glass is taken away. The child is then asked again, 'Which glass has more?' What do you think a child before about seven years of age would say?

Results and implications

Young children will often choose the taller, narrow glass and say that it has more in it because the water level is higher. They do not recognize that the amount of juice has been 'conserved', or held constant (the child has not yet developed the concept of conservation). This is apparently because the child focuses on the 'before' and 'after' states, and ignores the process of changing from the first state to the second.

The young child at this developmental stage lacks the ability to perform such mental operations as:

Reversibility – he cannot mentally reverse the series of events to return the poured liquid to its original glass.
Compensation, or decentring – he is unable to use both height and width to determine quantity, but instead he centres his thinking on a single dimension of the container.

When a child is able to exercise mental operations in relation to concrete objects, this will be reflected in the explanation he gives for his answer to the question, 'which glass has more?'

'If you pour it back where it was, they will have the same amount' (reversibility).
'The water goes up higher but the glass is thinner' (compensation).

Ginsburg, H.P., & Opper, S., 1988, *Piaget's Theory of Intellectual Development*, 3rd edn, London: Prentice Hall.

quantities remain constant (are conserved) despite changes in appearance.

Unlike behaviourists, Piaget ignored the issue of learning, which he long dismissed as 'the American question', and his theory of intelligence had little impact outside of Europe until John Flavell (1963) introduced Piaget's work to the English-speaking world. Faced with the difficulty of Piaget's writings and the scope of his work – which covered not only intelligence but also perception, language, play and such psychological processes as memory – it was all too easy for psychologists to focus only on aspects of the theory. Piaget considered this fragmentation the most common abuse of his work. And yet, even though much of his work was based on observation of his own children and has been criticized for relying too heavily on children's verbal abilities to explain their understanding, it had a profound impact on developmental psychology.

The most persistent and successful challenge to Piaget's findings came from work inspired by a new approach to understanding cognitive processes.

The cognitive revolution

It has been said that psychology 'lost its mind' with the advent of Watsonian behaviourism. It could equally be said that several factors led psychology to 'regain its mind', including the realization that:

1. the strict methodological controls that were part and parcel of behaviourism had resulted in the elimination of those concepts that related most closely to people's everyday experience (e.g. their experience of consciousness);
2. the stimulus–response approach was inadequate for explaining many psychological phenomena (e.g. how language develops); and
3. behaviourism had thereby deprived psychology of some of its most interesting problems (e.g. how people ascribe meaning to events and how this meaning influences subsequent behaviour).

The 'cognitive revolution', which pushed behaviourism from its dominant position in psychology, cannot be traced to a founding figure or the publication of a particular paper. But many agree that Ulrich Neisser's book *Cognitive Psychology* (1967) and Donald Broadbent's work at the Applied Psychology Research Unit in Cambridge were important influences.

Broadbent, in his work on human skills and performance ('human factors'), noted that humans are guided by information, or 'feedback', provided by machines (e.g. instruments in an aircraft cockpit), and that often the individual will not make use of all the information in operating the machine (flying the aircraft). The problem for the person operating the machine is the allocation of attention to direct the processing of available information.

So, continuing our aircraft example, on different occasions it will be more relevant for the pilot to focus attention on the altimeter or the speed indicator, or to distribute her attention more widely across multiple sources of information. For example, both the altimeter and the speed dial may provide critical information during landing.

human information-processing approach derived from ideas in information theory, a branch of communications sciences that provides an abstract way of analysing the processing of knowledge

Integrating this work with ideas from information theory – a branch of communications sciences that provides an abstract way of analysing the processing of knowledge – Broadbent did much to develop the *human information-processing approach*, which came to inform research in virtually all areas of modern psychology.

Contemporaneous with Broadbent's work was the emergence of the computer as a research tool. Computers gripped the imagination of psychologists, soon becoming a metaphor for mental functioning. They showed that complex actions can be broken down into a series of binary, yes-or-no decisions. In principle, this meant that, with a system of feedback, a computer could duplicate the behaviour of a human, no matter how complex that behaviour. These ideas quickly led to new models of behaviour that incorporated such mentalistic concepts as plans and goals.

The information-processing approach is often described as an abstract analysis. This means that it does not focus on the operation of the physical components of the processing system – whether they be brain cells or digital switches. Both the brain and the computer consist of millions of components, yet the behaviour of computers can be understood by studying the programs that run them. In the same way, a good account of human behaviour is considered possible by using terms abstract enough to transcend the operation of the brain's approximately 100 billion nerve cells.

From the human information-processing perspective, information delivered to the senses is translated into a cognitive code. In other words, specific aspects of the environment are detected and their organization begins. These are then delivered to working memory, a kind of workbench for cognitive codes where goals are established and a central processor comes into play. Two types of processing can occur: automatic processing, which is effortless and unconscious, and controlled processing, which is effortful and conscious.

connectionist approach also known as a 'neural network' approach, it is informed by a view of how the nervous system might compute different mental operations

More recently, the computer metaphor has been challenged by the 'brain metaphor', which gave rise to the *connectionist approach* – also known as a 'neural network' approach, meaning that it is informed by a view of how the nervous system might compute things.

Although largely interested in idealized nervous systems, connectionists do take pains to show that the human nervous system could process material in ways that are similar to their idealized systems. These systems conduct processing in parallel, not in the serial manner assumed in the information-processing approach. Connectionists also reject the idea of a central control unit – the notion of 'boss' neurons directing other neurons' activities is foreign to connectionism – and argue that mental processes cannot be broken down into components. Instead, the neural and cognitive systems function as a whole.

It is important to note that, while the cognitive revolution did not embrace biological explanations of behaviour, neither did it actively banish biology from psychology – unlike its behavioral predecessor. Startling new advances in the study of the nervous system have been made possible by technology, and neurobiologists (biologists who study the nervous system) can now study the brain in ways that were unimaginable just a couple of decades ago (see chapter 3). Imaging techniques allow us to see the brain at work as it engages in various activities. It is also possible to measure brain activity in a very fine-grained manner, focusing on areas that might be as small as a few cubic millimeters.

So far, these techniques have been applied to basic psychological processes such as reading, listening, remembering and experiencing emotion, and more recently to the study of social cognition (the processes involved in perceiving, interpreting, and acting on social information, see Phelps et al., 2000). But we are still not in a position to observe the brain as it operates in naturally occurring 'real life' situations.

FINAL THOUGHTS

The combination of cognitive psychology and neuroscience – cognitive neuroscience – brings us to the present day. It is not yet clear just how far this cutting-edge endeavour will advance our understanding of human behaviour, but it is one that holds much promise, especially with regard to psychological conditions and disorders (such as dyslexia or Alzheimer's disease) in which a thorough understanding of both cognitive and neurological perspectives may provide substantial 'added value'.

Other developments involve the further use of computers and information technology in psychology. For example, as psychologists now embrace computer-generated virtual reality, it is possible that they will unlock hidden aspects of perception using such previously unavailable technological advances.

Looking further into the future, if humans are successful in colonizing other planets and solar systems, it is possible that novel psychological phenomena will need to be studied and understood. Indeed, with the continuing evolution of new research techniques and methods, and the emergence of new psychological horizons, the psychology of the future may be virtually unrecognizable to today's generation of psychologists.

Summary

- We have seen in this chapter that psychology differs from 'common sense' but that we can sometimes be influenced by a psychological phenomenon known as the hindsight bias to believe that they are one and the same.
- We have also considered the emergence of psychology as a distinct discipline around 150 years ago, from its roots in physiology, physics and philosophy. These separate roots of modern day psychology can be discerned within the different schools of thought in psychology that we have considered in this chapter.
- Most centrally, psychology is the science of mental life and behaviour, but separate schools of thought place differing degrees of emphasis on understanding different facets of psychology.
- Most academic departments in the English-speaking world (such as that within which you as a student will be based) focus on the teaching of experimental psychology, in which scientific evidence about the structure and function of the mind and behaviour accumulates through the design, execution and evaluation of empirical investigations.
- In the history of psychology many different metaphors have been used for reflecting upon the workings of the human mind. Since the Second World War the most influential of these metaphors has been another complex information processing device: the computer. The value of this metaphor has been complemented in recent years through the use of experimental techniques that have enabled us to visualize activity in the human brain (i.e. the hardware within which the human mind is implemented and through which behaviour is regulated).

REVISION QUESTIONS

1. What is psychology, and how does it differ from 'common sense'?
2. Provide three examples of how psychological knowledge can be usefully applied in different professions/walks of life.
3. What were the key issues in the emergence of psychology as a distinct discipline around 150 years ago, from its roots in physiology, physics and philosophy?
4. Considering psychology as the science of mental life and behaviour, what are the fundamental differences between different schools of thought in psychology, and the methods that they employ?
5. What are the fundamental tenets of behaviourism? When thinking about your answer, reflect on how a behaviourist might account for the subjective phenomena of dreaming.
6. How would a) a psychoanalyst and b) your grandmother address the same question?
7. How would a structuralist consider the experience of eating an ice cream?
8. How would you design a study to determine whether there is a heritable factor underlying intelligence? How would you measure intelligence?
9. Is studying the brain relevant to our understanding of mental life and behaviour? How do you think a) an information processing theorist and b) a connectionist might address this question?
10. Can you think of any profession or walk of life in which the advice of a psychologist would *not* improve at least one aspect of that activity?

Further Reading

Evans, R.I. (1976). *The Making of Psychology*. New York: Alfred A. Knopf.
Consists of 28 engaging interviews with leading psychologists representing a variety of areas in psychology. Highly recommended for students interested in gaining insights into the person as well as their work in psychology.

Furnham, A. (1996). *All in the Mind*. London: Whurr Publications.
A good introduction to a number of controversies in psychology.

Schultz, D.P., & Schultz, S.E. (2000). *A History of Modern Psychology*. 7th edn. Fort Worth, TX: Harcourt Brace.
Excellent coverage of the emergence of psychology and its various schools of thinking.

Solso, R.L., & Masssaro, D.W. (1995). *The Science of the Mind: 2001 and Beyond*. Oxford: Oxford University Press.
Leading figures in their fields 'address an age-old question: Where have we been, where are we, and where are we going?' An engaging series of essays that provide both a retrospective on psychology as it entered the new millennium and predictions about its future.

Answers to questions on p. 6

1. False. Prior to psychological research on the topic there was a longstanding belief that happily married couples are characterized by a *quid pro quo* principle by which they exchange positive behaviour. But research shows that while dissatisfied spouses reciprocate one another's (negative) behaviour, happily married spouses tend to follow a 'bank account' model: positive behaviour is not reciprocated in the short term but adds to a balance of goodwill from which a spouse can draw in the longer term (Fincham & Beach, 1999).
2. 50–60 per cent. This amazing percentage is discussed further in this chapter.
3. True. This is the basis for several branches of psychology.
4. True none of the time. Schizophrenia (from the Greek *schizo*, meaning 'split', and *phrene*, meaning 'mind') does not refer to a split personality but simply designates the main attribute of the disorder – a disintegration of mental functioning. A key sign of schizophrenia is pervasive thought disturbance, and another pervasive feature is withdrawal from other people. Chapter 15 discusses this disorder in great detail.
5. Both humans and birds. The principles of learning that govern human behaviour were first discovered in studies of animals, as we discover later in this chapter. Greater detail about learning can be found in chapter 4.
6. True. Willingness to intervene in emergencies is higher when a bystander is alone than when they are surrounded by several others. This is the bystander effect. The sense of responsibility for helping decreases as the number of bystanders increases (Latané, 1981). Social psychologists who study helping behaviour have also found that the presence of bystanders can lead a potential helper to feel apprehension that their attempt to help might be viewed negatively rather than with approval (see chapter 18).
7. False. The highest and most persistent rate of desired behaviour is produced by rewarding the behaviour on a variable basis. See 'Radical behaviourism' in this chapter, and chapter 4 for more details.

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Methodology 2

CHAPTER OUTLINE

Learning Objectives

By the end of this chapter you should appreciate that:

- scientific psychologists follow strict methods when they conduct research;
- there is a significant difference between reliability and validity;
- there are different types of psychological data (e.g. behavioural, self-report and physiological);
- statistics are vital to psychological research;
- experiments help us to tackle the question of causation;
- there is an important difference between causation and correlation;
- ethical research practice is essential.

INTRODUCTION

'Psychology is the scientific study of behaviour.' 'Psychology is the science of the mind.' 'Psychology is an approach to understanding behaviour that uses scientific methods.' If you study psychology long enough you are likely to hear statements like these.

Why are words like 'science' and 'method' so important to psychologists? Why do they continually talk about ways of doing things, rather than just doing them? Surely anyone can be a psychologist just by being interested in the mind or in behaviour?

The answers to these questions are actually pretty simple. Whether they admit it or not, *everybody* is interested in the mind and behaviour. And just about everybody believes that he or she is an expert when it comes to understanding their own mental life and thoughts. This is understandable. After all, even if all the experts who have contributed to this book were watching you read this chapter, for all their expertise, they would not know as well as you do what is going through your mind.

But being interested in the mind or claiming that you are an expert is not enough to make you a psychologist. What is more, there are lots of other experts, such as philosophers and anthropologists, who are interested in the study of mind and behaviour. What sets psychologists apart from these other experts is their training in *psychological methods*. Many of these methods also appear in other scientific disciplines, partly because psychological methods are derived from general scientific methods. Not all psychologists agree entirely with all the methods, but they all understand them and know how to use the ones relevant to their own work. It is this common training that, more than anything else, makes us psychologists.

Of course, psychologists have methods for doing many different things. The methods we discuss in this chapter are those used for doing research. In other words, they are methods for finding out the answers to questions about the mind and behaviour.

You know from your own experience that different people often come up with different answers

to the same question. What is the tallest mountain in the world? You might say Mount Everest, but your answer is only correct if you measure the height from sea level, as we generally do. If you measure from the centre of the Earth, then some mountains in South America are actually taller (because the Earth is not quite round). So the answer to the question depends on how you interpret it. This does not necessarily mean there is no such thing as truth or that everything is arbitrary, but simply that the methods used to reach a conclusion need to be understood fully.

It can be much harder to answer interesting psychological questions than to measure the height of a mountain. There are plenty of psychological questions that have been asked many times and have not been definitively answered. For this reason, it is all the more important that we understand the ways that different psychologists try to answer the questions they are interested in. Then, if we find an unusual answer, we can decide whether it is in some sense worth taking seriously if we first understand the methods that have been used to reach it.

In the nineteenth century, before the science of psychology was established, a lot of people interested in the mind and behaviour studied phrenology. Phrenologists believed that behaviour could be understood by studying the bumps on people's heads. A particular bump in a particular place was supposed to be associated with particular types of behaviour. We now know that this is nonsense.

Nonsense or not, if the last hundred or so years of research in experimental psychology had not taken place, we would have no systematic way of knowing that this is nonsense (see chapter 14). To this day people put forward bad, sometimes harmful, ideas related to important tasks such as treating psychological disorders, assessing employees' ability to do a job, or teaching children to read. Psychological methods allow us to assess these ideas. This means that we can move beyond just arguing about whether an idea is good, and evaluate the evidence with reference to some shared and pre-determined criteria.

This is a vast topic. Even if every page of this massive text were devoted to research methods and statistics, most psychologists would agree that there was still more material that you needed to absorb to become an expert.

The aim of this chapter is to provide some signposts that will help to guide you. It will not enable you to deal with every statistical and methodological question that you might face, but you will learn how to develop and set about answering your own questions.

SOME FUNDAMENTALS

Research methods and statistics

We study research methods and statistics in order to benefit from the science of psychology – to qualify as a psychologist, to use psychological knowledge in other fields, or simply to apply psychology to issues that crop up in everyday life.

Imagine that your employer requires you to sit an intelligence test before you can be considered for higher duties in your organization. You sit the test and are told that your IQ score is 110. What does this mean? Your immediate future may depend on this number, but you can only understand it if you know something about intelligence testing (see chapter 13) and standard scores.

Similarly, newspapers and other sources are full of reports relating to research on psychological issues. Many draw alarming conclusions – often because they mistakenly assume that correlation is the same as causation (see below). A good knowledge of psychological research methods allows you to avoid making the mistakes that journalists, politicians and many others make because they lack the necessary scientific understanding.

Another consideration is that, in most countries, in order to become a psychologist you need to be not just an informed consumer of psychological research but also a *producer* of it. In other words, you need to conduct a piece (or several pieces) of research. Imagine you were employed by a school to determine whether its students are more or less intelligent than students at another school, or in an average school. You would not be able to answer this question properly without conducting a well-planned piece of psychological research.

Even if you do not go on to further study, the ability to conduct, analyse and evaluate psychological research is a very marketable skill that is central to a large number of occupations, such as marketing, management or policy making.

Finally, the intellectual challenges explored in this chapter can be stimulating and interesting in themselves. They are not inconsiderable, but if you can master them you will be better equipped to understand psychology as a whole. This is not because

studying methodology and statistics is an end itself (though it can be), but because it is a tool that allows you to get more (personally, intellectually and scientifically) from doing psychology.

Carrying out quality research

Psychological research enables us to find out more about human behaviour and the mental processes that underpin it. We also need to be sure that our answers are correct.

Suppose we are interested in whether 'absence makes the heart grow fonder'. Is it enough simply to look around, make informal observations and come to a conclusion we feel comfortable with? In one sense it is, and, as naturally inquisitive people, we do this sort of thing all the time as a means of forming our own opinions. But this approach inevitably leads different people to different conclusions – because we each focus on different information and have different experiences, different agendas. So some people think absence makes the heart grow fonder while others think the very opposite, that 'absence leads the heart to wander'.

scientific method a procedure for acquiring and evaluating knowledge through systematic observation or experimentation

To know which is correct, when each is correct and, more importantly, why, we need to act as scientists, not lay-scientists. Using the *scientific method* differentiates psychology from other disciplines that address similar questions. The scientific method is a set of procedures for acquiring and testing knowledge through systematic observation or experimentation.

Reliability and validity

reliability the extent to which a given finding will be consistently reproduced on other occasions

validity the extent to which a given study investigates what it purports to investigate

The most prized qualities of psychological research are *reliability* and *validity*. Put simply, reliability relates to our confidence that a given finding can be replicated – and is not just a 'freak' or chance occurrence. Reliability in psychological research has much the same meaning in relation to a car. A reliable car is one that nearly always works. A reliable finding can nearly always be reproduced.

Validity relates to our confidence that a given finding shows what we believe it to show. A valid car is a genuine car (a car that does what it is meant to do). A valid finding is a genuine finding (a finding that is what it purports to be – i.e. one that enhances your understanding in the manner indicated).

Imagine we carry out a study in which we send someone to an exotic overseas location on a number of occasions to see whether this makes them think more favourably of their partner. Let us assume that it does. If it does so repeatedly, then it is a reliable finding. However, the study does not necessarily show that absence makes the heart grow fonder, but may instead demonstrate that exotic holidays make people feel better about their lives in a general way – including about their partners. The finding is therefore almost certainly not valid in a specific sense.

Disputed validity is one of the most common and thorny problems in psychological research. Disputes arise when findings which purport to show one thing are *reinterpreted* to suggest that they actually show something completely different. The fact that the validity of research is often questioned is no bad thing. Indeed, this form of analysis and debate is central to psychological research and to one's skill as a researcher.

Other qualities of good research

As well as being valid and reliable, psychological research needs to be public, cumulative and parsimonious.

To become public, research must be published in a reputable scholarly journal. Sometimes, though rarely, it is translated into popular writing, as was the work of Freud, Pavlov, Piaget and Milgram. The likelihood of a piece of psychological research being adopted for popular publication can depend on such things as topicality, shock value or political trends, and its impact may be transitory. In contrast, the criteria for publication in scientific journals are much more clearly laid out, and they provide an enduring record of the key findings that emerge from a particular piece (or programme) of research.

Cumulative research builds on and extends existing knowledge and theory. It is not enough just to collect information in a haphazard or random fashion. Instead, research should build on previous insights in a given area. Newton expressed this idea clearly when he observed: 'if I have been able to see further than others it is because I have stood on the shoulders of giants'. Generally speaking, a piece of psychological research does not have value in isolation, but by virtue of extending or challenging other work in the field.

The cumulative nature of research is often revealed through literature reviews. These are research papers (normally published in reputable scientific journals) that discuss the results of multiple studies by different researchers. In some cases these reviews involve statistical analyses combining the results of many studies. This process is called *meta-analysis*.

meta-analysis a quantitative method for combining results across a number of studies by first converting the findings of each study into a metric for comparison

Parsimonious research develops explanations of findings that are as simple, economical and efficient as possible. In explaining the results in a given field, psychologists therefore attempt to account for as many different findings as possible using the smallest number of principles. For example, it may be that person A performs better than person B on a test of memory because A was more alert as a consequence of being tested at a different time of day. Or A might have ingested a psychoactive agent before testing took place, whereas B had not. By controlling for the possible influences of time of day, ingested substances and so on, we are left with the most parsimonious explanation for why A and B differ in their level of memory performance.

The role of theory in psychology

Science does not progress simply through the accumulation of independent facts. These facts have to be integrated in terms of theoretical explanations (*theories*). Theories are statements of why, not just what. They are capable of:

1. accounting for multiple facts, and
2. predicting what might happen in novel situations.

theory a coherent framework used to make sense of, and integrate, a number of empirical findings

The purpose of most psychological research is to test such predictions in the form of *hypotheses* – i.e. statements of cause and effect that are derived from a given *theory* and tested by research. So theories generally precede experimentation, not vice versa.

For example, the statement that absence makes the heart grow fonder does not provide a theoretical framework, but the following statement is distinctly more theory-based: 'separation from an object causes us to exaggerate an object's qualities (whether good or bad) because memory distorts reality'. This is because this statement attempts to explain and not just describe the relationship between separation and emotion. Moreover, having made this statement, we can test it by generating hypotheses and doing appropriate research. One *hypothesis* might be that people with memory disorders will make less extreme judgements of absent loved ones than people without such disorders.

hypothesis a statement about the causal relationship between particular phenomena (i.e. A causes B), usually derived from a particular theoretical framework, which is designed to be tested via research investigation

Designing experiments in psychology

What can we measure?

Something that differentiates psychology from other sciences is that the things in which we are interested – mental states and processes – can never be directly observed or measured. You cannot touch or see a mood, a thought, a disposition, a memory or an attitude. You can only observe things that are associated with these phenomena.

While this problem does occur in other sciences (such as astronomy), it can often be overcome through technological development (e.g. a better telescope). Psychology has made significant advances too (e.g. measuring skin conductance and brain blood flow), but these techniques still only allow psychologists to study the outcomes of mental activity, or things that are associated with it – never the activity itself.

Psychologists have developed three main types of measure to help them examine mental processes and states:

1 Behavioural measures These involve observation of particular forms of behaviour in order to make inferences about the psychological phenomena that caused or contributed to them. For example, developmental psychologists (see chapter 9) might observe which toys are approached or avoided by children in a play situation. On the basis of such observations, they might plausibly infer that decisions to approach a toy are determined by the toy's colourfulness.

2 Self-report measures These involve asking people about their thoughts, feelings or reaction to a particular question. Provided that it is possible for the participants to reflect consciously on the relevant thoughts or behaviours, their responses can be used either to supplement other behavioural measures or as data in themselves. So a researcher could ask a six-year-old (but clearly not a six-month-old) 'Which toys do you like?' or 'Did you pick that toy because it was brightly coloured?'

3 Physiological measures These involve measuring things that are believed to be associated with particular forms of mental activity. For example, heart rate or galvanic skin response (GSR – a measure of the electrical conductivity of the skin) can serve as measures of anxiety or arousal. In our developmental example, researchers might look at children's heart rate to see whether they become more excited when particular toys are presented or taken away.

Decisions about which of the above measures to use will be dictated by a number of factors. Many of these are practical and will be linked to other methodological choices. For example, self-report measures are relatively cheap and easy to administer, and so lend themselves to survey-based research examining large numbers of people in naturalistic settings. On the other hand, physiological measures can be difficult and expensive to obtain, so they are normally used only in experimental research with very few participants. However, decisions about which measures to use are guided as much by the particular question a researcher wants to address as by practical considerations.

experimental method a research method in which one or more independent variables are systematically manipulated and all other potentially influential variables are controlled (i.e. kept constant), in order to assess the impact of manipulated (independent) variables on relevant outcome (dependent) variables

quasi-experimental method embodies the same features as the experimental method but does not involve the random assignment of participants to experimental conditions

A rundown on research methods

Psychological research involves four main methods: the (true) *experimental method*, the *quasi-experimental method*, the *survey method* (sometimes

survey method the systematic collection of information about different variables in order to investigate the relationship between them

case study method research method that involves a single participant or small group of participants who are typically studied quite intensively

called the correlational method), and the *case study method*.

The experimental method

manipulation the process of systematically varying an independent variable across different experimental conditions (sometimes referred to as the experimental treatment or intervention)

experimental control the method of ensuring that the groups being studied are the same except for the manipulation or treatment under investigation

One very common research method is to manipulate one or more variables and to examine the effect of this *manipulation* on an outcome variable. To do this, the researcher examines participants' responses in the presence and the absence of the manipulation. *Experimental control* is used to make the different situations identical in every respect except for the presence or absence of the manipulation. Experiments can involve different people in each situation or the same people in different situations. People who take part in experiments are called participants, but if you read older research papers they are generally referred to as subjects.

Here is an example. To test the effect of a new training method (a manipulation) on memory, we might take 100 people and expose half of them to the new method. For reasons we will discuss in more detail below, we would assign participants to the two groups on a random basis (e.g. by the toss of a coin). We will call the first group the *experimental group*, as it is subjected to a relevant experimental *treatment*. The other half of our participants would not be exposed to the new training method. As they receive no experimental treatment, they are referred to as a *control group* (also discussed in more detail below). After administering the treatment, we would measure the performance of the two groups on a memory task and then compare the results.

experimental group participants in an experiment who are exposed to a particular level of a relevant manipulation or treatment (as distinct from a control group)

treatment the experimental manipulation of the independent variable

control group participants in an experiment who are not subjected to the treatment of interest (as distinct from the experimental group)

condition a situation in a research study in which participants are all treated the same way

between-subjects design a research study involving a systematic manipulation of an independent variable with different participants being exposed to different levels of that variable

The various levels of treatment in an experiment (including the control) are referred to as *conditions*. This experiment has two conditions and a *between-subjects design* (because the design involves making comparisons between different participants in different conditions). Note, however, that the same question could also have been addressed in a *within-subjects design*, which would involve comparing the memory performance of the same people with and without the new training method. The two basic designs have different strengths and weaknesses, which we will discuss below in relation to issues of experimental control.

within-subjects design a research design in which the same participants are exposed to different levels of the independent variable

The different conditions in the experiment make up the *independent variable* (or IV), sometimes called the treatment variable. A variable is simply something that changes or varies (is not constant). In true experiments, the independent variable is systematically manipulated or varied by the experimenter. Experiments can (and typically do) have more than one independent variable.

independent variable the treatment variable manipulated in an experiment, or the causal variable believed to be responsible for particular effects or outcomes

Experiments also involve at least one *dependent variable* (or DV). This is an outcome or measurement variable, and it is this variable that the experimenters are interested in observing and which provides them with data. In our last example, the dependent variable is the level of memory performance. Use the initial letter 'd' to remember the link between the dependent variable and the data it provides.

dependent variable the variable in which a researcher is interested in monitoring effects or outcomes

Control is the basis of experimental design. It involves making different conditions identical in every respect except the treatment (i.e. the independent variable).

In a between-subjects experiment, this is achieved by a process of *random assignment* of participants to the different conditions. For example, people should be assigned at random (e.g. on the basis of coin tossing), rather than putting, say, the first 50 people in one condition and the second 50 in another. This practice rules out the possibility that there are systematic differences in, say, intelligence, personality or age between the groups.

random assignment the process of assigning participants to study conditions on a strictly unsystematic basis

If there is a difference in results obtained from measuring the dependent variable for each group, and we have equated the groups in every respect by means of random assignment, we can infer that the difference must be due to our manipulation of the independent variable.

The quasi-experimental method

In quasi-experimental studies the independent variable is not (or cannot be) manipulated as such, and so assignment to experimental groups cannot be random. The fact that no manipulation

Pioneer

Donald Thomas Campbell (1916–96) trained as a social psychologist. He was a master methodologist and is best known for devising the method of quasi-experimentation, a statistics-based approach that allows replication of the effects of true randomization, which is often impossible in the study of human behaviour. Campbell also supported use of qualitative methods, according to the goals and context of the study. He promoted the concept of triangulation – that every method has its limitations, and multiple methods are usually needed to tackle important research questions.

occurs interferes dramatically with our ability to make conclusive causal inferences. Examples of independent variables that cannot be manipulated by an experimenter include gender and age. Obviously experimenters cannot change the gender or age of participants, but they can compare the responses of groups of people with different ages or of different genders.

Compared to the experimental method, there is no real control over the independent variable, so we cannot conclude that it is necessarily responsible for any change in the dependent variable. On this basis, as we will see, the quasi-experimental method actually has more in common with survey methodology than with the experimental method. It has all the weaknesses of the experimental method, but it lacks the main strength. In practice, it is often conducted in conjunction with the experimental method. For example, in our learning study we might compare the effect of the new training method on both men and women.

The survey (or correlational) method

The survey method is commonly used to identify the naturally occurring patterning of variables in the 'real world' rather than to explain those patterns (though often people want to put an explanatory gloss on them).

So to examine whether absence makes the heart grow fonder we could conduct a survey to see if people who are separated from their partners because of travelling away from home (group A) say more positive things about their partners than people who never travel away from home without their partners (group B). This might be an interesting exercise, but the validity of any causal statements made on the basis of such findings would be very limited.

For example, if we found from our survey that group A said more positive things about their partners when they were travelling than group B, it would be impossible to demonstrate conclusively that absence was the cause of the difference between groups A and B. In other words, while our survey could show us that absence is associated with a fonder heart, it could not conclusively show that absence actually causes the heart to grow fonder. It is quite possible (odd as it may sound) that the sorts of people who travel away from home without their partners are simply those that like their partners more (so fondness makes the heart go absent). Or perhaps both fondness and absence are caused by something else – for example, social class (i.e. being wealthy makes people both fond and absent).

In large part, then, surveys rely on methodologies that identify relationships between variables but do not allow us to make conclusive causal inferences.

The case study method

Most of the above methods are used for studies involving large numbers of participants. But what if only a few are available? How, for example, would you do research if you were interested in the reading difficulties of people with particular forms of brain damage? To investigate questions like this, researchers often resort to the case study method, which involves intensive analysis of a very small sample. This has particular problems (often with reliability), but some of the most famous studies in psychology have used this method – in particular the work of Freud (see chapter 14).

Taking a qualitative approach

When researchers report and comment on behaviour, without attempting to quantify it, they are using a *qualitative research method*. This involves attempts to understand behaviour by doing more than merely converting evidence into numbers.

Qualitative methods can include coding, grouping and collecting observations without assigning actual numbers to the observation. So a qualitative analysis of the speed of animals might result in the statement that the cheetah is a fast land animal, and a quantitative analysis might involve comparing the maximum speed of animals over (say) 20 metres. To take an example of human behaviour, you probably take a qualitative approach to the friendliness of the people you meet. In other words, you probably judge people as relatively friendly or unfriendly, but you would be unlikely to come up with a number that expresses their friendliness quotient.

Qualitative techniques are sometimes used in the initial stages of quantitative research programmes to complement the quantitative techniques, but they are also used by psychologists who challenge conventional approaches to psychological research. This may be because they believe that the conventional methods are inadequate for addressing the richness and complexity of human behaviour. In turn, many mainstream psychologists are critical of qualitative methods. (For further discussion of qualitative methods, see Haslam & McGarty (2003).)

Experiment versus survey

One common, but mistaken, belief is that the difference between surveys and experiments is a question of location, with surveys being conducted in the community and experiments in the laboratory. This is often the case, but not always. Experiments can be conducted outside laboratories, and surveys can be conducted in them.

The main differences between experiments and surveys relate to the sorts of questions that each can answer. As we suggested earlier, experiments tend to be concerned with establishing causal relationships between variables, and they achieve this by randomly assigning participants to different treatment conditions. Surveys, on the other hand, tend to be concerned with measuring naturally occurring and enduring relationships between variables. Researchers who use surveys usually want to generalize from the sample data they obtain to a wider population. They do this by using the sample to estimate the characteristics of the population they are interested in.

Why choose to carry out a survey rather than an experiment? Two reasons: sometimes we are only interested in observing relationships, and sometimes manipulations simply are not possible. This reasoning is not restricted to psychology. Astronomers or geologists rarely conduct experiments, simply because it is often impossible to manipulate the independent variables of interest (e.g. the position of certain stars or the gravitational force of a planet). Instead they rely largely on the same logic of controlled observation that underpins psychological surveys. But this does not mean that astronomy or geology are unscientific.

Surveys can also allow researchers to eliminate some causal links. If there is no relationship (at least in the survey environment) between variables, this allows us to conclude that one does not cause the other. For example, if no relationship is found between age and intelligence, then it is impossible for intelligence to cause age, or vice versa (bearing in mind that a relationship could be concealed by a third, or background, variable).

Which is the best method to use?

This is a very complex issue and depends on many factors, not least practical ones – including the amount of time, money and expertise that a researcher has. However, as a general principle, it is worth emphasising that no one method is universally superior. Part of any research psychologist's role is to make judgements about the appropriateness of a method for investigating the issues at hand. Being a good researcher is not a question of whether you do experiments or surveys: it is more a matter of when and how you do them.

In view of the potential limitations of any one method, many researchers consider using multiple research methods to explore the same issue in many different ways. This is the process of triangulation. If consistent results are obtained from a variety of different methods (perhaps from a quantitative experiment, a survey and qualitative case studies), this will tend to justify greater confidence in the findings. For this reason, the need to make methodological choices should be seen as an asset for researchers, rather than a basis for arguments about who has the best methods. The challenge researchers face is to exploit that asset appropriately.

Deciding what to manipulate

In selecting an independent variable for any piece of research, we must first decide what we are interested in. For example, we might be interested in whether attributional style (the way people explain events) affects people's responses to failure. We might hypothesize that people who tend to blame themselves for failure (i.e. those who internalize failure) are more likely to become depressed than people who blame their failure on other things (i.e. who externalize failure).

So the central theoretical variable – the focus of our interest – is the participants' attributional style. But, how can we manipulate this for the purposes of our experiment? Clearly we cannot open up people's heads and turn a dial that says 'attributional style' to maximum or minimum.

To get around such obstacles, psychologists usually manipulate the theoretical variable indirectly. They do this by identifying an independent variable that they believe will have a specific impact upon a given mental process, and then check that this is the case.

In our example, the researchers may expose participants to failure (e.g. in a test) and then ask some of them to answer questions like 'Can you explain why you did so much worse than everyone else?' – questions that encourage the participants to reflect on their own contribution to their performance (i.e. to internalize). They may then ask other participants questions like 'Do you think the fact that you were not allowed to revise for the test affected your performance?' – questions that encourage them to reflect on the contribution of other factors to their performance (i.e. to externalize).

To be sure that this manipulation has had the desired effect on the theoretical variable, the researchers may then want to perform a *manipulation check*. For example, in the case given above, the researchers might measure whether the 'internalizing' question produces greater agreement with a measure such as: 'How much do you think you were responsible for the test outcome?'

manipulation check a procedure that checks the manipulation of the independent variable has been successful in changing the causal variable the experimenter wants to manipulate

Note also the significant ethical issues relating to this study. The experimental manipulation could have the effect of making some participants more depressed – indeed, that is the hypothesized outcome in the condition where participants are encouraged to internalize their failure. We discuss ethical issues later in this chapter.

Deciding what to measure

As with the selection of IVs, the selection of dependent variables is often complicated by practical constraints. For example, if we are investigating the impact of alcohol consumption on road fatalities, we may manipulate the independent variable straightforwardly (by getting experimental groups to consume different quantities of alcohol). But it would be irresponsible (and illegal) to then get the participants to drive down a busy street so that we can count how many pedestrians they knock down!

To get round this, we may ask the high alcohol group to consume only a few beverages. But there are two problems with this.

Everyday Psychology

Testing the effectiveness of therapy for depression

'I'm feeling depressed.' Most likely you have heard someone say this. But such statements should not be confused with clinical depression, a disorder that produces greater impairment in everyday functioning than many physical health problems (e.g. hypertension, arthritis, diabetes; see chapter 15). You have approximately a 15 per cent chance of experiencing clinical depression in your lifetime. Should you be unfortunate enough to experience a depressive disorder you would surely want to get treatment for it that is effective. Cognitive behaviour therapy and non-directive counselling are common treatments for people with depressive symptoms (see chapter 16). But are these treatments any more effective than usual general practitioner (GP) care?

You might turn to psychological research for an answer. But how can psychologists evaluate the effectiveness of cognitive behaviour therapy, non-directive counselling and usual GP care in treating depression? An effective test requires the use of an experimental design in which patients are randomly assigned to treatment groups. This is necessary to allow any effects to be attributed to treatment type, rather than any other variable that might lead a participant to choose one treatment over another.

Ward et al. (2000) followed this procedure and allocated patients to one of three treatment groups: two psychological treatments (non-directive counselling and cognitive behaviour therapy) and one control condition (usual GP care). They measured the patients' level of depression before treatment began, at four months and at 12 months following the completion of the treatment.

What did they find? At four months, patients in both the psychological treatment groups (non-directive counselling and cognitive behaviour therapy) had significantly lower depression scores than patients in the control condition (usual GP care). There was no significant difference between the effectiveness of the two psychological treatments.

We can conclude from this experimental test (known as a 'clinical trial' when treatments are being tested; see chapter 16) that the two psychological treatments for depression are effective, at least in the short term. Ideally, however, you would want a treatment that produces lasting results, especially in light of the fact that depression tends to be both chronic and recurrent (see chapter 15). But when Ward et al. examined depressive symptoms at 12 months following treatment there was no significant difference between any of the three groups. In this study, then, the psychological treatments for depression were shown to be effective in the short term but not in the long term. Happily, there are other studies that document the longer-term effectiveness of cognitive behaviour therapy as a treatment for depression (see chapter 16).

Ward, E., King, M., Lloyd, M. et al., 2000, 'Randomised controlled trial of non-directive counselling, cognitive-behaviour therapy, and usual general practitioner care for patients with depression. I: Clinical effectiveness', *British Medical Journal*, 321, 1383–8.

First, alcohol may only affect driving behaviour when more than a few beverages are consumed. Second, our dependent variable (number of pedestrians killed) will not be sufficiently sensitive to detect the independent variable's impact. In other words, we may have good reason to think that alcohol could impair driving performance, but the degree of impairment may not (fortunately!) be so profound as to cause a detectable increase in the number of deaths caused.

To deal with this, we therefore have to select dependent variables that are both relevant to the outcome we have in mind and sensitive to the independent variable. In the case of drink-driving, we may look at participants' reaction time, because we believe that this is a critical determinant in driving safety and is likely to be a sensitive enough variable to detect an impairment in driving performance due to alcohol. We can then design and carry out a study in the laboratory, measuring the impact of alcohol consumption on reaction time.

In our attributional style example, too, it is unlikely that our manipulation of the independent variable will have a dramatic impact on the participants' depression. So if our dependent variable was the number of participants who need to be treated by a clinical psychologist, our experiment is very unlikely to uncover any effects. To get around this problem, we could administer a depression inventory, in which we ask the participants a battery of questions (e.g. 'Are you self-confident?', 'Do you feel hopeless about the future?') in order to measure their susceptibility to depression. We could then test our hypothesis by seeing whether scores on the depression inventory revealed a higher susceptibility to depression among participants who had been encouraged to make internal attributions.

Different ways of measuring

The psychologist S.S. Stevens developed a famous distinction between forms of data that psychologists can deal with. The four types he came up with are nominal, ordinal, interval and ratio measures.

Pioneer

Stanley Smith Stevens (1906–73) made significant contributions to several areas of psychology. He was an expert on the psychophysics of hearing and was interested in measurement and experimental psychology. Stevens set out to redefine psychological measurement by changing the perspective from that of inventing operations (the physical view) to that of classifying scales (a mathematical view). He also discovered that methods such as 'just noticeable differences', rating scale categories and paired comparisons produce only ordinal scales. Stevens' most oustanding contribution was his successful argument that there are different kinds of scales of measurement, being the first to define and discuss nominal, ordinal, interval and ratio scales.

Nominal measures

The data collected in this way are in the form of names, which can be categorized but cannot be compared numerically in any way. Examples include genders, countries and personality types.

Ordinal measures

These can be ranked in some meaningful way. Examples are the placings obtained by competitors in a race or an ordered set of categories (e.g. low stress, moderate stress and high stress).

Interval measures

Numerical measures without a true zero point are called interval measures, and cannot be used to form ratios. An example is temperature. The zero point has been arbitrarily chosen to be the freezing point of water rather than absolute zero (where there is no temperature), and it is simply not true that 40 degrees Celsius is twice as hot as 20 degrees Celsius. Similarly, it would not make sense to say that someone who responded with a '6' on the attribution scale above was twice as much of an externalizer as someone who responded with a '3'.

Ratio measures

Full numerical measures with a true zero point are ratio measures. Psychologists frequently assume that scores obtained from psychological measurement can be treated as ratio measures. But this assumption is not always justified.

Producing trustworthy results

Internal validity

We can be confident about the results of psychological research when the methods are valid. An experiment is said to have *internal validity* when we are confident that the results have occurred for the reasons we have hypothesized, and we can rule out alternative explanations of them.

internal validity the extent to which the effect of an independent (manipulated) variable on a dependent (outcome) variable is interpreted correctly

These alternative explanations (or threats to internal validity) can involve an experimental *confound* – an unintended manipulation of an independent variable. The risk of confounds can be reduced by better experimental design.

confound an unintended or accidental manipulation of an independent variable that threatens the validity of an experiment

Suppose we conduct a study to look at the effect of crowding on psychological distress by putting 50 people in a crowded room and 50 people in an open field. Having found that the people in the room get more distressed, we may want to conclude that crowding causes distress. But the participants' body temperature (generated by having a lot of people in one room) may represent a confound in the study: it may be the heat, not the crowding, that produces the effects on the dependent variable. The experiment could be redesigned to control for the effects of this confound by using air-conditioning to keep the temperature the same in both conditions.

External validity

A study has a high level of *external validity* when there are no reasons to doubt that the effects obtained would occur again outside the research setting. We might, for example, question a study's external validity if participants responded in a particular way because they knew that they were taking part in a psychological experiment. They might inadvertently behave in a way that either confirms or undermines what they believe to be the researcher's hypothesis. In experiments we usually try to deal with this specific potential problem by not telling experimental participants about the hypotheses that we are investigating until after the experiment has finished.

external validity the extent to which a research finding can be generalized to other situations

STATISTICS IN PSYCHOLOGY

Samples and populations – sorting out the jargon

You will often hear psychologists talking about samples and populations in relation to statistical analysis of research. What do they mean by these terms?

A population is a set of people, things or events that we are interested in because we wish to draw some conclusion about them. The population could consist of all people, or all people

with schizophrenia, or all right-handed people, or even just a single person.

A sample is a set selected from the population of interest and used to make an inference about the population as a whole. This kind of inference is called a *generalization*. A sample would normally be a group of people selected from a larger group, but it could also be a sample of behaviour from one person, or even a sample of neurons from a region of the brain (see chapter 3).

generalization related to the concept of external validity, this is the process of making statements about the general population on the basis of research

If we wish to generalize to a population, we need to make sure that the sample is truly representative of the population as a whole. This means that the sample should be similar to the population in terms of relevant characteristics. For example, if we are doing research on the human visual system, then members of our sample group need to have eyesight that is similar to the rest of the human population (as opposed to being, for example, noticeably worse). The easiest and fastest way to achieve this is to draw a *random sample* (of a reasonable size) from the population.

random sample a sample of participants in which each has the same chance of being included, ensured by using random participant selection methods (e.g. drawing lots)

Describing numerical results

Two key properties, referred to as *descriptive statistics*, come into play when we describe a set of data – or the results of our research. These are the *central tendency* (what we usually call the average) and the amount of *dispersion* – or variation.

descriptive statistics numerical statements about the properties of data, such as the mean or standard deviation

central tendency measures of the 'average' (most commonly the mean, median and mode), which tell us what constitutes a typical value

Imagine a choreographer selecting a group of dancers for a performance supporting a lead dancer who has already been cast. The choreographer wants the supporting cast to be pretty much the same height as the lead dancer and also pretty much the same height as each other. So the choreographer is interested in the average height (which would need to be about the same as the lead dancer's height) and the dispersion, or variation, in height (which would need to be close to zero).

dispersion measures of dispersion (most commonly range, standard deviation and variance) describe the distance of separate records or data points from each other

There are a number of ways in which the choreographer – or the psychologist – can measure central tendency (average) and dispersion.

Measures of central tendency

Measures of central tendency give us a typical value for our data. Clearly, 'typical' can mean different things. It could mean:

- the average value;
- the value associated with the most typical person; or
- the most common value.

In fact, all three are used by researchers to describe central tendency, giving us the following measures:

- The *mean* is the average value (response) calculated by summing all the values and dividing the total by the number of values.
- The *median* is the value with an equal number of values above and below it. So, if all values are ranked from 1 to N, the median is the $((N+1)/2)$th value if N is odd. If N is even, the median is the mean of the two middle values.
- The *mode* is the value that occurs most frequently in a given data set.

mean the sum of all the scores divided by the total number of scores

median the middle score of a ranked array – equal to the $((N+1)/2)$th value, where N is the number of scores in the data set

mode the most commonly occurring score in a set of data

Measures of dispersion

We might also want to describe the typical distance of responses from one another – that is, how tightly they are clustered around the central point. This is typically established using one of two measures. The first and probably most obvious is the *range* of responses – the difference between the maximum and minimum values. But in fact the most commonly used measure of dispersion is *standard deviation* (SD). This is equal to the square root of the sum of the squares of all the differences (deviations) between each score and the mean, divided by the number of scores (in fact, the number of scores minus one if we want a population estimate, as we usually do). If this sounds complex, do not be too concerned: scientific calculators allow you to compute standard deviations very easily. The square of the standard deviation is called the *variance*.

standard deviation the square root of the sum of the squares of all the differences (deviations) between each score and the mean, divided by the number of scores (or the number of scores minus 1 for a population estimate)

variance the mean of the sum of squared differences between a set of scores and the mean of that set of scores; the square of the standard deviation

Research close-up 1

A survey on psychiatric disorders

The research issue

Until the mid 1980s, research into the prevalence of psychiatric disorders, such as affective (mood) disorders, relied on institutional records. Lubin et al. (1988) set out to investigate the relationships between affect and demographic and physical health variables in a representative population sample.

Design and procedure

The Revised Multiple Affect Adjective Check List (MAACL-R) was administered to 1,543 adults throughout the United States. This sample was designed to produce an approximation of the adult civilian population at the time. The MAACL-R provided measures of five traits: anxiety, depression, hostility, positive affect (optimistic mood state) and sensation seeking. In addition, participants were interviewed in order to elicit demographic information and subjective impressions of physical health.

Results and implications

The sensation-seeking scale was not found to be internally reliable and so was not used in further analyses. The researchers analysed the data primarily using *t*-tests, analysis of variance and correlation.

Statistical tests showed that females scored significantly higher than males on measures of anxiety, depression and positive affect. Correlational analyses revealed significant relationships between measures of affect and subjective measures of physical health. Positive affect had a highly significant positive correlation with physical health ($r = .30$), while anxiety ($r = -.10$), depression ($r = -.20$) and hostility ($r = -.09$) were all significantly negatively correlated with physical health (though the correlations were relatively small).

Note, however, that this study does not allow us to conclude that feeling healthy causes one to be happier, less anxious, less depressed and less hostile, or that being happy (and not anxious, depressed or hostile) causes one to be physically healthy.

Lubin, B., Zuckerman, M., Breytspraak, L.M., Bull, N.C., Gumbhir, A.K., & Rinck, C.M., 1988, 'Affects, demographic variables, and health', *Journal of Clinical Psychology*, 44, 131–41.

Compared to the range alone, standard deviation tells us a lot about a distribution of scores, particularly if they are *normally distributed* – a feature we discuss further below. If this is the case, we know, for example, that about 68 per cent of all values will fall within 1 SD of the mean, 95 per cent fall within 2 SDs and 99 per cent fall within 3 SDs. For reasons that will become clear in later chapters (e.g. chapter 13), this sort of information is very useful.

How can we confidently generalize our results?

Although psychologists often spend a lot of time studying the behaviour of samples, most of the time they want to generalize their results to say something about a whole population – often called the underlying population. Knowing how ten particular people are going to vote in an election may be interesting in itself, but it is even more interesting if it tells us who is likely to win the next election.

But how can we make inferences of this sort confidently? By using *inferential statistics* we can make statements about underlying populations based on detailed knowledge of the sample we study and the nature of random processes. The key point here is that, while random processes are (as the name tells us) random, in the long run they are highly predictable. Not convinced? Toss a coin. Clearly, there is no way that we can confidently predict whether it is going to come down heads or tails. But if we were to toss the coin fifty times, we could predict, reasonably accurately, that we would get around twenty-five heads. The more tosses we make, the more certain we can be that around about 50 per cent of the tosses will come up heads (and it is this certainty that makes the business of running casinos very profitable).

inferential statistics numerical techniques used to estimate the probability that purely random sampling from an experimental population of interest can yield a sample such as the one obtained in the research study

Of course, psychologists do not usually study coin tosses, but exactly the same principles apply to things they do study. For example, the mean IQ is 100 (with an SD of 15), so we know that if we study a large number of people, about 50 per cent will have an IQ greater than 100. So if we get data from 100 people (e.g. a class of psychology students) and find that all of them have IQs greater than 100, we can infer with some confidence that there is something psychologically 'special' about this sample.

Our inference will take the form of a statement to the effect that the pattern we observe in our sample is 'unlikely to have arisen as a result of randomly selecting (sampling) people from the population'. In this case, we know this is true, because we know that psychology students are not selected randomly from the population but are selected on the basis of their performance on tests related to IQ. But even if we did not know this, we would be led by the evidence to make an inference of this kind.

Inferential statistics allow researchers to quantify the probability that the findings are caused by random influences rather than a 'real' effect or process. We do this by comparing the distribution obtained in an empirical investigation with the distribution suggested by statistical theory – in this case the *normal distribution*. We then make predictions about what the distributions would look like if certain assumptions (regarding the lack of any real effect on the data) were true. If the actual distribution looks very different from the one we expect, then we become more confident that those assumptions are wrong, and there is in fact a real effect or process operating.

normal distribution the symmetrical, bell-shaped spread of scores obtained when scores on a variable are randomly distributed around a mean

For example, the distribution of the mean IQ score of groups of people drawn from the population tends to have a particular shape. This is what we mean by the normal distribution – see figure 2.1. If a particular set of data does not look as though it fits the (expected) normal distribution, then we would start to wonder if the data really can be assumed to have been drawn at random from the population in question. So if you drew a sample of 100 people from a population and found that their mean IQ was 110, you can be fairly sure that they were not randomly drawn from a population with a mean of 100. Indeed, the normal distribution shows us that the likelihood of an event as extreme as this is less than one in a thousand.

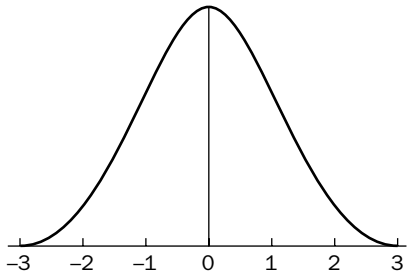

Figure 2.1

The shape of the normal distribution.

Finding out if our results are remarkable

Is there something going on here?

When we use inferential statistics, we might be in a position to make exact probability statements (as in the coin tossing example), but more usually we have to use a test statistic.

Two things influence our judgement about whether a given observation is in any sense remarkable:

1. the information that something is 'going on'; and
2. the amount of random error in our observations.

In the IQ example, information comes from the fact that scores are above the mean, and random error relates to variation in the scores of individual people in the sample.

For this reason, the statistics we normally use in psychology contain both an information term and an error term, and express one as a ratio of the other. So the test statistic will yield a high value (suggesting that something remarkable is going on) when there is relatively more information than error, and a low value (suggesting that nothing remarkable is going on) when there is more error than information.

Imagine we gave an IQ test to a class of 30 children and obtained a mean IQ of 120. How do we find out the statistical likelihood that the class mean differs reliably from the expected population mean? In other words, are we dealing here with a class of 'smart kids', whose performance has been enhanced above the expected level by some factor or combination of factors? Or is this difference from the population mean of 100 simply due to random variation, such as you might observe if you tossed a coin 30 times, and it came up heads 20 times?

A statistical principl known as the *law of large numbers* tells us that uncertainty is reduced by taking many measurements of the same thing (e.g. making 50 coin tosses rather than one). It means, for example, that although around 9 per cent of the population have IQs over 120, far fewer than 9 per cent of classes of 30 randomly selected students will have a mean IQ over 120. This statistical knowledge makes us more confident that if we *do* find such a class, this is highly unlikely to be a chance event. It tells us instead that these children are performing considerably higher than might be expected.

law of large numbers the idea that the average outcomes of random processes are more stable and predictable with large samples than with small samples

We can summarize the process here as one of deciding where the sample mean lies in relation to the population mean. If there is a very low chance of sampling that mean from the population we conclude that the sample is probably not drawn from that population but instead belongs to another population. Perhaps more intelligent students were assigned to this class by the school authorities, or perhaps they came from an area where education funding was especially good. In short, we cannot be sure *what the explanation is*, but we can be relatively sure that *there*

is something to be explained and this is the purpose of conducting statistical tests.

Judging when two conditions in an experiment are sufficiently different to be worth interpreting

Think back to our 'memory training study', in which one group of participants in an experimental condition experience a new training method and another group in a control condition do not, then both groups take a memory test. Common sense tells us that we are likely to get two sets of memory scores – one for the experimental condition, one for the control – with different means.

But how do we decide whether the difference is big enough to be meaningful? This is where inferential statistics come into play. Appropriate statistical procedures allow us to decide how likely it is that this difference could occur by chance alone. If that likelihood is sufficiently low (typically less than 1 in 20 or 5 per cent), we would reject the *null hypothesis* (expressed as H_0) that there is no difference between the means and that the manipulation of the independent variable has had no effect. Instead we would conclude that the manipulation of the IV has had a significant impact on the dependent variable – that is, that training does indeed improve memory. This process is typically referred to as *significance testing*, and this is one of the main approaches to statistical inference. While statistical tests can never tell us whether our results are due to chance, they can guide us in judging whether chance is a plausible explanation.

null hypothesis the hypothesis that the research reveals no effect

significance testing the process of deciding whether research findings are more plausibly due to chance (H_0) or due to real effects (H_1)

How does significance testing work in this case – that is, when comparing two means? In essence it comes down to the difference between the means relative to the variation around those means and the number of responses on which the means are based. The statistics that we calculate for comparing means are called *t* and *F* statistics. A large *t* or *F* statistic means there is a small probability that a difference as big as the one we have obtained could have occurred by randomly selecting two groups from the same population (i.e. it is not likely that the difference is due to chance). If that probability is sufficiently small, we conclude that there probably is a real difference between the means – in other words, that the difference is statistically significant.

JUDGING WHETHER TWO VARIABLES ARE RELATED

A lot of what we have discussed so far relates to comparisons between means, which is typically what we do when we use experimental methodology. But in a range of other research situations we are interested in assessing the relationship between two variables. For example, how is height related to weight? How is stress related to heart disease?

This type of question can be asked in experiments (what is the relationship between the amount of training and memory?), but is more typically addressed in surveys, where the researcher has multiple values of each variable. Suppose we are working on the concept of attraction, which occurs at many levels. We might have data recording both people's attraction to their partners and the amount of time they have spent apart from them, our interest lying in whether higher levels of attraction are associated with higher levels of time spent apart, or whether high levels of attraction are associated with lower levels of time spent apart, or whether there is no clear relationship between the two variables. This type of data is described as *bivariate*, as opposed to *univariate*.

bivariate the relationship or association between two variables ('variate' is another word for variable)

univariate relating to a single variable

One useful way to set about answering this type of question is to draw a scatterplot – a two-dimensional graph displaying each pair of observations (each participant's attraction to their partner and the time spent apart).

Figure 2.2 shows an obvious relationship between attraction and time apart: the higher one is, the higher the other is. We describe this as a positive correlation. A negative correlation would be obtained when one value decreases as the other increases.

Note that the stronger the relationship, the less scattered the various points are from a straight line, and the more confidently we can estimate or predict one variable on the basis of the other. In this example, it becomes easier to estimate from someone's

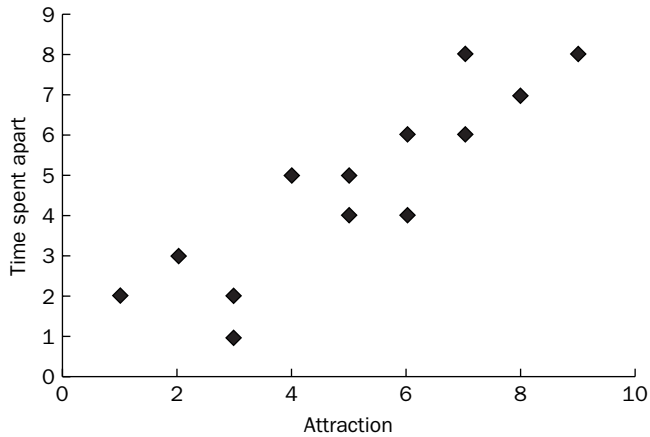

Figure 2.2

A graph (called a scatterplot) of the relationship between attraction and time spent apart. Note: these are not real data.

Research close-up 2

An experiment on group pressure

The research issue

Group pressure and conformity have been researched extensively in social psychology. One of the most influential studies is Asch's (1951) experiment involving a line judgement task. Asch wanted to investigate whether participants would choose an incorrect answer in order to conform to the group, and whether conformity would increase as the size of the group increased.

Design and procedure

Participants were shown two cards. One card showed one line, while the other card showed three. The participant's task was to indicate which of the three lines on the second card was the same length as the line on the first card.

Each participant was assigned to one of seven group size conditions, ranging from completing the task alone to completing the task with 16 other group members. The other group members were confederates and were trained to give the same wrong answer on 12 out of the 18 trials. Using this experimental design, Asch was able to test his null hypothesis, which was that the confederates would not affect the participants' responses.

Results and implications

Asch rejected his null hypothesis because, on average, participants chose the wrong line more often when there were confederates present than when they completed the task alone.

Furthermore, the mean number of errors increased as the group size increased. This led Asch to conclude that there was probably pressure to conform to a group's opinions and decisions, and that this pressure was likely to increase as groups became larger. Nonetheless, the results of this study were not subjected to statistical testing, so there is uncertainty as to the conclusions that can be drawn from this particular study.

Since then, however, other studies researching group pressure have found similar results that have been proved statistically significant. (See chapter 18 for more on this.)

Asch, S.E., 1951, 'Effects of group pressure on the modification and distortion of judgements' in H. Guetzkow (ed.), *Groups, Leadership and Men*, Pittsburgh: Carnegie.

attraction how much time they have spent apart from their partner, or to estimate level of attraction from the time spent apart.

Understanding correlation

Correlation does not imply causation

A mistake that is made by researchers more often than it ought to be is to assume that, because two variables are highly correlated, one is responsible for variation in the other. *Always remember that correlation does not imply causation.*

Suppose we conduct a study that reveals a strong positive correlation between the consumption of alcohol and aggressiveness. On this basis it cannot be concluded that alcohol causes aggressiveness. You could equally argue that aggressiveness causes people to drink more, or the relationship may be the product of a third factor, such as upbringing. Perhaps having hostile parents leads people to be aggressive and also to drink more. It is therefore possible that upbringing encourages alcohol consumption *and* aggressiveness, without each having a direct effect on the other.

There are many real-life examples of spurious correlations that have arisen from the influence of a third factor. For example, when researchers found that there was a high correlation between the presence of 'spongy tar' in children's playgrounds and the incidence of polio, they misguidedly inferred that 'spongy tar' caused polio. As a result, some schools went to great expense to get rid of it. In fact, both spongy tar and polio were both linked to a third factor: excessively high temperature. So it was this that needed to be controlled, not the type of tar in the playground.

This inability to draw strict causal inferences (and the associated temptation to do so) is by far the most serious problem associated with both correlational and survey methodology.

The measurement of correlation

Correlations are usually measured in terms of *correlation coefficients*. The most common of these is the Pearson product–moment correlation,

correlation coefficient a measure of the degree of correspondence or association between two variables that are being studied

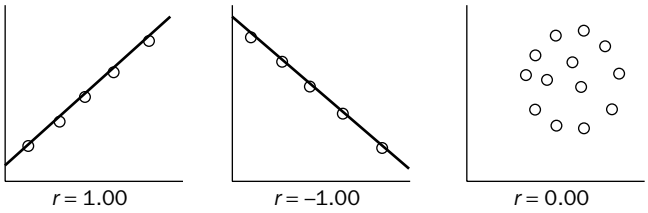

Figure 2.3

Examples of positive, negative and zero correlations.

Pearson's *r* the commonly used name for Pearson's product-moment correlation coefficient

or *Pearson's r*. The value of *r* indicates how strong a correlation is and can vary from −1.00 to +1.00.

As with *t*-tests, computation of Pearson's *r* involves going through a series of standard steps. These allow us to establish whether high scores on one variable are associated with high scores on the other, and if low scores on one variable are associated with low scores on the other.

As figure 2.3 illustrates, an *r*-value of +1.00 indicates a perfect positive correlation, and an *r*-value of −1.00 indicates a perfect negative correlation. In both these cases, the value of one variable can be predicted precisely for any value of the other variable. An *r*-value of 0.00 indicates there is no relationship between the variables at all.

Pioneer

Karl Pearson (1857–1936) graduated from Cambridge University in 1879 but spent most of his career at University College, London. His book *The Grammar of Science* (1892) was remarkable in that it anticipated some of the ideas of relativity theory. Pearson then became interested in developing mathematical methods for studying the processes of heredity and evolution. He was a major contributor to statistics, building on past techniques and developing new concepts and theories. He defined the term 'standard deviation' in 1893. Pearson's other important contributions include the method of moments, the Pearson system of curves, correlation and the chi-squared test. He was the first Galton Professor of Eugenics at University College, London, holding the chair from 1911 to 1933.

FINAL THOUGHTS

The role of ethics in research

Psychology is a science, and science is part of society. It follows that psychological scientists must work within limits imposed by society, including the standards that society sets for behaviour.

Psychological researchers are bound by research ethics – a code, or set of rules, that tells them which sorts of behaviour are acceptable when conducting research. These rules relate primarily to avoiding the risk of harm to research participants.

One important feature of ethical research is *informed consent*. The participants (or their guardians if they are children) must have the research procedures explained to them so that they can make an informed choice about whether they wish to participate. Any risks of harm to participants must be minimised, and if they cannot be eliminated, they must be justified.

informed consent the ethical principle that research participants should be told enough about a piece of research to be able to decide whether they wish to participate

Imagine some clinical psychologists develop a new form of therapy to treat a mental illness. Rather than simply using the therapy in their practice, they must first decide how to evaluate the treatment. Suppose that, in reality, the treatment has a slight risk of causing harm to participants. Before the researchers can test the effectiveness of the treatment, they must be confident that the potential benefits heavily outweigh any potential harm.

Where research involves animals, their treatment must be humane and meet the standards of animal welfare.

Major psychological societies, such as the American Psychological Association and the British Psychological Society, maintain web links that provide details of their ethical codes, and all researchers need to be familiar with these.

Want to know more about research?

As we noted at the outset, this chapter can really only scratch the surface of the field of research methods in psychology. If you want to know more, there are a number of very good books on research methods in psychology. Many of them cover statistics in great detail, others cover methodology and a third selection cover both methodology and statistics.

However your training in psychology develops, your most important aspiration should be to become an informed and critical user of its methods. It is only by confidently exploring the limits and strengths of methodology that we are able to extend the limits and build on the strengths of psychological knowledge.

Summary

- Research, as well as being important in its own right, underpins every aspect of involvement in psychology from introductory studies right through to professional practice.
- It is important therefore that research is done effectively. This means ensuring that research achieves valid findings through reliable and reproducible methods that involve testing and developing explanations (theories) of these findings.
- Psychologists have various methods at their disposal, and being a good researcher means choosing the appropriate method for the question in hand. The appropriateness of a method also depends on how ethical it is.
- Experiments have substantial advantages: by using random assignment to equate conditions in all respects except for the manipulation, they allow us to explain any results in terms of two competing explanations – chance, and the effects of the experimental treatment.
- Statistical tests are particularly useful for helping us to decide between these two explanations. For example, if we find differences in the mean scores of two different conditions that are much larger than we would expect, it is unlikely that both conditions are identical (i.e. belong to the same statistical population).
- Statistics can also help us to judge whether it is plausible that two variables are related. Such relationships are called correlations, and there are many ways to measure them. In considering any correlation, it is always crucial to remember that correlation does not imply causation. Just because two variables are related, we cannot conclude that the first variable causes the second, even if this seems plausible. It is also possible that the second causes the first, or that some third factor causes both.

REVISION QUESTIONS

1. Does it matter whether psychology is a science? If so, why?
2. What is problematic about findings that are reliable but not valid?
3. What do you think are the relative merits of behavioural, self-report and physiological measures of psychological processes?
4. How do experiments help us to deal with the problem that correlation does not imply causation?
5. What are the main descriptive statistics?
6. Why do we carry out statistical tests?
7. Can statistical tests tell us whether results are due to chance?
8. Are positive correlations stronger than negative correlations?
9. What purpose do research ethics serve?

Further Reading

BPS Code of Conduct, Ethical Principles & Guidelines (Nov. 2000). London: British Psychological Society. www.bps.org.uk/documents/Code.pdf
Similar guidelines have been developed by the American Psychological Association (http://www.apa.org/ethics/code2002.html), the Australian Psychological Society (http://www.psychsociety.com.au/aps/ethics/default.asp) and the New Zealand Psychological Society (www.psychology.org.nz/psychinnz/2002%20Code%20Cover.pdf).

Campbell, D.T., & Stanley, J.C. (1963). *Experimental and Quasi-experimental Designs for Research*. Chicago: Rand McNally.
The classic short text on research design that all psychologists should read (and read again).

Cohen, J. (1994). The Earth is round ($p < .05$). *American Psychologist*, 49, 997–1003.
An interesting discussion of some of the problems with the significance testing approach that we have outlined here.

Haslam, S.A., & McGarty, C. (2003). *Research Methods and Statistics in Psychology*. London: Sage.
This is the book on which this chapter was based. It involves a far more detailed treatment of the material (especially statistical tests) than is possible here.

Howell, D.C. (1999). *Fundamental Statistics for the Behavioral Sciences*. Belmont, CA: Duxbury.
An accessible and widely used introduction to statistics written by a psychologist.

Leong, T.L., & Austin, J.T. (1996). *The Psychology Research Handbook: A Guide for Graduate Students and Research Assistants*. Thousand Oaks, CA: Sage.
A useful guide on a whole range of research matters from research design to publication.

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The Nervous System

3

Learning Objectives

By the end of this chapter you should appreciate that:

- the components of the nervous system have specific functional roles;
- there is regional specialization within the brain;
- nerve cells (neurons) have to use energy to maintain their electrical potential gradients, and that neurons 'fire' through the generation of action potentials which perturb these gradients;
- nerve cells communicate with each other via neurotransmission;
- chemical neurotransmission informs the design of drugs;
- the brain is susceptible to environmental influence;
- neural tissue has limited potential for repair;
- we can study the function of the brain via dysfunction;
- the brain is a type of complex information processing device.

INTRODUCTION

We can study behaviour and thought without necessarily knowing anything at all about the nervous system – or how the behaviour is generated. Cognitive psychologists studying slips of the tongue, for example, may not care whether the brain is made up of rubber bands or of *neurons*. In fact, if you simply count the cells in the brain, neurons are very much a minority group; most of them are non-neuronal, *glial cells*. But rubber bands are rarer still in there.

neuron a nerve cell

glial cells non-neuronal cells in the brain that provide 'support' for the neurons

Nevertheless, our interactions with the world around us depend crucially on the activity of the nervous system. Without it, we not only have no senses and no ability to move; we also have no thoughts, no memories and no emotions. These are the very essence of our selves, yet they can be disastrously changed, and even completely erased, by disorders of the nervous system.

We can very effectively treat some psychological disorders simply by using words to change the ways in which patients think (see chapter 16). But the only generally available palliatives for other conditions, like Parkinson's disease or schizophrenia, are drug treatments. And some

conditions, such as Alzheimer's disease, are currently untreatable.

The more we learn about how the nervous system operates, the better we can understand how it can go wrong. That, in turn, will increase our chances of finding out how to prevent, or even reverse, psychological disorders. If we do not understand the way that the nervous system works, then we, like our forebears throughout humankind's history, are confined to a passive role as observers and documenters of the effects of nervous dysfunction.

HOW YOUR BRAIN PLAYS TENNIS

Imagine you are playing tennis, at match point, waiting to return your opponent's serve. You are on edge, your heart rate is up, but you are totally focused on your opponent's actions. You are thinking about your opponent's strengths and weaknesses and considering your options. Up goes the ball, the racquet flashes down, here comes the serve and your opponent is running in towards the net. You take a quick step, stretch out and hit the ball right in the centre of your racquet's sweet spot, sending your return fast and low, just inside the line but just beyond your opponent's reach. The whole sequence has taken no more than a couple of seconds, and you have won the match. What a feeling! But how did you manage to do it?

DECEPTIVELY SIMPLE . . .

The deceptively simple-looking sequence of behaviour that won you the match depends on some very complex interactions between different parts of your brain, and between your brain and the rest of your body.

As you were waiting, your body posture was being continually monitored and adjusted: you did this by constantly updating *proprioceptive* information from sensors located in your joints and muscles, and combining it with information from your middle-ear balance system, and with visual information.

Ian Waterman is one of only ten people in the world known to have lost this proprioceptive sense, which meant that he became unable to control his movements at all. His arm would unpredictably fly up in the air without his consent. Amazingly he taught himself to walk again, using vision to monitor the position of his limbs. But if someone turns out the lights, he is once again unable to move, or even just stand still normally (Cole, 1995). He is likely to collapse into a dangerously uncontrolled heap on the ground, unable to tell where the different parts of his body have ended up and unable to rearrange himself until the lights are turned on again.

To return to our tennis match, when the ball was served, you probably monitored the initial impact with your opponent's racquet, then moved your eyes to the place where you expected it to bounce. After the bounce, you would have followed the ball with your eyes for a fraction of a second longer to guide your own shot. You did not have to work out consciously how far to extend your racquet, as your brain's motor control systems have learned this in your hours of tennis practice.

. . . IMMENSELY COMPLEX

Your strategic planning and your ability to concentrate on limited, key aspects of your surroundings required *frontal lobe* function – brain function that is mediated by the most anterior portion of the brain. Your feelings of excitement and emotion result partly from the effects of hormones secreted into your bloodstream, in response to instructions originating in your brain (see chapter 6). Some of those hormones not only influence your heart and muscles, but also modify what is happening in your brain. Your elation at winning reflects activity in your brain's reward systems. And throughout the sequence, your memory systems (see chapter 11) were laying down records of what was happening, as well as recalling the information you had already stored about your opponent's strengths and weaknesses, and recognizing familiar tactical situations.

The immensely complex system that underlies all these experiences, actions and abilities depends on interactions between nerve cells. These highly specialized cells are called neurons. Their interactive nature is precisely what is so special about them. Each neuron's activity is controlled not just by its own internal condition, but by the myriad inputs it receives from other neurons, from sensory detection apparatuses (for example, those detectors located in the skin), or from chemical signals in the fluids that surround it. Neurons generate electric potentials. These are modified by the inputs they receive, and are used to send outputs to other neurons, glands or muscles in the body.

Different regions of the brain have their own specialized activities. So a great deal of what we know about brains comes from the study of patients with damage to specific areas of the brain, resulting in startlingly specific deficits. Throughout this chapter – or virtual tour of the nervous system – we take a look at what happens when particular components go wrong.

COMPONENTS OF THE NERVOUS SYSTEM

The nervous system has both central and peripheral components. The central part includes the brain and the spinal cord; the

central nervous system collectively, the brain and the spinal cord

peripheral part includes the nerves through which the *central nervous system* interacts with the rest of the body.

'Nerve' is a familiar word and is used in various ways in ordinary conversation. But in psychology we use it specifically to mean a cord of neuronal *axons* bundled together passing through the human body. We have probably all had the experience of hitting our 'funny bone' – the discomfort is due to the compression of the ulnar nerve. Nerves are typically sensory (afferent) – carrying information to the central nervous system from sensory neurons whose cell bodies are located in the periphery of the body – or motor (efferent) – extending out from the central nervous system to the organs and regulating muscular movement or glandular secretion.

axon the neuronal outgrowth through which the output is transmitted

The support and structure of neurons

Glial cells – more than just glue

The basic unit of the whole of the nervous system is the neuron. Neurons operate alongside various other types of cells, whose activity can be essential to normal neuronal function. Even in the brain, only about 10 per cent of the cells are neurons. Most are glial cells, which fall into several different classes, each with its own function. There are astrocytes, oligodendrocytes (in the central nervous system), microglia and ependymal cells. (The word ending *-cyte* means 'cell'.)

Glial cells were once thought of as the structural glue (that is what *glia* means in Greek) that holds the neurons in place, but their roles are proving to be far more complex. For example, astroctyes, which are the most common class, not only provide physical support to the neurons, but also help to regulate the chemical content of the fluid that surrounds the neurons. Astrocytes wrap closely round some types of *synapses* (the junctions between neurons) and help to remove glutamate (a neurotransmitter substance) from the *synaptic cleft* (the gap between neurons meeting at the synapse) via an active pumping system. If the pump fails, the system can become reversed, so that excess glutamate is released back into the synapse, which can be fatal to nearby neurons.

synapse the highly specialized area at which neurotransmission occurs between neurons; transmitter is released at the pre-synaptic axon terminal and binds to specialized receptors in the membrane of the post-synaptic target neuron

synaptic cleft the gap in the synapse between two adjacent neurons

The three components of neurons

Neurons come in many shapes – or morphologies – which give them their different functions. For example, *projection neurons* have fibres that connect them to other parts of the nervous system. Even within this category, there are many different morphologies, but all projection neurons share some basic similarities.

projection neurons neurons with connections that are not just local (i.e. they connect to other areas)

You can think of the neuron as having three essential components (see figure 3.2). The heart of the neuron is the *cell body*, where the cell's metabolic activities take place. Input from other neurons typically comes via the *dendrites*. These can be a relatively simple tuft of fine, fibre-like extensions from the cell body, or highly complex branches like the twigs and leaves of a tree.

dendrites the input system of a neuron, so called because of its branching structure

The output of the neuron is transmitted via its axon to the dendrites of other neurons, or other targets such as muscles. Axons can be very long, reaching right down the spinal cord, or so short that it is difficult to tell them apart from the dendrites. Nerve cells with such short axons are called *interneurons* rather than projection neurons, because all their connections are local.

interneurons neurons whose output projection targets are all local

Some neurons have just a single axon, although it may still make contact with a number of different target cells by branching out towards its end. Other cells have axons that are split into quite separate axon collaterals, each of which may go to an entirely different target structure.

The peripheral nervous system

Peripheral nerves are just bundles of axons. They appear as *white matter*, because most mammalian axons have a white myelin sheath around them, which helps to speed up nerve conduction. Although many neurons have cell bodies located in the central nervous system, there are clusters of cell bodies in the *peripheral nervous system* too. The simplest type of cluster is called a *ganglion* (plural, ganglia).

white matter those parts of brain consisting mostly of axons rather than cell bodies; the axons' myelin sheaths are very white

peripheral nervous system the autonomic nerves and the somatic nerves that branch out beyond the spinal cord itself (as opposed to the central nervous system)

ganglion a cluster of neuronal cell bodies, especially in the spinal cord

The sensory division of the peripheral system deals with inputs from *receptors* sensitive to pressure on your skin, for example. The motor division deals with outputs, or signals, causing muscles to contract or relax. Together,

receptor the specialized site of action at which neurotransmitters have their effects (e.g. by controlling a membrane ion channel)

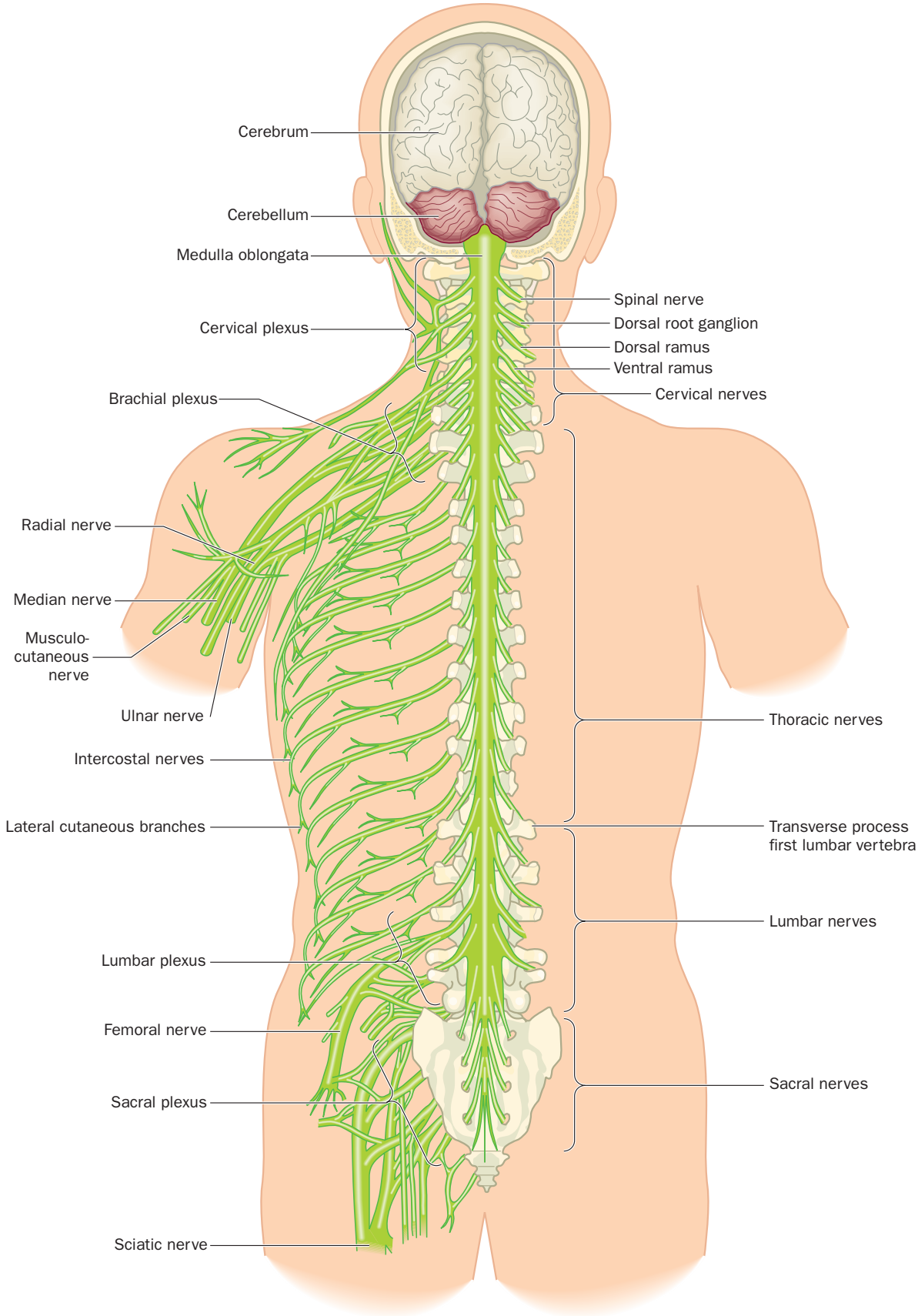

Figure 3.1

The human body and central and peripheral nervous systems. Source: http://publish.uwo.ca/~jkiernan/wholens.jpg

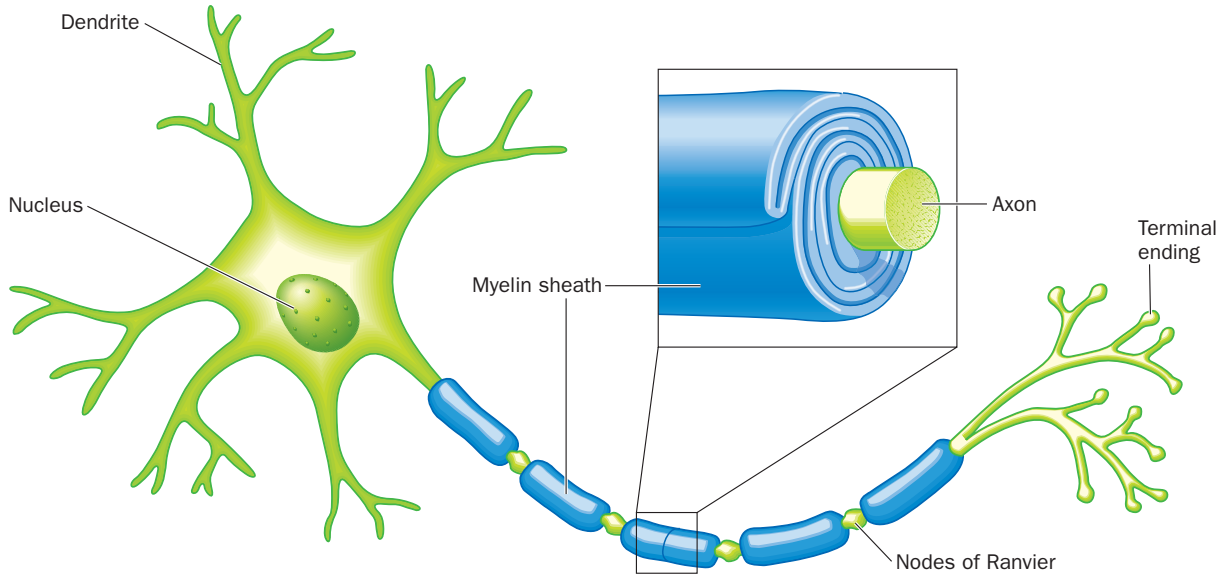

Figure 3.2

Diagram of a neuron. Source: www.msu.edu/course/asc/333/casby/myelin.jpg

somatic nervous system the part of the peripheral nervous system that includes the sensory and motor nerves, but excludes the autonomic nervous system

autonomic nervous system part of the peripheral nervous system, with sympathetic and parasympathetic components that control functions like heart rate and blood pressure

sympathetic nervous system part of the autonomic nervous system that prepares the body for emergency action

parasympathetic nervous system one of the components of the autonomic nervous system, essentially calming in its effects

these divisions make up the *somatic nervous system*, which enables you to interact with your external environment.

The *autonomic nervous system* is the manager of your internal environment. It controls activity in structures like your heart and your gut and some endocrine glands (which secrete regulatory hormones), and it governs sweating and the distribution of blood flow.

The autonomic nervous system is itself divided into the *sympathetic* and *parasympathetic nervous systems* (see figure 3.3), which have essentially opposite functions. The sympathetic system prepares you for emergency action. It redirects blood from your skin and your gut to your muscles, raises heart rate, dilates air passages to your lungs and increases sweating. These changes help you to run faster or fight more vigorously, and explain why people sometimes go white when they are really angry.

The parasympathetic system calms you down: it slows heart rate, increases blood flow to the gut to facilitate digestion, and so on. Your bodily state in part reflects the balance between these two systems.

The central nervous system

cerebellum the brain region important in skilled movement (in Latin, *cerebellum* means 'small brain')

The brain sits at the top of the spinal cord like a knotted end on a string or a walnut on a stick, with a smaller knot at the back (the *cerebellum* – Latin for 'little brain') which plays a key role in making movement smooth and efficient.

The spinal cord, made up of both axons and ganglia, gives us some essential reflexes. You can withdraw your hand from a fire before the information from your fingers has reached your brain: the spinal circuitry is complex enough to go it alone. It is also complex enough to contribute to other motor sequences, like those involved in walking.

Mammalian brains are made in two halves – or hemispheres – again like a walnut. The brain surface as viewed from the side or above is deeply wrinkled (see figure 3.4). This outer layer is the *cortex* (plural cortices), which comes from the Latin word meaning 'bark of a tree'. What this view hides are the numerous subcortical structures (see figure 3.5). These process sensory input and relay it to appropriate areas of the cortex, or process motor output before relaying it to the spinal cord and from there to the peripheral nervous system.

cortex structure made of a layer of cell bodies, especially neocortex, the multi-layered outside of the brain (*cortex* means 'bark' in Latin)

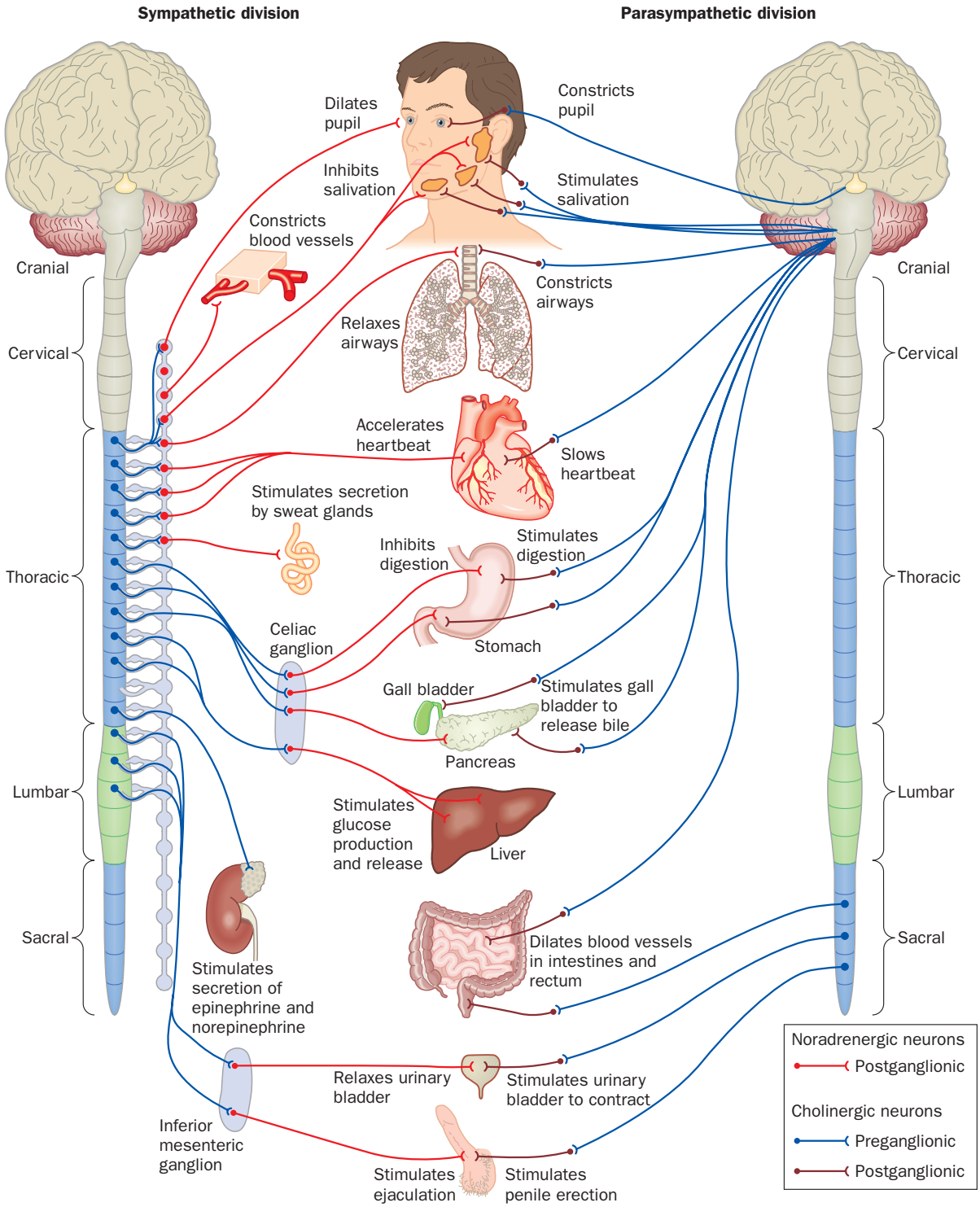

Figure 3.3

Sympathetic and parasympathetic nervous systems. Source: http://home.swipnet.se/sympatiska/anatomi.jpg

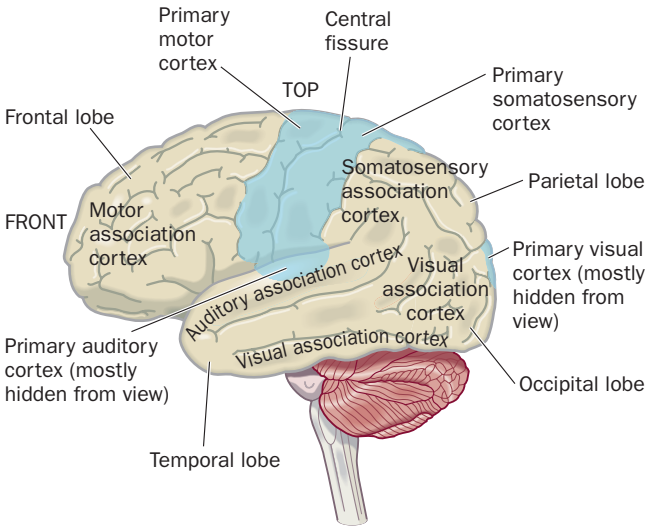

Figure 3.4

Surface view of the brain from the side. Source: Carlson (1981).

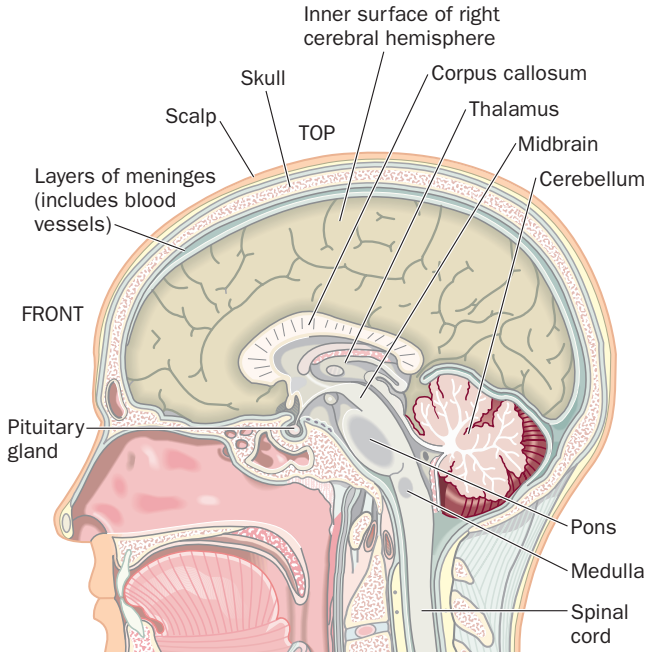

Figure 3.5

A view of the brain that has been sliced through the midline. Source: Carlson (1981).

But the brain should not be thought of as a sort of cognitive sandwich, with sensory information as the input, motor responses as the output, and cognition as the filling. Brain function is much more highly integrated than that. The motor and sensory systems are interactive, and each can directly modify activity in the other, without having to go through a cognitive intermediary.

A cluster of cell bodies in the brain might form a blob, or *nucleus* (plural, nuclei), or be organized into an extended layer like the cortex. These nuclei are often connected by clusters of axons, called fibre bundles.

nucleus a cluster of cell bodies in the brain (as opposed to a cortical layer)

If you cut into a nucleus, or into the cortex, the exposed surface does not appear white, but grey. The term *grey matter*, sometimes used colloquially, refers to areas that are composed primarily of cell bodies rather than axons.

grey matter parts of the brain that consist mostly of neuronal cell bodies rather than axons

Regions within the brain

Basic functions

The surface of the underside of the brain (looking up the string) is much smoother. If we work upwards from where the spinal cord joins the brain, at the *brain stem*, the first structure is the *medulla*. This is not just a relay station for incoming and outgoing communications; it also contains nuclei that control basic functions like breathing and heart rate.

brain stem a grouping of brain structures generally taken to include the medulla, pons, midbrain, hypothalamus and thalamus

medulla the nearest part of the brain stem to the spinal cord, where some vital control systems influencing heart rate and respiration are located

The brain stem also includes the *pons*. A variety of motor system connections are routed through the pons, and it includes some of the nuclei that seem to be important in sleep and arousal.

pons located just above the medulla, the pons has a role in arousal, autonomic function and sensory relays between the cerebrum and cerebellum

Sensory communication and motivation

Next we reach the midbrain (or *mesencephalon*). There are important early sensory relays here, particularly for the auditory system. The *substantia nigra*, which is the critical area lost in Parkinson's disease patients, is also in this region.

mesencephalon the mid-brain

substantia nigra part of the brain containing the cell bodies for the dopamine-containing projection to the striatum, which degenerates in Parkinson's disease (the Latin name means 'black substance')

The midbrain merges with the thalamus, under which is the *hypothalamus* (*hypo-* means 'under'). The thalamus contains major sensory relays to and from the cortex, but should not be thought of as

hypothalamus brain structure important in motivation and homeostatic regulation, located beneath the thalamus

Figure 3.6

An obese mouse with hypothalamic damage.

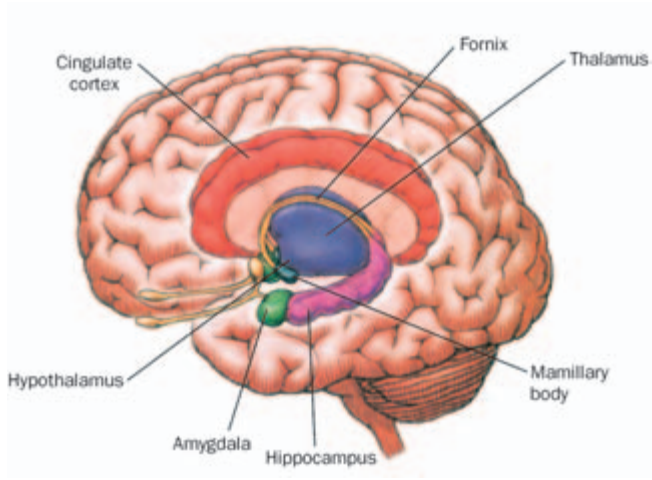

Figure 3.7

The limbic system. This system is made up of a number of subcortical structures, including the limbic lobe (consisting of the fornix, hippocampus, cingulate cortex and mamillary bodies); the thalamus; the hypothalamus; the basal ganglia; and the amygdala. Source: Gleitman, Fridlund and Reisberg (1999).

an exclusively sensory-processing structure; for example, specific nuclei of the thalamus are involved in important functional capacities such as memory.

The hypothalamus has major roles in motivation. Hypothalamic damage in one location can lead to gross over-eating (*hyperphagia*) and obesity (see figure 3.6), while damage at a different hypothalamic site can result in potentially fatal under-eating. The hypothalamus controls aspects of hormonal function: it can directly control hormone release from the *pituitary gland*, which lies just beneath the hypothalamus outside the brain itself. Pituitary hormones can themselves control hormone release from other endocrine glands, like the adrenal gland next to the kidneys, whose own hormones can in turn modify both peripheral function and brain function. So the brain and the endocrine system interact.

hyperphagia pathological overeating

pituitary gland an endocrine gland, located just outside and below the brain

Memory and emotion

Further up still, we reach some of the crucial motor system nuclei in the basal ganglia. We also encounter limbic structures, like the *hippocampus* – crucial for normal memory function – and the *amygdala*, which appears to play a key role in aspects of emotion, especially fear (see figure 3.7). Animals with amygdalar damage are less frightened than normal animals by signals of impending shock (LeDoux, 1992). Humans with amygdalar damage cannot recognize facial expressions of emotion, particularly fear and anger (Young et al., 1995), or angry or fearful tones of voice (Scott et al., 1997).

hippocampus brain structure important in memory processing, whose shape was thought to resemble a seahorse (*hippocampus* means 'seahorse' in Greek)

amygdala a group of nuclei in the brain, important in emotional processing, whose shape was thought to resemble an almond (*amygdala* means 'almond' in Latin)

Visual processing and other specialized functions

Beyond the hippocampus, which is the simplest example of a cortical layered structure we come to, there are various transitional cortical regions with increasingly complex layered structures, before we reach the neocortex, the most complex of them all. The neocortex has specialized motor areas, sensory processing areas and more general purpose association areas. Some of these are shown in figure 3.8.

Within each area there may be further, more specialized, modules. In the visual system, for example, separate modules for colour, form and motion speed up visual processing by handling all these attributes in parallel. This high level of specialization means that damage restricted to particular cortical regions can have very precise effects. For example, people with a condition called *prosopagnosia* are unable to recognize particular people's faces, despite other visual abilities remaining quite normal.

prosopagnosia a neurological condition in which the capacity to recognize individuals by their faces is lost, although other visual discriminations are unimpaired

High-level processing – the cortex

Sometimes people think of the cortex as the most important part of the brain because it evolved later than other parts, and because of its complexity and its roles in high-level processing and

Research close-up 1

Prosopagnosia

The research issue

The patient in this study has prosopagnosia. He has probably suffered brain damage in the posterior right hemisphere (McCarthy & Warrington, 1990). His visual acuity is good, but he cannot recognize the faces even of very close friends. He may have learned to recognize friends by the way they walk, and he can easily identify them by their voices, but he cannot identify them from their face. Yet, at the same time, his skin conductance response (the sort of response that is used in lie detectors) does discriminate between familiar and unfamiliar faces (De Haan et al., 1992).

Design and procedure

The patient is tested on a visual task. He looks at pictures of a variety of different objects, and then a picture of a close friend followed by a picture of a stranger. In each case, he is asked to identify the object or person. The neuropsychologist who is testing him studies traces on a machine which records skin conductance.

Results and implications

The patient recognizes the objects without difficulty, easily spotting very small details in the pictures. But when presented with a picture of a close friend and asked to identify them, he does not know who it is, any more than he recognizes the total stranger.

And yet the neuropsychologist notes a clear difference in the galvanic skin response to familiar and unfamiliar faces. This suggests that the patient implicitly recognizes his friends, even though he cannot explicitly recognize them.

De Haan, E.H., Bauer, R.M., & Greve, K.W., 1992, 'Behavioural and physiological evidence for covert face recognition in a prosopagnosic patient', *Cortex*, 28, 77–95.

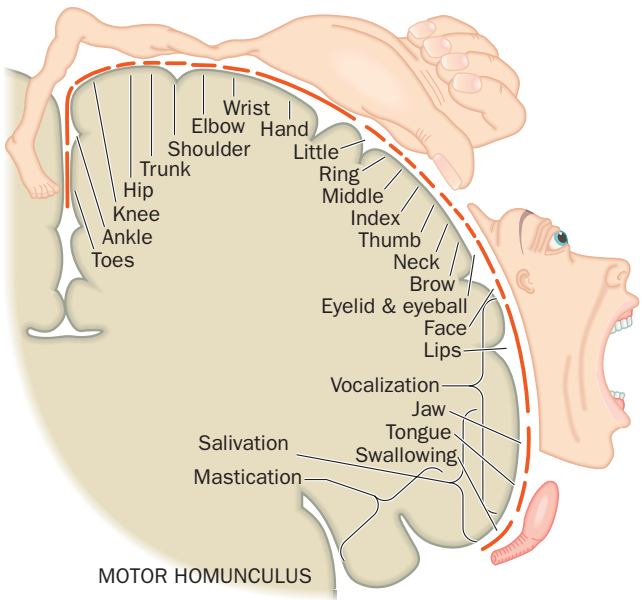

Figure 3.8

The motor homunculus. Source: Gleitman, Fridlund and Reisberg (1999).

Pioneer

John Hughlings Jackson (1835–1911) was a co-founder of the famous journal *Brain*. He is sometimes referred to as the father of British neurology. His wife suffered from epilepsy, and perhaps his most important inferences about brain function derived from his observations of the consistency of the patterns of epileptic seizures.

Jackson saw that in at least some patients the first signs of an impending seizure were twitchings of particular muscles. In the case of his wife, the seizures would start at one of her hands, then extend to include the arm, then the shoulder and then her face, eventually including her leg (all on the same side) after which the seizure would end. Jackson deduced that this kind of pattern could occur if the epileptic seizure was always initiated at the same point in the brain, from which it spread to related areas, assuming that each motor region of the brain had its own specialized function. He further suggested that the seizures were caused by electrical discharges in the brain, and that the condition might be treated by surgically removing the epileptic focus. In doing this he played an important role in the advance of neurosurgery.

Everyday Psychology

Studying and manipulating the living brain

It is one thing to study structures in the brain using post mortem techniques on either laboratory animals or humans, but is quite another thing to study structure and function in the living brain, or to manipulate the living brain. Techniques that allow this have been developed, and used more widely, only quite recently. There are several such techniques, each with its own advantages and disadvantages (see Owen, Epstein & Johnsrude, 2001).

The first technique that reliably and non-invasively showed up brain tissues in a living brain was the CAT (computerized axial tomography) scan. This uses X-rays, but complex computer programs allow a much clearer image to be constructed. More recently, two much more sophisticated methods have emerged – magnetic resonance imaging (MRI) and positron emission tomography (PET).

MRI relies on signals derived from putting the head into intense magnetic fields. Structural MRI gives a picture with a resolution in the cubic millimetre range.

Functional MRI (fMRI) – as you might expect – measures brain function. When a particular part of the brain increases its activity, the blood flow to that area increases as well. Changes in blood flow, and blood oxygen levels, change the fMRI signal. So we can now identify the different areas of brain that are active when we are thinking in different ways.

PET scanning can also detect blood flow changes, but with less precision than fMRI. Its advantage is that it can also show which areas of brain take up particular drugs or chemicals, so giving a map of specific neurochemical systems.

These functional imaging methods have high spatial resolution, the best being capable of remarkably finely detailed images showing structures as small as a millimeter across. But they do not have particularly good temporal resolution. They cannot show the brain's changing patterns of activity from second to second, let alone from millisecond to millisecond.

Neuronal activity occurs over a matter of milliseconds, but a single PET scan may take two minutes to complete. And fMRI has similar problems, with the local blood flow changes on which it relies taking some 7–10 seconds to reach their maximum.

The two non-invasive procedures with the best temporal resolution are electroencephalography (EEG), which records tiny electrical currents on the scalp resulting from the activities of the neurons within the brain (Mangun, 1995), and MEG (magnetoencephalography), which detects the tiny magnetic fields generated by neuronal activity. These give good temporal resolution but do not have the spatial resolution of fMRI.

Some laboratories and hospitals are now trying to get the best of both worlds by combining two techniques to follow information processing as it moves from structure to structure in the human brain.

Moving from the study of structure and function to the possibility of *manipulating* the brain, how can we study the ways in which changes in brain activity affect behaviour and cognition? The classic lesion method causes damage in the structure

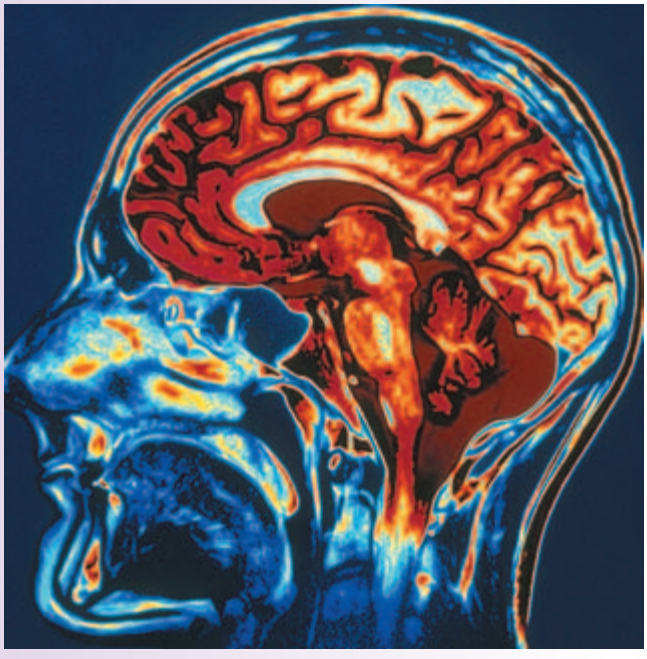

Figure 3.9

Structural MRI of a slice through the middle of the whole head.

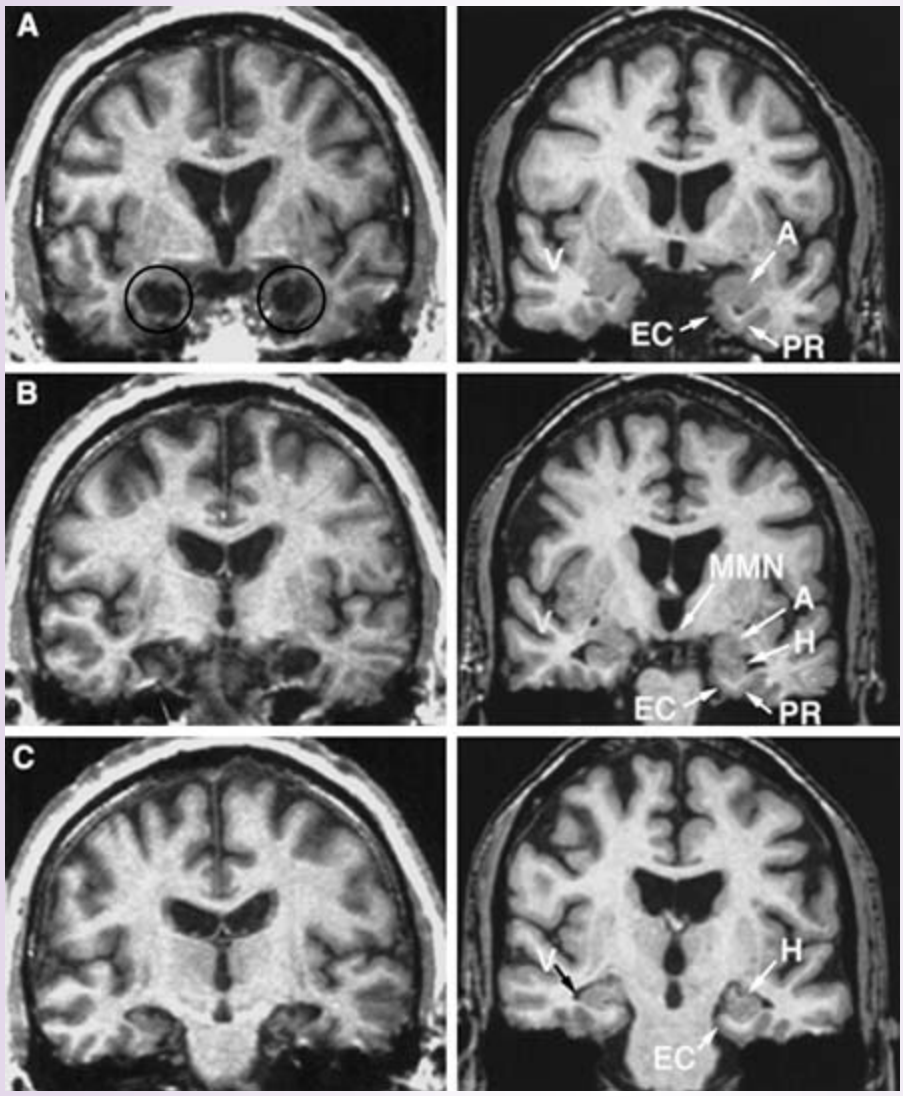

Figure 3.10

Structural MRI of patient H.M.

A = amygdala; H = hippocampus; EC = entorhinal cortex (a key input area for hippocampus); PR = perirhinal cortex. All these areas have been, at least partially, damaged in H.M.

of interest. Lesions can be made in a variety of ways: the most sophisticated cytotoxic lesions use microinjections of tiny volumes of chemicals (perhaps one ten thousandth of a millilitre) that kill particular types of neurons while leaving others unaffected. The effects of these lesions can be highly selective: rats with hippocampal lesions show clear deficits in spatial memory, while remembering individual objects perfectly well (Rawlins et al., 1993). Since single unit recording experiments have shown that some neurons in the hippocampus are active whenever the rat is in a particular place, it has been suggested that the role of this structure is to form and store maps of our spatial surroundings (O'Keefe & Nadel, 1978). Such conclusions are always more convincing when they are derived from different lines of converging evidence, as in the present example. Clinical studies of patients with hippocampal damage also show memory deficits, but they extend beyond just spatial memory. It is not yet clear whether this is because the brain damage in the patients is less selective than in the rats, or because hippocampal function is different in humans and in rats, or because it is difficult to find equivalent memory tests for humans and for rats.

Manipulative studies can also simply inactivate a target structure, rather than destroying it. This can be done by temporarily cooling a region, or by injecting drugs, or by passing small electrical currents into an area, so as to take over control of the activity of the neurons there. A recent procedure for temporary inactivation in humans uses intense magnetic fields, rather than electrical currents. These magnetic fields can pass through the scalp and skull, to control the activity of the neurons beneath. This transcranial magnetic stimulation (TMS) can be used to interrupt the normal activity of a target structure just below the skull to reveal how that structure contributes to normal information processing (Walsh & Cowey, 2000). If TMS was used to activate your visual area, then you would see 'phosphenes': little glowing patches of light. If the

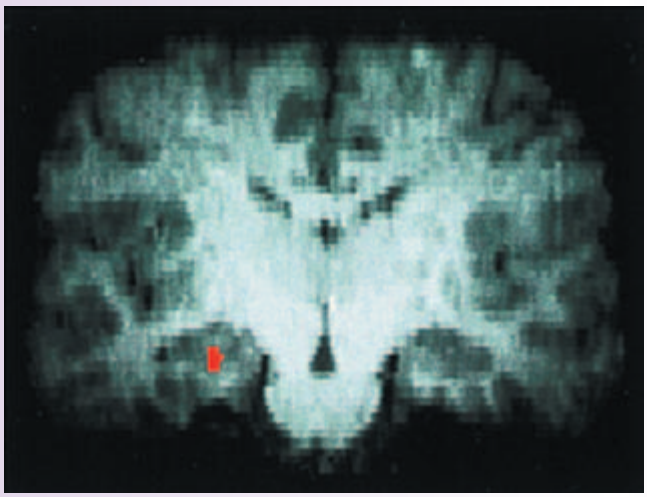

Figure 3.11

Hippocampal activation in learning. Source: Ploghaus et al. (2000).

area underlying motion perception is activated, then these phosphenes are typically moving. Although it is not possible selectively to activate deeper structures in the brain using this method, so its application is inevitably restricted, this advance has made a classic manipulative approach available for the study of brain function in healthy humans.

Owen, A.M., Epstein, R., & Johnsrude, I.S., 2001, 'fMRI: Applications in cognitive neuroscience' in P. Jezzard, P.M. Matthews & S.M. Smith (eds), *Functional MRI: An Introduction to Methods*, New York: Oxford University Press.

human faculties. But a good deal depends on what you mean by 'important'.

If you ask neuroscientists whether they would prefer to lose a cubic centimetre of cortex or a cubic centimetre of some subcortical region, they would probably choose to give up some cortex. This is because damage to the subcortex tends to be more profoundly disabling. For example, the loss of neurons in the small subcortical region called the substantia nigra results in Parkinson's disease, which eventually causes almost complete motor disability.

The functions of the different areas of the cortex have, until recently, been determined either by experimental studies of monkeys (which have a much more highly developed neocortex than animals like rats) or by neuropsychological studies of the effects of brain damage in clinical patients. The development of *functional neuro-imaging* methods has given us a new way to study the roles of different brain areas in cognition in healthy humans by allowing us to observe which brain regions are active.

functional neuro-imaging methods for observing which brain regions are active

THE STRUCTURE OF THE HUMAN BRAIN

Why did the cortex evolve later?

Imagine an animal with a simple brain made up of a big blob of neurons. How could such a brain develop, allowing space for extra neurons? It cannot just grow larger. The bigger the blob, the harder it is to sort out all the input and output axons for the cells in the middle. Somehow, all those connections have to find their way through gaps between all the new neurons on the outside of the blob.

The alternative solution is to arrange cell bodies in layers. The most complicated structure, the *neocortex*, is actually made up of six layers of cells (see figure 3.12). This allows all the inputs and outputs to run neatly along in a layer of their own. Fibres divert upwards to contact other cell bodies as needed, facilitated by the cortex being organized into columns.

Further development of the brain becomes much easier with this arrangement. You can simply add more columns, or 'bolt on' more modules, rather like plugging in a new component on your computer. You would not need to reorganize any pre-existing connections. You can also place cells that need to interact alongside each other, forming cortical modules that minimize inter-cell communication distances. This speeds up communications and saves space. Much the same arrangement is used for laying out printed circuit boards.

The wrinkles in the brain, which make it look like an outsized walnut, are all folds in the cortex. A valley, where the cortex is folded inwards, is called a *sulcus*, while a ridge is called a *gyrus*. This development enables the maximum

sulcus the inward folds in the wrinkled cortical surface

gyrus outgoing fold in the wrinkled cortical surface

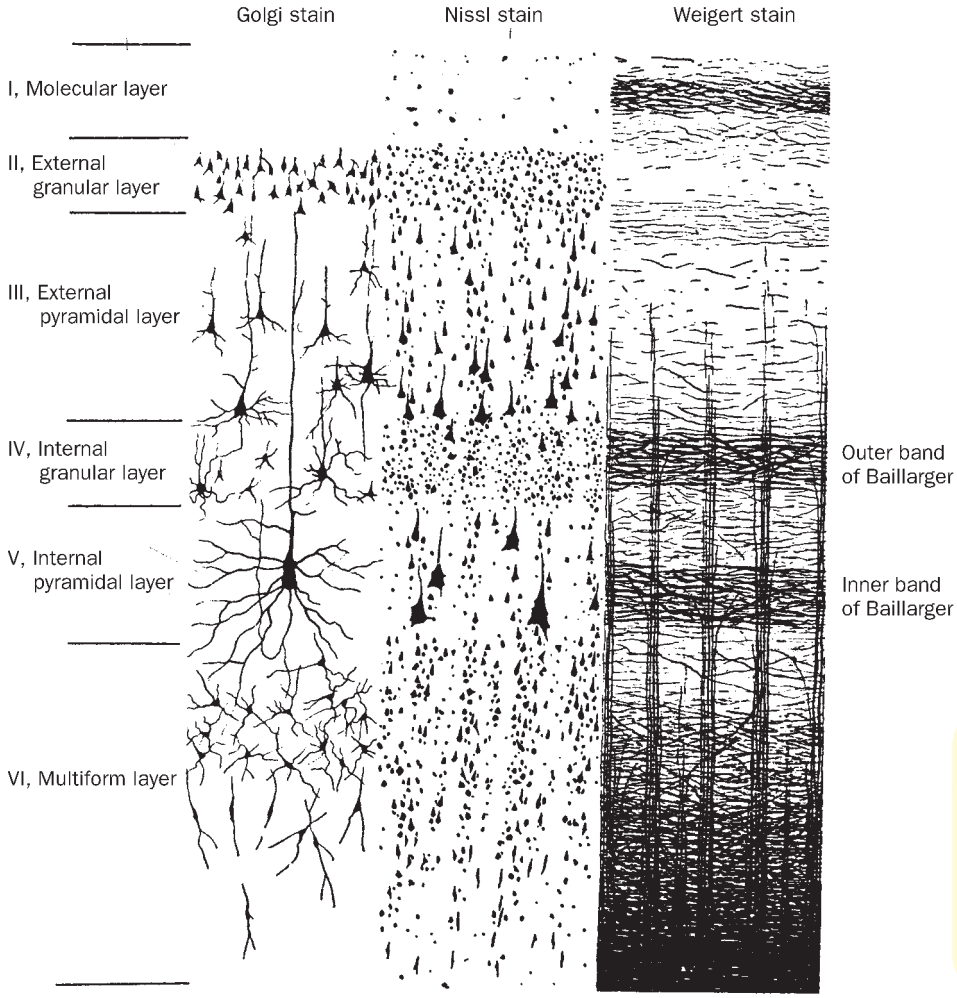

Figure 3.12

The six layers of the neocortex, as revealed by three different tissue stains. Golgi stains (left column) can show the whole neuron, from dendrites to axons; Nissl stains (middle column) show the cell bodies of the neurons; Weigert stains (right column) stain the myelin sheath that surrounds axons. Source: Nolte (1993).

cortical area to fit into a volume with minimal outside skull dimensions, just like crumpling up a newspaper to fit it into a small wastepaper basket. The volume and surface area of the newspaper are actually unchanged, but it fits into a neater space.

Is size everything?

The neurons that make up the human brain are essentially the same as those making up the brains of other animals. So how do we explain our extraordinary capacity for complex, abstract thought?

If you were to flatten out a human cortex, it would cover about four pages of A4 paper, a chimpanzee's would cover a single sheet, and a rat's would cover little more than a postage stamp. So we have big brains . . . but size is not everything. In mammals, brain size correlates with body size: bigger animals have bigger brains. But this does not make large animals more intelligent than smaller ones. Adaptable, omnivorous animals like rats are a favourite experimental subject for psychologists partly because they so readily learn new behaviours. Their opportunist lifestyle may well lead to greater behavioural flexibility, compared to larger but more specialized animals like the strictly herbivorous rabbit, whose food keeps still and does not need to be outwitted.

Nonetheless, there is something special about human brain size. Our brains are disproportionately large for our body weight, compared to our primate relatives (Jerison, 1985). This overdevelopment is especially marked in the most general purpose regions of the cortex, the association areas (though the cerebellum is disproportionately enlarged, too). It is possible that at least some of this enlargement provides extra processing facilities that support the human capacity for abstract thought.

Hemispheric differences

The two halves of our brains have different cognitive processing specialities. In most humans, language processing takes place in the left hemisphere. Damage on this side of the brain (see figure 3.13) can leave people unable to speak (aphasic), though quite capable of understanding spoken language. Paul Broca (1861) was the first to describe a condition known as Broca's *aphasia* and to identify the key area of damage responsible for it.

aphasia loss of speech ability

Just a few years later, Wernicke (1874) reported that damage at a different point of the language system in the left hemisphere

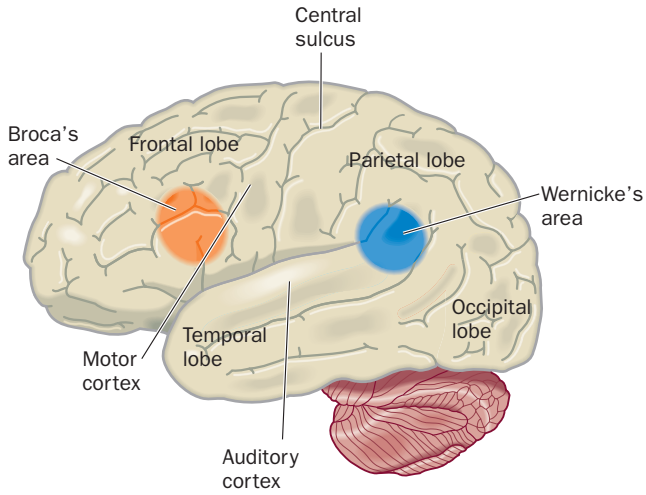

Figure 3.13

Broca's area and Wernicke's area.
Source: http://uhaweb.hartford.edu/lboudreau/wernipic.gif

leaves people with a different kind of speech problem, Wernicke's aphasia. These patients speak perfectly fluently, but what they say makes no sense, and they do not appear to understand what is said to them.

hemi-neglect a neuropsychological condition leading the patient to ignore one side of the world, including one side of their own body

Other neuropsychological conditions are typically associated with right rather than left hemisphere damage. For example, severe *hemi-neglect* often results from damage to the right parietal lobe. Patients with hemi-neglect may ignore the entire left half of the world, so that they eat only the food from the right side of their plates, shave only the right side of their face, and, when dressing, pull their trousers on to their right leg only. Some patients will even try to throw their left leg out of bed, since they do not consider it as being their own!

Neglect of the right-hand side of the world, resulting from left hemisphere damage, is much rarer. The underlying reasons for this are not yet certain, but it suggests that the right hemisphere might be able to support bilateral spatial attentional processes, whereas the left hemisphere (perhaps because of its own specialized allocation to language processing) can only support unilateral spatial attention. This would mean that when the left hemisphere is damaged, the right takes over processes that would normally depend on the left hemisphere. But when the right hemisphere is damaged, the left presumably continues to support its usual processing of events in the right half of the world, but cannot take over processing of events on the left.

The two hemispheres are joined together below the surface by the *corpus callosum*, a massive fibre pathway. *Split brain* patients have had their corpus callosum cut, for example to stop the spread of epileptic seizures from one side of the brain to the other. This disconnection can have startling consequences.

corpus callosum massive fibre system of axons connecting the two hemispheres

split brain occurs when the corpus callosum has been cut (e.g. in order to prevent the spread of epileptic seizures)

If a split brain patient sees a word briefly flashed up so that it falls on the part of the eye that is connected to the right hemisphere, then the patient cannot read out the word. This is because

Research close-up 2

Hemi-neglect

The research issue

When a patient with hemi-neglect tries to fill in the numbers on a clock face, he writes the numbers in the correct order but places them all on the right hand side of the circle (see figure 3.14).

Similarly, when presented with a paper that has a large number of short lines on it and asked to cross off each of the lines, he crosses off all the lines on the right half of the sheet, leaving the lines on the left side untouched. The subject confirms that the task is finished. Is this because he simply cannot see anything on the left?

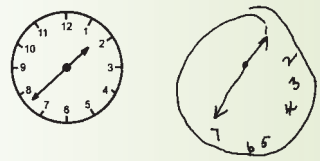

Figure 3.14

Typical response of a hemi-neglect patient attempting to draw a clock face. Source: Adapted from Sterling (2002).

Design and procedure

A neuropsychologist asks the patient to imagine that he is standing in a town square that he knows well, facing the main building of the square. (This finding was originally reported for the cathedral square, the Piazza del Duomo in Milan.) She asks him to tell her what he would be able to see from that viewpoint. Later, she asks him to imagine he is standing with his back to the main building, and, again, to tell her what he would be able to see.

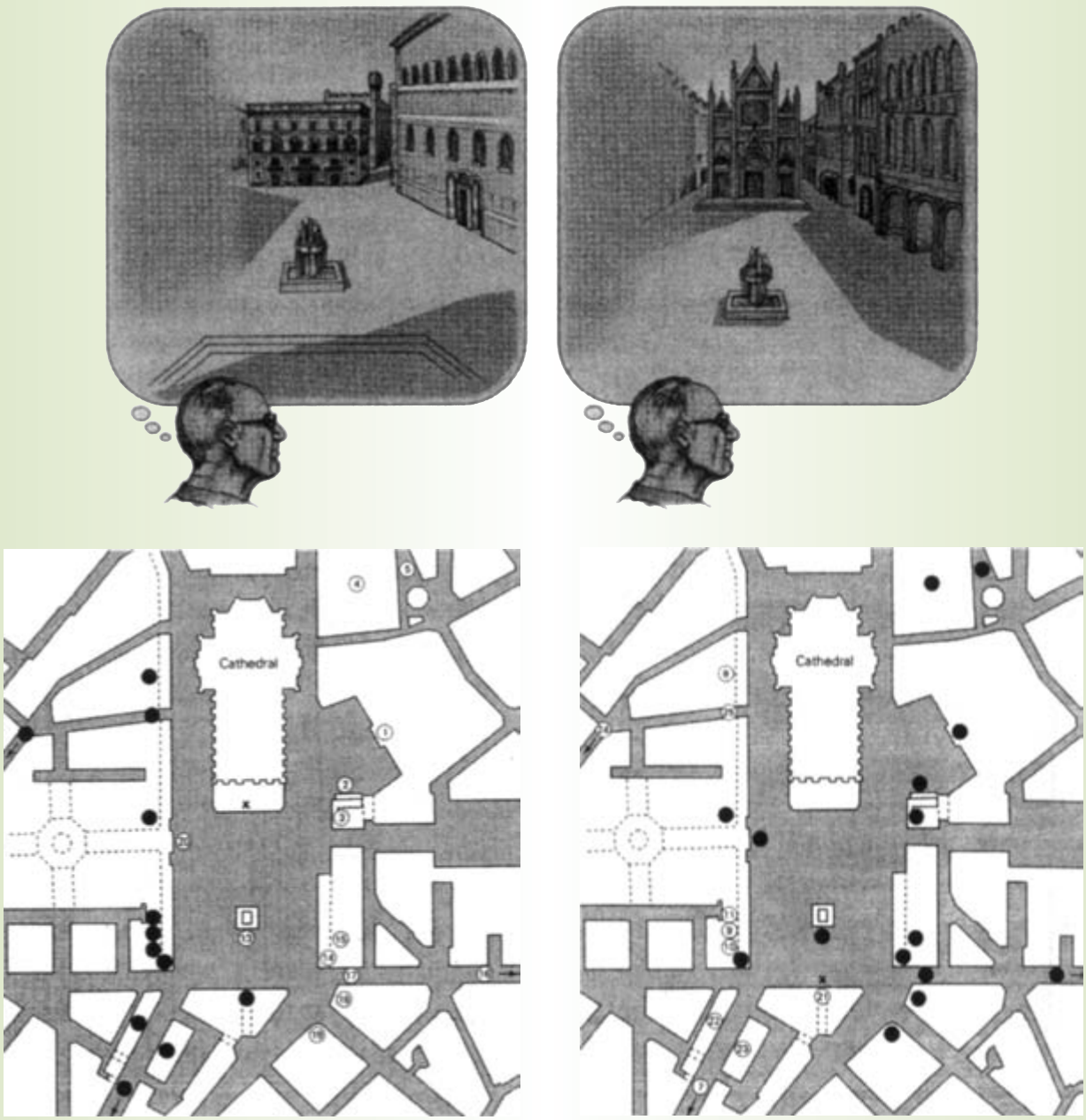

Figure 3.15

An illustration of the effects of hemi-neglect on spatial attention. Source: Bisiach and Luzzatti (1978).

Results and implications

The patient describes a number of buildings and landmarks, all on the right of his imagined viewpoint. Eventually he cannot think of any more.

Imagining his back turned to the main building, he again describes the buildings and landmarks on his right, but now he is naming the buildings that he omitted in the first part of the test, and this time omitting the buildings that he had named before (Bisiach & Lazzatti, 1978).

It is therefore clear that he knew about the buildings on both sides of the square, even though from each imagined viewpoint he only reported what lay in half of the physical space. So this kind of hemispatial neglect cannot simply be a visual defect.

Bisiach, E., & Luzzatti, C., 1978, 'Unilateral neglect of representational space', *Cortex*, 14, 129–33.

the visual information has not reached the left hemisphere, and so cannot be processed properly as language. But it is fascinating to see that if the word is the name of an object, the patient can use their left hand (which is connected to the right hemisphere) to select that object from among a variety of others. The patient may even be able to demonstrate how the object is used, but until they touch it with their right hand, they will remain unable to say what it is called (see Sperry, 1974).

NEURAL INTERACTION

What do neurons look like?

Until the nineteenth century, we really had no idea what neurons looked like. Early workers were only able to stain the neurons' cell bodies: until the axons and dendrites could be seen, neurons looked not so very different from liver or muscle cells.

This changed in 1862, when a cell staining method was developed (largely by accident) that enabled the structure of a single neuron to be seen clearly through a microscope. Camillo Golgi's staining method was a bit hit and miss: sometimes no cells at all might be stained; at other times all the cells in a particular section of brain might be so densely stained that the whole section looked black and individual cells could not be distinguished at all. But sometimes just a few cells would be darkly stained, and their *morphology* could then be established. It soon became clear that there are many different kinds of neurons.

morphology the shape or form of a neuron

The great brain anatomists like Ramón y Cajal ([1892] 1968) and Lorente de Nó (1934) used these kinds of techniques to examine, describe and draw the structures of the brain at a level of detail that would previously have been inconceivable. Nowadays you can inject a dye directly into a cell, so that it alone is filled; you can then visualize the neuron in its entirety. Where such studies are combined with functional studies recording the activity of that cell and the other neurons most intimately connected with it, the relationship between form and function can be established with great rigour.

We also discover where each neuron's incoming connections originate, and where their own outputs go, by injecting anatomical *tracers*. These are substances that are absorbed by cell bodies, or by axon terminals, and then transported through the cell. This, coupled with electrophysiological studies in which we stimulate activity in one area and determine its effects in others, enables us to identify how neurons interconnect and interact. Neuronal interaction is what the brain is all about.

tracers substances used in neuroanatomy that are taken up by neurons (e.g. at the axon terminals) and transported along them (e.g. to the cell body), allowing the neurons' connections to be identified

Pioneer

Santiago Ramón y Cajal (1852–1934) was born in the Spanish village of Petilla. His father, at that time the village surgeon but subsequently the Professor of Dissection at the University of Zaragoza, found him a difficult teenager, and apprenticed him first to a shoemaker and later to a barber. The young Ramón y Cajal himself wished to become an artist, but eventually went to medical school, graduating in 1873. He entered academic life in 1875, but his great life's work began when, in 1887, he was shown brain sections stained by Camillo Golgi's silver method. Ramón y Cajal was captivated. Thereafter he studied and drew the nervous system in great detail. His observations led him to propose that the nervous system is made up of vast numbers of separate nerve cells: the 'neuron doctrine'. He shared the Nobel Prize with Golgi in 1906.

Electrical activity

Neurons are integrators. They can have a vast number of different inputs, but what they produce is a single output signal, which they transmit to their own targets. How is this done?

The key lies in the electrical potentials they generate. There is a small voltage difference between the inside and the outside of the neuron. The inputs are tiny amounts of chemical *neurotransmitters*. The target cell has specialized receptor sites, which respond to particular neurotransmitters by subtly changing the cell's electrical potential for a short time. If enough signals come in together, then the total change can become big enough for the target cell to 'fire' – or to transmit an output signal along its axon to modify the activity in its own target cells.

neurotransmitters chemical messengers used for communication between neurons, released from specialized sites at the axon terminal and affecting specialized receptor sites across the synaptic cleft

So our first task is to find out how neurons produce electric potentials. Then we can see how these potentials change in response to inputs. Once we understand that, we can look at the way this same electrical potential system produces a fast and reliable output from the cell.

The resting potential

The outside of a neuron is made of a highly specialized membrane. Within the neuron, much of the chemical machinery is made up of large, negatively charged protein molecules, which are too big to leak out through the membrane. Outside the membrane, in the gaps between neurons, lies the extra-cellular space, which contains fluid with electrically charged ions dissolved in it.

What does this mean? Well, common salt, for example, also called sodium chloride, is a compound of two elements – sodium

and chlorine (giving a chemical formula of NaCl). When it is dissolved in water, it dissociates into a positively charged sodium ion (Na^+) and a negatively charged chloride ion (Cl^-). Potassium chloride also dissociates into its ionic constituents – potassium (K^+) and Cl^-.

Mobile, positive ions are electrically attracted to the negatively charged proteins held within the neurons, but although the neuronal membrane lets potassium ions through, it is relatively impermeable to sodium ions. So potassium ions are pulled into the cell and held there by the electrical charge on the intracellular proteins. As potassium levels within the cell rise above those outside it, this inward flow of charged ions reduces, because there is now a concentration gradient tending to pull potassium *out* of the neuron.

Equilibrium is reached (with the inside of the neuron more negative than the outside) when the opposing pulls of the concentration gradient and of the electrical gradient balance each other. There is also an active pumping of ions across the neuronal membrane: for example, some sodium leaks into the neuron and is actively pumped out. These processes give neurons their characteristic electrical charge – the *resting potential* (see figure 3.16).

resting potential the potential difference across the neuron's membrane when it is neither activated nor inhibited (roughly 70 millivolts)

Some ions have their own channels that let them pass through the cell membrane. These can be opened or closed, selectively altering membrane permeability. Some pumps move ions inwards and others move them outwards. Neurotransmitters use these different *ion channels* to manipulate the cell's membrane potential – a complicated balancing act.

ion channel specialized opening in the neuron's outer membrane, which lets electrically charged ions flow through, so changing neuronal potentials

These activities consume a lot of energy. Your brain is only 2.5 per cent of your body weight, but uses some 20 per cent of your resting energy. This increases when the nervous system is actively processing signals. When a region increases its energy consumption, its blood supply needs to increase as well. This can be detected by functional neuro-imaging systems to help us identify which parts of the brain are activated during particular kinds of mental processing.

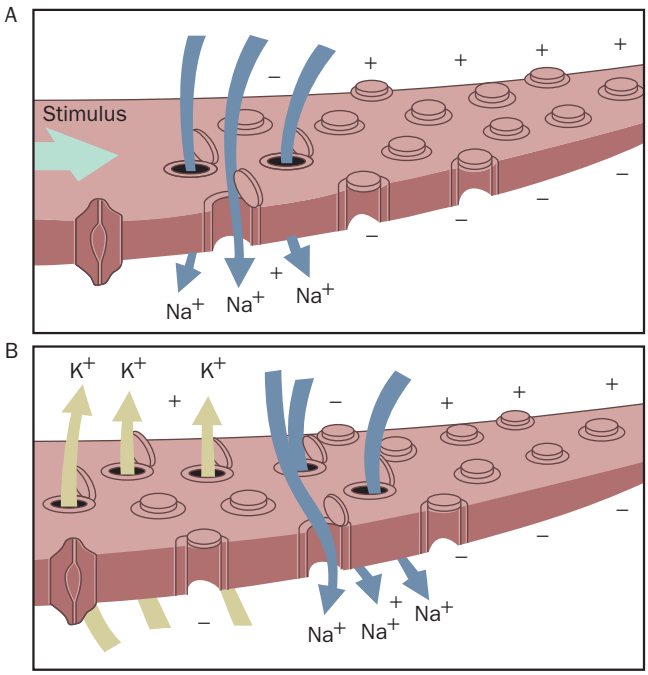

Figure 3.16

Ion flows across the neural membranes. The white area in the upper part of (A) and (B) is extracellular fluid, and the white in the lower part of each diagram is the cell interior.
Source: Gleitman, Fridlund and Reisberg (1999).

The action potential

When a neuron is activated by its input, the potential across the cell membrane changes. This is because when a neurotransmitter binds to its receptor, it can open channels that let particular ions go through the membrane.

Say we open a sodium channel. Positive Na^+ ions will flow through the membrane into the cell for two reasons:

- The resting potential keeps the inside of the cell negatively charged, so positive ions are attracted in.
- There is an attracting concentration gradient for sodium, because there are many more Na^+ ions outside the cell than inside it.

The resulting influx of positive ions makes the inside of the cell less negative, reducing the resting potential. This is called depolarizing the cell.

If the cell is depolarized from its resting potential of around minus 70 millivolts to its *threshold potential* of about minus 55 millivolts, an abrupt change is seen. This is called an *action potential* (see figure 3.17). It has been studied with great precision by controlling the membrane potential directly using electrical stimulation. The potential across the cell membrane suddenly flips radically from the normal state, in which the inside is negative relative to the outside, to a transient state in which, for a millisecond or so, the inside becomes positive relative to the outside.

threshold potential the voltage at which depolarization of a cell leads to generation of an action potential

action potential the all-or-nothing electrical output of a neuron

The normal direction of polarization is rapidly restored once the stimulation stops. In fact, the neuron becomes *hyperpolarized* for a few milliseconds, which means that its inside becomes even more negatively charged than

hyperpolarization increasing neuronal membrane potential to more than its usual resting potential (making it harder to induce the cell to produce an action potential)

Pioneer

Lord Adrian (1889–1977) was a physiologist who initiated single neuron recording methods. He was the Nobel Prize winner in 1932, shared with Sir Charles Sherrington. Adrian pioneered the use of then state-of-the-art electronics to amplify the signals he recorded and display them on an oscilloscope. This was a crucial technological advance that allowed him to monitor activity in single nerve fibres. One of his key findings was that intensity of sensation was related to the frequency of the all-or-nothing action potentials of constant size – so-called 'frequency coding', as opposed to 'intensity coding'.

Adrian also studied the sensory homunculus in different species. He reported that in humans and monkeys both the face and the hand have large areas of the sensory cortex devoted to them, whereas in pigs, the greater part of sensory cortex dealing with touch is allocated to the snout. So the richness of sensory representation can be related to the typical needs and activities of the species concerned. Subsequently, Adrian moved from work on the peripheral nervous system to study the electrical activity of the brain itself, opening up new fields of investigation in the study of epilepsy and other types of brain injury

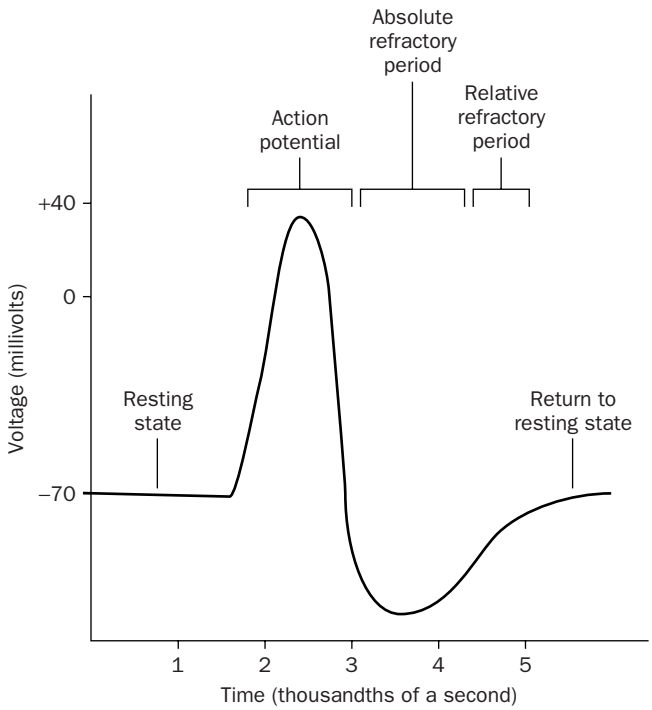

Figure 3.17

The action potential. Source: http://psychology.uww.edu/305ww/neuron/action%20potential.jpg

refractory period a brief period following the generation of an action potential, during which a neuron is hard to re-excite

usual. During this time – the *refractory period* – the hyperpolarized neuron is less readily able to respond to further input. So a single, relatively small, stimulation pulse can produce a radical change in the neuron's electrical state.

How does this happen? The crucial mechanism lies in the way that the different ion channels are controlled. While some are controlled by neurotransmitter receptors, others respond to the electrical potential across the cell membrane. When the cell has been depolarized all the way to the threshold potential, additional sodium channels suddenly open. More sodium ions pour into the cell through these channels, because there is still both a concentration gradient and an electrical gradient to attract them. This drives the depolarization further downwards, leading to further opening of sodium channels. So depolarization proceeds very rapidly.

If we are to restore the original resting potential, ready for the next action potential, we have to reverse this current flow as quickly as possible. This is achieved by an outflow of positively charged potassium ions from the cell, combined with a process that deactivates sodium flow. Although the full picture is much more complicated than this, and involves many more different ions and channel types, an understanding of the sodium and potassium currents conveys its essence.

Once an action potential has been generated, it will rapidly travel along the cell's axon, changing membrane permeability as it goes. This active, self-regenerating method of spreading makes the classical action potential a very effective and reliable way to transmit information. If the neurons' signals were conducted passively, in the way that heat is conducted along a wire, the signals would get weaker and weaker the further they had to go. If you use a long enough poker you can safely stir the red hot embers of a fire without your hand getting burnt. The hotter the fire, the longer the poker you need to use. But if heat were propagated actively, like an action potential, you would have to wear asbestos gloves, however long the poker.

The action potential is the same size whether the depolarizing stimulus is only just strong enough to reach threshold or depolarizes well beyond threshold. This all-or-nothing property often leads people to liken action potentials to the digital signals in a computer. But this vastly underestimates the complexity of the nervous system and the potential subtlety of its responses. As we shall see, the propagation of the action potential may be all or nothing, but its effect can be very subtly graded.

Neurotransmission

We know how electrical signals are generated – but how do they activate neuronal targets? If we compare neurons to electrical circuits, then the answer is clear. Each wire in a circuit connects to the next wire in a circuit and current flows uninterrupted through all of them.

But very few neurons are connected together in this way. Instead, communication between neurons usually relies on neurochemical transmission.

The limitations of gap junctions

Where there are points of structural continuity between neurons, current can flow from one neuron to the next, just as it would from one wire to another that has been soldered to it. The electrical potential in one neuron then directly affects the electrical potential of the next, depolarizing the target neuron as though it were no more than an extension of the neuron in which the signal originated.

gap junction extremely close contact between two neurons allowing direct flow of electrical current between them

Such connections – or *gap junctions* – do have some advantages. The signal is passed on at the maximum possible speed, and activity amongst groups of neurons is more easily synchronized, which can have its own advantages. But if all the neurons in our nervous system were interconnected in this way, whatever happened to one neuron would affect all the others and would at the same time be affected by all the others. This would radically reduce the system's capacity for information processing. If all the neurons end up doing exactly the same thing, you might as well have only one neuron and be done with it.

So to get the most out of each neuron, you want them to be able to operate to some extent independently. In particular, you may not want the activity of the target neurons to determine the activity of their own inputs. This problem of how to keep neurons independent and ensure that information flows in the right direction is solved by chemical neurotransmission.

The advantages of chemical neurotransmission

Chemical neurotransmission takes place at the synapse, across a very narrow gap called the synaptic cleft, where the axon of the input neuron most closely approaches its target (see figure 3.18). Both the axon terminal region and the post-synaptic membrane (i.e. the membrane on the target cell's side of the synaptic cleft) are highly specialized. The axon's terminal region contains small *vesicles* – packages filled with neurotransmitter. The neurotransmitter is released from the axon terminal, crosses the synaptic cleft and binds to specialized receptors in the membrane of the target neuron. For chemical neurotransmission to be fast, the chemical messengers need to be made of rather small molecules. The classical synapse in the brain is where an axon makes contact with the dendrites of its target neuron, although contacts from axon to axon and dendrite to dendrite are also known to occur.

vesicle subcompartment of a neuron in which neurotransmitter is stored prior to release

When an action potential reaches the axon terminal, some vesicles fuse with the external cell membrane of the neuron, and the neurotransmitter chemical they contain is released. Because the distance across the synapse is very small, the neurotransmitter rapidly diffuses across to the post-synaptic neuron, where

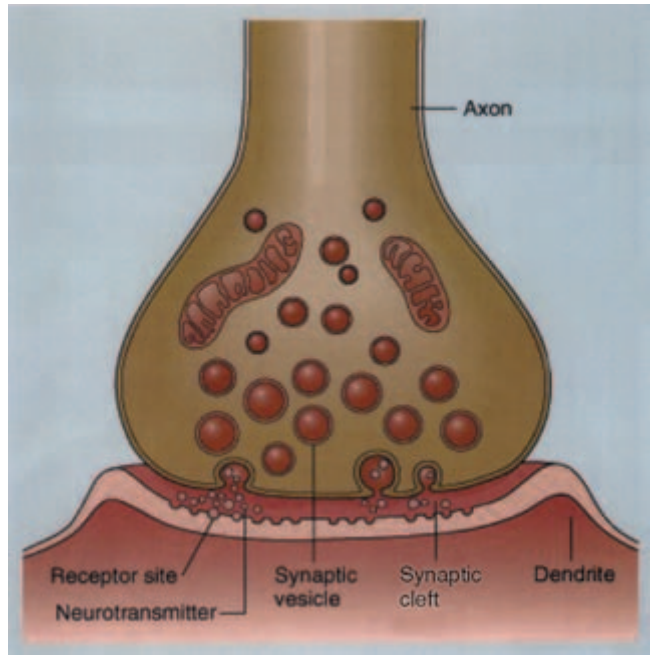

Figure 3.18

The synapse, showing transmitter release.
Source: www.usm.maine.edu/psy/broida/101/synapse.JPG

it binds to its receptor sites. Stimulation of different receptor subtypes produces different physiological effects. For example, the classical acetylcholine receptor opens sodium ion channels, leading to a Na^+ influx that depolarizes its target cells, as described earlier.

Once a neurotransmitter has been released, two more events must occur. First, more of the transmitter chemical is synthesized in the cell body and transported along the axon to the terminal region, ready for the next output signal. Second, the effects of the neurotransmitter in the target cell must be turned off again. Otherwise, a single input would depolarize its target forever, and no more information could be passed that way. A muscle, for example, would be left in a permanent state of contraction, whether it received a single impulse or a whole series of them.

There are several mechanisms for deactivating neurotransmitters. The molecule might be degraded into a form that has no physiological effects. In the case of acetylcholine, this is done by the action of the enzyme cholinesterase, which completes the job within a millisecond. It can also be done by reabsorbing the neurotransmitter back into the axon terminal that released it, or by absorbing the neurotransmitter into an adjacent glial cell.

Neurons as integrators

You know by now that neurons' output signals are all-or-nothing action potentials, and that a neuron must be depolarized beyond

its threshold to generate an action potential. How are the neuron's many different inputs combined?

Input axons typically connect to target dendrites. The branching dendritic trees of some neurons may have as many as one hundred thousand synapses on them. At any moment, each of those synapses may be either active or inactive. Each active excitatory input will to some extent depolarize the target cell membrane around its synapse. But unless the target cell is depolarized all the way to its threshold potential, so that an action potential is generated, that individual excitatory input will not lead to any output from its target. The more inputs there are, the more sodium ions flow into the target cell, and the more likely it becomes that threshold potential will be reached.

So the eventual activity of the cell depends on the overall pattern of activity of its many inputs. This means that, although neurons have all-or-nothing outputs, those outputs cannot control their targets in an all-or-nothing way. The effect on the target depends on the signals coming in at the same time from all its many inputs. In this way, neurons are effectively integrating their own inputs.

Disrupting the system

Neurotransmission mechanisms are open to disruption. We can manipulate the receptors, or the transmitter release system, or the transmitter inactivation mechanisms. By designing drugs that affect the system in these ways, we can alter brain function.

Antagonists – blocking the goal

Curare is an Amazonian plant product. It paralyses movement by binding to the acetylcholine receptor on the muscles, and prevents acetylcholine released from motor nerves from reaching its intended target. Unlike acetylcholine, curare does not depolarize muscles, so the motor nerves can no longer cause muscle contractions. This loss of movement includes breathing. This is an example of an *antagonist*. Antagonists block the effects of neurotransmitters, often by occupying the transmitter's receptor site.

antagonist neurotransmitter antagonists prevent or reduce the normal effect of a neurotransmitter

Curare was first used by South American Indians as a poison for hunting, but its synthetic derivatives are nowadays widely used in surgery. It can be very valuable for the surgeon to be able to control muscle movement and maintain respiration through artificial ventilation.

Another way to produce essentially the same effects would be to block acetylcholine release. Botulinus toxin (from the bacterium *clostridium botulinum*, which sometimes grows in preserved foods that have been imperfectly sterilized) has this effect. It is one of the most lethal poisons known. You could kill off the entire human population of close to six billion people with about 28 grams of toxin. Nowadays it is sometimes used in cosmetic surgery to reduce brow wrinkles by paralysing the muscles under the skin.

Neurotransmitter antagonists also have an important role in psychiatry. The hallucinations and delusions in schizophrenia are often treated using dopamine receptor antagonists like haloperidol. Unfortunately, prolonged use of these drugs sometimes induces movement disorders as an unwanted side effect, by blocking the action of dopamine in the *nigrostriatal* pathway. This is the pathway damaged in patients with Parkinson's disease (see below).

nigrostriatal the pathway from the substantia nigra to the striatum, which degenerates in Parkinson's disease

Agonists – keeping signals switched on

Neurotransmitter *agonists* are chemicals that have the same kind of action as the neurotransmitter itself. If their action is irreversible, or much more powerful than the natural compound whose place they usurp, then they are just as dangerous as powerful antagonists. They can equally disrupt function, by keeping signals permanently switched on.

agonist neurotransmitter agonists mimic or enhance the effect of a neurotransmitter

This can be done in several ways. Nicotine is a very widely used acetylcholine receptor agonist. It acts both centrally and peripherally. The lethal dose of nicotine for a human adult is 40–60 mg. There can be this much nicotine in just two or three cigarettes, but smoking leads to much lower nicotine absorption than eating.

There are also *indirect agonists*, which work by inducing greater than normal neurotransmitter release, or preventing re-uptake. Amphetamine is a somewhat unselective, indirect dopamine agonist, which effectively increases dopamine release. Amphetamine abuse can lead to hallucinations and delusions – essentially the opposite of the effect of haloperidol, described above.

indirect agonists substances increasing neurotransmitter effects, typically by inducing additional neurotransmitter release

Direct neurotransmitter agonists also have an important role in neurology. Parkinson's disease results from loss of dopamine neurons in the nigrostriatal system. One way to help restore normal movement in these patients is to boost dopamine function in the nigrostriatal pathway. This can be done by giving apomorphine – a direct dopamine agonist, which simulates the effects of the missing dopamine. Or we can give a dopamine precursor, L-DOPA, which helps the surviving neurons to synthesize more dopamine. Too much L-DOPA can lead to terrible hallucinations. So clinical manipulations of dopamine activity need to manage some tricky balancing acts.

Preventing neurotransmitter deactivation

A third way to increase neurotransmitters' effects in the synapse is to disrupt deactivation mechanisms. So, although neurotransmitter is released perfectly normally, its period of effective action

is abnormally prolonged. The result is similar to the effect of a direct neurotransmitter agonist.

Cholinesterase inhibitors, which stop cholinesterase from performing its usual job of breaking down acetylcholine into inactive fragments, work in just this way. They are found in a number of plants and are widely used as insecticides. (They also form the basis of some of the most deadly nerve gases.) So the direct acetylcholine agonist, nicotine, and the cholinesterase inhibitors are both synthesized by plants – presumably because they both make the plants toxic by overactivating the cholinergic systems of animals that consume them. But they achieve this effect by two, quite different, biochemical routes.

These kinds of mechanisms can offer therapeutic benefits as well. Psychiatrists have for many years used monoamine oxidase inhibitors to treat depression. These drugs neutralize the enzymes that normally deactivate monoamine transmitters (noradrenaline, dopamine and serotonin). This increases the effectiveness of monoamine neurotransmission, leading to clear clinical improvements after a few weeks of treatment.

Although these drugs are still in clinical use, it is now more usual to treat depression with newer compounds that use a rather different mechanism aimed at prolonging the actions of monoamine neurotransmitters. Perhaps the best known is Prozac (fluoxetine). This is a specific serotonin re-uptake inhibitor (or SSRI). It reduces the re-uptake of a particular monoamine, serotonin, into the neuron from which it has been released. Once again, this means that whenever neurotransmitter is released, its effects on its targets are longer-lasting (see chapter 16).

Inhibitory neurotransmission

So far we have considered only excitatory neurotransmission – how one cell induces an action potential in a target. But there is much more to chemical neurotransmission than signal amplification and one-way information flow. There are also *inhibitory neurotransmitters*, which reduce the excitability of a cell. If a cell has a constant but low level of incoming stimulation that keeps it firing at a regular rate, an inhibitory transmitter can reduce that firing. And if a target cell is quiescent, an inhibitory neurotransmitter can prevent it from being excited.

inhibitory neurotransmitters neurotransmitters that make their target cell less excitable, so it becomes harder to induce an action potential

The classic inhibitory neurotransmitter is GABA (gamma-amino-butyric acid). GABA works by increasing chloride ion flow into the interior of the cell. Since chloride ions are negatively charged, they increase the cell's negativity. This is called hyperpolarization. It is harder to excite an action potential in a hyperpolarized cell.

Just as some drugs are designed to disrupt excitation, others work on inhibitory transmission to modify neuronal activity. Enhancing inhibition has much the same effect as disrupting excitation: both reduce neuronal activity. Yet because these two approaches depend on different chemical neurotransmitters, they can have rather different side effects.

Among the various subtypes of GABA receptors is $GABA_A$. This is a particularly interesting one, because it includes the site of action of the very widely used benzodiazepine minor tranquillizers – the class to which Librium and Valium belong. These drugs increase chloride flow into the cell. Alcohol and barbiturates act on other components of the $GABA_A$ receptor to have much the same effect, so in some ways they also act like inhibitory neurotransmitters.

It is an easy mistake to think of inhibitory neurotransmitters as simply inhibiting thought or action. But in a complex network of neurons, in which inhibitory projections may inhibit other inhibitory cells, it is hard to predict the eventual outcome of inhibiting neuronal activity. Nonetheless we can generalize about the effects of blocking inhibitory GABA transmission. Drugs that do this tend to produce epileptic seizures. Equally, drugs that enhance inhibitory transmission can be used to prevent epilepsy. If a patient has been treated for a long time with drugs that increase GABA transmission and that treatment is suddenly stopped, there is a risk that the patient may suffer from epileptic convulsions.

So at some very general level, inhibitory transmitters do damp down the excitability of the brain. Some of the most horrific poisons, like strychnine, produce their effects by preventing inhibitory transmission (in this case at glycine-dependent inhibitory interneurons in the spinal cord).

Further intricacies

Autoreceptors

We have so far described transmitter being released by the pre-synaptic neuron, crossing the synaptic cleft, binding to post-synaptic receptors, and shortly afterwards being deactivated. In fact, by no means all receptor sites are located on the post-synaptic membrane. Surprisingly, some axons have receptors for their own neurotransmitter – *autoreceptors*.

autoreceptor a neurotransmitter receptor located on a neuron so as to be activated by that neuron's own release of neurotransmitter

For example, there are dopaminergic cells with dopamine autoreceptors on their axons. These can be activated by the dopamine that their own cells release, to provide a local, negative feedback loop, which can inhibit the cell from further firing. So input neurons can modify their own activity while activating their post-synaptic targets.

Paracrine effects

Target neurons can also have receptors located outside the specialized synaptic region. They are presumably activated either by neurotransmitter that escapes from the synaptic cleft, or perhaps by a transmitter that is itself released outside specialized synaptic regions.

paracrine non-classical effects of neurotransmitters that may not be released at the synapse, and/or whose receptors are not located at the synapse

neurocrine classical neurochemical action of transmitters that are released at the axon terminal to affect specialized receptor sites across the synaptic cleft

These extra-synaptic routes for chemical communication are sometimes called *paracrine* systems, as opposed to the more classical *neurocrine* routes. Their existence adds yet further subtleties to neuronal activity. It is possible that, under certain neuronal conditions, overflow from the synaptic cleft becomes more likely. This overflow could then differentially activate these non-classical paracrine communication routes, potentially producing qualitatively different actions on the target structures.

Neuromodulators and hormones

A still further level of complexity is provided by non-classical neurotransmitter substances. Some of these are released by neurons like the conventional neurotransmitters already described, but they can have longer-lasting actions and (like paracrine neurotransmitters) act at greater distances from their release sites. Some may have no directly measurable effects on their targets, but they may change the target neuron's responsiveness to its other classical neurotransmitter inputs.

neuromodulators neurochemicals that indirectly affect neuronal activity, usually by modifying response to other chemical neurotransmitters

There is a more or less indefinable boundary between these substances – often called *neuromodulators* – and hormones. For example, cholecystokinin (CCK) is a peptide that is released as a hormone by the duodenum (part of the digestive tract), but is also released like a neurotransmitter from dopaminergic neurons in the brain, where it modifies the responses of dopamine autoreceptors. So the same molecule can operate as a neuromodulator in the brain and as a hormone in the gut.

Hormones are molecules that are released into the bloodstream from specialized endocrine glands (such as the pituitary gland or the adrenal gland) and can therefore, in principle, act anywhere in the body. For hormones, specificity of action results from the presence of chemically specific receptors on the target structures that are bathed by the bloodstream. The hormonal receptors are activated when the hormones pass by in the blood. Hormones can affect neuronal function in a similar way to neuromodulators, changing sensitivity to other inputs and altering the release of neurotransmitters.

Experience as a modifier

LTP and LTD

Although there are many ways to modulate neuronal function, they are not usually linked to specific psychological functions. But there is one form of synaptic modifiability that has led researchers to make striking and specific claims, presenting it as a possible neural basis for some forms of learning or the ability to lay down new memories (see Andersen, 1983; Bliss & Lømo, 1973; Morris et al., 1986).

Pioneers

Tim Bliss (1940–) and **Terje Lømo** (1935–) first reported the phenomenon of long-term potentiation. The plausibility that a strengthening of synapses might underlie memory storage increased tremendously when the phenomenon of long-term potentiation (LTP) was discovered by these two researchers. In the 1970s, Bliss and Lømo noticed that if they applied a few seconds of high frequency electrical stimulation to certain neurons in the rabbit hippocampus, synaptic transmissions to those neurons would increase in amplitude. More surprisingly, this enhancement seemed to be long-lasting, sometimes persisting for weeks (Bliss & Lømo, 1973). This phenomenon has since been termed long-term potentiation, or LTP. In the twenty years since its discovery, a great debate has raged among neuroscientists about whether this LTP might be the crucial mechanism underpinning learning and memory.

The first crucial observation was made by electrophysiologists studying the responses of cells in the hippocampus, a structure that is crucial in memory processing. They found that the size of the neuronal response to a single pulse of electrical stimulation at a given intensity could be increased, in a long-lasting way, by giving a relatively brief burst of high frequency stimulation (Bliss & Lømo, 1973; Lømo, 1966). By comparing the size of the response to a single pulse before and after this high frequency series of pulses, researchers showed beyond doubt that neuronal responsiveness had increased (see figure 3.19). This change is called *long-term potentiation*, or LTP.

long-term potentiation (LTP) a long-lasting increase in a target neuron's response to a given level of activity of its input neurons

It is now clear that LTP can be seen in many structures in the brain, and not only those thought to be associated with memory. It is highly likely, though, that LTP always reflects experience-dependent changes in neuronal functioning, whether in the sensitization produced by painful stimuli, or in perceptual development in the visual cortex, or in the laying down of memory traces in the brain.

It has also become clear that there is a complementary process – *long-term depression*, or LTD – which describes a decrease in neuronal response. The ability either to increase or to decrease synaptic connectivity as appropriate offers maximum flexibility for adjusting neuronal function.

long-term depression (LTD) a long-lasting reduction in a target neuron's response to a given level of activity of its input neurons

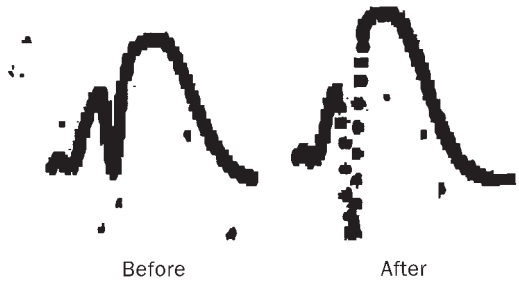

Figure 3.19

LTP: field potentials before and after potentiation.

The NMDA receptor

NMDA receptor a subtype of glutamate receptor

One key element in LTP is a particular subtype of glutamate receptor, the *NMDA receptor*. Calcium entry into the cell is one of the triggers for the development of LTP. The NMDA receptor controls a calcium ion channel that is both transmitter dependent and voltage dependent. This means that even when the NMDA receptor is activated by glutamate, no calcium will pass into a cell through the NMDA-controlled channel unless the target cell has also recently been depolarized. So NMDA-dependent LTP can only develop in a cell that has been depolarized and then receives a further input – exactly the conditions that apply during a burst of high frequency stimulation.

The mechanism underlying this dual sensitivity to neurotransmitter levels and voltage levels is remarkably simple. It turns out that in cells at their normal resting potential, a positively charged magnesium ion is held in the channel by the electrostatic gradient across the cell membrane. If the NMDA receptor is activated, so that the channel could, in principle, be opened, the inflow of calcium is blocked by the magnesium ion. Once the cell is depolarized, nothing holds the magnesium ion in place, so it can diffuse into the extracellular fluid. If the NMDA receptor is again activated at this point, the ion channel opens and, with the magnesium block removed, calcium can pour into the cell, triggering the series of events that leads to LTP. Of course, as the cell repolarizes, the magnesium ion is drawn back into position once more.

The LTP system, particularly in the hippocampus, has been a focus of intense research activity. Rat experiments have shown the blockade of the NMDA receptor by the drug AP5 prevents the development of LTP, and at the same time appears to prevent the normal operation of hippocampus-dependent spatial memory (Morris et al., 1986). More recently still, psychological studies of 'knockout' mice, genetically engineered so they can no longer show LTP in the hippocampus, have also shown striking failures of hippocampus-dependent spatial memory tasks, that neatly parallel the effects on LTP (e.g. Reisel et al., 2002). If we can combine these new techniques in molecular biology with sophisticated behavioural analysis, we will have ways to study the relation between brain and cognition at a finer level of detail than has ever been possible before.

So we have seen that the adult nervous system is highly modifiable: our brains change in accordance with our experiences. Is the development of our brains modified by the environment too?

THE GROWTH OF THE CENTRAL NERVOUS SYSTEM

Neonatal brain development

When mammals are born, they have to pass through a narrow birth canal, which places a practical limit on neonatal head size. But this does not necessarily limit ultimate brain size, so long as further brain development can take place after birth.

This is not too much of a problem for human infants, whose particularly helpless state at birth is made feasible by parental care. Small animals like rats can hide their young safely away in holes. So, like humans, the young can be born immature without incurring excess risk. In contrast, herbivores that inhabit open grassland may need to be able to run with the herd within minutes, or at most a few hours, of their birth. Such creatures could not afford a long postnatal period of general brain development. This problem has been solved in a different way by the kangaroo, which is born very early in its development but remains protected in the safety of its mother's pouch, where it continues to develop until it is capable of independent movement.

Our own protracted postnatal development not only allows us to grow a bigger brain (the adult brain is around four times the size of a new-born baby's brain). It also ensures that our brain continues to develop while we are interacting with our environment. So each person's brain will, to a certain extent, be adapted to the circumstances of their lives.

Survival of the most useful

The first sign of what will become the brain appears very early in human gestation. By the end of the second week, a neural plate made up of precursor neurons can be identified. By the end of the first month, a primitive brain has already formed.

Like other parts of the body, the brain develops when cells migrate to the appropriate place. Those cells have to know how to differentiate into the right kinds of eventual cell types, and when to stop differentiating. But brain development requires more than cells simply knowing how to get to the right place and what to do when they are there. For this particular organ, a high level of competitiveness is involved.

During development, connections in the brain respond to what is going on. We start off with many more potential neurons than will eventually survive. Neurons compete to make connections with their targets, and it is the connections that are actually used which seem to have a better prospect of survival. Unsuccessful neurons die, through a process of programmed cell death, called *apoptosis*. If one set of neurons fails to make its normal connections, then another set of opportunist neurons may colonize the vacant space.

apoptosis genetically programmed self-destruction of a neuron

The capacity for neural regeneration

So the eventual wiring of the adult brain in part reflects experiences during the long period of brain development that takes place after birth. And, to some extent, the brain responds to those experiences by making structural changes. However, once the mammalian brain is fully developed, the capacity to form new neurons is drastically reduced, though not totally lost (see below). Even before full development is reached, a lack of input during a critical stage can lead to a permanent loss of appropriate connection.

For example, covering one eye during development can distort visual connections, leading to persistent impairment of adult vision that depends on that eye (Mitchell, Murphy & Kaye, 1984; Murphy & Mitchell, 1986). As little as two weeks of occluded vision can induce these effects in human infants. This has implications for eye surgery procedures in children – for example, placing a patch over the eye after surgery could significantly impair the efficient wiring of the visual system.

In this respect, the central nervous system differs from the peripheral nervous system, in which regeneration occurs regularly after injury. Areas of axonal loss can be reinnervated (i.e. the neural connections can be re-established) under some circumstances, to afford a complete recovery of function. But in the central nervous system, spinal cord damage, for instance, leads to permanent paralysis. Christopher Reeve, once the star of *Superman* films, is now confined to a wheelchair due to spinal cord damage sustained during a riding accident.

It is possible that this difference between the central nervous system and the peripheral nervous system lies in the non-neuronal cells that are found alongside neurons. In the central nervous system, these are glial cells; in the peripheral nervous system, they are schwann cells. These non-neuronal cells provide the environment for the neuron, and can clearly secrete a variety of bioactive signalling substances. When peripheral nerves are cut, the portion of axon lying beyond the injury is cleared away, partly by the schwann cells, which form into cylindrical guides along the original path of the axon. New axon processes sprout and spread from the remaining stump, and if one of these processes enters the schwann cell guide tube, then its growth rate increases and it is led along the tube towards the nerve's original target. Central nervous glial cells do not seem to have this ability to guide regenerating axons.

Can we repair damaged brains?

The question of whether it might be possible to induce the central nervous system to regenerate has taken a new turn since the early 1970s. At this time, it became clear that adult neurons can sometimes form new connections. If one input to a target area is lost, the remaining inputs sometimes send out new branches from their axons to colonize the vacant space (Raisman & Field, 1973).

This is not necessarily an advantage. If normal function of the target area depends partly on interactions between two inputs, it may be worse off having a double signal from only one of them than having a normal signal from one and no signal from the other.

How can we encourage the right kind of regeneration in response to injury?

Neural grafting

One way is to transplant into the damaged brain a new supply of neurons of the missing kind. If the transplanted neurons are themselves taken from a brain at the right stage of development, they will grow in an adult host brain and form new connections, leading at least to a partial restoration of normal function.

This has been most convincingly demonstrated in the dopamine system running from the substantia nigra to the caudate-putamen at the base of the forebrain. Destruction of this dopaminergic pathway leads to movement disorders in rats, and to Parkinson's disease in humans (Hornykiewicz, 1973; Ungerstedt, 1971). Transplants of dopamine cell bodies lead to a clear restoration of some motor functions in the rat (Dunnett et al., 1981), and alleviate some of the symptoms of Parkinson's disease in human patients (Hagell et al., 1999).

If the transplant is made into the site in the substantia nigra where the original dopamine cell bodies would have been located, it will not grow its axons to the original target for the dopamine pathway. So the transplant has to be made into the caudate-putamen. This means that the incoming connections to the original dopamine cell bodies will not be made to the transplanted dopamine cell bodies, as these are not where the original cells were located.

How do we explain the success of this transplanting procedure? The most plausible explanation is that the implanted dopamine cells make synaptic connections where they can release dopamine in appropriate amounts, although this dopamine release will not be controlled normally by the activities of the remainder of the brain. The success of this procedure also illustrates the key role of dopamine – to enable other neurons in the motor system to operate normally, rather than carrying some specific signals of its own. The dopamine system itself does not seem to give instructions about which muscle to move next.

The capture and transmission of more specific information by transplanted neural tissue has been demonstrated in retina transplant experiments. A retina is transplanted so as to make connections with the brain of a developing rat. In adulthood, the rat can learn to respond to illumination of the transplanted retina as readily as it responds to illumination of its own natural retina (Coffey, Lund & Rawlins, 1989).

While these kinds of transplant procedures in no way reconstruct the original circuitry in its entirety, more recent developments offer some hope of coming much closer to this ideal. In these procedures, instead of neurons that have already differentiated into a particular neuronal variety, neuronal stem cells are transplanted. These neuronal precursors have the potential to develop into any kind of neuron. So when they are transplanted into a damaged brain, they migrate to the areas in which cells are missing and form new structures that become integrated into the host brain (Lundberg et al., 1997). It is possible that this kind of technique will result in a far more complete recreation of the missing circuitry (Svendsen & Smith, 1999).

Research close-up 3

Temporal lobe amnesia

The research issue

A patient known as H.M. had surgery for the treatment of epilepsy in 1953. The surgeon removed the inner face of the temporal lobe in each hemisphere, including the hippocampus, the amygdala and the rhinal cortex.

Since then, H.M. has remembered almost nothing new, though he still remembers clearly events in his life before the operation. His other cognitive skills are unaffected. He is clearly capable of learning new motor skills, like mirror drawing, and perceptual skills, like completing pictures (figure 3.20), although he does not remember doing so.

In fact his IQ went up slightly after his operation, which successfully reduced the frequency and severity of his epileptic seizures.

Design and procedure

Before testing begins, H.M. talks with the neuropsychologist for a few minutes, having not met her before. The neuropsychologist asks him what he had for breakfast that day: he does not remember. Testing begins.

The neuropsychologist has a collection of photographs of faces. She shows some to H.M., who studies them all carefully. A few minutes later he cannot identify which faces he has just seen and which ones he has not. The same sort of thing happens with a list of words. The neuropsychologist then shows him a very rudimentary line drawing and asks him if he recognizes it. He correctly identifies it as an aeroplane. He is also able to repeat a string of six numbers immediately after hearing them.

Figure 3.20

Example from Gollin's (1960) incomplete drawing test. Source: McCarthy and Warrington (1990).

The neuropsychologist then shows him another very rudimentary line drawing (like the top panel illustrated to the left) and asks him if he recognizes it. He has seen all the drawings before, in previous test sessions, and now correctly identifies the fish even from seeing only the least complete version of the drawing.

The neuropsychologist leaves the room, and H.M. waits with the nurse. Twenty minutes later the neuropsychologist returns. The patient clearly does not recognize her, gets up, and politely introduces himself.

Results and implications

amnesia a clinical problem, often with underlying neurological damage, involving chronic and serious memory problems

H.M. is a particularly 'pure' *amnesic* patient with a highly selective memory loss. His short-term memory is intact, and he still recalls events from his pre-operative childhood, but his memory for everyday events is disastrously impaired. It was initially suggested that his damage left him specifically unable to consolidate (store) new memories, because he can clearly retrieve memories laid down before his surgery and also registers new events in short-term memory. However, we now know that he can learn new skills and perform implicit memory tasks. He learned to identify the line drawing as a fish following training with all five versions of the drawing in the panel. Initially he would not have 'seen' what the top panel was, but once having learned it he continues to give the right answer, even though he cannot remember his training sessions themselves. This persisting new learning makes it unlikely that a consolidation failure accounts for his symptoms.

So some fifty years after his surgery, neuroscientists still do not agree on exactly why he shows profound memory loss. Nonetheless, his case has focused attention on the hippocampus as a core memory structure, and this has proved to be a crucial step in developing neurobiological theories of information storage in the brain.

Scoville, W.B., & Milner, B., 1957, 'Loss of recent memory after bilateral hippocampal lesions', *Journal of Neurology, Neurosurgery and Psychiatry*, 20, 11–21.

Is it possible for brains to regenerate?

In some birds, the brain region related to memory (the hippocampus) varies in size according to demand. In the Americas, cowbirds parasitize other birds' nests in the same way that the European cuckoo does, by laying eggs in them to be brought up by foster parents. Successful brood parasites need to know where the hosts' nests are, and how the egg laying is going in each nest. It is not much use laying your egg after the host's eggs have been incubated, giving them a head start in the race to hatching, nor is it a good idea to lay your egg before the host has laid any eggs at all. Cowbirds therefore need to keep careful track of what is going on during the breeding season. It is now clear that at this time the cowbird hippocampus increases in size relative to other structures in the brain.

In one species of cowbird, only the female keeps track of nest development. In this species, the female's hippocampus increases in relative size during the breeding season and decreases again afterwards, but the male's does not. In another species, both male and female keep track of nests, and the hippocampus in both sexes increases for the breeding system. A third species of cowbird is not a brood parasite at all, and in this species the hippocampus shows no sign of growing or shrinking (Reboreda, Clayton & Kacelnik, 1996).

In humans, hippocampal damage leads to such a profound amnesia that the patient is more or less incapable of living an independent life. Yet birds appear to need a hippocampus only some of the time. At other times they get rid of it, even though they will have to regrow it next year. Why? It has been suggested to me (by my colleague Professor Sir John Krebs) that the answer lies in energy saving, since the brain uses a great deal of energy, and a reduction in energy load may be vitally important. Small birds in cold climates can lose a significant proportion of their body weight overnight, so even a marginal saving could make a vital difference. Whatever the reason, the bird's ability provides a striking example of the potential for reforming circuitry in adult brains.

Neurogenesis in adult mammals

The potential for neural replacement (*neurogenesis*) is almost completely absent in the adult mammalian brain – but not entirely absent (Gage, Ray & Fisher, 1995). Intriguingly, one of the two areas of the adult mouse brain that show neurogenesis lies in the dentate gyrus (part of the hippocampus). Elderly mice living in enriched environments show an increase in the numbers of new neurons formed, as well as increased numbers of surviving dentate granule cell neurons (Kemperman, Kuhn & Gage, 1997). Perhaps the mammalian brain more closely parallels the avian brain in its potential for reconstructing central nervous circuitry than we have tended to assume.

Recent work shows evidence of neurogenesis in the adult hippocampus of primates, including humans (Eriksson et al., 1998; Kornack & Rakic, 1999). A structural imaging experiment has shown that London taxi drivers – whose job demands an extraordinary knowledge of London streets – have a relatively larger posterior hippocampus compared to age-matched controls (Maguire et al., 2000). The extent of the increase in size correlated with the length of time spent as a taxi driver.

It is thus conceivable that constant use of a spatial navigation system has led to growth of the adult human hippocampus, or at least to selective protection from age-related hippocampal shrinkage. One day we may be able to take advantage of this potential, and use it for clinical therapy.

Modular processing

The brain can solve immensely difficult computational problems. We can judge distances, we can identify objects, we can walk through complex environments relying solely on vision to guide us. These abilities are way beyond the capacities of current computers, even though their processing elements operate very much faster than our neurons.

So, how do we solve complex problems of visual geometry so rapidly? The key lies in the brain's parallel processing capacity (see figure 3.21). In principle, different aspects of a visual stimulus

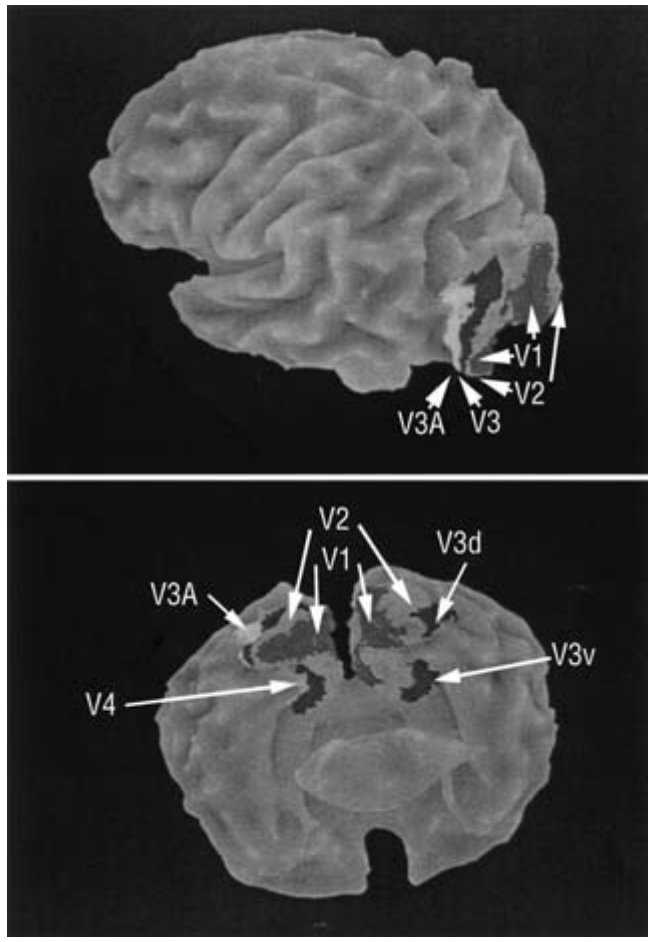

Figure 3.21

Visual processing modules of the brain.
Source: http://ahsmail.uwaterloo.ca/kin356/ventral/v2.jpg

are analysed by different modules in the brain. One module may deal with form, another with motion, and another with colour. By splitting up the task in this way, it is possible to solve complicated problems rapidly.

There might also be an evolutionary explanation for modularity in the brain. To add a new perceptual analysis feature to our existing perceptual analysis systems, the simplest route would be to leave the existing analysis systems unchanged and simply 'bolt on' a new feature. The alternative would be to rewire and reconfigure all the existing systems to add the mechanisms for the new analysis. It is harder to imagine how this might happen without the risk of radically disrupting the pre-existing systems.

A computational stratagem like this poses new problems, however. There needs to be some way of ensuring that the different aspects of a stimulus, although processed separately, are nonetheless related to each other. A cricket ball heading towards you is red, shiny, round and moving. You need to know that these separate attributes all refer to the same object. How does our brain solve this problem? It is possible that the different brain regions analysing different aspects of the same stimulus show synchronized oscillations, which act to link these structures together (e.g. Gray et al., 1989).

The visual processing modules are in some senses independent, but not completely so. Identifying a shape or form, for example, sometimes depends on solving the problem of colour or reflectance. A uniformly coloured, curved surface, lit from above, may emit different wavelengths of light from different points on the surface. We perceive it as being a single colour partly because we are also seeing it as a curved surface. And our perception of it as being curved equally depends partly upon light intensities and/or wavelengths reaching us from different points on the surface. So form and reflectance need to be solved simultaneously, and the solutions are, to some extent, interdependent. Although parallel processing is still an appropriate way to explain how the brain solves problems, as so often seems to be the case, things are a bit more complex than that.

FINAL THOUGHTS

We have just completed a very brief tour of the nervous system. The brain has sometimes been referred to as the most complex entity in the known universe. The human brain contains some 100 billion neurons – the individual units from which this system is built. Each of these may have up to 100,000 synapses providing inputs from other neurons. Those facts alone would be enough to make the brain a system of awesome complexity. Over and above this, there are many different kinds of neurons. Each can have its own responsiveness subtly adjusted by the many and varied chemical inputs it receives. The operations of a vast network, built of individually variable components, are bound to be extraordinarily difficult to unravel and understand.

An introductory chapter can do no more than sketch some of the outlines of neuroscience's achievements so far, and identify a few of the prospects that lie ahead. This chapter aims to give a sense of how the nervous system operates, so that you will not be constrained to thinking of the brain as a series of rather arbitrarily named boxes, each in some unspecified way connected to others. Thinking about why the brain is organized in the way that it is, and appreciating the many ways in which we – and our environments – can alter brain function for good or ill, make behavioural and cognitive neuroscience not only more comprehensible, but far more exciting too.

Summary

- The nervous system is built of individual neurons. The human brain contains some 100 billion neurons, of many different kinds. Each neuron may have up to 100,000 synapses providing inputs from other neurons. Inputs come via the dendrites, and outputs are sent along the axons.
- Neurons maintain electrical potentials, which change in response to inputs from other neurons. When a neuron 'fires', it sends a rapid action potential along its axon, which is 'insulated' by myelin sheaths.
- Neurons interact using chemical transmitters. There are many different neurotransmitters in the brain. Each neuron can have its own responsiveness subtly adjusted by the many and varied chemical inputs it receives.
- The significance of chemical neurotransmission between neurons is revealed in the design of effective therapeutic drugs for neurological illnesses such as Parkinson's disease and schizophrenia.
- The human nervous system has many different components and levels of organization, each element having being fine-tuned through millennia of evolution to serve its current role (e.g. the peripheral nervous system vs. the central nervous system; the cerebral cortex vs. the subcortex; the left cerebral hemisphere vs. the right cerebral hemisphere).
- The nervous system comprises distinct 'modular' components but nevertheless (unless damaged or depleted) operates as a functional integrated whole.
- Some brain regions have highly specific functions. This allows parallel processing of information, to speed up our computations, but also means that very restricted brain damage can produce profound but selective deficits (e.g. the loss of colour vision, or loss of the ability to identify individuals from their faces, while other visual processing remains intact).
- The human nervous system forms many of its connections after birth. This helps to match our brain's development and organization to our interactions with our environment.
- The brain is highly plastic: some connections remain modifiable, and at least some new brain cells can be created, even in adulthood. This might offer long-term avenues for brain repair.

REVISION QUESTIONS

1. How does the peripheral nervous system differ from the central nervous system?
2. What is special about the cortex?
3. Why do nerve cells have to use energy to maintain their electrical potential gradients?
4. How are action potentials generated?
5. How do nerve cells communicate with each other?
6. What are the advantages of chemical neurotransmission? How can it be exploited in drug design?
7. Does our environment influence the structure of our brains?
8. Can damaged brains be repaired?
9. What are the advantages of modularity in the brain?
10. Should we think of the brain as operating like a digital computer?
11. What, if anything, is special about the human brain?
12. Why might neurons with different integrative functions have different morphologies?
13. How have advances in neuroscientific research methods contributed to our ability to understand structure and function in the brain?
14. Can we understand normal function by studying dysfunction?
15. How can different approaches to studying brain function be combined so as to complement one another?

Further Reading

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A very good introductory text.

Greenfield, S.A. (1997). *The Human Brain: A Guided Tour*. London: Weidenfeld & Nicolson.
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An excellent introduction to neuroscience.

Ramachandran, V.S., & Blakeslee, S. (1999). *Phantoms in the Brain*. London: Fourth Estate.
Fascinating descriptions of patients who have suffered damage to their nervous systems, illustrating some of the links between brain function and thoughts and feelings.

Shepherd, G.M. (1988). *Neurobiology*. 2nd edn. Oxford: Oxford University Press.
Another excellent introduction.

Strange, P.G. (1992). *Brain Biochemistry and Brain Disorders*. Oxford: Oxford University Press.
Explains how disturbances of brain chemistry can lead to disturbances of thought and behaviour with insights into drug treatments for psychiatric conditions.

Zeki, S.A. (1993). *A Vision of the Brain*. Oxford: Blackwell.
An interesting and well-illustrated account of how we see and how the brain processes information.

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Learning 4

CHAPTER OUTLINE

LEARNING OBJECTIVES

INTRODUCTION

CLASSICAL CONDITIONING
- Pavlov's dogs
- Other examples of conditioned responses
- Associative analysis
- The importance of classical conditioning

INSTRUMENTAL LEARNING
- Thorndike's cats
- The Skinner box
- The law of effect
- Control of performance
- The importance of instrumental learning

THE PRINCIPLES OF ASSOCIATION FORMATION
- Contiguity and predictiveness
- Selective association formation

NON-ASSOCIATIVE LEARNING
- Responding to a single stimulus
- Spatial learning
- Discrimination learning

FINAL THOUGHTS

SUMMARY

REVISION QUESTIONS

FURTHER READING

Learning Objectives

By the end of this chapter you should appreciate that:

- classical conditioning involves fundamental learning processes;
- the classical conditioning procedure forms certain kinds of specific associations;
- classical conditioning plays a role in psychological phenomena observed outside the laboratory;
- instrumental training procedures engage learning mechanisms to form particular associations;
- there are important factors that determine when instrumental learning will be expressed in behaviour;
- classical conditioning and instrumental learning depend on association formation;
- the associative principle does not apply to some forms of learning.

INTRODUCTION

We all know what 'learning' means. As we develop, we learn new motor skills, such as playing the piano or riding a bike. We acquire new cognitive skills, such as long division or computer programming. And we might learn a body of information, such as the dates of the kings of England or the words of a song.

In psychology, the term 'learning' covers all this and more. A wider, psychological definition might go something like this: 'Learning is the process whereby an organism interacts with its environment and becomes changed by the experience so that its subsequent behaviour is modified.' The acquisition of new information and new skills falls within this definition, but so do the following events:

- A snail experiences a brief jolt of the surface on which it is crawling and reacts by retracting its tentacles. Subsequent jolts, however, are found to be less effective in inducing withdrawal until the reaction finally disappears.
- The first conspicuous moving object seen by a newly hatched chick is a laboratory attendant. As a consequence, the chick develops an attachment to that person, approaching and following him or her, and tending to avoid other things.
- A rat is given access to a distinctively flavoured foodstuff that has been laced with a small amount of poison, enough to induce nausea but not enough to kill. On recovering from its illness, the rat will tend to shun the flavour, even if it is one that it liked beforehand.

Figure 4.1

As we develop, we learn new motor skills, such as riding a bike.

- A hungry pigeon is given a small amount of food each time it happens to make a turn in a particular direction. After experiencing a few rewards, the bird develops an increasing tendency to circle on the spot in the 'correct' direction.

These examples are all interesting in themselves, but that is not enough to explain why many psychologists should have chosen to concentrate on experimental studies showing how special training procedures conducted in rather constrained and artificial circumstances can produce changes in the behaviour of laboratory animals. The reason lies in their hope that, by focusing their attention on relatively simple examples of learning that are amenable to experimental and theoretical analysis, they will be able to discover basic principles of learning that can then be used to explain a wide range of complex learning phenomena.

Hence the interest in laboratory studies of learning in animals. Just as the geneticist has studied the genetics of the fruitfly in the laboratory to determine generally applicable laws of inheritance, so the psychologist has studied the behaviour of the rat in the maze in the hope of discovering equally general laws of learning. Whether psychologists have been successful in this endeavour, the rest of this chapter will tell.

CLASSICAL CONDITIONING

Our definition of learning mentions changes taking place. What kinds of changes are we talking about? The physical basis of the changes that constitute learning lies in the brain, and neuroscientists are close to discovering exactly what these changes are. But our concern in this chapter is with the psychological mechanisms of learning, rather than the physiological mechanisms.

Foremost among these is the concept of *association*. There is a philosophical tradition, going back at least 300 years, which supposes that, when two events (ideas or states of consciousness) are experienced together, a link, connection or association forms between them, so that the subsequent occurrence of one is able to activate the other.

association a link between two events or entities that permits one to activate the other (such as when a characteristic odour elicits an image of the place where it was once experienced)

In the twentieth century the proposal was taken up by experimental psychologists, who thought that association formation might be a basic psychological process responsible for many, if not all, instances of learning. The first to explore this possibility in any depth was the Russian I.P. Pavlov with his work on *classical conditioning*.

classical conditioning learning procedure in which two stimuli are paired – one (the conditioned stimulus) usually presented shortly before the other (the unconditioned stimulus) to produce a conditioned response to the first stimulus (learning)

PAVLOV'S DOGS

Pavlov spent the first half of his long scientific career working on the physiology of digestion, turning to the study of learning in about 1900. He had noticed that dogs which salivate copiously when given food also do so in response to other events – for example, at the approach of the laboratory attendant who

supplied the food. This response was clearly acquired through experience. Pavlov (1927) took a version of this procedure into the laboratory, making it a model system that could be used to reveal basic principles of learning.

Pavlov's standard procedure involved a quiet, distraction-free laboratory, which gave the experimenter full control over events experienced by a lightly restrained dog. From time to time the dog was given access to food, and each presentation was accompanied (usually slightly preceded) by the occurrence of a neutral event, such as a flashing light. After several training trials (pairings of light and food), the dog would salivate at the flash of light, before any food had appeared.

unconditioned response (**UR**) evoked by a stimulus before an animal has received any explicit training with that stimulus

unconditioned stimulus (**US**) evokes an unconditioned response

conditioned response (**CR**) evoked by a conditioned stimulus as a result of classical conditioning

conditioned stimulus (**CS**) evokes a conditioned response as a result of classical conditioning

Salivation at the presentation of food is called an *unconditioned response* (UR), since it occurs automatically (unconditionally). The food is an *unconditioned stimulus* (US). The animal's tendency to salivate when the light flashes is conditional on the light having been paired with food, so this is referred to as a *conditioned response* (CR) and the event that evokes it as a *conditioned stimulus* (CS). The whole training procedure was labelled conditioning. As other forms of training, introduced later, have also been described as conditioning, Pavlov's version became known as classical conditioning.

Pioneer

I.P. Pavlov (1849–1936), born the son of a priest in Ryazan (250 miles south-east of Moscow), moved in 1870 to study natural science and medicine in St Petersburg. He spent the rest of his life there conducting scientific research, first on the physiology of the digestive system (for which he was awarded a Nobel prize in 1904) and later on conditioned reflexes. Although the study of conditioned reflexes was taken up mostly by psychologists, Pavlov insisted that his approach as a physiologist was far superior to that adopted by the comparative psychologists of his day. His demonstration of the salivary conditioned reflex in dogs, for which he is widely known, was just the start of an extensive body of work, in which he analysed the conditioning process in detail, revealing phenomena and suggesting learning mechanisms that are still being actively investigated today.

Other examples of conditioned responses

Following Pavlov's pioneering work, the study of classical conditioning has been taken up in many laboratories around the world. Few of these have made use of dogs as the subjects and salivation as the response, which are merely incidental features of conditioning. The defining feature is the paired presentation of two stimuli – the CS and the US. The presentation of the US is often said to be contingent on (i.e. to depend on) the presentation of the CS.

Here are just a few of the wide range of training procedures that employ this contingency:

conditioned emotional response result of the superimposition of the pairing of a conditioning and an unconditioned stimulus on a baseline of operant or instrumental behaviour

- *Conditioned emotional response* The experimental animal, usually a rat, is presented with a neutral cue, such as a tone sounding for one minute (the CS), paired with a mild electric shock (US) that occurs just as the tone ends. After several pairings (the exact number will depend on the intensities of tone and shock), the rat's behaviour changes. It begins to show signs of anxiety, such as freezing and other 'emotional responses', when it hears the tone before the shock has occurred. This is the CR.

autoshaping classical conditioning used with pigeons which results in pecking at an illuminated response key that has been regularly presented before the delivery of food, even though the delivery of the food does not depend on the pecking behaviour

- *Autoshaping* A hungry pigeon is presented with grain (US) preceded by the illumination for ten seconds of a small light (CS) fixed to the wall of the cage. After 50 to 100 trials, the bird develops the CR of pecking at the light prior to food delivery. It is as if the bird is predisposed to respond to the light even though the pecking does not influence whether or not it receives the grain.

flavour aversion learning classical conditioning procedure in which animals are allowed to consume a substance with a novel flavour and are then given some treatment that induces nausea, resulting in the flavour being subsequently rejected

- *Flavour aversion learning* Rats are given a novel flavour (e.g. saccharin is added to their drinking water) as the CS. This is followed by a procedure, such as the injection of a mild poison into their body, that makes them feel sick (the US). When it is subsequently made available, the rats will no longer consume the saccharin-sweetened water; they have developed an aversion (CR) to that flavour.

This is clearly a very varied set of phenomena, but what they all have in common is the presentation of two stimuli, one contingent on the other. And, despite the fact that there is nothing in these training procedures that actually requires a change in

behaviour, in every case the animal's behaviour changes as a result of its experience.

In the autoshaping case, for instance, the experimenter simply ensures that the light reliably accompanies food. There is no need for the pigeon to respond to the light in any way, since food is delivered regardless of the bird's behaviour.

So why does behaviour change? Why are conditioned responses acquired? This puzzle must be dealt with by more detailed theoretical analysis.

Associative analysis

When a dog trained by Pavlov's procedure sees the light (CS), certain neural mechanisms are activated. Without specifying what these mechanisms are, we can refer to this pattern of activation as constituting a representation of the CS. This is often referred to as the CS 'centre', implying that it is localized in a specific part of the brain, although this might not necessarily be the case (for the purposes of our current behavioural analysis, this does not matter too much). Eating food (the US) will also have its own pattern of proposed neural activation, constituting the US representation or 'centre'.

One consequence of the Pavlovian conditioning procedure is that these two centres will be activated concurrently. Pavlov suggested that concurrent activation results in a connection between the two centres, which allows activation in one to be transmitted to the other. So, after Pavlovian learning has taken place, presentation of the CS becomes able to produce activity in the US centre, even when the food has not yet been presented.

This theory therefore explains classical conditioning in terms of the formation of a stimulus–stimulus association between the CS centre and the US centre. (Given this framework, the fact that the presentation of the US provokes an obvious response is not strictly relevant to the learning process.)

Sensory preconditioning

If this account is correct, it should be possible to trigger classical conditioning using paired neutral stimuli that themselves evoke no dramatic responses. Evidence that this can occur comes from a phenomenon called *sensory preconditioning*, first demonstrated by Brogden (1939) and confirmed many times since. In Brogden's experiment (see table 4.1), the animals in the critical experimental condition received a first stage of training consisting of paired presentations of two neutral stimuli, a light and a buzzer. If our theory is correct, an association should be formed between the central representations of these stimuli. The problem is to find a way to reveal this association.

sensory preconditioning pairing of two neutral stimuli prior to one of them being used as the conditioned stimulus in a standard classical conditioning procedure, leading to the other stimulus acquiring the power to evoke the conditioned response

Brogden's solution was to give a second stage of training in which one of the original stimuli (say the light) was given orthodox conditioning, being paired with a US until it came to evoke a CR (in this procedure, a response of flexing the leg). A final test showed that the buzzer was also able to evoke the leg flexion response, even though the buzzer had never previously been paired with the US. This result is what might be expected on the basis of the stimulus–stimulus association theory. The light evokes the CR by virtue of its direct association with the US, whereas the buzzer is able to do so 'by proxy' because its association with the light allows it to activate the representation of that stimulus.

Table 4.1 Design and results of the experiment by Brogden (1939) on sensory preconditioning.

Condition	*Phase 1*	*Phase 2*	*Test (leg flexions to B)*
Experimental	A + B	A → shock	9.5
Control	no training	A → shock	0.5

A and B represent a light and a buzzer.

Why and how does the CR occur?

What remains to be explained, once the stimulus–stimulus association theory has been accepted, is why the CR should occur and why it should take the form that it does. Pavlov's dogs might 'know', by virtue of the CS–US link, that light and food go together, but this does not necessarily mean that the animal should start to salivate in response to the light. The most obvious explanation is that activation of the US (food) centre will evoke a given response, whether that activation is produced by presentation of the US (food) itself or, via the learned CS–US (light–food) connection, by presentation of the CS (light).

An implication of this interpretation is that the CR and the UR should be the same, and this is true for the case just considered: the dog salivates (as a UR) to food and also comes to salivate (as a CR) to the light that has signalled food. In other examples of conditioning, however, the CR and UR are found to differ. In the autoshaping procedure, for instance, the UR is to approach and peck inside the food tray, whereas the CR that develops with training is to approach and peck at the light. In this case, the CR appears to be a blend of the behaviour that activation of the US (food) centre tends to evoke and the behaviour evoked by the CS (the light) itself.

So we cannot say that the CR and the UR are always the same. There is, however, a simple rule that describes the relationship between them for most cases of conditioning, in that, as a result of classical conditioning, the animal generally comes to behave toward the CS (the light in these examples) as if it were the US (food). In other words, the CS (light) appears to take on some of the properties of the US (food) and to serve as an adequate substitute for it. So the unconditional response of a hungry animal is to approach food, probably salivating as it does so, and then to consume the food (by pecking, if the animal is a pigeon). The CR consists of directing these behaviour patterns toward the CS, in

Everyday Psychology

How are phobias acquired?

phobias intense and seemingly irrational fears

Phobias can be very debilitating and distressing phenomena. Many of us know someone who is anxious about enclosed spaces, needles or spiders. Watson and Rayner (1920) speculated that the complexity of emotional responsiveness in adults might be explained by the conditioning of children's simple emotional reactions when they are exposed to new stimuli in their youth. They decided to test this proposal by attempting to establish a conditioned emotional response in a child under experimental conditions.

The study was done with a 'stolid and unemotional' infant boy, Albert B. At eight months of age he was exposed to a number of stimuli, including a white rat, a rabbit and a monkey, and showed no signs of fear to any of these stimuli. The fear reaction could be produced, however, by a sudden loud noise (produced by striking a steel bar with a hammer). On the first presentation of this noise, the child 'started violently'; on the second occasion, the 'lips began to pucker and tremble'; and on the third, the child 'broke into a sudden crying fit'.

At 11 months, Albert was subjected to the conditioning trials. The CS was a white rat, which Albert was allowed to play with, and the US was the loud noise. On six occasions over the course of a week, Albert was presented with the rat and at the same time he was subjected to the noise produced by striking the steel bar.

Evidence for emotional conditioning came from a test trial in which the rat was presented alone (i.e. not accompanied by the noise). Here is Watson and Rayner's description of the result: 'The instant the rat was shown, the baby began to cry. Almost instantly he turned sharply to the left, fell over on [his] left side, raised himself on all fours and began to crawl away' (1920, p. 5). Subsequent tests show that the fear response generalized to other stimuli, both animate and inanimate. A rabbit and a fur coat both produced a strong response, although the responses to a dog and to cotton wool were less marked.

This experiment establishes three important points:

1. It confirms, in a very vivid way, that classical conditioning processes work for humans as well as non-human animals.
2. It establishes that conditioning can influence whole patterns of emotional responding (in addition to the simple reflexes that had been most commonly studied up to this point in the learning literature).
3. Watson and Rayner note the parallel with the clinical condition of phobia – intense and seemingly irrational fear of intrinsically harmless objects or events. They suggest that phobias present in adults may be the product of a traumatic conditioning episode occurring earlier in life. Although it is not always possible to obtain evidence of such an episode, the general proposition that phobias derive from conditioning is widely accepted, albeit these days with some caveats related to the notion of preparedness and the apparent selectivity of some learning phenomena.

Watson, J.B., & Rayner, R., 1920, 'Conditioned emotional reactions', *Journal of Experimental Psychology*, 3, 1–14.

stimulus substitution when the conditioned stimulus comes to acquire the same response-eliciting properties as the unconditioned stimulus

so far as the physical properties of the event used as the CS will allow this. This rule is sometimes referred to as the *stimulus substitution* hyphothesis.

The importance of classical conditioning

If classical conditioning were simply a procedure that allows a reflex response previously elicited solely by a particular US (such as food) to come under the control of another stimulus (such as the presentation of a light), then perhaps there would be no reason to regard it as fundamentally important to our understanding of learning. But three features of our analysis give us reason to believe that it is fundamentally important:

1. Although the behavioural consequence of conditioning may appear to be merely the development of an anticipatory reflex, the underlying process is fundamental to learning about the relationship among environmental events. Sensory preconditioning tells us that when neutral stimuli co-occur, an association forms between them. Presumably, the informal equivalent of sensory preconditioning will be occurring all the time as an animal goes about its normal everyday business. Simply moving through the environment will expose the animal to sequences of events that go together, and the associations that form among them will constitute an important piece of knowledge – a 'map' of its world.
2. As a laboratory procedure, classical conditioning is important because it allows exploration of the nature of associative learning. The observed CR (salivation, pecking, or whatever) may not be of much interest in itself, but it provides a useful index of the otherwise unobservable

formation of an association. Researchers have made extensive use of simple classical conditioning procedures as a sort of 'test bed' for developing theories of associative learning. Some of these will be described in a later section of this chapter.

3. As a mechanism of behavioural adaptation, classical conditioning is an important process in its own right. Although the CRs (such as salivation) studied in the laboratory may be trivial, their counterparts in the real world produce effects of major psychological significance. Here are two examples from the behaviour of our own species.

Illness-induced aversion learning

Experiencing illness after consuming a given flavour will induce an aversion to that flavour, not just in rats, but in people too. Informal surveys of undergraduate students reveal that about 50 per cent report having an aversion to a particular flavour (usually a novel alcoholic drink). Most can clearly remember the occasion on which they tasted that flavour and subsequently became ill.

More significant are the aversions that can develop with the severe nausea that sometimes results from chemotherapy used to treat cancer. Chemotherapy patients sometimes find that strongly flavoured foods eaten prior to a session of treatment start to develop aversive properties. The need to change our eating habits is an inconvenience. But more worrying is the phenomenon known as anticipatory nausea and vomiting. Some patients (up to 50 per cent for some forms of treatment) develop an aversion to the clinic in which treatment is given, so that, after a few sessions, they begin to feel nauseous and even vomit as soon as they walk in. This reaction can be so severe that the patient refuses to continue treatment, with obvious life-threatening consequences.

Research on the nature of association formation has suggested ways of limiting this clinic–illness association (Hall, 1997).

Figure 4.2

Rats can learn to avoid a food associated with illness.

Emotional conditioning

The conditioned emotional response was first demonstrated not in rats, but with a human participant. In what may well be the most famous and influential experiment in psychology (although not one that would survive the scrutiny of a modern-day ethics committee), Watson and Rayner (1920) set out to establish that Pavlovian conditioning procedures would be effective when applied to a human infant. See *Everyday Psychology* and chapter 1 for more on this.

INSTRUMENTAL LEARNING

THORNDIKE'S CATS

At about the time that Pavlov was beginning work on classical conditioning in Russia, E.L. Thorndike, in the United States, was conducting a set of studies that initiated a different tradition in the laboratory study of basic learning mechanisms.

Thorndike was interested in the notion of animal intelligence. Motivated by an interest in Darwinian evolutionary theory, comparative psychologists of the late nineteenth century had investigated whether non-human animals can show similar signs of intelligence to those shown by humans. Thorndike took this endeavour into the laboratory. In his best-known experiment, a cat was confined in a 'puzzle box' (figure 4.3). To escape from the box, the cat had to press a latch or pull a string. Cats proved able to solve this problem, taking less and less time to do so over a series of trials (figure 4.4).

Cats solved the problem not by a flash of insight but by a gradual process of trial and error. Nevertheless, here was a clear

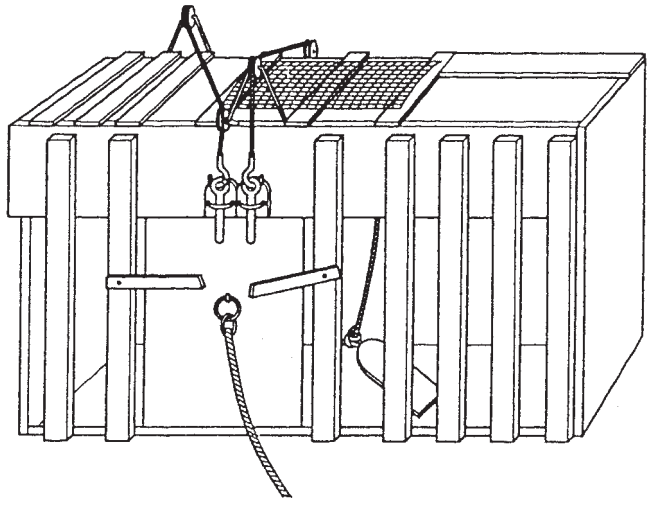

Figure 4.3

One of the 'puzzle' boxes used by Thorndike (1898) in his studies of instrumental learning in the cat.

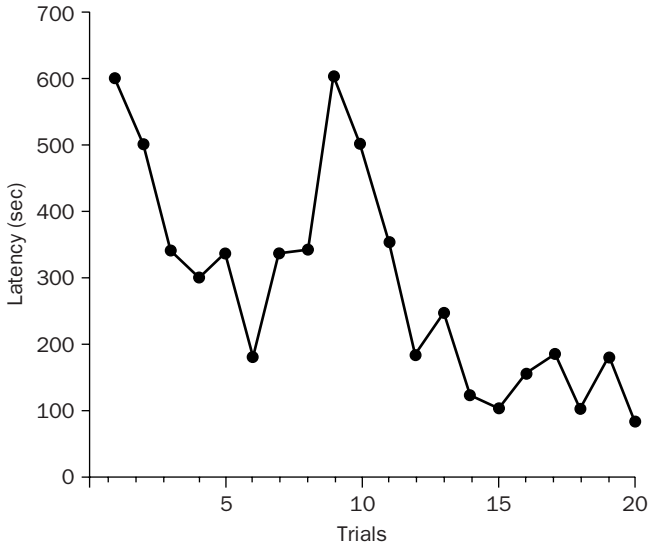

Figure 4.4

Time taken by a cat to escape from the puzzle box over a series of 20 successive trials. Source: Based on Thorndike (1898).

instrumental learning the likelihood of a response is changed because the response yields a certain outcome (a reward or punishment) (also called operant conditioning)

example of learning. Its characteristic feature was that the animal's actions were critical (instrumental) in producing a certain outcome. In this respect, *instrumental learning* is fundamentally different from classical conditioning, in which the animal's response plays no role in determining the outcome.

Subsequent researchers who took up the analysis of this form of learning include the Polish physiologist Konorski (1948), who called it Type II conditioning (as distinct from Pavlov's Type I conditioning). Another investigator interested in this type of conditioning was Skinner (1938) in the United States, who named it operant conditioning (Pavlov's version of learning being referred to as *respondent conditioning*). However termed, all agreed that its defining feature was a contingency between a preceding stimulus, a pattern of behaviour (or response) and a subsequent state of the environment (the effect or outcome).

respondent conditioning alternative name for classical conditioning

The Skinner box

The Skinner box soon replaced Thorndike's puzzle box in the laboratory study of instrumental learning. In the version used for the rat, the Skinner box consists of a chamber with a lever protruding from one wall and a nearby food cup into which food pellets can be delivered by remote control (figure 4.5). Pressing the

Figure 4.5

A rat in a Skinner box. The animal pictured has his nose next to a lever; when it depresses the lever, a food pellet can be delivered from the container outside the chamber on the left. In normal use, the apparatus is enclosed in a sound- and light-attenuating outer shell.

lever operates an electronic switch and automatically results in food delivery. So there is an instrumental contingency between the lever-press (the response) and the food (the effect or outcome). A rat exposed to this contingency presses the lever with increasing frequency. The Skinner box is similar to Thorndike's puzzle box, but instead of using escape from the box as a reward, the animal stays in the box and the reward is delivered directly to it.

This is an example of rewarded, or appetitive, instrumental learning, but the same general techniques can be used to study aversive instrumental learning. There are two basic aversive paradigms, *punishment* and *avoidance*.

punishment an aversive event as the consequence of a response to reduce the probability of the response

avoidance instrumental training procedure in which performing a given response brings about the omission of an aversive event that is otherwise scheduled to occur

Punishment The event made contingent on the response is aversive. For example, the habit of responding is first acquired. Subsequently, occasional lever-presses produce a brief electric shock through a grid floor fitted to the box. Unsurprisingly, the rate of responding declines. (It is worth adding that, although the effect may not be surprising, it still requires explanation. It often happens in psychology that the basic behavioural facts seem obvious; but when we try to explain them, we realize how little we really understand them.)

Avoidance A signal occurs from time to time, accompanied by a foot shock. If the rat presses the lever, the shock is cancelled. So there is an instrumental contingency between the response and the omission of a given outcome. By behaving appropriately, the animal can avoid the shocks. In fact, rats are rather poor at avoidance learning when the response required is a lever-press; they respond better when they are required to jump over a hurdle. So the apparatus usually used is a two-compartment box, with a hurdle separating the two parts. Rats readily acquire the habit of jumping the hurdle in response to the warning signal.

Training procedures that inflict pain (however slight) on the animal should obviously be employed only for good reason. Studies like this are justified by the insights they have provided into the nature of human anxiety disorders and neuroses (see below).

The law of effect

Thorndike's studies of cats in the puzzle box led him to propose the following interpretation of their behaviour: 'Of several responses made to the same situation, those which are accompanied or closely followed by a state of satisfaction to the animal will, other things being equal, be more firmly connected with the situation, so that, when it recurs, they will be more likely to recur' (Thorndike, 1911, p. 244). This is the *law of effect* as applied to appetitive instrumental learning.

law of effect Thorndike's proposal that reward will strengthen the connection between the response that preceded it and any stimuli present when it is delivered, or more generally, the principle that the consequence (effect) of behaviour will determine how likely it is to recur

Thorndike also put forward (and later retracted) a negative counterpart for the case of punishment, which proposed that certain effects ('annoyers') would weaken the connection between a response and the training situation. In modern terminology, Thorndike's 'satisfiers' and 'annoyers' are called reinforcers and punishers.

Thorndike's presentation of the law of effect has two major features:

1. What is learned is a stimulus–response (S–R) association.
2. The role of the effect produced by the response is to determine whether this association will be strengthened or not.

Both of these propositions are debatable and, as we shall shortly see, this theoretical version of the law of effect has not stood up well to further experimental analysis. As an empirical generalization, though, the law seems much more secure. Everyone accepts that the likelihood of an animal responding in a particular way can be powerfully controlled by the consequence of that response.

Pioneer

B.F. Skinner (1904–90) developed the framework of radical behaviourism, focusing on establishing laws of behaviour (empirical relationships between environmental events and behaviour). This framework was based on the intensive observation of a single subject under carefully controlled experimental conditions. His approach, the experimental analysis of behaviour, investigated 'operant' behaviours – so-called because they 'operate' on the subject's environment. Skinner's classic work involved the study of bar pressing (or pecking) by rats (or pigeons) in a 'Skinner box' that was constructed to eliminate all extraneous stimuli. A hungry animal was placed in the box and allowed to explore it. Sooner or later the animal would accidentally press a lever that released a food pellet. The food acted as a reinforcing stimulus (or reinforcer) for the bar-pressing behaviour, increasing the probability of its future occurrence.

Partial reinforcement

Skinner, who completely rejected the theoretical law of effect, devoted several years of research (e.g. Ferster & Skinner, 1957) to exploring and demonstrating the power of the empirical law. He worked mostly with pigeons, trained in a Skinner box to peck a disc set in the wall for food reinforcement. Skinner investigated the effects of *partial reinforcement*, in which food was presented after some responses but not all. Animals will usually respond well in these conditions, and with some *schedules of reinforcement* the rate of response can be very high indeed. If, for example, the animal is required to respond a certain number of times before food is delivered (known as a fixed ratio schedule), there will usually be a pause after reinforcement, but this will be followed by a high frequency burst of responding. Other ways of scheduling reinforcement control different but equally systematic patterns of response. There is a clear parallel here between the pigeon responding on a partial reinforcement

partial reinforcement the delivery of a reinforcer in operant conditioning is scheduled to occur after only a proportion of the responses rather than after all of them (continuous reinforcement)

schedules of reinforcement rules that determine which responses will be followed by a reinforcer in operant conditioning (see **partial reinforcement**)

schedule and the human gambler who works persistently at a one-armed bandit for occasional pay-outs.

The punishment paradigm

For a while, doubts were raised about how reliable the negative version of the empirical law of effect was. It soon became clear, however, that early studies failed because the punishment (such as the presentation of white noise) was too weak. Subsequent work using more intense punishments, such as shock, confirmed the effectiveness of the procedure in suppressing behaviour. What remained to be shown was that the shock had its effect by way of the instrumental contingency.

The following study conducted by Church (1969) investigated this question. Three groups of rats were all trained to lever-press for food. One group then began to receive occasional shocks contingent on lever-pressing (contingent group). A second group received the same number of shocks but these occurred independently of lever-pressing (noncontingent group). The third group of rats was given no shocks (control group). Church found that simply presenting shocks in the apparatus, with no contingency on behaviour, was enough to produce some response suppression. So the threat of shock (an effective Pavlovian unconditioned stimulus or US) is enough in itself to suppress behaviour to some extent. But powerful suppression of the response was seen only in the contingent group, demonstrating that the instrumental contingency between the response and the outcome is effective in producing pronounced learning (see figure 4.6).

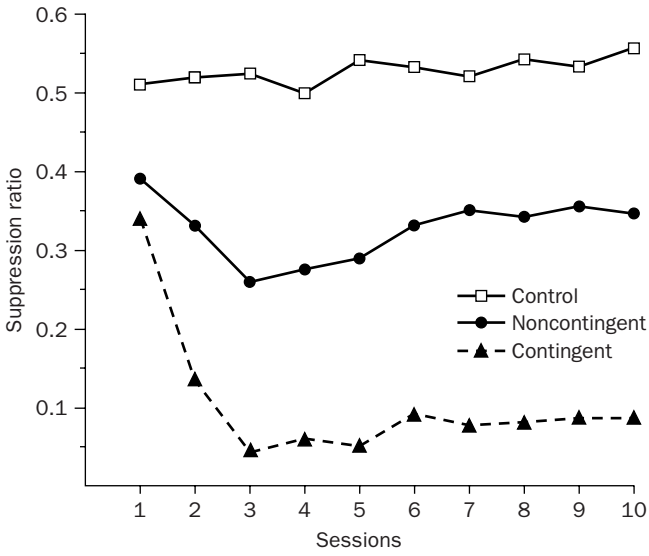

Figure 4.6

Results of an experiment by Church (1969) on the punishing effects of shock. The contingent group, which received shock when it responded, came to show response suppression. (A ratio score of 0.5 means no suppression; a score of zero means complete suppression.) The noncontingent group received shocks independently of its behaviour and showed less suppression. The control group received no shocks and showed no suppression.

When learning becomes habit

reinforcer an event that, when made contingent on a response, increases the probability of that response; also another term for the unconditioned stimulus in classical conditioning

According to the theoretical version of the law of effect, the only function of the *reinforcer* is to strengthen a connection between the response (R) that produced that reinforcer and the stimulus (S) that preceded the R. It follows that an S–R learner does not actively know what the consequence of the R will be, but rather the response is simply triggered based on previous contingencies. In other words, the rat in the Skinner box is compelled in a reflex-like fashion to make the R when the S is presented and it is presumed to be as surprised at the delivery of the food pellet after the hundredth reinforced response as it was after the first. Not only is this an implausible notion, but experimental evidence disproves it.

The evidence comes from studies of the effects of reinforcer revaluation on instrumental performance. The results of one such study are summarized in figure 4.7. In a first stage of training, rats were allowed to press the lever in a Skinner box 100 times, each response being followed by a sugar pellet. Half the animals were then given a nausea-inducing injection after eating sugar pellets – a flavour-aversion learning procedure. As you might expect, these rats developed an aversion to the pellets, so the reinforcer was effectively devalued.

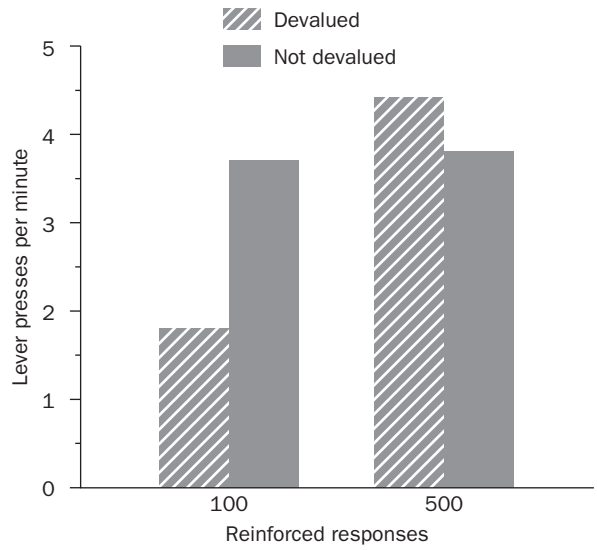

Figure 4.7

Results of an experiment by Adams (1982) on the effects of reinforcer devaluation on instrumental responding. Scores are from a 20-minute test session in which rats were allowed to respond by depressing a lever without consequences. In initial training some animals had received 100 reinforced responses, others 500. For half the animals in each condition the reinforcer was then devalued by being associated with illness.

In the subsequent test phase, the rats were returned to the Skinner box and allowed access to the lever (although no pellets were now delivered). The researchers found that rats given the devaluation treatment were reluctant to press the lever, compared with the control animals. This result makes common sense – but no sense in terms of the theoretical law of effect. According to the strict interpretation of the law of effect, an S–R connection would have been established at the end of the first stage of training by virtue of the reinforcers that followed responding, before the nausea-inducing injection was administered. Subsequent changes in the value of this reinforcer (which, according to the theory, has already done its job in mediating a 'state of satisfaction') should have been of no consequence.

These results suggest that the critical association in instrumental learning is not between stimulus and response, but between representations of a) the response and b) the reinforcer (or more generally, between the behaviour and its outcome). The stronger this association, assuming that the outcome is valued, the more probable the response will be. But an association with an aversive outcome (i.e. a devalued foodstuff or a punishment) will lead to a suppression of responding.

This does not mean that S–R learning can never occur. Often, after long practice, we acquire patterns of behaviour (habits) that have all the qualities of reflexes. In other words, they are automatically evoked by the stimulus situation and not guided by consideration of their consequences. The results shown in figure 4.5 may be an experimental example of this. One group of rats was given extensive initial training in lever-pressing (500 rather than 100 reinforced trials) prior to the reinforcer-devaluation treatment. As the figure shows, these animals continued to press the lever in the test phase. One interpretation of this result is that with extensive training, behaviour that is initially goal-directed (i.e. controlled by a response–outcome association) can be converted into an automatic S–R habit.

When next you absent-mindedly take the well-worn path from your home to the college library, forgetting that on this occasion you were intending to go to the corner shop, your behaviour has been controlled by an S–R habit rather than the response–outcome relationship – just like the rats!

Control of performance

If an animal has acquired an S–R habit, then we can predict that the R will occur whenever the S is presented. But what controls performance if learning is the result of a response-outcome association?

A rat can be trained to press for food or jump to avoid shock only in the presence of a given stimulus (called a *discriminative stimulus*) which signals that food or shock are likely to occur. Presumably the response-outcome association is there all the time, so why is it effective in producing behaviour only when the stimulus is present? How does the presentation of the discriminative stimulus activate the existing instrumental association?

discriminative stimulus signals whether or not a given response is likely to produce a particular outcome

Classical conditioning and motivational control

For instance, a rat trained on an avoidance task, in which the sounding of a tone indicates that shock is likely, will, at least before the avoidance response has been fully learned, experience some pairings of the tone and the shock. As well as acquiring a response–outcome association, the rat can also be expected to form a tone–shock association. In other words, classical conditioning will occur, as a sort of by-product of the instrumental training procedure.

This Pavlovian (S–S) association, it has been suggested, is responsible for energizing instrumental responding. By virtue of the S–S link, the tone will be able to activate the shock representation, producing in the animal both an expectation of shock and the set of emotional responses that we call fear. The state of fear is presumed to have motivational properties, so that the presentation of the tone could effectively boost the supply of energy that causes the animal to behave.

The expectation evoked by the tone also gives value to the outcome. In avoidance learning, the outcome associated with the response is the absence of an event (the omission of shock). The absence of an event would not normally be reinforcing in itself, but it could certainly become so given the expectation that something unpleasant is likely to occur.

This account of avoidance learning is a version of *two-process theory*, so called because it acknowledges that classical and instrumental learning processes both play a part in determining this type of behaviour. Although the theory was first elaborated in the context of avoidance learning, there is no reason to suppose that it applies only to this procedure. We have already seen how classical conditioning might contribute to the response suppression generated by the punishment procedure (see the earlier discussion of the experiment by Church, 1969, and figure 4.4). In the appetitive case, stimuli present when an animal earns food by performing an instrumental response can be expected to become associated with the food. These stimuli will then be able to evoke a positive state (an 'expectation of food', a 'state of hopefulness') that parallels the negative, fearful, state produced in aversive training procedures.

two-process theory emphasizes the interaction of instrumental and classical conditioning processes in producing many types of behaviour

Conditional learning and stimulus control

Although the ability of the discriminative stimulus to evoke a (conditioned) motivational state is undoubtedly important, this still does not fully explain how it controls instrumental responding.

It is difficult to believe that a rat that receives food for lever-pressing in the presence of a tone is insensitive to the conditional nature of the task – in other words, that it fails to learn that the response yields food only if the tone is on. But the version of two-process theory just described proposes only that the rat will form two simple associations – stimulus–food and response–food.

There is no room in this account for the learning of a conditional relationship of the form 'only lever-pressing in the presence of the tone results in the presentation of food'.

This issue has been addressed experimentally in recent years, and several researchers have demonstrated that animals are capable of conditional learning. The stimulus control of performance revealed by these experiments cannot be explained in terms of standard two-process theory, in which discriminative stimuli have their effects solely by virtue of orthodox associations with reinforcers. Instead, it shows that animals are capable of learning the conditional relationship between a stimulus and a particular response–reinforcer relationship. So, discriminative stimuli exert their effects because they are able to trigger not just the representation of the reinforcer but also the more complex, response–outcome representation produced by instrumental training. This represents the learning of a conditional relationship.

Research close-up 1

The hierarchical structure of instrumental learning

The research issue

If lever-pressing is rewarded only in the presence of a tone, a rat will learn to respond only when the tone is sounding. How is such stimulus control achieved? Colwill and Rescorla (1990) accepted that the formation of a classically conditioned association between the tone and food could play a role (as outlined in our discussion of two-process theory on p. 82). But they also suspected that some other process might be involved. So they devised a training procedure which attempted to establish stimulus control that could not be the consequence of direct stimulus–food association.

Design and procedure

A slightly simplified version of their experimental design is presented in table 4.2. The apparatus offered two possible responses (R1 and R2): the rats could press a lever or pull on a chain hanging down from the ceiling. Two different reinforcers (rf1 and rf2) were also available: the rats could be trained to make one response to receive a standard food pellet and the other response for a small amount of sugar solution. But which response produced which reinforcer depended on the stimulus conditions. Two stimuli (S1 and S2, a light and a noise) were used. In the presence of S1, the lever produced food and the chain sucrose; in the presence of S2, the lever produced sucrose and the chain food – so both S1 and S2 became associated with both the reinforcers. This is a conditional discrimination, in that the outcome of a given response differs according to which background stimulus was present.

In Phase 2, instrumental training was discontinued. Rats simply received 'free' deliveries of one of the reinforcers. After consuming the food or sucrose, the rat received a nausea-inducing injection, so that this particular reinforcer became devalued. In the final test phase, the rats were given access to the lever and the chain again. The light and the noise were each presented eight times and the rate of response in the presence of each stimulus was noted.

Results and implications

Figure 4.8 shows the rate of response for each test trial and for two categories of responding – one in which the stimulus signalled that the response chosen might lead to the devalued reinforcer, and one in which the stimulus signalled that the response chosen might lead to the valued reinforcer. In fact, no reinforcers were presented during the test (hence the steady decline in responding).

Table 4.2 Design of the experiment by Colwill and Rescorla (1990) on stimulus control.

Phase 1 (discrimination)	*Phase 2 (devaluation)*	*Test*
S1: R1 → rf1; R2 → rf2	rf1 → illness	S1: R2 vs. R1
S2: R1 → rf2; R2 → rf1		S2: R1 vs. R2

R1 and R2 represent two different responses, pulling a chain, and pressing a lever; S1 and S2 represent two different discriminative stimuli, noise and light; rf1 and rf2 represent two different reinforcers, food pellets and a sucrose solution. In the test, both responses were available and the rate at which they were performed in the presence of each stimulus was measured. No reinforcers were presented during the test.

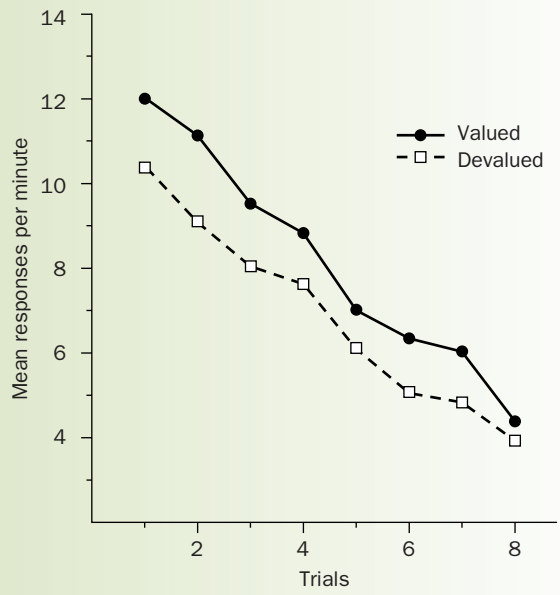

Figure 4.8

Test performance in the experiment by Colwill and Rescorla (1990). Each of the two possible responses might lead to a devalued reinforcer or to a valued reinforcer, according to the stimulus presented. The higher rate of response in the valued condition, compared with the devalued condition, indicates that the rats were less likely to make the response that (given the stimulus present) might be expected to produce the devalued reinforcer.

The important result is that the rats were unwilling to perform the response that might produce the devalued reinforcer. They were behaving selectively, showing an unwillingness to perform R1 in the presence of S1 and to perform R2 in the presence of S2. This selectivity cannot be explained in terms of classically conditioned associations between stimuli and reinforcers, because both stimuli have been associated with both reinforcers, so their classical associations are equivalent. Devaluing one of the reinforcers might reduce the animal's general readiness to respond, but there is no reason to predict that this would occur selectively to one particular response in the presence of a particular stimulus.

Colwill and Rescorla concluded that the rat is capable of learning the conditional relationship between a stimulus and a given response–reinforcer relationship – for example, that R1 produces food in the presence of S1 but produces sucrose in the presence of S2. This implies the existence of a hierarchy of associations in instrumental learning. Not only do the animals form the response–outcome association already discussed, but they also form a link between a stimulus and the response–outcome association that has been formed in its presence. This higher-order association allows the stimulus to activate the lower-order link, contributing to the stimulus control phenomenon.

Colwill, R.M., & Rescorla, R.A., 1990, 'Evidence for the hierarchical structure of instrumental learning', *Animal Learning and Behavior*, 18, 71–82.

The importance of instrumental learning

As we have seen, classical conditioning allows an animal to learn about the relationship between events in the environment and so anticipate what will happen next on the basis of stimuli currently present. If there are grey clouds in the sky, then it will probably rain; if the light is presented, then food may well follow. Instrumental learning is the process by which an animal learns about the relationship between its behaviour and the consequences of that behaviour. And it serves a complementary but equally important function in allowing the animal to control (at least partially) the occurrence of environmental events – in other words, to bring about a desired event or to avoid an aversive event by responding in a particular way.

Instrumentally trained responses are not entirely elicited by identifiable stimuli. Instead, they are controlled by their consequences, becoming more likely when they produce a positive result and less likely when they lead to an aversive outcome. As Skinner emphasized, this sort of control is the characteristic feature of what we call 'voluntary' behaviour. So the study of instrumental learning and performance is important for what it tells us about the nature of voluntary, goal-directed behaviour.

obsessive–compulsive disorder (OCD) characterized by intrusive unwelcome thoughts (obsessions) and the need repeatedly to perform certain patterns of behaviour (compulsions), such as hand-washing

On the other hand, instrumental learning processes can also play a role in establishing and maintaining behaviour that seems, at first sight, anything but voluntary. Patients with the clinical condition known as *obsessive–compulsive disorder* (OCD) suffer from persistent, intrusive, unpleasant thoughts (obsessions) and feel compelled repeatedly to carry out certain acts (compulsions) that they know are senseless but which appear to provide some relief (see chapter 15). OCD can be quite disabling. One patient, who believed that contact with everyday objects contaminated her in some way, felt compelled to shower at least six times a day and to wash her hands very systematically every 20 minutes. With hands rubbed raw and half her working day taken up in these activities, her ability to lead a normal life was severely curtailed. OCD patients tend to feel a build-up of extreme anxiety prior to performing the compulsive ritual, which dissipates as the ritual is enacted. This has been measured both by patients' own reports and by objective indices such as heart-rate (Hodgson & Rachman, 1972).

A parallel can be drawn between such cases and a trained rat 'compulsively' responding to the presentation of a tone by jumping

a hurdle, and continuing to perform this apparently senseless act for a large number of trials in the absence of any obvious reward. Although this behaviour appears senseless, it becomes understandable when the rat's training history is known – when it becomes clear that the tone evokes fear by virtue of its initial association with shock and that the response avoids a shock that would otherwise occur.

In the same way, the rituals performed by OCD patients may well be avoidance responses that are reinforced and maintained because they reduce the sufferer's state of anxiety. Of course it remains to be explained why the patient has acquired such a fear of dirt, or whatever, in the first place. Nevertheless, this illustration demonstrates the relevance of the analysis of basic instrumental learning processes to an understanding of interesting and important aspects of human behaviour.

THE PRINCIPLES OF ASSOCIATION FORMATION

Classical conditioning and instrumental learning both depend on the formation of associations. An association will be formed between a pair of events (two stimuli, or a response and a stimulus) that occur together (in contiguity). This *principle of contiguity* is clearly important, but it has some limitations.

principle of contiguity the proposal that events must be experienced close together in time and space for an association to be formed between them

CONTIGUITY AND PREDICTIVENESS

Asymptote – where learning stops

When a CS (e.g. a light) and a US (e.g. food) occur together, an association appears to be established between their central (i.e. neural) representations. And the more often they occur together, the stronger this association becomes. This is revealed by the growing strength of the CR (e.g. light-induced salivation). But this growth does not go on forever. With repeated CS–US pairings, the increment in the strength of the CR (and also, we deduce, the underlying association) becomes progressively smaller until there is no observable increase in its strength. At this point – referred to as asymptote – contiguity between the CS (light) and US (food) is no longer producing learning. Why does this happen?

The most widely accepted explanation is that, as conditioning proceeds, presentations of the US lose their effectiveness. We know from a number of research studies that, during learning, the formation of a CS (light)–US (food) association allows presentation of the CS to evoke activity in the US representation before the US occurs. To adopt the terms used by the influential theorist Wagner (e.g. 1981), the CS induces a state of secondary activation in the US representation (as opposed to the primary activation produced by the US itself). Wagner proposes that secondary activation is not capable of supporting association formation; furthermore, it stops the US (food) from evoking the primary state of activation. The result is that the US becomes less effective as learning proceeds. As the CS–US link grows stronger, Wagner proposes that the CS (light) becomes more effective at producing the secondary state of activation and the US (food) becomes less able to produce the primary state necessary for further strengthening to occur.

So, while contiguity is important for learning, its nature needs precise specification. The events that must occur together are not so much the CS and US per se as the primary states of activation of their central representations.

Pioneers

A.R. Wagner (1934–) and **R.A. Rescorla** (1940–) carried out research at Yale University in the late 1960s. Their experiments showed that simple contiguity of the CS and US is not sufficient to produce conditioning, and that it is also necessary for the CS to provide information about the likely occurrence of the US. (The phenomenon of blocking, described here, is an example.) The theoretical model they devised to explain this effect (published in 1972) was able to deal with a wide range of learning phenomena and set the agenda for almost all the research that has been done on associative learning mechanisms since then. Although the details of the Rescorla–Wagner model have been much debated, its central principles have been adopted by a wide range of associative (or 'connectionist') theorists attempting to explain not only simple learning processes, but human cognition in general.

Blocking – failure to learn

The phenomenon of *blocking* provides an interesting and much-studied instance of failure to learn, in spite of contiguous presentations of CS and US.

blocking training an organism with one stimulus as a signal for an unconditioned stimulus to prevent the organism from learning about a second stimulus when both stimuli are subsequently presented together as signals for the same unconditioned stimulus

In a blocking experiment, animals receive training with what is termed a compound CS (Phase 2) – in this example (table 4.3) represented by the simultaneous presentation of a noise and a light followed by a shock reinforcer. However, the experimental group has first received a phase of training in which the noise alone is conditioned (Phase 1). The performance of the control group of participants shows that training (Phase 2) with a compound CS is normally sufficient to establish associations between individual CS elements (noise, light) and the US (shock). So in this control group the light, when subsequently presented on its own, will

Table 4.3 Design and results of an experiment by Kamin (1969) on blocking.

Group	*Phase 1*	*Phase 2*	*Test light*
Experimental	Noise → shock	Light + Noise → shock	No CR
Control	–	Light + Noise → shock	CR

evoke a CR. But the experimental group shows no (or very little) evidence of learning about the light in Phase 2. Although they have received light–US pairings, just as the control participants have, in Phase 2, the formation of the light–US association appears to have been blocked by initial training with the noise in Phase 1.

A possible explanation of the blocking effect links directly to the asymptote phenomenon. Recall that a US representation in a secondary state of activation will not support association formation. In our blocking experiment, Phase 1 training for the experimental group establishes the noise as a CS, enabling it to activate the US representation in a secondary state of activation. So for these participants, during Phase 2, the presentation of the US will not be able to produce the state of primary activation, which means that the light introduced as part of the CS at this stage of testing will be unable to acquire associative strength.

Predictive power

Blocking has been of special interest not just because it provides an example of the failure of the contiguity principle, but also because it seems to demonstrate the operation of another principle. Animals in the experimental condition learn well about an event with predictive power (the noise in the first stage of training predicts that the US will shortly occur), but they do not learn about an uninformative event (the added light in Phase 2 supplies no added information). The principle here is that conditioning occurs only to a CS that gives information about the likely occurrence of a succeeding event – i.e. what we might term a predictive CS.

Selective association formation

A further challenge to the principle of contiguity came in the 1960s when psychologists began to realize that the principle might apply only to certain pairings of events. They had long suspected that some associations might form more readily than others, but they were usually able to find reasons to dismiss their worries. For example, when attempts to replicate Watson's demonstration of emotional conditioning in infants proved unsuccessful when an inanimate object, rather than a live animal, was used as the CS, researchers suggested that the CS was simply not salient enough to be noticed.

But an important experiment by Garcia and Koelling (1966) showed selectivity in association formation that could not be easily explained away. Their study demonstrates the phenomenon of *preparedness*. The rats in this study appeared to be prepared to associate external cues with painful consequences and to associate illness with taste cues. But taste did not become readily associated with shock, nor external cues with illness. The usefulness to the rat of having a learning system that operates in this way should be clear; after all, gastric illness is more likely to be caused by something the rat ate than something it heard or saw. But to the psychologist investigating general laws of learning, the preparedness effect constitutes a problem in need of explanation.

preparedness tendency of certain combinations of events to form associations more readily than others

One possibility is that a *principle of similarity* operates in conditioning. By this principle, not only should the events to be associated occur together, but if learning is to take place they should also be similar to one another. Applying this principle to the Garcia and Koelling result, a taste and an illness might be readily associated because they are similar in that both are detected by receptors (called interoceptors) concerned with the animal's internal environment. External cues, on the other hand, have little in common with an internal state, making it difficult to associate auditory and visual events with illness.

principle of similarity suggestion that association formation occurs particularly readily when the events are similar to one another

Compared with the massive amount of experimental effort that has been expended on establishing the finer points of the contiguity principle, investigation of the similarity principle has been almost totally neglected. Perhaps we will see more studies in this area before too long.

NON-ASSOCIATIVE LEARNING

Laboratory studies of learning have concentrated on conditioning procedures in which the participants experience two events (two stimuli, or a response and a stimulus) in close contiguity. It is hardly surprising, therefore, that association between events has proved so dominant in theories of learning. This approach has been justified by the assumption that the complex instances of learning shown in our everyday behaviour may well be governed by associative principles.

But this should not blind us to the fact that learning can also result from procedures in which there is no intentional pairing of two events.

Responding to a single stimulus

Repeated presentation of a stimulus that elicits a particular UR will result in *habituation* – a gradual reduction in the magnitude of the response. A good instance in vertebrates is the startle response produced

habituation waning of the unconditioned response with repeated presentation of the eliciting stimulus

Research close-up 2

Selectivity in aversive conditioning

The research issue

In laboratory studies of conditioning, participants and procedures have generally been chosen on the basis of convenience. The laboratory rat, for instance, is easy to obtain, cheap to keep and, when properly treated, easy to handle. Pairings of tone and shock or flavour with nausea will readily establish conditioned responses that are easy to observe. Although these kinds of studies are rather artificial, researchers have assumed that the results obtained from them reveal general principles about the nature of association formation, which apply to other species and other stimuli.

The experiment by Garcia and Koelling (1966) presented an important challenge to this assumption by showing, for laboratory rats, that animals appear to be especially 'prepared' to associate some combinations of events and to have difficulty in forming associations between other combinations. Similar principles of preparedness may well apply to humans.

Design and procedure

Rats were allowed to drink a saccharin-flavoured solution while a light and noise were being presented: each lick at the drinking tube closed a circuit that produced a flash of light and a click. So they experienced a compound CS comprising a taste element and an auditory–visual element. Some rats then received a nausea-inducing injection of lithium choride (LiCl) as the US; other rats received an electric shock to the feet as an aversive US. Both groups of rats showed a reduction in willingness to drink over the course of several training sessions. In the final test, animals received either access to the saccharin solution in the absence of the auditory–visual cue, or access to unflavoured water but with the auditory–visual cue still being presented.

Results and implications

The results of the test phase are presented in figure 4.9. Animals given LiCl as the US showed an aversion to saccharin but were willing to drink plain water even when it was accompanied by the light and the click. Animals given shock as the US drank saccharin readily but shunned the 'bright noisy' water. Evidently, the events used as CSs and USs in this experiment are capable of entering into associations but show a certain 'choosiness' about which other events they are prepared to become linked to: the LiCl as an aversive US became linked to the taste of the saccahrin water, and the foot shock as an aversive US became linked to the light and click, but not vice versa.

This result, and others like it, have led some researchers to suggest that we might be misguided in our attempt to establish general laws of learning. How can we retain contiguity as a general principle when the pairing of two events sometimes results in association formation and sometimes does not? An alternative view is that the preparedness effect reflects the operation of a further, previously unsuspected, general principle that must be added to contiguity in order to produce a comprehensive theoretical account.

Garcia, J., & Koelling, R.A., 1966, 'The relation of cue to consequence in avoidance learning', *Psychonomic Science*, 5, 123–4.

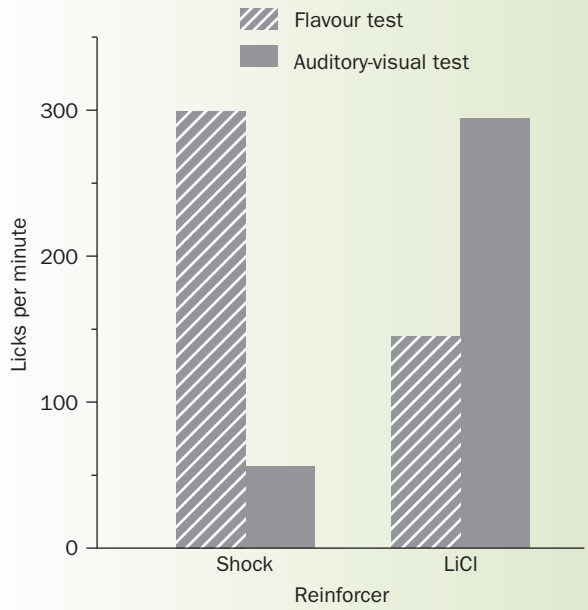

Figure 4.9

Drinking by rats of flavoured water or water associated with auditory/visual cues. In previous training the rats had experienced the flavour and auditory-visual cues together followed, for some animals, by a shock reinforcer, and for other animals by a nausea-inducing injection of lithium chloride (LiCl). Rats conditioned with illness as the reinforcer show a stronger aversion to the flavour cue; rats conditioned with shock show a stronger aversion to the auditory-visual cues. Source: Adapted from Garcia and Koelling (1966).

by a sudden loud noise, a response that reliably declines if the noise is regularly repeated. See figure 4.10, which also shows the phenomenon of *dishabituation*, whereby the response returns when a salient extraneous stimulus (e.g. a flashing light) is presented just before a trial with the habituated noise.

dishabituation restoration of a habituated response by presentation of a strong extraneous stimulus

The observation that the response can be easily restored in this way shows that habituation is not solely a matter of sensory or motor fatigue – it is a genuine case of learning. And since habituation occurs as a consequence of the presentation of a single event, it is difficult to interpret this form of learning in terms of association formation. The most likely explanation, at least for simple instances of the phenomenon, is that changes occur in the neuronal pathway connecting the S and R that make transmission of nervous impulses less likely to occur.

A series of elegant neurophysiological studies by Kandel and colleagues (e.g. Kandel, 1979) using the marine mollusc *Aplysia* (see figure 4.11) has gone some way towards establishing which synaptic connection loses effectiveness during habituation, and the biochemical basis of this loss. (For this work Kandel was awarded the Nobel prize for medicine.)

imprinting the development of filial responses by newly hatched birds to an object (usually the mother) experienced early in life, or more generally the early formation of social attachments in animals

Loss of the UR is not the only effect produced by stimulus exposure. Consider the phenomenon of *imprinting*,

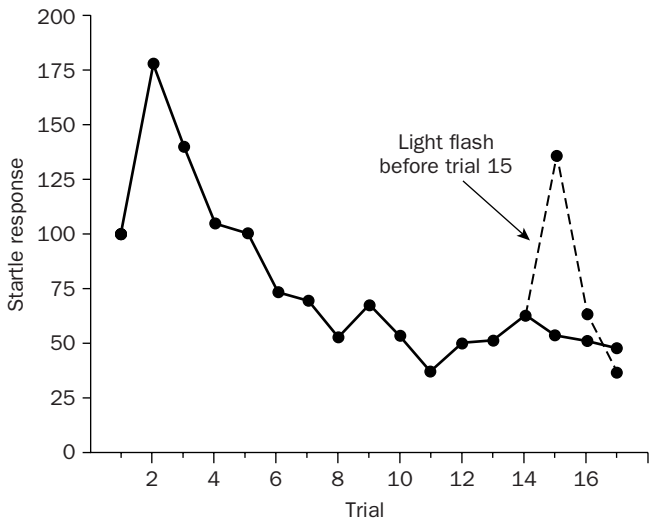

Figure 4.10

Habituation of the startle response of rats to an auditory stimulus. The response magnitude is expressed with respect to the initial level, which is given a score of 100. For half the animals a light flash was presented before trial 15 resulting in a temporary recovery of the startle response (dishabituation).
Source: Based on Groves and Thompson (1970).

Figure 4.11

Perhaps surprisingly, studies of molluscs have helped researchers find out more about how the brain works.

in which a chick becomes attached to a conspicuous object experienced early in life. This behaviour pattern is found only in some species, but other features of the imprinting process appear to be more general. Most animals exposed to complex objects are able to learn the characteristics of the object, and subsequently to distinguish more easily the object from other similar things. This phenomenon is known as *perceptual learning*. The nature of the mechanism responsible for it is not fully known, but it seems likely that associative processes are involved, in that learning the characteristics of a complex object involves learning that its various features go together. This is achieved by the formation of associative links among its component parts.

perceptual learning exposure to events, increasing subsequent ability to discriminate between them

The perceptual learning process, which enables the animal to build up an accurate representation of the stimulus, probably plays a role in some instances of habituation. When animals are habituated to a complex event, the response can be restored if some element of that complex is omitted or changed. Such dishabituation occurs, it has been suggested (Sokolov, 1963), because animals are sensitive to any mismatch between incoming stimulation and the central representations of events they have already experienced.

Spatial learning

Figure 4.12 shows apparatus used to assess rats' ability to learn about the layout of their environment. A rat is set to swim in a pool of water from which it naturally wants to escape. It can do this by reaching a small platform, which is just below the surface and not visible to the animal (because of the 'milkiness' of the water). Finding the platform on the first trial is a matter of

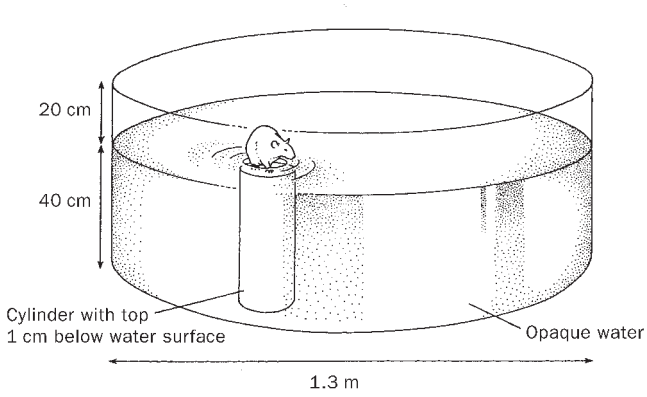

Figure 4.12

Swimming pool apparatus introduced by Morris (1981). Although it cannot see, smell or hear the target, the rat learns to swim straight to the small, just-submerged, platform from wherever it is put into the pool.

chance, but with further training the rat rapidly learns to swim straight to the platform. Since the rat cannot see the platform to home in on it, how can it be performing this feat?

One obvious possibility is that the rat learns to swim in the general direction of some feature of the room outside the pool, which lies on a continuation of the line between its starting point and the platform. But this cannot be the whole story, because in other trials, rats were put back in the pool at a different starting position from that used in training. Figure 4.13 shows the paths that the rats followed. Clearly, in these trials, following a line to an extra-pool cue would not work. However, as the results show, even under these conditions the rats were still very good at finding the platform.

To explain this in terms of standard conditioning processes, we must assume that the rat learns to approach not single cues, but complex configurations of cues. We know from other training procedures that rats can learn about combined (often referred to as configural) cues. But such learning tends to occur painfully slowly, whereas spatial tasks are mastered much more easily by rats. This suggests that spatial learning operates according to principles quite different from those that underlie classical and instrumental conditioning procedures. It is possible that exposure to an environment allows the animal to form a *cognitive map* of that environment – some sort of internal representation of the spatial relationships among the cues it has experienced. The animal is then able to navigate because it knows its own position with respect to this internal representation. But no one has yet supplied a full account of the process by which the map is constructed, how the animal knows its own position, and so on.

cognitive map postulated internalized representation of the layout of the environment in which information about the relative spatial relationships of various features is preserved

Discrimination learning

In a discrimination learning task the animal is presented with two stimuli (sometimes more) that are associated with different outcomes. For example, a pigeon might be presented with a choice between two discs, one coloured red and the other green; pecking at the green disc will produce food, but pecking at the red disc will not. The pigeon will solve this problem, coming reliably to choose the green disc after a few dozen trials. Its ability to do this task is no puzzle and can be fully explained in terms of standard conditioning processes.

More intriguing is the fact that training on such a task will transfer to other similar tasks. If the pigeon is now asked to solve a similar discrimination problem, in which the choice is between blue and yellow discs, learning can occur very rapidly: we call this *positive transfer*. The original associations involving red and green

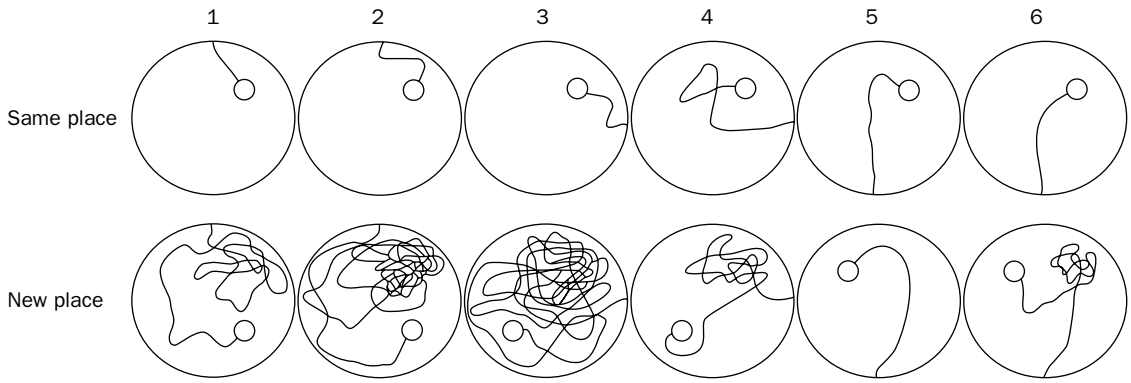

Figure 4.13

Plan view of the paths taken by rats on test trials in the swimming pool of Figure 4.12. The top row shows the performance of six rats swimming from a novel starting point to a platform remaining in the same place as was used in training. The second row shows performance for rats required to swim to the platform in a new place in the pool.

are clearly irrelevant to this new discrimination task, so the transfer must have some other source. The pigeon appears to have acquired a fairly abstract concept in the course of acquiring the first discrimination – something along the lines of 'differences in colour are important and should be attended to'.

Studies involving primates have produced more dramatic examples of abstraction. In the *learning-set* procedure (first introduced by Harlow, 1949), a rhesus monkey is presented with two objects and given a small amount of food for picking up one of them. After six trials the original objects are replaced with two new ones and, again, responding to only one of the objects was rewarded. After six trials on this new problem, the objects were again changed, and so on for many, many pairs of objects.

Early in training performance is unremarkable, six trials being insufficient for the monkey to solve the problem. But as training proceeds, performance begins to improve, until finally it is as near perfect as it can be (see figure 4.14). After training on hundreds of these problems, the monkey is able to solve a new problem with no more than a single error, switching its choice to the other object if its first choice is wrong, but staying with its original choice if this proves correct. By experiencing many problems of a similar type, the animal appears to abstract some general rule about how to behave in this situation – a rule that allows the near-instantaneous solution of a problem that it had, in fact, never faced before.

The rule that operates in this case is the *win-stay, lose-shift* strategy: in other words, the animal learns to persist with a choice that yields food, but shift to the other object if it does not. Associative theory can go some way towards explaining this. The occurrence of reward (or non-reward) can be regarded as a stimulus that, like any other, can enter into associations or acquire discriminative control over an instrumental action. The special feature of the learning-set procedure is that these stimuli and associations come to dominate the animal's behaviour to the exclusion of all others.

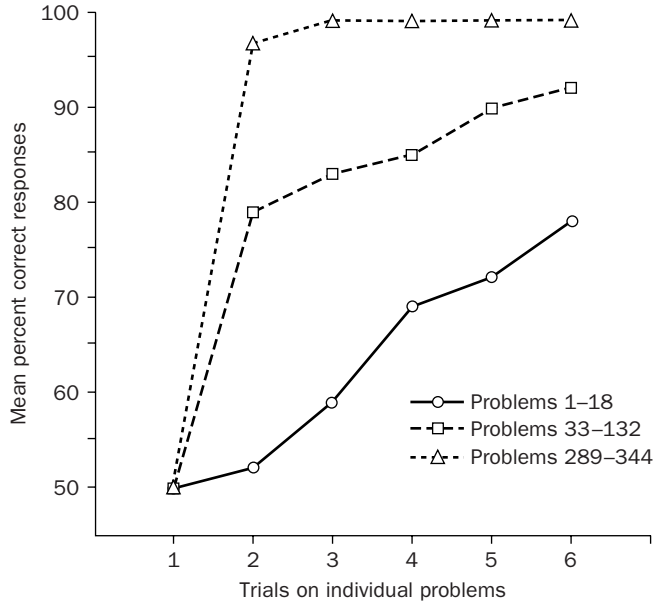

Figure 4.14

Performance of monkeys over a series of 344 six-trial discriminations. On each new problem, performance starts at chance, but the rate at which learning occurs is more rapid for problems encountered late in the series than for those encountered earlier. Source: Adapted from Harlow (1949).

So the animal learns to focus on classes of cues that are accurate predictors of reward and to ignore others that are not. Intensive research is currently going into the nature of such higher-level learning processes that might modulate the mechanims of simpler associative processes.

FINAL THOUGHTS

At the start of this chapter we said that the aim of the psychologist whose focus of interest is learning was to discover general principles that govern the way in which organisms interact with their environment and become changed by the experience.

What has emerged from this brief survey is the central notion of association. The principle of association provides a useful theoretical underpinning for the outcome of many learning studies. Building on this foundation, researchers in the future will need to:

1. continue the detailed study of conditioning procedures to refine our understanding of the laws of association (e.g. contiguity) and, perhaps, to detail the need for other principles (e.g. similarity); and
2. extend the study of more complex forms of learning in order to assess how far these can be understood in terms of underlying associative processes, and, where they cannot, to specify what further principles should be introduced to supplement the principle of association.

Ethical issues arising from research into learning include the implications of emotional states being subject to classical conditioning, and the use of punishment to eliminate unwanted behaviour. Is it really appropriate to call behaviour 'voluntary' if it is in fact controlled by a response–outcome association?

Summary

- Learning is defined as the process whereby an organism interacts with its environment and becomes changed by the experience so that its subsequent behaviour is modified. Note that we infer that learning has occurred through our observations of changes in behaviour.
- The basic principles of learning have been established through laboratory studies of animals but are also applicable to humans. Indeed, these basic principles have been applied to the analysis of human conditions such as obsessive–compulsive disorder.
- Classical conditioning reflects the formation of stimulus–stimulus associations. Such associations constitute the main way in which an organism represents information about the relations between environmental events; and they can endow previously neutral events with emotional significance.
- In instrumental learning (the other major form of conditioning), an association is formed between a response and its consequences. When the consequences of the response are pleasant, the likelihood of the response will increase; when the consequences are unpleasant, the likelihood will decrease (the law of effect).
- Behaviour controlled by such associations may be described as voluntary or goal-directed. For example, when in our car we may learn that the response of pressing our foot on the car accelerator when the traffic lights are green results in a positive outcome (increasing the likelihood of this behaviour). By contrast, performing this same response when the traffic lights are amber is likely to result in an unpleasant outcome, thereby decreasing the likelihood of this response in the future.
- Conditioning procedures are used to investigate the laws of association. They have shown that the co-occurrence of the events to be associated is important (principle of contiguity) but also that associations may fail to form unless one event supplies information about the occurrence of the other (principle of predictiveness).
- The associative principle has been thoroughly tested and shown to have wide relevance. It has difficulty, however, in explaining some examples of complex (e.g. the learning of abstract concepts or rules) or very simple (e.g. habituation) forms of learning.

REVISION QUESTIONS

1. What is the defining feature of the procedure used to establish classical conditioning?
2. What is the nature of the association formed as a result of the classical conditioning procedure?
3. What role does classical conditioning play in psychological phenomena observed outside the conditioning laboratory?
4. What feature is common to the various procedures used in the study of instrumental learning?
5. What is the nature of the association formed as a result of instrumental training procedures?
6. What factors determine when instrumental learning will be expressed in behaviour?
7. How has the laboratory study of instrumental learning helped enhance our understanding of normal and abnormal human behaviour?
8. What determines whether or not the pairing of two events will result in association formation?
9. What forms of animal learning cannot be explained in terms of association formation?

Further Reading

Dickinson, A. (1980). *Contemporary Animal Learning Theory*. Cambridge: Cambridge University Press.
Focuses on the importance of association formation in learning.

Domjan, M. (2003). *Principles of Learning and Behaviour*. Belmont, CA: Thomson/Wadsworth.
A wide-ranging textbook, which covers all the main areas in the study of learning.

Mackintosh, N.J. (ed.) (1994). *Handbook of Perception and Cognition: Animal Learning and Cognition*. San Diego, CA: Academic Press.
An advanced and demanding text, which nevertheless provides state-of-the-art expositions by specialist contributors on most of the topics covered in this chapter.

O'Donohue, W. (1998). *Learning and Behavior Therapy*. Boston, MA: Allyn and Bacon.
An up-to-date exposition of how studies of animal learning can help us to understand human fears and anxiety (and also help in devising treatments for anxiety disorders).

Pearce, J.M. (1997). *Animal Learning and Cognition: An Introduction*. Hove: Psychology Press.
An introductory textbook covering in more detail and with great clarity all the phenomena dealt with in this chapter. It also includes material on other cognitive processes that have been studied in animals, such as navigation, communication and social learning.

Shanks, D.R. (1995). *The Psychology of Associative Learning*. Cambridge: Cambridge University Press.
Describes in detail how the simple associative notions outlined in this chapter have been developed to explain a wide range of human cognitive processes.

Shettleworth, S.J. (1998). *Cognition, Evolution, and Behavior*. New York: Oxford University Press.
The evolutionary perspective adopted by this book makes an interesting contrast to the approach adopted in this chapter.

Contributing author:
Geoffrey Hall

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Motivation 5

CHAPTER OUTLINE

LEARNING OBJECTIVES

INTRODUCTION

HUNGER AND THE CONTROL OF FOOD INTAKE

- Peripheral factors
- Control signals
- How the brain controls eating
- Taste + smell = flavour
- Obesity – possible factors

THIRST AND THE CONTROL OF DRINKING

- Cellular dehydration
- Extracellular thirst stimuli
- Control of normal drinking

SEXUAL BEHAVIOUR

- Sociobiology and sexual behaviour
- How the brain controls sexual behaviour

FINAL THOUGHTS

SUMMARY

REVISION QUESTIONS

FURTHER READING

Learning Objectives

By the end of this chapter you should appreciate that:

- central motivational states (such as hunger, thirst and interpersonal attraction) underlie human behaviour (feeding, drinking and sexual activity);
- these motivational states energize people to work for goals and avoid punishment;
- particular brain mechanisms are involved in linking motivation and emotion;
- there are a number of possible factors underlying obesity;
- behaviour can be described in sociobiological terms;
- links have been made between genetics, evolution and sexual reproduction.

INTRODUCTION

What motivates us to work for food when we are hungry, or water when we are thirsty? How do these motivational control systems ensure that we eat approximately the right amount of food to maintain our body weight, or drink enough to quench our thirst? And how do we explain overeating and obesity?

In this chapter, we will consider the nature of motivation and how it is controlled, focusing on the biological basis of food and fluid intake. There are two reasons for choosing these motivational behaviours:

1. There is considerable evidence about how the brain processes the relevant signals controlling food intake.
2. These are crucial survival functions. Undereating and drinking too little result in loss of body mass, impaired metabolism and – in extreme cases – starvation, dehydration and death, whereas overeating and obesity lead to significant health risks (see chapter 19). Understanding the control of food intake is therefore important.

In the last part of the chapter, we will introduce some of the biological and neural underpinnings of another type of motivated behaviour – sexual behaviour.

But first some definitions. A *reward* is something an animal will work to obtain or achieve, whereas a *punisher* is something it will work to escape or avoid. In order to exclude simple reflex-like behaviour, we use the term 'work' to refer to a voluntary behaviour (see chapter 4), also called an *operant response*. Examples are pressing a lever in a Skinner box in order to obtain a reward or avoid a punishment, putting money in a vending machine to obtain food, or

reward something for which an animal will work

punisher something an animal will work to escape or avoid

operant response (or instrumental response) an arbitrary response or behaviour performed in order to obtain a reward or escape from or avoid a punishment

removing your hand when lighting a candle to avoid singed fingers.

So motivated behaviour is when an animal (either human or non-human) performs an operant response to obtain a reward or avoid a punishment. This definition implies that learned responses are important in demonstrating motivated behaviour, and this is certainly true of two types of learning – classical conditioning and instrumental learning (see chapter 4).

Motivation also has close links with emotions, since these can be regarded as states elicited (in at least some species) by rewards and punishers (see chapter 6 and Rolls, 1999).

The material in this chapter will involve a degree of anatomical and physiological complexity, which you may find challenging. But remember that the terms used here are essentially labels created by earlier investigators. It is the principles concerned that are most important.

HUNGER AND THE CONTROL OF FOOD INTAKE

To understand how the motivation to eat (and food intake) are controlled, we first need to consider the functions of peripheral factors (i.e. factors outside the brain), such as taste, smell and gastric distension, and control signals, such as the amount of glucose in the bloodstream. Then we can examine how the brain integrates these different signals, learns about which stimuli in the environment represent food, and initiates behaviour to obtain the correct variety and amount.

Peripheral factors

The functions of some peripheral factors in the control of eating can be demonstrated by the sham feeding preparation shown in figure 5.2. In this preparation, the animal tastes, smells and eats the food normally, but the food drains away from the stomach. This means that, although the animal consumes the food, the stomach does not become full, since the food does not enter the stomach or intestine.

Figure 5.1

The pleasant smell and taste of food give us immediate reward, a separate process from satiety – or the feeling of fullness. The brain brings the two processes together to control the amount of food we eat.

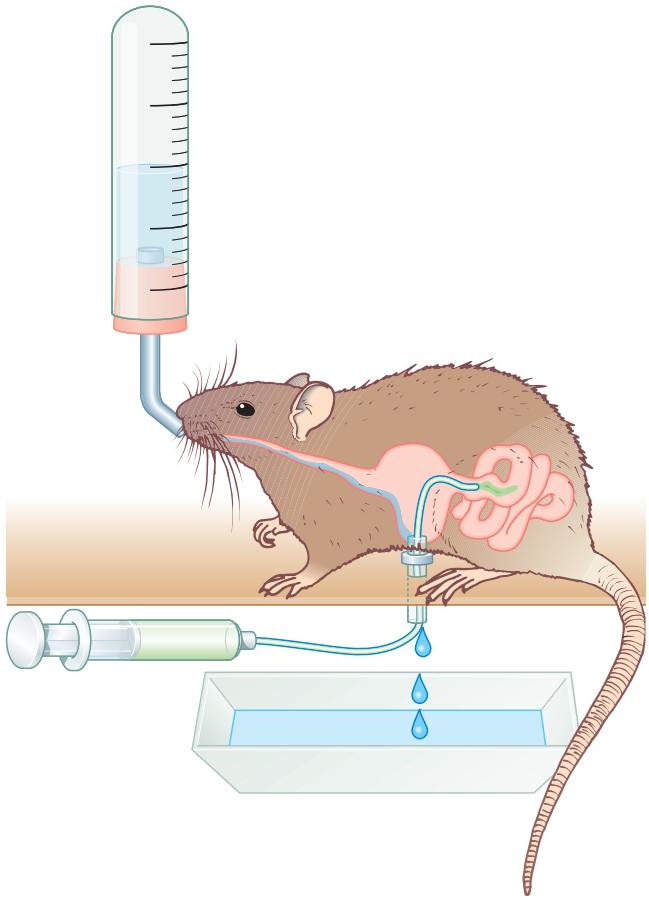


Figure 5.2

Sham feeding preparation. When food is drained from a rat's stomach it will often continue to eat for over an hour.

Experiments have shown that rats, monkeys and humans will work for food when they are sham feeding (see Rolls, 1999), often

continuing to eat for more than an hour. This demonstrates that it is the taste and smell of food that provide the immediate reward for food-motivated behaviour. Further evidence for this is that humans are more likely to rate the taste and smell of food as being pleasant when they are hungry.

satiety reduction of appetite

oropharyngeal the oral cavity and pharynx

A second important aspect of sham feeding is that *satiety* (reduction of appetite) does not occur. From this we can conclude that taste, smell and even swallowing (i.e. *oropharyngeal* factors) do not of themselves make us feel satisfied, or satiated. Instead, satiety is produced by food accumulating in the stomach and entering the intestine.

Gastric distension is an important satiety signal, and intestinal signals also have a part to play (Gibbs et al., 1981). When an animal is allowed to eat to normal satiety and then has the food drained from its stomach, it starts eating again immediately. Moreover, small infusions of food into the duodenum (the first part of the intestine) decrease feeding, indicating satiety. Interestingly, however, animals have difficulty learning to perform a response that brings a reward of food if the food is delivered directly into the stomach, demonstrating that this form of feeding is not very rewarding in itself (see Rolls, 1999).

We can draw important conclusions about the control systems for motivated behaviour from these findings:

- Reward and satiety are different processes.
- Reward is produced by factors such as the taste and smell of food.
- Satiety is produced by gastric, intestinal and other signals after the food is absorbed from the intestine.
- Hunger and satiety signals modulate the reward value of food (i.e. the taste and smell of food are rewarding when hunger signals are present and satiety signals are not). To put this in more general psychological terms, in most behavioural situations the motivational state modulates or controls the reward or reinforcement value of sensory stimuli. So, for example, in certain species the female may apparently find the male of the species 'sexually attractive' only during certain phases of the female's reproductive cycle.
- Since reward and satiety are produced by different bodily (i.e. peripheral) signals, one function of brain (i.e. central) processes in the control of feeding is to bring together the satiety and reward signals in such a way that satiety modulates the reward value of food.

Control signals

The following descriptions of the different signals that control appetite are placed roughly in the order in which they are activated during a meal. All of these signals must be integrated by the brain.

1 Sensory-specific satiety If we eat as much of one food as we want, the pleasantness rating of its taste and smell change from very pleasant to neutral. But other foods may still taste and smell pleasant. So variety stimulates food intake.

For example, if you eat as much chicken as you want for a meal, the pleasantness rating of the taste of chicken decreases to roughly neutral. Bananas, on the other hand, may remain pleasant, so you might eat them as a second course even when the chicken has already 'filled you up', or produced satiety. This type of satiety is partly specific to the sensory qualities of the food, including its taste, smell, texture and appearance, and has therefore been named sensory-specific satiety (see Rolls, 1999).

2 Gastric distension Normally gastric distension is one of the signals necessary for satiety. As we saw earlier, this is demonstrated when gastric drainage of food after a meal leads to immediate resumption of eating.

pyloric sphincter controls the release of food from the stomach to the duodenum

Gastric distension only builds up if the *pyloric sphincter* closes. The pyloric sphincter controls the emptying of the stomach into the next part of the gastrointestinal tract, the duodenum. The sphincter closes only when food reaches the duodenum, stimulating *chemosensors* and *osmosensors* to regulate the action of the sphincter, by both local neural circuits and hormones (see Gibbs et al., 1981).

chemosensors receptors for chemical signals such as glucose concentration

osmosensors receptors for osmotic signals

3 Duodenal chemosensors The duodenum contains receptors sensitive to the chemical composition of the food draining from the stomach. One set of receptors respond to glucose and can contribute to satiety via the vagus nerve, which carries signals to the brain. The vagus is known to represent the critical pathway because cutting this nerve (vagotomy) abolishes the satiating effects of glucose infusions into the duodenum. Fats infused into the duodenum can also produce satiety, but in this case the link to the brain may be hormonal rather than neural (a hormone is a blood-borne signal), since vagotomy does not abolish the satiating effect of fat infusions into the duodenum (see Greenberg, Smith & Gibbs, 1990; Mei, 1993).

4 Glucostatic hypothesis We eat in order to maintain *glucostasis* – that is, to keep our internal glucose level constant. Strictly, the crucial signal is the utilization of glucose by our body and brain, as measured by the difference between the arterial and the venous concentrations of glucose. If glucose utilization is low, indicating that the body is not able to extract much glucose from the blood stream, we feel hungry, whereas if utilization is high, we feel satiated. This is confirmed by the following findings:

glucostasis constancy of glucose availability (e.g. reflected in the glucose concentration in the plasma)

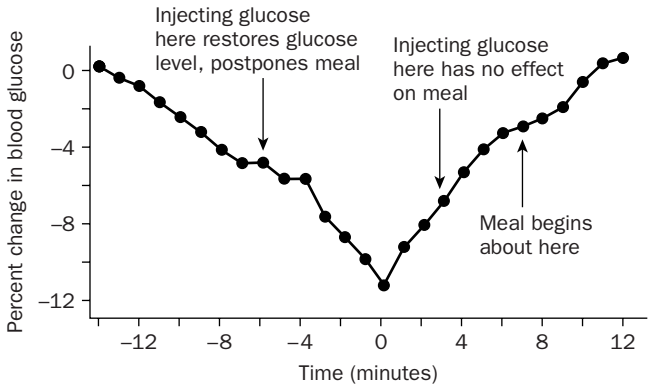


Figure 5.3

The fall in glucose concentration in the plasma typically seen in rats before a meal is initiated. Plasma glucose concentration is at its lowest at time 0, typically just before a meal starts. Source: Adapted from Campfield and Smith (1990).

- Rats show a small decrease in plasma glucose concentration just before meals, suggesting that decreased glucose concentration initiates eating (Campfield & Smith, 1990) (see figure 5.3). At the end of a meal, plasma glucose concentration rises, and so does insulin, which helps the glucose to be used by cells.
- Injections of insulin, which reduce the concentration of glucose in the plasma (by facilitating its entry to cells and storage as fat), provoke food intake.
- Infusions, or injections, of glucose and insulin (together enabling glucose to be taken up by the body's cells) can reduce feeding.
- The brain's monitoring system for glucose availability seems to be in the part of the brain called the medulla (part of the brainstem), because infusions there of a competitive inhibitor of glucose (5-thio-glucose) also provoke feeding (Levin et al., 2000).

5 Body fat regulation and the role of leptin The signals described so far help to regulate hunger from meal to meal, but they are not really adequate for the long-term regulation of body weight and, in particular, body fat. So the search has been on for scientists to identify another signal that might regulate appetite, based on, for example, the amount of fat in the body. Recent research has uncovered a hormone, leptin (also called OB protein), which performs this function (see Campfield et al., 1995).

6 Conditioned appetite and satiety If we eat food containing lots of energy (e.g. rich in fat) for a few days, we gradually eat less of it. If we eat food with little energy, we gradually, over days, ingest more of it. This regulation involves learning to associate the sight, taste, smell and texture of the food with the energy that is released from it in the hours after it is eaten.

This form of learning has been demonstrated by Booth (1985). Two groups of participants ate different flavoured sandwiches – one flavour being high energy sandwiches and the other being low energy. On the critical test day, the participants chose to eat few of the sandwiches that tasted like the high energy ones eaten previously, but far more of the sandwiches that had the flavour of the previously consumed low energy sandwiches. And yet, on the test day, all the sandwiches consumed in fact had medium energy content. This suggests that the level of consumption of the medium energy sandwiches on the test day was strongly influenced by the energy content of the sandwiches that had been eaten previously.

How the brain controls eating

Since the early twentieth century, we have known that damage to the base of the brain can influence food intake and body weight. One critical region is the ventromedial hypothalamus.

Bilateral lesions of this area (i.e. two-sided, damaging both the left and right) in animals leads to hyperphagia (overeating) and obesity (see Rolls, 1999). By contrast, Anand and Brobeck (1951) discovered that bilateral lesions (that is, damage) of the lateral hypothalamus can lead to a reduction in feeding and body weight. Evidence of this type led, in the 1950s and 1960s, to the view that food intake is controlled by two interacting 'centres' – a feeding centre in the lateral hypothalamus and a satiety centre in the ventromedial hypothalamus (see figure 5.4).

But problems arose with this dual centre hypothesis. Lesions of the ventromedial hypothalamus were found to act indirectly by increasing the secretion of insulin by the pancreas, which in turn reduces plasma glucose concentration, resulting in feeding. This has been demonstrated by cutting the vagus nerve, which

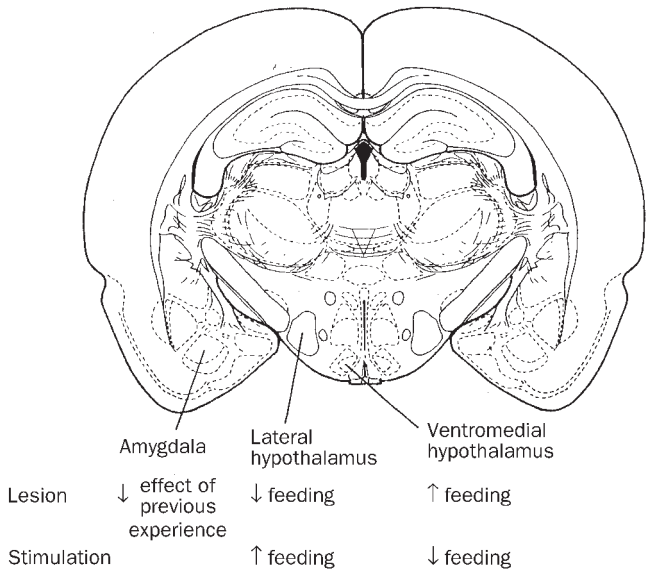


Figure 5.4

Effects of lesions and stimulation of the lateral and ventromedial hypothalamus on eating. A coronal (transverse or vertical) section through the rat brain is shown.

Research close-up 1

Long-term regulation of body weight and fat

Research issue

Different satiety signals help to regulate hunger from meal to meal. But most of these signals are not really adequate for the long-term regulation of body weight and, in particular, body fat. So how do we regulate body weight and fat over the long term?

Recent research has uncovered a hormone, leptin (also called OB protein), which performs this function. Leptin is found in humans as well as in laboratory mammals such as mice.

Design and procedure

A variety of research methodologies have been used to address this issue, focusing on the evaluation of laboratory animals (mice), which have been especially bred to manifest a specific genetic profile.

Leptin is the hormone encoded (i.e. produced) by the mouse OB (obesity) gene. This gene comes in two forms: OB (the dominant form of the gene) and ob (the recessive form). It can be manipulated in different strains of mouse and the outcomes recorded in the laboratory. Further experimental manipulations include the administration of leptin to mice of different genetic strains.

Results and implications

- The possession of the OB gene appears to regulate whether or not obesity occurs in the mouse. More specifically, genetically obese mice that are *double recessive* for the obesity gene (i.e. ob ob mice), and thereby lack the OB gene, produce no leptin.
- Leptin administration decreases food intake in wild type (lean) mice (who have OBOB or OBob genes, so that they produce leptin) but also in obob mice. This finding shows that obob mice do have receptors sensitive to leptin, but they do not produce it spontaneously, because they lack the OB gene.
- The satiety effect of leptin can be produced by injections into the brain.
- However, leptin does not produce satiety (i.e. decrease food intake) in another type of genetically obese mouse (db db mice, which are double recessive for the diabetes gene). These mice may be obese because they lack the leptin receptor, or mechanisms associated with it, so that even when leptin is administered artificially it cannot produce satiety in these mice.
- Leptin fluctuates over 24 hours, but not in relation to individual meals. It might therefore be appropriate for the long-term regulation of appetite.

double recessive the two copies of a gene in an animal are both recessive (i.e. non-dominant), as opposed to one copy being dominant (in which case the phenotype, or body characteristic, will be that of the dominant gene)

These and other related pieces of experimental evidence lead to the hypothesis that leptin represents one of the important signals in humans that controls how much food is eaten.

Campfield, L.A., Smith, F.J., Guisez, Y., Devos, R., & Burn, P., 1995, 'Recombinant mouse OB protein: Evidence for a peripheral signal linking adiposity and central neural networks', *Science*, 269, 546–9.

disconnects the brain from the pancreas, preventing ventromedial hypothalamic lesions from causing hypoglycaemia, and therefore preventing the consequent overeating.

So the ventromedial nucleus of the hypothalamus is now thought of as a region that can influence the secretion of insulin and, indirectly, affect body weight, but not as a satiety centre per se.

On the other hand, the hypothesis that damage to the lateral hypothalamus produces a lasting decrease in food intake and body weight has been corroborated by injecting focal neurotoxins (agents that kill brain cells in a very specific manner, such as ibotenic acid), into rats. These damage the local cell bodies of neurons but not the nerve fibres passing nearby. Rats with lateral hypothalamus lesions also fail to respond to experimental interventions that normally cause eating by reducing the availability of glucose (Clark et al., 1991).

A matter of taste

How are taste signals (which provide one of the most significant rewards for eating) processed through different stages in our brains, to produce (among other effects) activation of the lateral hypothalamic neurons described above (see Rolls, 1996, 1997, 1999)?

Research close-up 2

What happens in the brain when we see or taste food?

Research issue

What information relevant to food and feeding is mediated by the lateral hypothalamus? This question can be addressed by recording cellular activity while presenting food (sight and/or taste) to a laboratory animal.

Design and procedure

In these experiments, laboratory animals (typically monkeys) are anaesthetized and an electrode is surgically implanted into the lateral hypothalamus. This enables researchers to record cell response before and after the presentation of food.

It is also possible to electrically stimulate cells in the lateral hypothalamus, in a manner analogous to natural stimulation (such as might occur, for example, after the presentation of food), using surgically implanted electrodes.

Results and implications

- Some neurons in the lateral hypothalamus respond only to the sight of food (11.8 per cent), some respond to the taste of food (4.3 per cent), and some of these (2.5 per cent) respond to both the sight and taste of food (Rolls, Burton & Mora, 1980).
- The neurons only respond to the sight or taste of food if the monkey is hungry. This suggests that these lateral hypothalamic neurons represent information that is closely related to activity in the autonomic nervous systems (see chapter 3) because autonomic responses to food and eating behaviour only occur if hunger is present.
- If a lateral hypothalamic neuron has ceased to respond to a food on which the monkey has been fed to satiety, then the neuron may still respond to a different food (Rolls et al., 1986). This is reflected in the monkey's rejection of the food on which he has been fed to satiety, and acceptance of other foods.
- Hypothalamic neurons can learn to respond to the sight of a previously neutral stimulus – a container – from which the monkey has been fed orally. The neurons stop responding to the stimulus if it is no longer associated with food (Mora, Rolls & Burton, 1976; Wilson & Rolls, 1990). This type of learning underlies some forms of classical conditioning (see, for example, the classical studies of Pavlov reported in chapter 4).

Direct evidence of this type is essential for understanding how the brain works in representing rewards (see Rolls & Treves, 1998). Other evidence suggests that animals will work to obtain activation of these lateral hypothalamic neurons. It therefore seems likely that it is the stimulation of these brain regions by the consumption of food in the natural state that makes food psychologically rewarding (see Rolls, 1999).

Rolls, E.T., 1999, *The Brain and Emotion*, Oxford: Oxford University Press.

Some of the brain connections and pathways in the macaque monkey described in this chapter are shown in figure 5.5. The monkey is used to illustrate these pathways because neuronal activity in non-human primates is considered to be especially relevant to understanding brain function and its disorders in humans.

rostral towards the head or front end of an animal, as opposed to caudal (towards the tail)

During the first few stages of taste processing (from the *rostral* part of the nucleus of the solitary tract, through the thalamus, to the primary taste cortex), representations of sweet, salty, sour, bitter and protein tastes are developed (protein represents a fifth taste, also referred to as 'umami'). The reward value or pleasantness of taste is not involved in the processing of the signal as yet, because the primary responses of these neurons are not influenced by whether the monkey is hungry or satiated. The organization of these first few stages of processing therefore allows the primate to identify tastes independently of whether or not it is hungry.

orbitofrontal cortex above the orbits of the eyes, part of the prefrontal cortex, which is the part of the frontal lobes in front of the motor cortex and the premotor cortex

In contrast, in the secondary cortical taste area (the *orbitofrontal cortex*), the responses of taste neurons to a food with which the monkey is fed to satiety decrease to zero (Rolls et al., 1989, 1990). In other words, there is modulation or regulation of taste responses in this taste-processing region of the brain. This modulation is also sensory-specific (see, for example, figure 5.6). So if the monkey had recently eaten a large number of bananas, then there would be a decreased response of neurons in this region of the orbitofrontal cortex to the taste of banana, but a lesser decrease in response to the taste of an orange or melon. This decreased responding in the

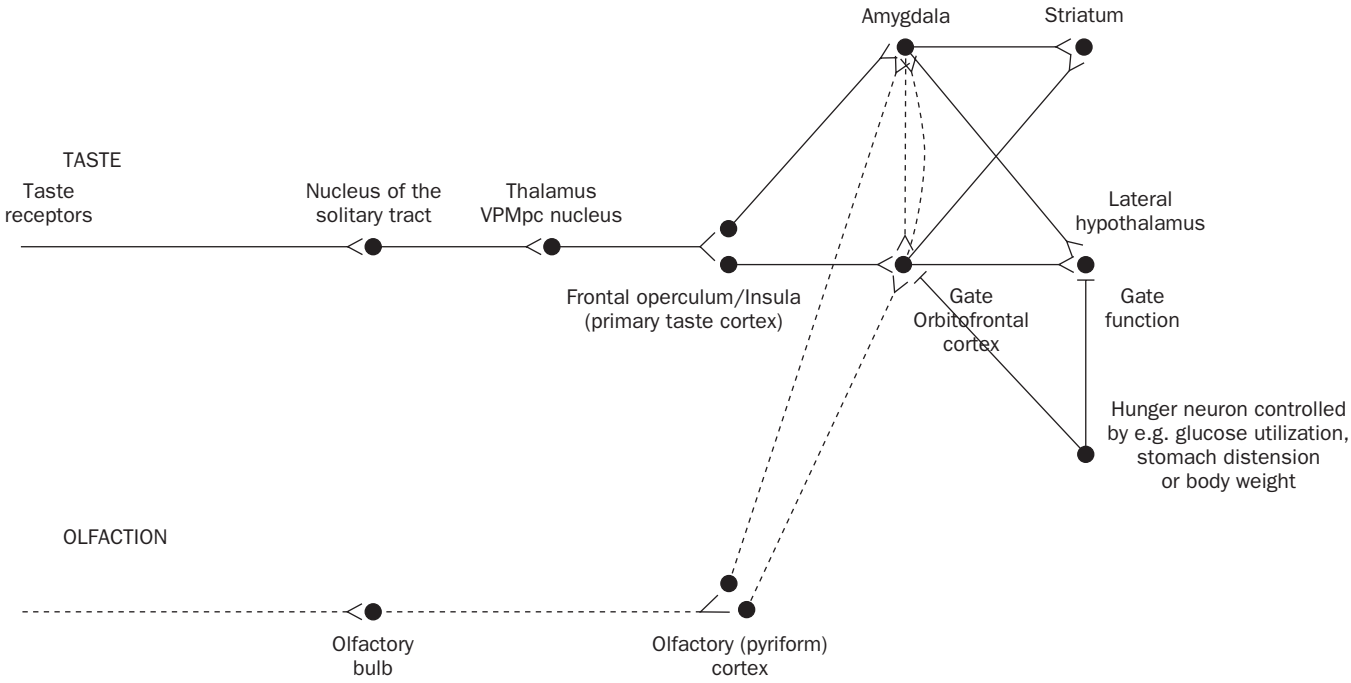


Figure 5.5

Schematic diagram showing some of the gustatory (taste) and olfactory pathways involved in processing sensory stimuli involved in the control of food intake. Areas of processing where hunger affects the neuronal responses to the sight, smell or taste of food are indicated by the gating or modulatory function of hunger.

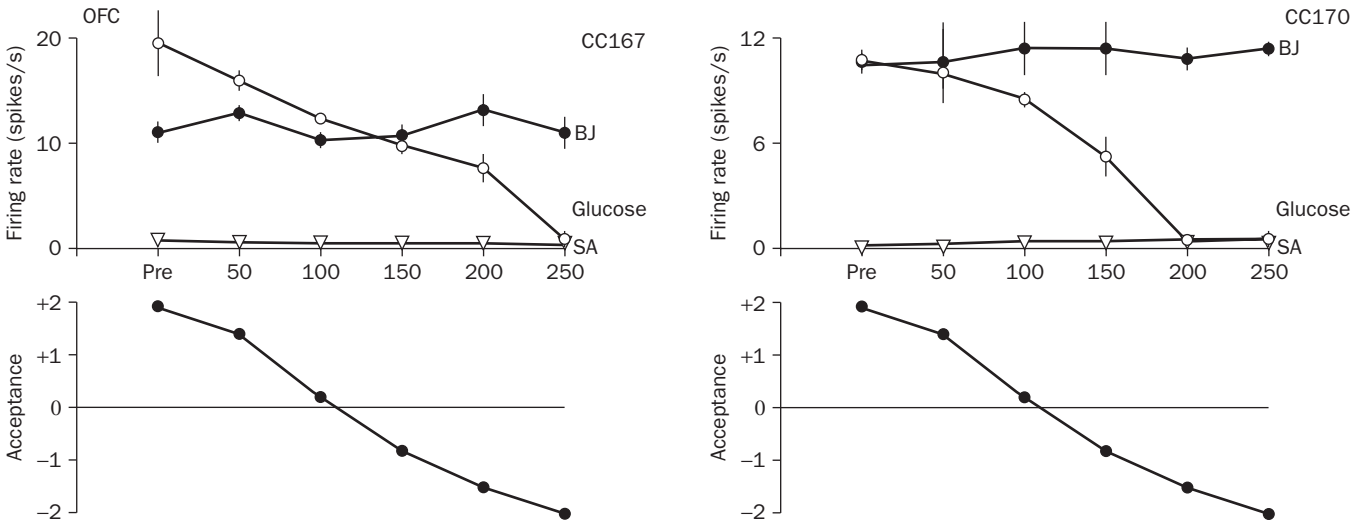


Figure 5.6

The effect of feeding to satiety with glucose solution on the responses of a neuron in the secondary taste cortex to the taste of glucose and of blackcurrant juice (*BJ*). The spontaneous firing rate is also indicated (*SA*). Below the neuronal response data for each experiment, the behavioural measure of the acceptance or rejection of the solution on a scale from +2 to –2 (see text) is shown. The solution used to feed to satiety was 20 per cent glucose. The monkey was fed 50 ml of the solution at each stage of the experiment as indicated along the abscissa (*x*-axis) until he was satiated, as shown by whether he accepted or rejected the solution.

Pre – the firing rate of the neuron before the satiety experiment started; *OFC* – orbitofrontal cortex; *CC167* and *CC170* – two different neurons. Source: Adapted from Rolls, Sienkiewicz and Yaxley (1989).

orbitofrontal cortex neurons would be associated with a reduced likelihood for the monkey to eat any more bananas (and, to a lesser degree, any more orange or melon) until the satiety had reduced.

So as satiety develops, neuronal activity in the secondary taste cortex appears to make food less acceptable and less pleasant – the monkey stops wanting to eat bananas. In addition, electrical stimulation in this area produces reward, which also decreases in value as satiety increases (Mora et al., 1979). It is possible that outputs from the orbitofrontal cortex subsequently influence behaviour via the connections of this region to the hypothalamus, where it may activate the feeding-related neurons described earlier.

TASTE + SMELL = FLAVOUR

Flavour refers to a combination of taste and smell. The connections of the taste and olfactory (smell) pathways in primates (see figure 5.5) suggest that the necessary convergence may also occur in the orbitofrontal cortex. Consistent with this, Rolls and Baylis (1994) showed that some neurons in the orbitofrontal cortex (10 per cent of those recorded) respond to both taste and olfactory inputs (see figure 5.7). Some of these neurons respond equally well to, for example, both a glucose taste and a fruit odour. Interestingly, others also respond to a visual stimulus representing, say, sweet fruit juice.

olfactory pathways smell pathways through the brain

This convergence of visual, taste and olfactory inputs produced by food could provide the neural mechanism by which the colour of food influences what we taste. For example, experimental participants reported that a red solution containing sucrose may have the flavour of a fruit juice such as strawberry, even when there was no strawberry flavour present; the same solution coloured green might subjectively taste of lime.

There is also another olfactory area in the orbitofrontal cortex (see figure 5.5). Some of these olfactory neurons respond to food only when the monkey is hungry, and so seem to represent the pleasantness or reward value of the smell of food. These neurons therefore function in a similar manner with respect to smell as the secondary taste neurons function with respect to taste.

The orbitofrontal cortex also contains neurons that respond to the texture of fat in the mouth. Some of these fat-responsive neurons also respond to taste and smell inputs, and thus provide another type of convergence that is part of the representation of the flavour of food. A good example of a food that is well represented by these neurons is chocolate, which has fat texture, sweet taste and chocolate smell components.

The orbitofrontal cortex

Neurons that respond to the sight of food do so by learning to associate a visual stimulus with its taste. Because the taste is a reinforcer, this process is called stimulus-reinforcement association learning. Damage to the orbitofrontal cortex impairs this type of learning by, for example, altering food preferences. We know this because monkeys with such damage select and eat substances they would normally reject, including meat and non-food objects (Baylis & Gaffan, 1991; Butter, McDonald & Snyder, 1969).

The functioning of this brain region could have critical implications for survival. In an evolutionary context, without this function of the orbitofrontal cortex, other animals might have consumed large quantities of poisonous foodstuffs and failed to learn which colours and smells signify nutritious foods.

The orbitofrontal cortex is therefore important not only in representing whether a taste is rewarding, and so whether eating should occur, but also in learning about which (visual and olfactory) stimuli are actually foods (Rolls, 1996, 1999, 2000c).

Because of its reward-decoding function, and because emotions can be understood as states produced by rewards and

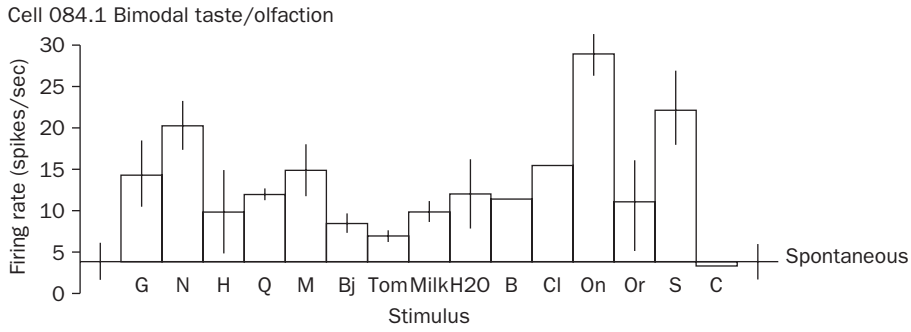


Figure 5.7

The responses of a bimodal neuron recorded in the caudolateral orbitofrontal cortex. The neuron responded best to the tastes of NaCl and monosodium glutamate and to the odours of onion and salmon.

G – 1M glucose; *N* – 0.1M NaCl; *H* – 0.01M HCl; *Q* – 0.001M Quinine HCl; *M* – 0.1M monosodium glutamate; *Bj* – 20 per cent blackcurrant juice; *Tom* – tomato juice; *B* – banana odour; *Cl* – clove oil odour; *On* – onion odour; *Or* – orange odour; *S* – salmon odour; *C* – control no-odour presentation. The mean responses ± se (standard error of the mean) are shown. Source: Rolls & Baylis (1994).

Figure 5.8

There are neurons in the orbitofrontal cortex that respond to the texture of chocolate. Add its distinctive flavour (taste + smell) and you have an appealing combination.

punishers, the orbitofrontal cortex plays a very important role in emotion (see Rolls, 1999).

The amygdala

Many of the amygdala's connections are similar to those of the orbitofrontal cortex, and indeed it has many connections to the orbitofrontal cortex itself (see figure 5.5).

Bilateral damage to the temporal lobes of primates, including the amygdala, leads to the Kluver–Bucy syndrome, in which, for example, monkeys place non-food as well as food items in their mouths and fail to avoid noxious stimuli (Aggleton & Passingham, 1982; Baylis & Gaffan, 1991; Jones & Mishkin, 1972; Kluver & Bucy, 1939; Murray et al., 1996). Rats with lesions in the basolateral amygdala display similar altered food selections.

Given the neural connectivity between the orbitofrontal and amygdalar regions, we might relate these phenomena to the finding that lesions of the orbitofrontal region lead to a failure to correct inappropriate feeding responses.

Further evidence linking the amygdala to reinforcement mechanisms is illustrated when monkeys perform physical work in exchange for electrical stimulation of the amygdala. For example, they might be prepared to press a lever for a long period of time to receive amygdalar stimulation (via an electrode which has been implanted in their brain), implying that this stimulation is significantly rewarding. In addition, single neurons in the monkey amygdala have been shown to respond to taste, olfactory and visual stimuli (Rolls, 2000a).

But although the amygdala is similar in many ways to the orbitofrontal cortex, there is a difference in the speed of learning. When the pairing of two different visual stimuli with two different tastes (e.g. sweet and salt) is reversed, orbitofrontal cortex neurons can reverse the visual stimulus to which they respond in as little as one trial. In other words, neurons in the orbitofrontal cortex that previously 'fired' in response to a sweet taste can start responding to a salty taste, and neurons that previously 'fired' in response to a salty taste can start responding to a sweet taste, very quickly (see Rolls, 1996, 2000c). Neurons in the amygdala, on the other hand, are much slower to reverse their responses (Rolls, 2000a).

To explain this in an evolutionary context, reptiles, birds and all mammals possess an amygdala, but only primates show marked orbitofrontal cortex development (along with other parts of the frontal lobe). So the orbitofrontal cortex may be performing some of the functions of the amygdala but doing it better, or in a more 'advanced' way, since as a cortical region it is better adapted for learning, especially rapid learning and relearning or reversal (Rolls, 1996, 1999, 2000c).

The striatum and other parts of the basal ganglia

We have seen that the orbitofrontal cortex and amygdala are involved in decoding the stimuli that provide the rewards for feeding, and in connecting these signals to hunger/satiety signals. How do these brain regions further connect to behavioural systems?

One path is via the hypothalamus, which is involved in autonomic responses during feeding (such as the need for increased blood flow to the gut, to facilitate the assimilation of food into the body), and also in the rewarding aspects of food. Another route is via the striatum (one part of the basal ganglia, requiring dopamine to function – see chapter 3) and then on through the rest of the basal ganglia (see figure 5.5). This route is important as a behavioural output/feeding system, because disruption of striatal function results in aphagia (lack of eating) and adipsia (lack of drinking) in the context of a general akinesia (lack of voluntary movement) (Rolls, 1999; Rolls & Treves, 1998).

Neurons in the ventral striatum also respond to visual stimuli of emotional or motivational significance (i.e. associated with rewards or punishments; Williams et al., 1993), and to types of reward other than food, including drugs such as amphetamine (Everitt, 1997; Everitt & Robbins, 1992).

OBESITY – POSSIBLE FACTORS

With all of these brain functions promoting food regulation, why, then, is there such a high incidence of obesity in the world today?

Many different factors can contribute to obesity, and there is only rarely a single cause (see Garrow, 1988). Occasionally, hormonal disturbances, such as hyperinsulinemia (that is, substantially elevated levels of insulin in the bloodstream), can produce overeating and obesity. Otherwise, there are a number of possible contributory factors:

- It is possible that the appetite of some obese people is more strongly stimulated by external factors such as the sight and smell of food (Schachter, 1971). The palatability of food is now much greater than it was in our evolutionary past, leading to an imbalance between the reward from *orosensory* control signals and the gastrointestinal and post-absorptive satiety signals controlling the reward value of sensory input. In other words, the rewards from the smell, taste and texture of food are far greater than the satiety signals can control.

orosensory the sensory systems concerned with the oral cavity, including taste, smell and the texture of what is in the mouth

- Animals evolved to ingest a variety of foods, and therefore nutrients. So satiety is partly specific to a food just eaten, while appetite remains for foods with a different flavour. Overeating may therefore be partially explained by the tremendous variety of modern foods, encouraging us to eat more by moving from one food to another.
- Modern humans take less exercise than our ancestors due to our more sedentary lifestyles, so unless regular exercise is proactively built into our daily lives, we may be inclined to gain weight.
- Human meal times tend to be fixed. Animals normally regulate their food intake by adjusting the inter-meal interval. A long interval occurs after a high energy meal, and a short interval after a low energy meal. Quite simple control mechanisms, such as slower gastric emptying (and therefore a feeling of fullness for a long time after an energy rich meal) may contribute to this. But the fixed meal times often preferred by humans deter this control mechanism from operating normally. Obese people tend to eat high energy meals and then eat again at the next scheduled mealtime, even though gastric emptying is not yet complete.
- Obese people often eat relatively late in the day, when large energy intake must be converted into fat and is less easily burned off by exercise and heat loss. Regulation of heat loss is one way that animals compensate for excessive energy intake. They do this by activating brown fat metabolism, which burns fat to produce heat. Although brown fat is barely present in humans, there is nevertheless a mechanism that, when activated by the sympathetic nervous system, enables metabolism to be increased or reduced in humans, depending on energy intake (see Garrow, 1988; Trayhurn, 1986).
- Obesity may be related to higher stress levels in contemporary society. Stress can regulate the sympathetic nervous system to increase energy expenditure, but at the same time it can also lead to overeating. Rats mildly stressed (e.g. with a paperclip on their tail) show overeating and obesity.

Figure 5.9

Obesity has many possible contributing factors and is rarely the result of a single cause.

THIRST AND THE CONTROL OF DRINKING

But what of water intake, and drinking? The human body can survive without food for very much longer than it can survive without water – how does our physiological make-up help direct this vital function?

Body water is contained within two main compartments, one inside the cells (intracellular) and the other outside (extracellular). Intracellular water accounts for approximately 40 per cent of total body weight; and extracellular water for about 20 per cent, divided between blood plasma (5 per cent) and interstitial fluid (15 per cent) (see figure 5.10).

When we are deprived of water, both the cellular and extracellular fluid compartments are significantly depleted. The depletion of the intracellular compartment is shown in figure 5.11 as cellular dehydration, and the depletion of the extracellular compartment is known as hypovolaemia (meaning that the volume of the extracellular compartment has decreased).

CELLULAR DEHYDRATION

When our bodies lose too much water, or we eat foods rich in salt, we feel thirsty, apparently because of cellular dehydration, leading to cell shrinkage. For instance, if concentrated sodium chloride solution is administered, this leads to withdrawal of water from the cells of the body by *osmosis*, and results in drinking.

Cellular dehydration is sensed centrally in the brain, rather than peripherally in the body. For instance, low doses of hypertonic sodium chloride (or sucrose) solution infused into the carotid arteries, which supply the brain, cause dogs to drink water, but similar infusions administered into peripheral regions of the body, which don't directly supply the brain, have no effect (Wood et al., 1977).

Everyday Psychology

Obesity: a disease of affluence?

Obesity is an extremely common disorder in our society. The prevalence of overweight or obese people in many Western countries is over 50 per cent and increasing. One estimate suggests that the average adult in developed countries has been adding one gram per day to body weight over the last decade. This has significant health consequences, and can cost these countries around 3 to 5 per cent of their total health budgets.

How can societies tackle the obesity problem? Major recent research investment has been made in seeking to understand the physiology, psychology and genetics of obesity. And many public education programmes publicize the value of healthy eating and exercise, although the effect of these programmes has been fairly minimal.

The National Health and Medical Research Council (NH&MRC) in Australia (a country that suffers from the same 'obesity epidemic' as other Western countries) commissioned a report, Acting on Australia's Weight, published in 1997. It suggested that the driving forces behind the increasing prevalence of obesity in recent decades are likely to be found in environmental changes inherent in modernizing societies. The report argued that a new model is needed to tackle the obesity epidemic, shifting the emphasis away from metabolic defects and genetic mutations.

A key concept within this framework is that obesity reflects a 'normal physiology within a pathological environment'. It is accepted that some people are genetically predisposed to obesity, but that the major role in most cases is played by psychosocial factors. To tackle this issue requires an environmental or lifestyle change.

Other relevant factors cited in the report are quantity and type of energy (food) intake and level of physical activity. The report argues that 'different combinations of genetic effect, food intake and energy output, modulated by psychosocial factors, interact in different populations, ethnic groups and families to produce overweight and obesity – no single or simple cause has been isolated'.

In industrialized countries, if we reflect on our everyday lives it becomes apparent that energy-dense foods are heavily promoted and readily available commercially. Also, labour-saving – and therefore physical activity reducing – devices are common both at home and in the workplace. The report argues that encouraging individuals to control their weight and providing them with information about how to do this is unlikely to be effective unless steps are taken to modify the environmental influences that underpin weight problems. For example, a programme that promotes low-fat foods is likely to meet with limited success unless there are enough low-fat products in supermarkets that are clearly labelled, placed near to full-fat alternatives and realistically priced.

Similarly, a strategy that encourages physical activity as part of a daily routine is unlikely to succeed if shops and workplaces are not within easy walking distance of people's homes, or if there are limited opportunities for physical activity outdoors.

The Australian NH&MRC document therefore proposes that public health strategies should be developed to promote environmental changes supporting healthy weight-control behaviours, including:

- encouraging schools to provide programmes that emphasize healthy dietary and physical activity behaviour in children; and
- increasing opportunities for people to be physically active in the community (for example, through better urban planning and the provision of exercise facilities at or near the workplace).

The report concludes that a major challenge for future research will be to identify precisely which environmental variables influence people's eating and exercise behaviour most effectively.

Commonwealth of Australia, 1997, *Acting on Australia's Weight: A Strategic Plan for the Prevention of Overweight and Obesity: Summary Report*.

The part of the brain that senses cellular dehydration appears to be near or in a region extending from the preoptic area through the hypothalamus.

Extracellular thirst stimuli

Although the amount of fluid in the extracellular fluid (ECF) compartment is less than that in the cells, it is vital that the ECF be conserved to avoid debilitating changes in the volume and pressure of fluid in the blood vessels. The effects of extracellular fluid loss can include fainting, caused by insufficient blood reaching the brain. The behavioural response of drinking in response to hypovolaemia, a disorder consisting of a decrease in the volume of blood circulation, ensures that plasma volume does not fall to dangerously low levels.

There are a number of ways that ECF volume can be depleted experimentally, including haemorrhage, lowering sodium content in the diet, and excessive sweating, urine production or salivation. Two main thirst-inducing systems are activated by

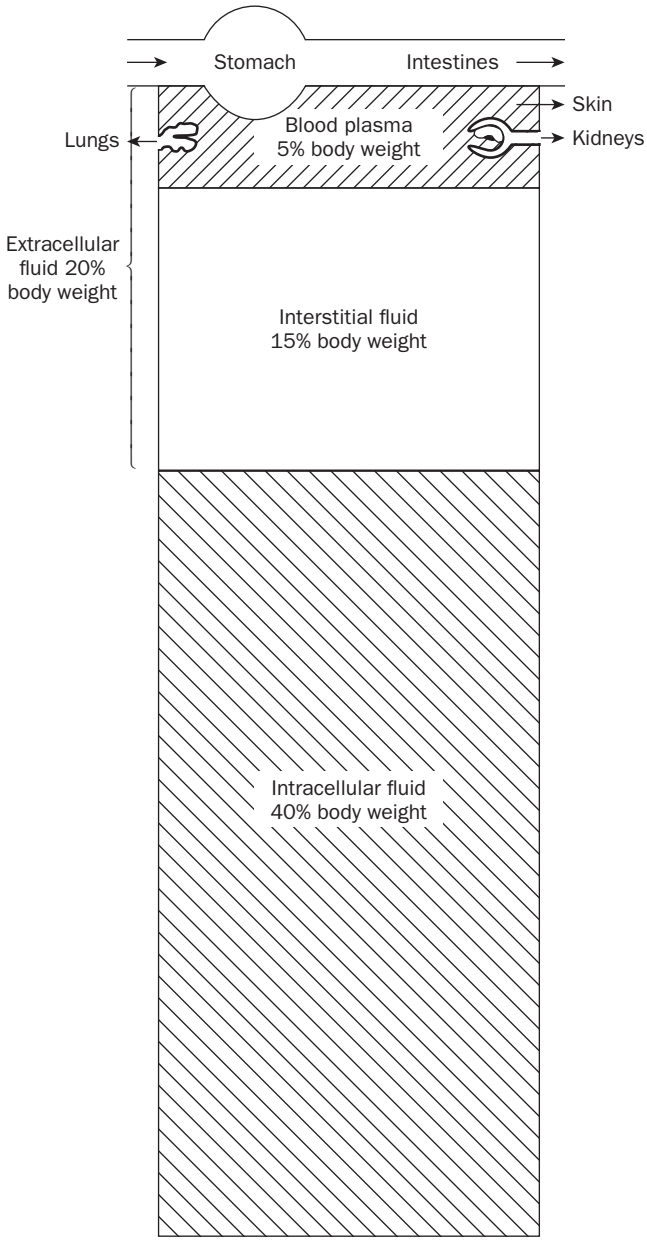


Figure 5.10

Body water compartments. Arrows represent fluid movement. Source: Adapted from Rolls and Rolls (1982).

hypovolaemia. One is the renin–angiotensin system mediated by the kidneys. When reductions in blood pressure or volume are sensed by the kidneys, the enzyme renin is released, leading to the production of the hormone angiotensin II which stimulates copious drinking

A second thirst-inducing system activated by hypovolaemia is implemented by receptors in the heart. For example, reducing the blood flow to the heart in dogs markedly increases water intake (Ramsay et al., 1975). It is still not clear precisely where such cardiac receptors are located. But it seems likely that they

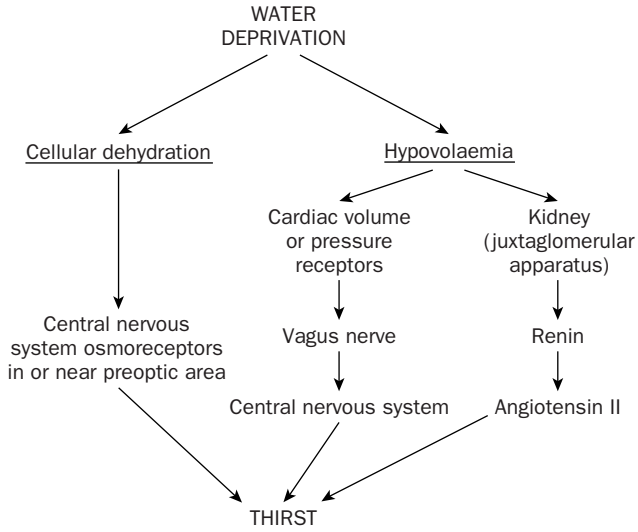


Figure 5.11

A summary of the factors that may lead to drinking after water deprivation. Source: Adapted from Rolls and Rolls (1982).

are located in the venous circulation around the heart, since the compliance (i.e. the ability to change diameter) of these vessels is high, making them responsive to changes in blood volume. Information from these receptors is probably carried to the central nervous system via the vagosympathetic nerves, from where information is relayed to the brain and drinking behaviour can be regulated.

Control of normal drinking

In drinking caused by, for example, water deprivation, both the cellular and extracellular thirst systems are activated. Experiments show that, in many species, it is the depletion of the cellular, rather than the extracellular, thirst system that accounts for the greater part of the drinking, typically around 75 per cent (see Rolls & Rolls, 1982; Rolls, 1999).

It is important to note that we continue to drink fluids every day, even when our bodies aren't deprived of water. The changes in this type of thirst signal are smaller, partly because drinking has become conditioned to events such as eating foods that deplete body fluids, and also because humans have a wide range of palatable drinks, which stimulate the desire to drink even when we are not thirsty. (See earlier explanation of sensory-specific satiety, which means that we can drink much more if we are offered a variety of different drinks than if we were presented with only orange juice.)

SEXUAL BEHAVIOUR

Just as we need to eat to keep ourselves alive, working to obtain rewards such as food, so we need to have sex and reproduce in

order to keep our genes alive. In this part of the chapter, we will look at the following two questions:

How can a socio-biological approach (that is, an approach which seeks to reconcile our biological heritage as a species with our highly social organization) help us to understand the different mating and child-rearing practices of particular animal species? How does the human brain control sexual behaviour?

Sociobiology and sexual behaviour

Sperm warfare

Monogamous primates (those with a single mate) living in scattered family units, such as some baboons, have small testes. Polygamous primates (those with many mates) living in groups, such as chimpanzees, have large testes and copulate frequently. This may be related to what sociobiologists call 'sperm warfare'. In order to pass his genes on to the next generation, a male in a polygamous society needs to increase his probability of fertilizing a female. The best way to do this is to copulate often and ejaculate a large quantity of sperm, increasing the chances that his sperm will reach the egg and fertilize it. So, in polygamous groups, the argument is that males have large testes to produce large numbers of sperm.

In monogamous societies, with less competition between sperm, the assumption is that the male just picks a good partner and produces only enough sperm to fertilize an egg without the need to compete with others' sperm. He also stays with his partner to bring up the offspring in which he has a genetic investment, and to guard them (Ridley, 1993).

What about humans? Despite widespread cultural pressure in favour of monogamy or restricted polygamy, humans are intermediate in testis size (and penis size) – bigger than might be expected for a monogamous species. But remember that although humans usually do pair, and are apparently monogamous, we also live in groups, or colonies. Perhaps we can find clues about human sexuality from other animals that are paired but also live in colonies.

A problem with this type of comparison, though, is that for most primates (and indeed most mammals) it is the female who makes the main parental investment – not only by producing the egg and carrying the foetus, but also by feeding the baby until it becomes independent. In these species, the male apparently does not have to invest behaviourally in his offspring for them to have a reasonable chance of surviving. So the typical pattern in mammals is for the female to be 'choosy' in order to obtain a healthy male, and for the males to compete for females.

But, because of its large size, the human brain is not fully developed at birth, so infants need to be looked after, fed, protected and helped for a considerable period while their brain develops and they reach independence. So in humans there is an advantage to paternal investment in helping to bring up the children, because the paternal resources (e.g. food, shelter and protection) can increase the chances of the father's genes surviving into the next generation to reproduce again. In humans, this therefore favours more complete pair bonding between the parents.

Couples in colonies

It is perhaps more useful to compare humans with birds that live in colonies, in which the male and female pair up and both invest in bringing up the offspring – taking turns, for example, to bring back food to the nest. Interestingly, tests on swallows using DNA techniques for determining paternity have revealed that approximately one third of a pair's young are not sired by the male of the pair (Ridley, 1993). So the female is sometimes mating with other males – what we might call committing adultery! These males will probably not be chosen at random: she may choose an 'attractive' male by responding to indicators of health, strength and fitness.

One such indicator in birds is the gaudy tail of the male peacock. It has been suggested that, given that the tail handicaps movement, any male that can survive with such a large tail must be very healthy or fit. Another theory is that a female would choose a male with an attractive tail so that her sons would be attractive too and also chosen by females. (This is an example of the intentional stance, since clearly the peahen is incapable of any real propositional thought; but it has also been criticized as representing a somewhat circular line of argument.) Choosing a male with an attractive tail may also benefit female offspring, so the argument goes, because of the implied health/fitness of the fathering peacock.

In a social system such as the swallows', the 'wife' needs a reliable 'husband' to help provide resources for 'their' offspring. A nest must be built, the eggs must be incubated, and the hungry young must be well fed to help them become fit offspring ('fit' here means capable of 'successfully passing on genes into the next generation'; see Dawkins, 1986). The male must in some sense 'believe' that the offspring are his – and, for the system to be stable, some of them must actually belong to him. But the female also benefits by obtaining genes that will produce offspring of optimal fitness – and she does this by sometimes 'cheating' on her

Figure 5.12

The gaudy tail of the male peacock is one indicator of attractiveness in birds. Given that the tail handicaps movement, any male that can survive with such a large tail must be very healthy or fit, which may explain why peahens have evolved to choose males with large tails.

Pioneer

Richard Dawkins (1941–), Professor for the Public Understanding of Science at the University of Oxford, in his book *The Selfish Gene* (1976), highlighted the way in which natural selection operates at the level of genes rather than individuals or species. W.D. Hamilton, also of the University of Oxford, provided some of the theoretical foundations for this approach (described in *The Narrow Roads of Gene Land*, 2001). 'Selfish gene' theory provides potential explanations for a number of aspects of animal and human behaviour that are otherwise difficult to explain. For example, it explains how the likelihood that an individual will display altruistic behaviour towards another depends on how closely the two are related genetically. This approach has also been used to understand the phenomenon of sperm competition, and the effects that this has on sexual behaviour. This approach is now thought of as a modern version of Darwinian theory, and has set a new paradigm for many disciplines including biology, zoology, psychology and anthropology.

'husband'. To ensure that the male does not find out and therefore leave her and stop caring for her young, she 'deceives' him by 'committing adultery' secretly, perhaps hiding behind a bush to mate with her 'lover'. So the 'wife' maximizes care for her children by 'exploiting' her 'husband', and maximizes her genetic potential by finding a 'lover' with better genes that are subsequently likely to make her offspring more attractive to future potential mates.

The implication is that genes may influence our motivational behaviour in ways that increase their subsequent success (see Rolls, 1999, ch. 10).

Are humans like swallows?

Again, how might this relate to human behaviour? Though it is not clear how important they are, there is some evidence to suggest that such factors could play some part in human sexual behaviour.

One potentially relevant piece of evidence in humans concerns the relatively large testis and penis size of men. The general argument in sociobiology is that a large penis could be adaptive in sperm competition, by ensuring that the sperm are placed as close as possible to where they have a good chance of reaching an egg, and so displacing other sperm, thereby winning the 'fertilization race'.

A second line of evidence is that studies in humans of paternity using modern DNA tests suggest that husbands are not the biological fathers to about 14 per cent of children (Baker & Bellis, 1995; see Ridley, 1993). So it is possible that the following factors have shaped human sexual behaviour in evolution:

- women might choose a partner likely to provide reliability, stability, provision of a home, and help with bringing up her children;
- women might also be attracted to men who are perhaps successful and powerful, increasing the likelihood of producing genetically fit children, especially sons who can themselves potentially have many children;
- men might engage in (and be selected for) behaviours such as guarding the partner from the attentions of other men, to increase the likelihood that the children in which he invests are his; and
- men might be attracted to other women for their childbearing potential, especially younger women.

Much of the research on the sociobiological background of human sexual behaviour is quite new and speculative, and many of the hypotheses have still to be fully tested and accepted. But this research does have interesting implications for understanding some of the factors that may influence human behaviour (see Baker, 1996; Baker & Bellis, 1995; Buss, 1999; Ridley, 1993).

How the brain controls sexual behaviour

We can be pretty sure that, in males, the preoptic area (see figure 5.13) is involved in the control of sexual behaviour (see Carlson, 1998; Rolls, 1999) because:

1. lesions of this region permanently abolish male sexual behaviour;
2. electrical stimulation of this area can elicit copulatory activity;
3. neuronal and metabolic activity is induced in this area during copulation; and
4. small implants of the male hormone testosterone into this area restore sexual behaviour in castrated rats.

Pioneer

David Buss (1953–), a professor in the Evolutionary Psychology Research Lab, University of Texas at Austin, has pioneered the use of modern evolutionary thinking in the psychology of human behaviour and emotion. His primary research has focused on human mating strategies and conflict between the sexes. He has championed the idea that men and women have different long-term and short-term mating strategies, and that monogamous and promiscuous mating strategies may coexist. Some interesting extensions to his work include references to sexual jealousy and coercion, homicide, battery and stalking. In an effort to find empirical rather than circumstantial evidence to show that human psychological preferences have evolved and are not only learned, Buss has performed many cross-cultural studies containing up to 10,000 participants from many countries around the globe. Overall, his evolutionary psychology has highlighted the dynamic and context-sensitive nature of evolved psychological mechanisms.

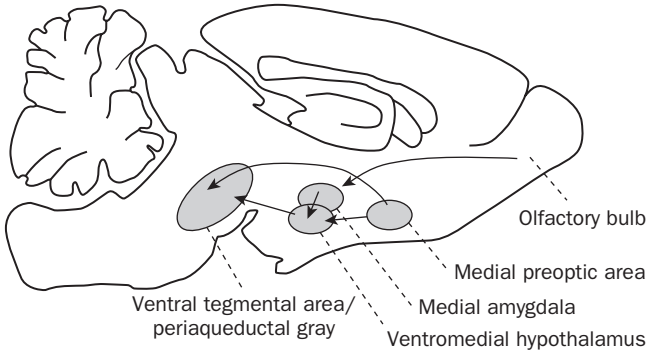


Figure 5.13

A midline view of the rat brain showing some of the brain regions involved in the control of sexual behaviour.

In females, the preoptic area is involved in the control of reproductive cycles, and is probably directly involved in controlling sexual behaviour too.

The ventromedial nucleus of the hypothalamus (VMH) is also involved in sexual behaviour. Outputs from the VMH project to the periaqueductal gray of the midbrain, and this region is also necessary for female sexual behaviour, including lordosis (the position adopted by a female to accept a male) in rodents. This behaviour can be reinstated in ovariectomized female rats by injections of the female hormones oestradiol and progesterone into the VMH brain region.

Can the brain help us to understand sexual arousal at the sight and smell of someone to whom we are sexually attracted? By receiving inputs from the amygdala and orbitofrontal cortex, the preoptic area receives information from the inferior temporal visual cortex (including information about facial identity and expression), the superior temporal auditory association cortex, the olfactory system and the somatosensory system. It is presumably by these neural circuits that the primary rewards relevant to sexual behaviour (such as touch and perhaps smell) and the learned stimuli that act as rewards in connection with sexual behaviour (such as the sight of a partner) reach the preoptic area. And it is likely that, in the preoptic area, the reward value of these sensory stimuli is modulated by hormonal state, perhaps (in females) related to the stage of the menstrual cycle – women are more receptive to these sensory stimuli when they are at their most fertile.

The neural control of sexual behaviour may therefore be organized in a similar way to the neural controls of motivational behaviour for food. In both systems, external sensory stimuli are needed to provide the reward, and the extent to which they do this depends on the organism's internal state, mediated by plasma glucose concentration for hunger and hormonal status for sexual behaviour. For sexual behaviour, the internal signal that controls the motivational state and the reward value of appropriate sensory stimuli alters relatively slowly. It may change, for example, over four days in the rat oestrus cycle, or over weeks or even months in the case of many animals that only breed during certain seasons of the year.

Figure 5.14

We now know that the pleasantness of touch is represented in the human orbitofrontal cortex. This finding contributes to our understanding of the motivational rewards involved in sexuality.

The outputs of the preoptic area include connections to the tegmental area in the midbrain. This region contains neurons that are responsive during male sexual behaviour (Shimura & Shimokochi, 1990). But it is likely that only some outputs of the orbitofrontal cortex and amygdala that control sexual behaviour act through the preoptic area. The preoptic area route may be necessary for some aspects of sexual behaviour, such as copulation in males, but the attractive effect of sexual stimuli may survive damage to the preoptic area (see Carlson, 1998). Research findings suggest that, as for feeding, outputs of the amygdala and orbitofrontal cortex can also influence behaviour through the basal ganglia.

Much research remains to be carried out into how the amygdala, orbitofrontal cortex, preoptic area and hypothalamus represent the motivational rewards underlying sexual behaviour. For instance, it has recently been found that the pleasantness of touch is represented in the human orbitofrontal cortex (Francis et al., 1999). Findings such as these can enhance our understanding of sexuality in a wider context.

FINAL THOUGHTS

Motivational states lead animals (including humans) to work for goals (such as food, drink or sex). In this chapter, we have principally been looking at motives arising from the biological goals that we must reach in order to guarantee our own survival (eating, to ward off starvation and to promote healthy growth), and for the survival of our genes (sexual behaviour).

Part of the adaptive value of motivational states is that they specify the goal for behaviour (whether that be obtaining food, drink or sex), and then an appropriate behavioural action is co-ordinated to attain that goal. Emotional states are elicited by rewards (which we are motivated to obtain) and punishers (which we are motivated to avoid). Examples include fear produced by a noise that has been previously associated with pain, or joy produced by the sight of a long-lost loved one.

Motivations and emotions are not merely theoretical concepts, but also have considerable significance in the real world. For example, one of the central topics of this chapter is obesity, which is becoming a major problem is Western society. Why do so many people consistently eat in excess of their body's energy requirements when food supplies are plentiful? On the other side of the coin, why are some people motivated to deprive themselves of adequate nutritional input (see chapter 15 on anorexia and bulimia)? It will be very important in future to apply our developing knowledge of the many factors involved in motivated behaviours to provide help and support to those at risk of obesity and other clinical disorders in which motivational and emotional mechanisms appear to become dysfunctional.

Summary

- Motivational states are states that lead animals (including humans) to work for goals. Motivation also has close links with emotions, since these can be regarded as mental states (present in at least some species) that are elicited by rewards and punishments.
- Goals can be defined as rewards that animals will work to obtain, while punishers are events or situations that animals will escape from or avoid.
- One example of a goal is a sweet taste, which is rewarding when the motivational state of hunger is present. Hunger is signalled by decreases of glucose concentration in the bloodstream.
- The reward for eating is provided by the taste, smell and sight of food.
- Satiety is produced by (a) the sight, taste, smell and texture of food, (b) gastric distension, (c) the activation by food of duodenal chemosensors, (d) rises in glucose concentration in the blood plasma, and (e) high levels of leptin. Satiety signals modulate the reward value of the taste, smell, and sight of food to control appetite and eating.
- The orbitofrontal cortex contains the secondary taste cortex and the secondary olfactory cortex. In this brain region, neurons respond to the sight, taste and smell of food, but only if hunger is present. The orbitofrontal cortex is the first stage of processing at which the reward or hedonic aspects of food is represented. It is the crucial site in the brain for the integration of the sensory inputs activated by food (taste, smell, sight etc.) and satiety signals.
- The lateral hypothalamus has inputs from the orbitofrontal cortex and it also contains neurons that are necessary for the normal control of food intake. Once again, neurons in the lateral hypothalamus respond to the sight, taste and smell of food, but only if hunger is present. These neurons thus reflect the reward value of food, by reflecting the integration between the sensory inputs that maintain eating and satiety signals.
- The orbitofrontal cortex, and the amygdala, are involved in learning which environmental stimuli are foods (for example, in learning which visual stimuli taste good).
- Sexual behaviour has been influenced in evolution by the advantages to genes of coding for behaviours such as parental attachment, which increase the probability of survival of those genes.
- As with other motivational systems, such as hunger, genes achieve this by coding for stimuli and events that animals find rewarding. This is achieved by specifying, in parts of the brain such as the amygdala, orbitofrontal cortex, preoptic area and hypothalamus, which sensory inputs and events should be represented as rewards.

REVISION QUESTIONS

1. Is sensory-specific satiety a feature of most reward systems? How do you think that sensory-specific satiety is adaptive, i.e. would benefit the survival of the organism?
2. Discuss factors that may contribute to obesity, and possible treatments for obesity.
3. What are the functions of the orbitofrontal cortex and amygdala?
4. How plausible are sociobiological 'explanations' of behaviour?
5. Justify your response with respect to what you have learned in this chapter about the regulation of sexual behaviour.
6. Do you think that humans are intrinsically monogamous?

Further Reading

Baker, R., & Bellis, M. (1995). *Human Sperm Competition: Copulation, Competition and Infidelity*. London: Chapman and Hall.
A fascinating and controversial volume presenting analyses and hypotheses regarding some of the factors involved in human sexual behaviour and reproduction.

Carlson, N.R. (2003). *Physiology of Behavior*. 7th edn. Boston: Allyn and Bacon.
A thorough textbook, which reviews the areas covered in this chapter as well as many other aspects of physiological psychology.

Dawkins, R. (1989). *The Selfish Gene*. 2nd edn. Oxford: Oxford University Press.
An influential and provocative sociobiological perspective on how genes influence behaviour.

Ridley, M. (1993). *The Red Queen: Sex and the Evolution of Human Nature*. London: Penguin.
A sociobiological perspective on how genes influence sexual behaviour.

Rolls, E.T. (1999). *The Brain and Emotion*. Oxford: Oxford University Press.
Reviews brain mechanisms underlying hunger, thirst, sexual behaviour and reward, and the nature, functions, adaptive value and brain mechanisms of emotion.

Rolls, E.T., & Treves, A. (1998). *Neural Networks and Brain Function*. Oxford: Oxford University Press.
An introduction to how the brain actually works computationally.

Contributing author:
Edmund Rolls

Emotion 6

CHAPTER OUTLINE

LEARNING OBJECTIVES

INTRODUCTION

FIVE PERSPECTIVES ON EMOTION
- Emotion as feeling
- Emotion as behaviour
- Emotion as arousal
- The cognitive approach to emotion
- The social approach to emotion

SPECIFIC EMOTIONS
- Five fundamental emotions
- Other discrete emotions

THE DEVELOPMENT OF EMOTION
- Early theories
- Recent theories
- Attachment
- Emotional intelligence

CAN EMOTIONS MALFUNCTION?
- Psychosomatic disorders and panic attacks
- Theories of neurotic anxiety

FINAL THOUGHTS

SUMMARY

REVISION QUESTIONS

FURTHER READING

Learning Objectives

By the end of this chapter you should appreciate that:

- emotions have been investigated via at least five main approaches, involving feelings, behaviour, arousal (physiology), cognition and social context;
- the measurement techniques of psychological science can significantly inform the study of emotion;
- different research methodologies have been used to investigate feelings, emotional behaviour, and physiological measurements of emotion;
- there is an important interaction between emotion and cognition, especially involving appraisal;
- the communicative functions of emotion differ between specific emotions such as fear, anger, happiness and sadness;
- some aspects of emotion are inherited, but emotion continues to develop throughout the lifespan;
- in extreme forms, emotions can be integrally involved in psychological disorders.

INTRODUCTION

Measurement is fundamental to any science, but there are obvious difficulties with the measurement of emotion. How do you measure somebody's anxiety? Through facial expressions? Through physiological indices such as heart rate? Simply by asking them?

The complexity of emotion sets limits on how psychologists can set about its scientific investigation and measurement. This has led different investigators to emphasize different aspects of emotion and to develop measurement techniques that spring from each of these approaches. As we will see, these range from self-report, diary-keeping and questionnaires, through coding of facial expressions, to the intricacies of psychophysiological and neurophysiological measurement.

Psychologists have also developed quite distinct descriptive languages, depending on their perspective. To speak of the feelings of anger is quite different from describing its typical facial expression, or its characteristic physiological changes.

A particular problem comes from the existence of a strong folk psychology of emotion. Because we are used to observing emotion and thinking about it in everyday life, over time, cultures and subcultures have developed their own language for communicating about emotion. The language used in the scientific study of emotion is simply another of these.

There are important differences between a measurement-based science and an everyday folk psychology. The layperson might argue that if something as complex as emotion is studied through scientific methods, then much of its richness is lost. On the other hand, the psychologist/scientist would argue that if something cannot be studied using the methods of science then it will not be possible to say anything useful about it. In

practice, it is possible both to measure emotion and to make firm science-based statements about it. However, emotion as understood in everyday terms and as portrayed in fiction offers insights that should not be ignored.

The fundamental problem in the study of emotion concerns the links between subjectivity and objectivity. In everyday life, feeling, or the subjective side of emotion, is central. How can I get inside you to understand your feelings? If I could, would this let me understand your emotions? Feelings matter because they are one of the aspects of emotion we must live with, although of course we also have to live with the consequences of our emotional expressions. However, for experimental psychologists who are concerned with the scientific status of their discipline, feelings are too subjective for comfort. To ignore them entirely (as happened through much of twentieth century psychology) is surely to miss the point though.

FIVE PERSPECTIVES ON EMOTION

Imagine that it is late at night and you are alone in the house. There is a sudden scream, a great crash against the front door, and then silence. What would you feel?

Or think of tripping over in the street, stretching out your hands to save yourself, and having them skid along in a mound of dog excrement. How would you react?

Or imagine that you have just completed a 5,000-word essay. It is your best work, but your tutor says, 'I'm sorry, but it was due in an hour ago. I cannot accept it.'

Emotions colour and enrich our lives, and help to energize us so that we can deal with whatever comes our way. They are adaptive and basic to human existence.

In spite of its fundamental importance to life, emotion is hard to define because it can be viewed from five distinct but nevertheless interrelated perspectives.

1. In the everyday sense, it is the subjective experience of emotion that seems to be most important to us. You feel happy and I feel sad, you feel angry and I feel embarrassed. Subjectively, these experiences give emotion its urgency, an urgency that can range from pleasant to unpleasant, from exciting to debilitating. Of course, feeling extends beyond emotion: as well as feeling happy, disgusted or ashamed, we can also feel pain, sick, ill, an ache. Nevertheless, it is the feeling aspect of emotion that seems to be so significant in everyday life.
2. Emotion has its *behavioural* aspects. An angry conversation takes a different course from a calm conversation. If you were extremely anxious in an examination, you would perform differently than if you were only mildly anxious. You can see emotional behaviour in the facial expressions of other people. You also know that not only does a smile feel different from a frown, but it also has different social consequences. In other words, emotion prepares us for action; it has an 'action readiness' associated with it that frequently translates into behaviour.
3. *Physiological* changes are involved in emotion. Narrowly escape a road accident and you can feel your heart beating faster and your muscles trembling. You can feel your face blush as you tip too far back and fall off your chair in class.
4. Emotion involves *cognition*, thought and emotion being intertwined. We perceive things and appraise their value to us – and it is this value that is thought to generate the emotion. This is a significant (perhaps even a necessary) forerunner to our emotional reactions. Whether or not emotion and cognition are necessary to each other, they are certainly strongly linked. Spend a moment or two thinking of a close friend and then thinking of a close competitor and compare the emotional reactions that begin to occur.
5. Emotion occurs in a context that is usually *social*, although it is possible to experience emotion when alone. Emotion tends to have a social communication function even when its biological significance is paramount, as with certain types of fear.

Figure 6.1

An angry conversation will take a different course from a calm conversation.

Emotion is a combination of all these functions, although the balance between them varies from time to time. If any one of them is left out, the richness of emotion decreases. Together they define emotion, and emotion defines the colour of our lives. Any definition of emotion must therefore be intricate. Kleinginna and Kleinginna (1981) reviewed many definitions of emotion and integrated them into the following:

> Emotion is a complex set of interactions among subjective and objective factors, mediated by neural/hormonal systems, which can (a) give rise to affective experiences such as feelings of arousal, pleasure/displeasure; (b) generate cognitive processes such as emotionally relevant perceptual effects, appraisals, labeling processes; (c) activate widespread physiological adjustments to the arousing conditions; and (d) lead to behaviour, that is often, but not always, expressive, goal-directed, and adaptive.

The five perspectives on emotion described above have given rise to five approaches to its investigation. There is not an exact mapping, but, as will become clear, each of these approaches embraces particular types of measurement, empirical research and theory (see table 6.1).

Emotion as feeling

Imagine that you are sitting at the dinner table on a visit to your family. You bear them no ill will but did not really want to make the visit, having other things you would have preferred to do. The conversation ebbs and flows in much the usual way as your parents start talking to your younger brothers about their clothes and their school grades. You eat quietly, letting the conversation lap around you, but it is impossible to remain indifferent.

You feel little bursts of empathy and sympathy for your brothers, remembering what you had to go through at their age. You feel old naggings of resentment. You look at your parents and feel sad at their lack of change as they become older. You worry about the work that you have to do and keep feeling needles of concern about a relationship that might be going wrong. None of this shows on your face as you calmly eat your meal.

How might different schools of psychological thought seek to appraise this scenario? Well, phenomenological psychologists, for example, emphasize the study of consciousness and subjective experience, and argue that psychologists should study what people experience, here and now, at this moment, in their present state. This is very much a holistic view, considering the whole, integrated person. Phenomenologists such as Giorgi (1970) argue that the foremost study of human beings should involve their consciousness. Of course, there are then considerable difficulties of measurement in the material of interest. How is it possible to work out what Rodin's *Thinker* might be feeling (see figure 6.2)?

The questionnaire as an assessment method

Recently, the experiential aspects of emotion have been investigated in a series of diary studies. These either involve keeping emotion diaries (Oatley & Duncan, 1992) or analysing previously published diaries (Haviland & Goldston, 1992). But the main way of assessing emotional experience is by reports, often in response to a questionnaire.

What are you feeling? Are you feeling angry? What did you feel like when she said that? In this type of test, the problem comes not with questions of this sort but with the answers. Are the respondents saying what they think we want to hear? Are they trying to project a particular image of themselves? Are they accurate, or do they lie? Do people actually know the answers?

Table 6.1 Summary of the major emphases and an example of research for the five major approaches to the study of emotion.

Basic approach	*Emphasis*	*Example of research*
Biological	– On the brain structures, neural pathways, and physiological underpinnings of emotions.	e.g. Examining the relationship between experimental lesions to certain areas of the brain and emotions (with animals), as well as studying emotions in previously brain-damaged humans.
Cognitive	– On understanding how an individual's goals and their interpretations or appraisals of a situation or event influence the way they feel.	e.g. Asking people to describe or to rate the importance of the particular thoughts (appraisals) associated with emotional experiences.
Phenomenological	– On describing and understanding the emotional experiences and feelings of the individual.	e.g. Conducting an interview asking the person a number of open-ended questions about the experience, emotions, the situation and so on.
Behavioural	– On how emotions are reflected in behaviour, and on how reinforcement histories influence emotional responding.	e.g. Studying how new stimuli or events acquire emotional value, or how emotions are related to instrumental behaviours.
Social	– On understanding how emotions, particularly emotional expression and recognition, are influenced by the individual's culture, learned 'rules', and the situation.	e.g. Studying how emotions are expressed in different situations, and how they depend on gender and the relationship between people in different cultures.

Figure 6.2

Rodin's *The Thinker*.

Are they able to distinguish between feeling, say, angry or afraid or jealous?

In spite of these difficulties, this method of assessment has led to a consideration of the importance of commonsense or folk theories of emotion. We all hold implicit psychological theories, constructed from everyday, commonsense observations and thoughts. For example, we might well believe that it is important to express emotion, because if it is bottled up it will eventually break out in ways that could cause discomfort or even be injurious to health. The study of such 'lay' theories and how they map onto theories of academic or professional psychologists has become important in its own right (see Fletcher, 1995).

Some interesting findings

A strong argument in favour of assessing emotional experience by questionnaire has been put forward by Scherer, Wallbott and Summerfield (1986) in a book entitled *Experiencing Emotion*. They focused on four of the basic universal emotions – joy, sadness, fear and anger – and asked participants to describe significant episodes involving these emotions that they had experienced during the previous few weeks. Being particularly interested in cultural differences in the experience of these emotions, Scherer et al. conducted a large-scale cross-cultural study throughout Europe (Belgium, France, Great Britain, Italy, Spain, Switzerland and West Germany) and Israel.

The research was concerned with:

1. the antecedent situation (e.g. what types of situation elicit different emotions? what are the important social settings?);
2. differentiated actions (e.g. are different behaviour patterns reported for different emotions? do the various response patterns differ in importance?);
3. person specificity (e.g. are there differences in the experience of emotion due to age, gender, social and occupational background?); and
4. social regulation and control (e.g. are different amounts of regulation or control reported with respect to the different emotions? are there individual differences in control?).

As an illustration of the investigators' analysis, they found clear differences in the duration of the experienced emotions. Fear appears to last from a few seconds to about an hour, anger between a few minutes and a few hours, joy from an hour to a day, and sadness from a day to many days. Although there were some cultural differences in the emotional experiences, the similarities across cultures were more marked.

Scherer and colleagues have, then, gone at least some way towards the psychologist's impossible ideal of experiencing another person's emotions and finding a method for describing them objectively.

EMOTION AS BEHAVIOUR

Those who take a behavioural perspective on emotion view it as something that we do rather than something that we feel. Hull and Skinner, for example, adopted three main approaches when tackling emotion (although these had petered out by the 1970s).

emotionality the extent to which we react emotionally – akin to a personality trait, and thought to be partly inherited.

1. Emotionality The open-field test was used to study *emotionality* in rats. Levels of emotionality, reflected in changes in defecation and urination, increase when rats are placed in a large, brightly lit space. This is perhaps an evolutionary precursor to the reactions of many people to strange environments. Within a few generations, rats can be bred to be either less or more emotional in this situation, showing that emotionality is at least partly under genetic control.

Emotionality was also studied by observing the *perseverative* effects of noxious stimuli. Typically, rats were given an electric shock prior to their normal time of eating, drinking or pressing of a lever to obtain food. The perseverative emotional effects of shock were increased food and water intake but the suppression of instrumental behaviour such as lever-pressing. In more detail, the effects depended on the quality of the food and the duration of the shock. The intake of food adulterated with quinine was lowered even further, whereas the intake of food enhanced by sucrose was actually elevated. On the other hand, prolonged durations of prior shock always led to the suppression of intake.

2. The frustration effect Think of how you feel and what you do if you put money into a vending machine, press the button or pull the drawer, and nothing happens. Amsel (1958, 1962) trained rats to run down an alley to food in a goal box and, from there, along a second alley to a second goal box. When the first goal box was left empty, the rats ran faster along the second alley.

frustration effect an increase in the vigour of responding, following the absence of reward, in a place where reward was experienced previously

This increase in vigour is known as the *frustration effect*. It is reasonable to regard an increase in behavioural vigour following the frustration of experiencing non-reward, where reward was previously experienced, as an indirect measure of emotion.

3. Conditioned emotional response Again using laboratory animals, the procedures that demonstrate conditioned emotional response involve a mixture of classical and instrumental conditioning (see chapter 4).

Picture a rat in a Skinner box pressing a bar for food reinforcement. Sometimes a light comes on and is followed by an unavoidable electric shock. The rat soon learns to associate light and shock. When the light is on, it will decrease its rate of bar-pressing. After the shock, it will increase it again. This effect is sometimes known as conditioned anxiety and sometimes as conditioned suppression.

Much of everyday life appears to be characterized by this type of mixture of instrumental and classical conditioning. Unconditioned stimuli are frequently emotional and influence other behaviour. Millenson (1967) used these ideas to suggest a three-part behavioural model of emotion, in which all emotions are seen as deriving from various intensities and combinations of anxiety, elation and anger. As we have seen, a neutral stimulus that leads to a negative unconditioned stimulus leads in turn to anxiety. Moreover, a neutral stimulus that leads to an unconditioned positive stimulus (say, free food to a hungry rat) leads to elation, and a neutral stimulus that leads to the removal of an unconditioned positive stimulus results in anger. Variations in intensity and duration of the stimuli and the links between them are thought in the terms of this model to lead to variations in the intensity of these types of emotion.

Action readiness

The behavioural view of emotion is clearly limited and does insufficient justice to its richness. It has provided some useful behavioural information but over time has given way to the physiological and cognitive approaches.

A relatively recent and promising consideration of the behavioural aspects of emotion comes from Frijda (1996; Mesquite & Frijda, 1994), who proposes that the behaviour in emotion comes from action readiness, or tendency. Frijda emphasizes potential behaviour rather than the behaviour itself. The central notion here is that emotion carries with it a readiness to behave in a general way, rather than necessarily being associated with particular behaviours. So, for example, fear might produce a tendency to run away or to hide, but there could be very many ways of running away or hiding. Also, as Frijda sees it, an action tendency might be suppressed or hidden behind some other behaviour, for social reasons. So we might feel like running away or hiding, but we do not because of the risk of looking foolish or cowardly.

Clearly Frijda's approach to emotion–behaviour links is very different from earlier ones. It is more subtle, more realistic and of more obvious relevance to human emotion.

Emotion as arousal

arousal the fluctuating state of physiological activation of the nervous system

The physiological changes associated with emotion are very familiar to us. It is hard to imagine even the mildest emotional experience without its attendant *arousal*.

When we are happy or sad, afraid or angry, jealous or disgusted, the changes in our bodies are obvious. We might experience 'butterflies in the stomach', 'a sinking feeling', or 'our heart in our mouth'. We feel ourselves blush, feel our heart race as we narrowly miss an accident, and feel the drooping depletion in our body that accompanies sadness or depression.

We are more aware of the peripheral nervous system than we are of the central nervous system (CNS). We can feel our skin sweating or our muscles tensing, whereas most of us cannot feel our hypothalamus sending out signals, even though we might become aware of the result. We cannot feel our brain doing its work, emotional or otherwise.

How do we learn to recognize the bodily changes that accompany our emotional states? Do they differ, depending on the emotion we are experiencing? Can there be emotion without physiological change?

Variation in patterns of arousal

Emotion is about coping with sudden changes in our environment, changes that have significance for our survival (physical or social). So the autonomic nervous system (ANS) prepares the body for action and helps it back to quiescence later. These are what we refer to when we talk about changes in arousal.

Over the years, psychologists have proposed that the various emotions experienced in everyday life have their own specific *response patterns*, in terms of arousal. So, fear should have a different pattern from anger, which in its turn should be different from sadness and happiness, and so on.

response patterns particular patterns of physiological responses, in this case linked to various emotions

These suppositions were endorsed by the much-quoted study of Wolf and Wolff (1947). These researchers investigated a man who had had a gastric fistula inserted (a pipe directly into the stomach) for medical reasons. Wolf and Wolff (1947) found clear and consistent gastric differences between anxiety and anger. But

further evidence demonstrating differential physiological response patterns for different emotions was scarce for many years.

Lacey and Lacey (1970) found some evidence for emotion specificity in the cardio-vascular system, but it was not until 1990 that Levenson, Ekman and Friesen offered clear support for emotional response patterning. By instructing people on which facial muscles to use, they asked them to hold various emotional expressions for ten seconds. They found that happiness, surprise and disgust (or, at least, the facial expressions associated with these emotions) are characterized by a different heart rate than anger, fear and sadness, for example. Moreover, skin temperature is found to be lower in fear than in anger.

Theories of emotion

The physiological arousal aspect of emotion has been responsible for many theoretical developments. The James–Lange theory of emotion has probably been referred to more than any other. It began with William James (1884) but was also propounded by Carl Lange (1885) and stressed the importance of physiological mechanisms in the perception of emotion. It is the following quotation from James (1884) that is most frequently cited: 'the bodily changes follow directly the perception of the existing fact, and . . . our feeling of the same changes as they occur *is* the emotion' (1884, p. 189).

This theory drew attention to bodily changes occurring in response to environmental events, and suggested that emotion is our feeling of the bodily changes that follow perception. This reverses the commonsense idea that we perceive something that causes the emotional experience, which, in turn, causes the bodily changes. As shown in figure 6.3, the primary processing of environmental information occurs from the sensory receptor to the cerebral cortex, after which information is relayed back and forth between the cerebral cortex and the viscera (internal organs) and musculature. According to the James–Lange framework, it is the interpretation of these bodily changes that represents the perception of emotion.

The first and most vociferous opposition to the James–Lange theory came from Walter Cannon (1915, 1927, 1931, 1932) in

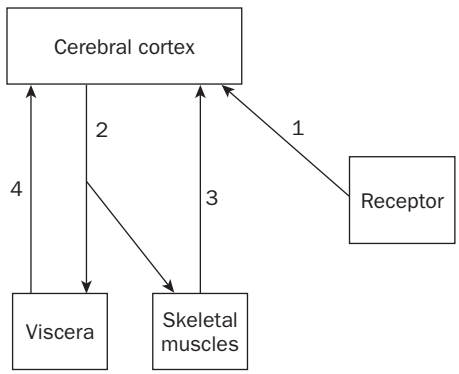


Figure 6.3

The James–Lange theory. Source: Strongman (1996).

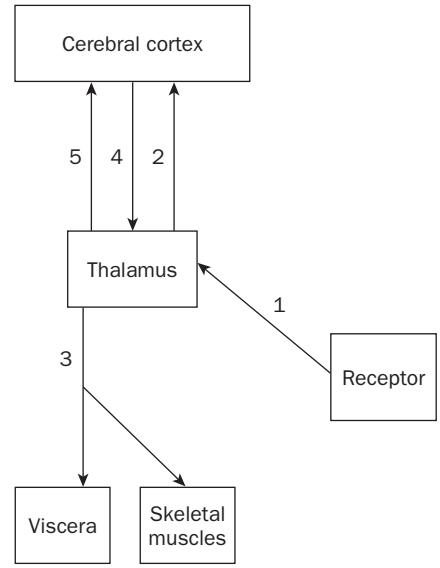


Figure 6.4

The Cannon–Bard theory. Source: Strongman (1996).

what has come to be known as the Cannon–Bard theory of emotion. Cannon emphasized the physiological foundations of emotion, including the CNS, and particularly the thalamus (see figure 6.4). According to the Cannon–Bard framework, environmental information is first relayed from the sensory receptor to the thalamus, after which it is sent to the cerebral cortex and to the internal organs and skeletal muscles, and then back and forth between the cerebral cortex and thalamus. Note that there is no direct communication in this framework between the cerebral cortex and the viscera or muscles.

Cannon also put forward some cogent criticisms of James' theory. The most important were that:

1. internal organs react too slowly to be a good source of information about emotional feelings;
2. a drug, whilst it might induce sympathetic arousal in the nervous system, does not in itself produce emotion (see our discussion of Maranon, later); and
3. bodily arousal patterns do not differ much from one emotion to the next.

This third point was certainly prophetic of the later lack of empirical success in finding clear, dissociable bodily response patterns in emotion.

Nevertheless, the psychophysiological analysis of peripheral mechanisms in emotion makes it abundantly clear that arousal is an integral part of emotion. It also seems that the various emotions might have some characteristic patterns of psychophysiological reactions associated with them. It is therefore possible that, as measurement techniques become more advanced in the future, patterns of psychophysiological responses might be found for the various emotions. But the current belief is that for any

subtle emotional differentiation, cognitive mechanisms underlying emotion need to be directly addressed (see below).

The lie detector

The history of the lie detector is a practical reflection of the lack of firm ground in the psychophysiology of emotion.

Determining whether someone is being truthful is important in all walks of life. Historically, the methods used have ranged from torture through interrogation to interview. At one time, suspected witches were ducked under water for some time. If they drowned, they were innocent. If they did not drown, they must be witches and so were put to death anyway. There was no way out of this test (what these days we may refer to as a 'Catch 22') – but the obvious way to deal with slightly less extreme methods is to tell people what you think they want to hear (that is, to lie but in such a way that it 'beats' the test).

The rationale behind the lie detector, or polygraph (figure 6.5), is that the act of lying causes measurable psychophysiological changes in emotional arousal. The polygraph measures such responses as heart rate, blood pressure, respiration and the electrical conductivity of the skin (which changes with variations in sweating). Measures are taken from the person when relaxed and again when a mixture of critical and non-critical questions are put: 'When did you last hold a gun?' versus 'When did you last hold a party?' for example. Similar questions might be asked of an 'innocent' person and patterns of response compared.

Our psychophysiological responses are thought to give us away but, in practice, polygraph methods of lie detection are not reliable. Merely being asked about a gun might cause changes in psychophysiological measures, and, furthermore, it is very unlikely that there is a particular response pattern for lying (e.g. Lykken, 1984; Saxe, 1991).

If a foolproof way to detect lying is ever devised, enormous ethical dilemmas will arise. Imagine taking a lie detector test at a job interview and then being told that you would not be employed because you had cheated once at school. Imagine parents giving such tests to their children. (For a discussion of deception more generally, see Ekman 1985.)

Figure 6.5

The polygraph is used for lie detection.

The limbic system

By now it should be clear that emotions have biological and evolutionary bases and involve both the CNS and the ANS. Although subcortical brain mechanisms are implicated in emotion – from the brain stem to the hypothalamus, thalamus and amygdala – cortical structures play an executive role. Animals with their cortex removed but with intact hypothalamus and thalamus show violent (sham) rage (Dusser de Barenne, 1920). Sham rage is so called because a weak stimulus can cause a release of autonomic responses (such as sweating and increasing blood pressure) that are normally only elicited by strong stimuli, and the anger is not directed at any one particular entity. Electrical stimulation of the hypothalamus can also produce such rage. Subcortical structures alone, however, do not provide the physiological mediation of emotion. This is provided by the limbic system of the cortex, with its extensive connections to the subcortex. See chapter 3.

The long history of research in these regions includes work by MacLean (1954, 1957, 1970, 1993). This work suggests that the limbic system, throughout its evolution, has helped to refine the emotional feelings that influence self-preservation. More recently, Panksepp (1981, 1989, 1991, 1992, 1993) made a very significant theoretical contribution to the physiology of emotion. He agrees that emotion is centred in the limbic system and has provided evidence for four, or possibly five, hard-wired emotion-mediating circuits. Panksepp is certain about the emotions of i) expectancy, ii) fear, iii) rage and iv) panic, although his evidence is not quite as convincing for the fifth, ludic (play) system.

Interestingly, Panksepp's approach is not solely neurophysiological but also considers the subjective or experiential. So, not only are there structural similarities between mammalian limbic systems across species, but Panksepp further uses subjective experience as a guide for distinguishing between those human brain states of emotion that appear also to be differentiated neurophysiologically.

Simultaneously, Le Doux (1999) demonstrated convincingly that much of the CNS work in relation to emotion is performed by the amygdala. Le Doux argues that the amygdala acts as an 'emotional computer', analysing any incoming information for its significance. In right-handed people, the right side of the brain, with which the amygdala has more extensive connections, is more associated with emotion than the left side. Le Doux argues that the connections between the amygdala and the thalamus may be especially relevant in the perception of emotion. In left-handed people, it is likely that the converse holds – i.e. that there are left hemisphere–amygdala connections.

It should be apparent from the discussion presented above that the physiological investigation of emotion has added much to our current knowledge. We now turn to a consideration of the complementary cognitive perspective.

The cognitive approach to emotion

In recent years, research into emotion and cognition has positively exploded, coming to dominate the field, although it remains a controversial approach to the psychology of emotion (see, for example, Power & Dalgleish, 1997).

Linking arousal and cognition

Schachter (1964, 1970) put forward a two-factor theory that had a profound influence on the way that psychologists think about emotion. Briefly, he argued that a necessary part of emotion is arousal of the sympathetic nervous system. The intensity of such arousal differs from situation to situation, and, according to Schachter, is interpreted according to our beliefs and/or knowledge about the situation. This means that our experience of emotion depends on two factors – physiological arousal and cognition.

Schachter derived three empirical predictions from his theory, which he tested in a cunningly devised experiment (Schachter & Singer, 1962). This work, conducted over 40 years ago, has provided the impetus for research on the relationship between emotion and cognition that continues up to the present day.

Schachter's work was partly based on a study by Maranon (1924), who had injected 120 patients with epinephrine (adrenaline) and asked them to say what it made them feel like. Adrenaline causes changes in sympathetic arousal reflected in rises in heart rate and blood pressure, respiration and blood sugar. Subjectively, this takes the form of palpitations, tremors, flushing, faster breathing, and so on. About 70 per cent of Maranon's patients reported only physical effects while the other 30 per cent also mentioned emotional effects. Typically, participants in the latter group said that the injection made them feel 'as if' they were afraid, rather than actually feeling afraid.

Schachter (1959) believed that an epinephrine injection would produce a state of arousal that people would evaluate in terms of whatever they perceived around them, if they were unaware of the effects to expect from the injection. He made three propositions that, between them, show the necessity of both cognition and arousal to emotion:

1. If we are in a physiologically aroused state for which there is no obvious explanation, then we will label it by using whatever cognitions are available to us. The same state might be labelled in many different ways.
2. If we are in a physiologically aroused state for which the explanation is obvious, then we will not seek further explanations.
3. For emotion to occur, there must be physiological arousal.

To test these propositions, Schachter and Singer (1962) persuaded participants to agree to an injection of a 'vitamin' so that its effects on vision could be determined. In fact, they were injected either with epinephrine or a placebo (saline). For ethical reasons, participants would nowadays be debriefed after the completion of such a study concerning the misinformation they had received. Participants were then given one of three 'explanations' of the effects of the injection. Epinephrine-informed participants were told that the 'vitamin' might have side effects lasting for about 20 minutes. The effects described to them were the actual effects of epinephrine. Epinephrine-ignorant participants were told that the injections would have no side effects. Epinephrine-misinformed participants were told to expect impossible side effects, such as numb feet, body itches and headaches. There was also a control group, injected with saline, which had the same instructions as the epinephrine-ignorant group.

Following the injection, individual participants were taken to wait in a room with another person whom they believed was another participant, although it was, in fact, a confederate of the experimenters. For some participants, the room was a mess and the confederate was friendly and extraverted ('euphoric' condition). The remaining participants and the confederate were in a different room (the 'anger' condition), and they had personal and somewhat insulting questionnaires to complete. The confederate became steadily more angry with this and eventually stormed out ('anger' condition). Participants were observed through one-way mirrors and were given self-report questionnaires afterwards, the major questions concerning how angry or irritated, or how good or happy, they felt.

In the euphoric condition, the epinephrine-misinformed or epinephrine-ignorant participants rated themselves as being significantly more euphoric than the epinephrine-informed participants. The placebo control participants were less euphoric than either the misinformed or ignorant groups, but more euphoric than the informed group, although these differences were not significant. The epinephrine-misinformed and epinephrine-ignorant participants had no good explanation for their bodily state. Similarly, in the anger condition, epinephrine-ignorant participants were significantly angrier than the epinephrine informed, with no differences between controls and the misinformed or ignorant groups. (See figure 6.6 for a summary of the experiment.)

In this ingenious experiment, Schachter and Singer were convinced that they had supported Schachter's three propositions by manipulating cognition and arousal. Schachter's (1970) general conclusions were that there is little physiological differentiation between the emotions, the labelling of emotional states being largely a cognitive matter.

Even though both Schachter's ideas and his studies have been influential, they have also been criticized (see Cotton, 1981; Izard, 1972; Leventhal, 1974; Plutchik & Ax, 1967; Reisenzein, 1983). To take one example, Schachter did not prove that emotion depends on physiological arousal and cognition. It may be possible to induce physiological arousal through cognition, or to produce a sort of physiological tranquillization cognitively. For example, it is possible to speed up or slow down heart rate and respiration simply by imagining playing a vigorous sport or by visualizing a tranquil scene.

Leventhal (1974) goes further, arguing that Schachter has never shown exactly how arousal and cognition combine in emotion, particularly in children. From a Schachterian perspective, how would a young child be able to feel any emotion before knowing the linguistic label for that feeling?

In the end, although Schachter's ideas have not been disproved, neither have they stood up robustly to criticism. At

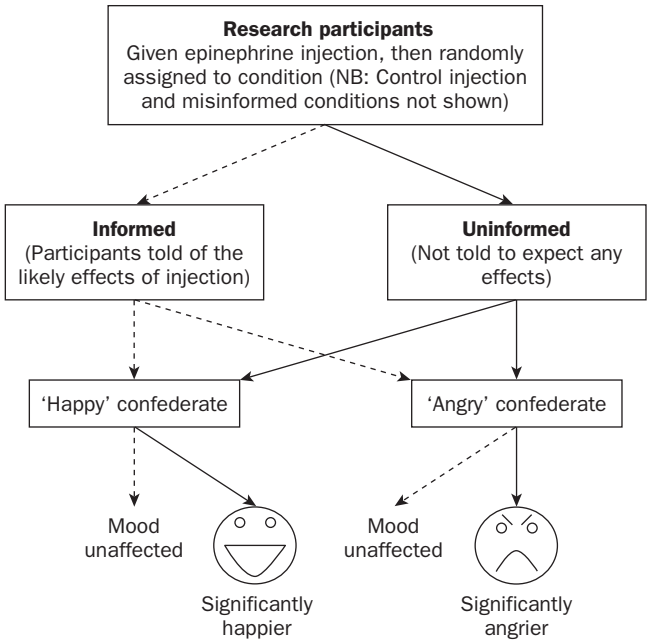


Figure 6.6

Diagram showing a simplified version of the experiment by Schachter and Singer (1962). The dotted lines trace the manipulation and consequences for the 'informed' participants, while the solid lines trace those for the 'uninformed' participants.

Pioneer

Stanley Schachter (1922–97), an innovator in the 1960s, more than anyone else succeeded in introducing significant ideas emanating from the 'cognitive revolution' into the area of emotion. His influence has continued to the present day, especially regarding the reciprocal influence of emotion and cognition, and the particular significance of attribution. His ingenious study with Singer began many years of exploration into the relationship between physiological arousal and cognitions (especially appraisals) in the psychology of emotion. His general conclusions were that there is little physiological differentiation between different emotions, the labelling of emotional states being largely a cognitive matter. These conclusions have been vigorously challenged but his influence in the field remains.

present, it is reasonable to conclude that feedback from physiological arousal can directly intensify emotional states. Moreover, the arousal–emotion link is mediated, or at least affected, by causal attributions, or appraisals (see chapter 17), about the source of the arousal. Whether both physiological arousal and cognition are necessary for the perception of emotion remains an open question.

The role of appraisal

Do we think before we experience an emotion, or do we experience the emotion and then reflect on it cognitively, or both?

Compare these two situations:

1. You are sitting in the waiting room of a specialist, waiting for the results of some tests done to track down the cause of chest pains that have been bothering you. The receptionist comes over to you and apologizes that the doctor has been held up but asks you to wait because he would definitely like to see you.
2. You are crossing the street, lost in thought, when there is the sudden loud blare of a horn, the screech of locked wheels and the hiss of air brakes. You jump for your life and stand trembling as a truck rumbles past, the driver angrily shouting through the window.

These two situations both involve cognition and emotion, but in very different ways.

Appraisal is the foundation stone on which the emotion–cognition structure is built. Theorists maintain that our evaluation – or appraisal – of the personal significance of an event leads to an emotional reaction. Such appraisals allow us to make fine distinctions between our emotional experiences and help us to determine the extent or intensity of the emotion. For example, being criticized privately is a very different experience from a public condemnation, and the appraisal leads to a less intense emotional reaction (be it anxiety or anger). Attention was first drawn to the significance of appraisal for emotion by Arnold (1960) and continued most strongly by Lazarus (1993), although its importance is assumed by many theorists who link emotion and cognition.

Ellsworth (1991; Smith & Ellsworth 1985) lists six dimensions of appraisal:

1. attention
2. pleasantness
3. certainty
4. anticipated effort
5. human agency
6. situational control

Each appraisal is considered to be unique, making each emotional experience unique, and the degree to which appraisals are similar determines the similarity between emotions.

The relationship between emotion and cognition

The question that remains is whether cognition, and in particular cognitive appraisal, is necessary for the perception of emotion. If someone lacks the cognitive capacity to make a particular appraisal of an event, can they experience the emotion that is normally associated with that event?

coping processes ways of dealing with stressors – usually a mixture of being problem-focused and emotion-focused

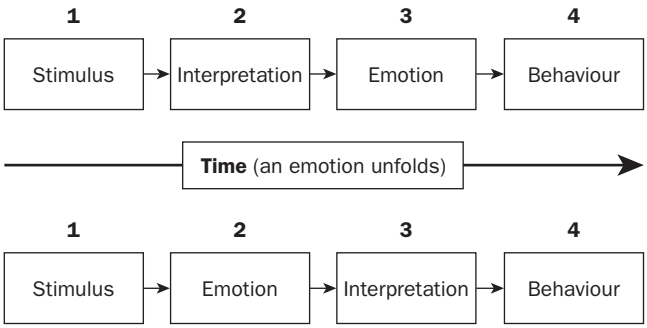
Lazarus (e.g. 1982, 1984, 1991, 1993) has added greatly to our understanding of emotion and *coping processes*. He believes that an event must be understood before emotion can follow. On the other hand, Zajonc (e.g. 1980, 1984) argues that cognition and emotion are independent, with emotion even preceding cognition in some cases.

This debate about whether cognition necessarily precedes or follows emotion turns on the definition of cognition (see Buck, 1991; Ellsworth, 1991). It is clear that conscious thought is not involved in some rapid emotional reactions. A sudden screech of brakes tends to produce an unthinking, uncontrolled emotional reaction. But it can also be argued that some appraisals might also occur unconsciously and immediately. If such appraisals are cognitions, then all emotion is preceded by and involves cognition. The alternative is that some emotions involve cognition and others do not. Figure 6.7 shows two of the possible temporal relationships in emotion.

Perhaps this is an arid debate. In everyday life the interplay between emotion and cognition is very intricate. There is a huge difference between the internal lurch you would feel at a sudden loud noise in the middle of the night and the combination of thoughts and feelings you would experience if this turned out to be the precursor to your house going up in flames. In other words, a simple, immediate reflex action that might send a burst of adrenaline through the system is very different from the complexities of emotional reaction when the cortex is involved and specific hopes, fears, memories and expectations are implicated. The reflex system is primitive and very much centred on the 'now', whereas what might be termed 'real' emotion also involves the past and the future (through appraisals).

It is clear that emotions can – or, as Lazarus would argue, must – result from appraisal. It is also clear that emotional states can affect thoughts and even subsequent emotions. You have judged that your partner has been unfaithful to you (appraisal) and this makes you react jealously (emotion). But when you are jealous (emotion) this may in turn stop you thinking (cognition) as clearly as you normally would, and you may become anxious (emotion) about that.

1. Sequencing in the commonsense theory



2. Sequencing in the affective-primacy theory

Figure 6.7

The temporal relationships between aspects of an emotion. The most common sequencing of the elements (the commonsense theory) is shown at the top, while an alternative view is presented below. Source: Ellsworth (1991).

THE SOCIAL APPROACH TO EMOTION

The fifth way of approaching emotion concerns its mainly social nature. This highlights the importance of emotional expression as well as personal characteristics, such as gender, that may be related to differences in emotional expression.

Are emotional expressions universal? How do we recognise emotions in other people? How do we express emotion?

Body language – nonverbal expression of emotion

Although we can experience emotion when alone, emotion is mainly a social occurrence. Emotional expressions communicate a great deal, and we rely on recognising them in others to assist in the smooth running of our social interactions.

body language expressions, gestures, movements, postures and paralinguistic aspects of speech that form the basis of nonverbal communication

Body language is central to emotional communication, which is essentially nonverbal. While we communicate about the world verbally, there is a nonverbal subtext that relates to the interplay of our emotions. The interpretation of the emotional meaning of body language is a skill that we seem to acquire and use unconsciously, even automatically. Some people are better at it than others, just as some people are more openly expressive of their emotions than others. Our ability to suppress and moderate our emotional expression further complicates matters.

To find out more about emotional expression, we first have to decide whether to study it in everyday settings or in the laboratory. Both have their difficulties – the context of ordinary life is complicated by a multitude of influences, while the laboratory is essentially an artificial environment with respect to normal social interaction.

Methods used in the laboratory to study the accuracy of emotional expression include photographs of real or posed expressions, actors, schematic drawings, emotional readings of the alphabet, and electronic filtering of voices (leaving only the manner rather than the content). For example, actors may be asked to express a range of emotions, with photographs of these expressions being shown to volunteers to determine if they can be recognized correctly. Or emotion-laden conversations may be recorded and then the actual words used filtered out electronically, with volunteers then being asked if they can recognize any emotions being expressed in the resultant sounds.

Back in the 1970s, Ekman, Friesen and Ellsworth (1972) demonstrated that most people are able to judge emotional expressions

Figure 6.8

Body language is central to emotional communication.

reasonably accurately. In other words, we can correctly recognize the emotion being expressed on another person's face. One way of studying this is to ask participants to identify the emotions portrayed in photographs posed by actors.

Many of these expressions are universal, to the extent that they are present in all the cultures studied. Emotional expressions are also recognisable across cultures, including pre-literate cultures untouched by Western influence (see figure 6.8). Izard (e.g. 1980) argues that there are ten basic emotions that are interpreted similarly across cultures, each with its own innate neural programme (that is, a programme defining how the nervous system is wired up, present from birth; see chapter 3):

1. interest/excitement
2. joy
3. surprise/startle
4. distress/anguish
5. disgust
6. contempt
7. anger/rage
8. shame/humiliation
9. fear/terror
10. guilt

Pioneer

Carroll Izard (1923–), with his differential emotions theory, has been the main proponent of the study of individual, distinct emotions since the 1970s. He has stressed the importance of studying emotion from a developmental perspective. In *Differential Emotions Theory*, he suggests that emotions are motivational and organize perception, cognition and behaviour, helping us to adapt and cope with the environment, and to be creative. Arguing that there are several discrete emotions, Izard has proposed that the emotional system is independent of any other, although linked closely with motivation and personality, and that they develop together from the early years.

Pioneer

Paul Ekman (1934–) has been the acknowledged expert on the expression and recognition of emotion from the early 1960s to the present. Among important research issues that he has investigated over his long and influential career, he has drawn attention to the importance of non-verbal behaviour, context, deception and many other aspects of emotional expression, particularly in the face. The findings of his work have generated considerable discussion of the possible universality of facial expression. Deriving from his research findings, his theory of emotion is based on three central assumptions: 1) emotion has evolved to deal with the fundamental tasks of life, 2) to be adaptive in evolutionary terms, each emotion must have a distinct facial pattern, 3) for each emotion, a distinctive pattern exists between expression of that emotion and the physiological mechanisms associated with it, and this is linked to appraisal of the emotion.

The possible universality of the facial expression of emotion and its recognition is another central debate in the study of emotion (see articles by Ekman, 1994, and Russell, 1994, for opposing views). In general, although there is a very widespread agreement across cultures, it is difficult to make a completely compelling generalization from this type of research. Without investigations into all cultures, universality cannot be finally concluded. There are also cultural and subcultural rules governing the display of emotional expression. Fear might be expressed in a similar way universally, but its expression might be more suppressed in some cultures than others. And in Western cultures, anger is usually more openly expressed by men than by women.

Ekman (e.g. 1982, 1992) bases his theory of emotion on three assumptions:

1. Emotion has evolved to deal with the fundamental tasks of life.
2. To be adaptive in evolutionary terms, each emotion must have a distinct facial pattern.
3. For each emotion, a distinctive pattern exists between expression of that emotion and the physiological mechanisms associated with it, and this is linked to appraisal of the emotion.

Some of Ekman's more fascinating work concerns what happens when we attempt to hide or suppress an emotion. Ekman

and Friesen (e.g. 1969) suggest that feelings 'leak out' nonverbally. Although we might successfully suppress our facial expression, our social anxiety might be expressed through movements of our hands and arms, and even our legs and feet. Ekman (1985) developed this research with respect to deception in general, mentioned earlier in this chapter in the context of lie detection.

facial feedback hypothesis the view that our experience of emotion is determined by physiological feedback from facial expressions

The expressive aspect of emotion has generated the *facial feedback hypothesis* (e.g. Tomkins, 1962). This suggests that the experience of emotion is intensified by the proprioceptive feedback we receive from its facial expression. So if you fix a smile or a frown on your face for some minutes, you should begin to feel happier or more irritable, respectively. Try holding a pen sideways between your front teeth for a few moments, a technique used by Strack, Martin and Stepper (1988), and you might begin to experience feedback effects, such as you might experience if you were feeling happy and in good humour. Now compare holding the pen between your lips (see figure 6.9).

This provides an interesting link with the James–Lange theory – perhaps it is possible that we become irritable *because* we frown or happy *because* we smile?

Gender

Are Western women irrational and emotional, and Western men logical and non-emotional?

Brody and Hall (1993) showed that women are generally more emotionally expressive than men. They are also better at expressing sadness and fear, whereas men have the edge on them with anger.

Yet such gender differences are probably more dependent on cultural than genetic factors. In Western society, girls are usually brought up to be more emotionally accountable to society than boys, and also to be responsible for their own emotional lives and for the emotional lives of those around them. Relatively speaking, boys are often encouraged to deny their emotions.

Whether these differences are currently changing in Western society is an open question. See Shields (2002) for a recent thorough exploration of the relationship between gender and emotion.

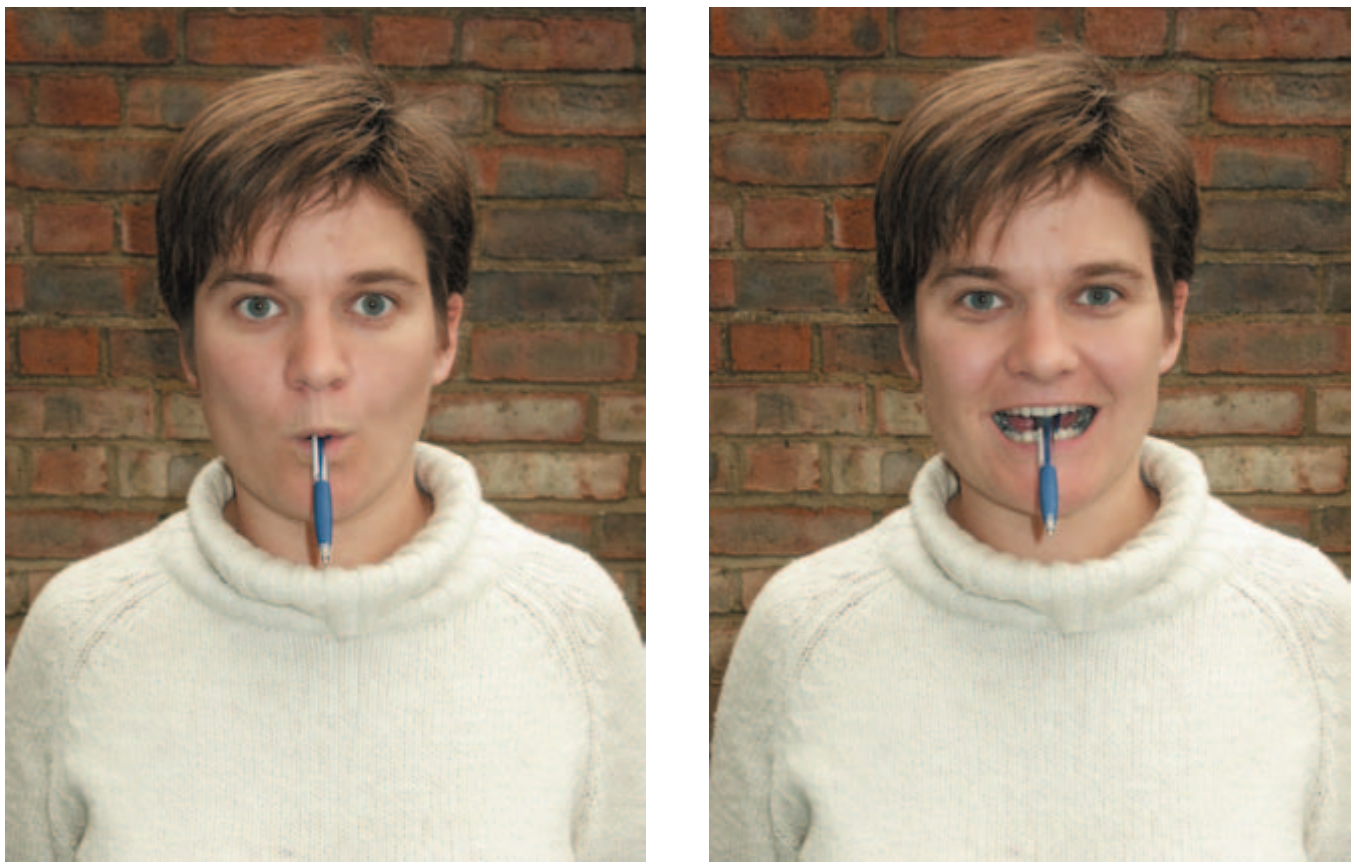


Figure 6.9

Facial configurations from the facial feedback experiment by Strack, Martin and Stepper (1988).

Research close-up 1

Sociocultural influences on emotion

The research issue

In *The Expression of the Emotions in Man and Animals*, Charles Darwin (1872) argued that the facial expressions of humans are innate, that they are therefore the same in all cultures around the world, and that they are modified from the emotional expressions of non-human animals.

Today, psychologists still believe that emotions, especially facial expressions of emotion, have strong heritable factors. For example, children who are blind at birth and have never observed the smile or frown on another person's face nevertheless smile or frown in the same way as children with intact vision.

Darwin's argument is further supported by more recent cross-cultural research indicating that there is evidence for universal emotional expressions across cultures.

Design and procedure

Ekman, Friesen and colleagues (Ekman, Friesen & Ellsworth, 1972) asked people from around the globe, including the United States, Estonia, Germany, Turkey, Brazil and Japan, to indicate which emotions were being expressed in a series of photographs. The universal similarity of people's judgements was highly informative.

Ekman and Friesen also showed similar pictures of facial expressions to people in an isolated tribe in Papua New Guinea called the South Fore who had little contact with the outside world.

Results and implications

The South Fore people matched the pictures with specific emotions, and their judgements were similar to those of people from other parts of the world (see figure 6.10). This represents further evidence indicating that expressions are innate and not learned from other sources such as the media or society. However, more recent research has shown that accuracy in emotional judgement is higher when emotions are both expressed and recognized by members of the same national, ethnic, or regional group, suggesting that some cultural learning of emotion does take place.

Ekman, P., Friesen, W.V., & Ellsworth, P., 1972, *Emotion in the Human Face*, New York and Oxford: Pergamon Press.

Figure 6.10

On the top is a Western woman. On the bottom is a Taiwanese woman. Notice the similarity in their expressions of 'disgust' and 'happiness'.

SPECIFIC EMOTIONS

So far we have considered emotion in general terms, but there have also been many attempts to study specific emotions (see figure 6.11).

Izard (e.g. 1977, 1993) is one psychologist who has discussed specific emotions in detail. He argues that there are discrete emotions, a view that makes good everyday sense. In *Differential Emotions Theory*, he suggests that emotions are motivational and organize perception, cognition and behaviour, helping us to adapt and cope with the environment, and to be creative. Like many other theorists, Izard links emotion with personality, believing that they develop together from the early years.

Everyday Psychology

Gender influences

The stereotype about the female being more emotional than the male is a powerful and pervasive image in most cultures. However, researchers have found that females and males are often more similar in the manner they experience emotion than this stereotype would lead us to believe.

For example, males and females often show the same facial expressions and adopt similar language and descriptions when they talk about their life experiences. For these aspects of emotional expression, there are no substantial differences between the two genders. But in everyday life males seem to engage in these activities less spontaneously than females.

There are also certain typical beliefs about how emotions should be displayed, which differ across gender. For example, men appear more likely to show anger towards strangers when they feel challenged, and more likely to transform their anger into aggressive action than are women.

We often use stereotypical beliefs about emotion to distinguish between what is 'masculine' and 'feminine', and to offer explanations and attributions for our behaviour. For example, we might say, 'I must be sensitive, like all women,' or 'I must be tough; after all I'm a man.'

Emotional differences between females and males are also more likely to occur in contexts that highlight different social roles and relationships. For example, it seems that females are more likely to express fear and sadness, especially when communicating with their friends and family, and this may be further exaggerated when they are talking to other females. And they are more likely than males to give accounts of emotion that include interpersonal relationships.

Fischer, A.H. (ed.), 1999, *Gender and Emotion: Social Psychological Perspectives*, Cambridge: Cambridge University Press.

Figure 6.11

The many faces of emotion.

Five fundamental emotions

Of the five fundamental discrete emotions, four are generally judged to be 'negative' – fear/anxiety, anger, sadness and disgust – and one to be 'positive' – happiness. Although there is only one positive emotion, the negative emotions are not always experienced as negative. In fact, the distinction between positive and negative emotions may not be altogether appropriate, as we shall see.

Anxiety will be discussed later in this chapter when we consider abnormalities in emotion. Fear is directed towards specific objects or events; it alerts us to danger and prompts us to escape or avoid.

Anger, on the other hand, is quite different. In a perceptive analysis of anger, Averill (1982) argues that it is an emotion about conflict, and is inevitably linked to aggression. However, even though aggression might be biologically determined, Averill sees anger as largely socially constructed, aimed at correcting perceived wrongs and upholding standards of conduct. As such, the experience of anger is not necessarily negative.

The third specific emotion, sadness, has a directness that makes it seem a little less negative than some of the other negative emotions. It is usually a reaction to loss that slows us down into discouragement, downheartedness and loneliness. Grief is an extreme and very complex form of sadness and always involves the loss of something, or more usually, someone, of great importance to us. Izard (e.g. 1991) describes grief as including sadness, anger, disgust, contempt, fear, guilt and shyness, and shock, protest, despair and reorganisation.

The last of the negative emotions, disgust, is very primitive. Its central concern is with the rapid expulsion from the body of any substance that might be toxic, noxious or harmful to it.

Happiness, joy, elation, and so on, seem to be variations on a theme. In recent years, there has been an increasing emphasis on the study of 'positive psychology' (embracing constructs such as happiness) in contrast to the study of what might be termed 'negative psychology' (see, for example, chapter 14 and the work that has been conducted at the Positive Psychology Center, University of Pennsylvania, by Martin Seligman and colleagues: www.positivepsychology.org). However, Averill and More (1993) argue that happiness is difficult to understand because it can take on so many different meanings.

Other discrete emotions

There are, of course, many other discrete emotions. Jealousy and envy are sometimes confused with one another in everyday conversation, but are quite easily distinguished. We become jealous if we think that we might lose someone's affections (usually those of a sexual partner) because a third person is involved. On the other hand, we envy someone who has something (a possession, a quality, etc.) that we would like. It makes little sense to be jealous of a friend's car.

There is also a class of self-conscious emotions – embarrassment, pride, shyness, shame and guilt. They all make reference in some way to the self, particularly the self in a social context. Most emotions are social, but the self-conscious emotions are distinctive insofar as they depend on other people's opinions. Lewis (1993) describes shame, for example, as involving an evaluation of our actions in relation to our entire self (our character), following a transgression of standards, rules or goals. It is always very negative and painful, and disrupts both thought and behaviour. Shame is concerned with a fundamental failure of the self, a character flaw, and we have a very strong motivation to avoid or escape it.

The development of emotion

Are we born with our emotions or do we learn them? What happens as we turn from the emotional excesses of childhood to the more inhibited world of the adult? How important are early relationships to emotional development?

Early theories

While individual differences in temperament seem to be there from birth, emotion, cognition and social behaviour appear to develop together and to be dependent on one another. However, some aspects of emotion must be built in or hard-wired.

Studies by Watson and Raynor (1920) and Bridges (1932) dominated the early investigation of emotion development. From a behavioural perspective, Watson and Raynor were interested in emotional development through conditioning and studied the conditioned fear of rats in a boy of 11 months (see chapters 1 and 4).

Watson argued that our emotional lives build up around this type of conditioning, although he argued that the foundations for this are provided by what he saw as the three basic built-in emotions. Watson called them X, Y and Z, although they could be named fear, rage and joy. His observations of infants suggested that these reactions are elicited by, respectively, a sudden loss of support, a thwarting or hampering of physical movement, and a stroking or tickling of the body.

Bridges' (1932) approach to emotional development was based on observation rather than experiment. She believed that we have only one built-in emotional state – undifferentiated excitement. By about the age of three months, Bridges argued that this divides into positive (delight) and negative (distress). There follows increasing differentiation of the emotions, until, by about the age of two, we show a primitive form of all of the adult emotions. With respect to this proposed differentiation, Bridges argued that at about six months comes anger, then disgust, and then fear, and at 18 months or so jealousy breaks away from anger. As for positive emotions, it is proposed that elation develops at about seven or eight months, joy at about 20 months, affection for adults at about nine months, and affection for children at about 15 months.

For many years, Bridges' descriptions could be found in most psychological texts, even though it could be argued that her

observations were very sketchy, her definitions inexact, and she had not dealt adequately with emotion in newborn infants.

Recent theories

Following these early beginnings, the study of emotional development was relatively quiescent until the 1980s, when new theories and more sophisticated empirical research began to appear. For example, Harris (e.g. 1989) carried out a series of studies on how children understand emotion, often using stories and asking children to make judgements about the characters' emotions. Among other results, he found that children of about six cannot imagine people having an emotion without their expressing it, but by the age of ten children understand hidden feelings in others.

A clear theory of emotional development was developed by Izard and Malatesta (1987; Magai [formerly Malatesta] & McFadden, 1995). They suggest that emotion is a system that relates to life-support, and to behavioural and cognitive systems, but develops independently of them. They view emotions as generating much of the motivational force behind behaviour. Izard and Malatesta express their theory with formal postulates about the neurochemistry of emotion, and the expression and experience of emotion. Although they believe (like Bridges) that emotions become differentially associated with internal states very early in life, Magai and Hunziger (1993) suggest that individual emotional development hinges on life's crises and transitions, such as puberty, marriage or retirement. However, they argue that everything begins with attachment (see below), and if an emotion overwhelms at age 17, it might still overwhelm at 77, despite the process of individual emotional development. In other words, although we might learn to express our emotions in different ways throughout our lifespan, the *experience* of the emotions remains constant. Moreover, some of the most compelling emotional experiences that many people have are concerned with their social attachments (romantic or otherwise).

Lewis is another major theorist of emotional development (e.g. 1992, 1993). He regards emotional development as dependent on maturation, socialisation and cognitive development, through gradual differentiation of emotional states. Lewis argues that we have to be self-aware to truly experience emotion. So before the infant has developed self-awareness, according to Lewis it could have an emotion but would not properly experience it.

Like Bridges and Malatesta/Magai, Lewis believes that most emotions have appeared by about the age of three. Lewis argues that distress, interest and pleasure are there from birth. Joy, sadness and disgust, then anger, appear from three to six months, followed by surprise and fear. In the second half-year of life, with self-awareness developing, Lewis argues that the self-conscious emotions of embarrassment, empathy and envy appear. Finally, Lewis states that the self-conscious evaluative emotions of pride, shame and guilt appear. These emotions depend on seeing the self as both subject and object, requiring a theory of mind – the understanding that other people have minds and hence separate viewpoints (see chapter 9). In the end, for Lewis, the cornerstones of emotional development are cognition and socialization.

From the two theories that we have reviewed above, it should be possible to ask what actually develops during emotional development. The answer takes us back to the five perspectives on emotion described earlier in this chapter. So we develop (a) emotional experience, (b) emotional behaviour and (c) physiological reactions. We also learn to express and recognize emotion in various social situations, depending on personal maturation and cognitive development (see figure 6.12).

Attachment

attachment the close links formed between a human infant and caregiver, or the intimate bond that can form between adults

A core part of early emotional development is *attachment* – the initial emotional bond that forms between an infant and caregiver. According to many theories, this forms the basis of both social and emotional development of the individual.

The seminal work on attachment was carried out by Bowlby (e.g. 1973, 1980; see also Ainsworth, 1989, and Bretherton, 1985), who described two major types of attachment pattern – the secure, and the insecure. Insecure attachment is further divided into two types – one defined by avoidance of the attachment

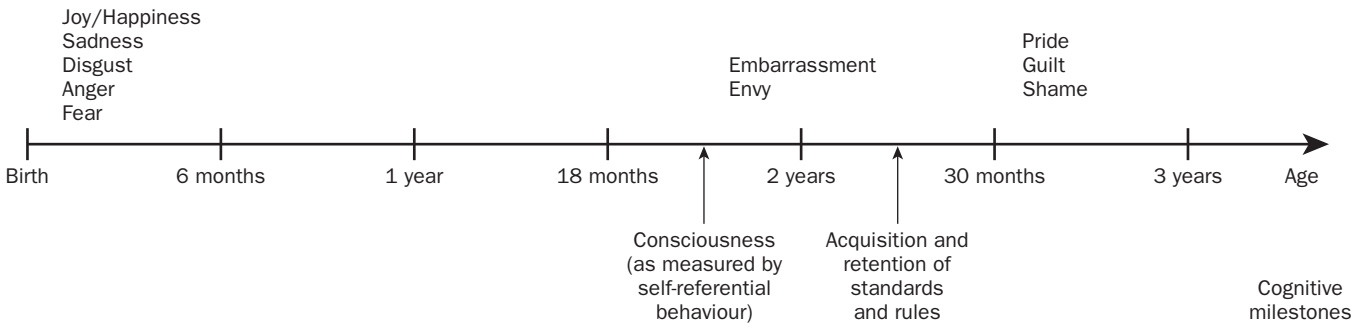


Figure 6.12

Child development and the appearance of discrete emotions. Source: Adapted from Lewis (1993).

figure (avoidant) and the other by anxiety and ambivalent feelings towards the attachment figure (anxious–ambivalent).

In drawing attention to attachment, Bowlby placed great emphasis on the emotional relationship between the child and the caregiver during the first two years of life. His basic idea was that a warm continuous relationship with a caregiver leads to psychological health and well-being throughout life. So the nature of the emotional bond of the initial social attachment has implications not only for future intimate relationships but also for potential psychopathology.

Bowlby (e.g. 1980) argued that the child's relationship with the caregiver prompts the development of internal working models. These give the child a schema of how accessible and responsive a caregiver is and how deserving of care the child is. These models will then affect future relationships. A secure working model will prompt expectations of good relationships and an open positive manner. By contrast, an insecure working model may lead to expectations of poor, unsupportive relationships and a distrustful, hostile manner. Of course, these differences in style will bring about obvious outcomes – what we might call self-fulfilling prophecies.

The enormous amount of research linking initial attachment to later development has been reviewed by Thompson (1999). He concludes that the relationship between early attachment and later relationships (including love relationships) is not straightforward. Rather than becoming fixed at an early age and then unchanged, it is mediated by a continuing harmonious parent–child relationship and depends on the nature of other short-term relationships too. Internal working models of how people relate might be established on the basis of the initial attachment, but can be changed by later social experiences and even by psychotherapy.

Thompson summarises the effects of early attachment to caregivers as providing children with answers to four questions:

1. What do other people do when I express negative emotion?
2. What happens when I explore?
3. What can I accomplish?
4. How do I maintain good relationships with others?

A great deal of research on attachment in children and adults documents its importance from both developmental and clinical perspectives. For a full coverage, see Cassidy and Shaver (1999).

It should by now be clear that, although early processes (such as attachment to the primary caregiver during infancy) are important, emotion goes on developing throughout the life-span. Indeed, some of the more fulfilling emotional experiences occur later on in life. For a review of this topic, see Strongman and Overton (1999).

Emotional intelligence

emotional intelligence the capacity to be sensitive to and regulate our own emotional state, and that of other people

Finally, the study of *emotional intelligence* and regulation is rapidly becoming an important area within emotional development research, highlighting the link between emotion and cognition.

Emotional intelligence refers to a set of skills that we use to deal with emotion-relevant information. Salovey, Hsee and Mayer (1993) suggest that it is concerned with:

1. the appraisal and expression of emotion;
2. the use of information based on emotion; and
3. the adaptive nature of emotion regulation.

Of particular importance is how we learn to regulate our own emotions.

Salovey and colleagues argue that emotional self-regulation depends on two factors. The first is how disposed we are to regulate our own emotions. This in turn depends on emotional awareness and our thoughts about our own moods. Secondly, it depends on strategies that can be used to affect our own feelings. For example, we might manipulate what we feel by spending a day helping other people, or perhaps by completing the less pleasant tasks of the day early on, saving the more pleasant things for later. Thompson (1990, 1991) links changes in emotional self-regulation to the development of cognitive skills, allowing emotion to be seen as analysable and capable of change. No doubt, such capacities themselves depend on a mixture of genetic influences and the development of language and social behaviour.

As emotional intelligence and the ability to self-regulate develop, so does a child's own way of thinking about emotion. This, in turn, will be influenced by socialization. So emotional intelligence and self-regulation may to some extent depend on the attachment style the child experiences and how well socialized she becomes. Emotional intelligence is, of course, also concerned with accurately interpreting and dealing with others' emotions.

CAN EMOTIONS MALFUNCTION?

As our emotional life develops, can it go wrong? Is it possible to be too happy or too sad or too angry? Is it useful to face life with a moderate degree of anxiety?

Emotion is always normal. It can be extreme or unusual, but it is always providing information for whoever is experiencing it. It might be seen as inappropriate by other people, but for those who are experiencing the emotion, it is simply their experience. They might be able to limit its expression on the outside but unable to influence directly their own personal emotional reaction. Emotion is functional, both in the immediate sense of providing information, and in the true evolutionary sense of being adaptive (otherwise it would not have been preserved by natural selection). However, emotions have also been seen as contributing to most forms of mental illness, leading Oatley and Jenkins (1992) to ask: how can emotions malfunction?

Psychosomatic disorders and panic attacks

In psychosomatic disorders, there are links between emotion, cognition, and physical symptoms (including pain). Examples

where such links have been established are asthma, peptic ulcers, hypertension and skin rashes, where psychosomatic conditions may exacerbate the condition even if they do not cause them *per se*. These disorders are usually mediated via organs or organ systems that are innervated by the autonomic nervous system (ANS).

Furthermore, many physical illnesses are now thought to have a psychological, more particularly an emotional, component (e.g. Robinson & Pennebaker, 1991). Pennebaker (e.g. 1990) has also reported some fascinating research showing that communicating (by talking or writing) about our illnesses and negative emotional experiences may help to ameliorate them.

Anxiety is thought to be at the root of many psychosomatic disorders. It is one of the most common emotions, and certainly contributes to many types of illness, physical or mental. At one level, it is a commonplace experience and has had more theories offered to account for it than most other emotions (see McNaughton, 1996; Strongman, 1996). On another level, there is extreme anxiety.

Imagine this. You suddenly start to tremble, shake and feel dizzy. Your heart is speeding up and slowing down uncontrollably and you have pains in your chest. You feel overwhelmingly hot and break out in a sweat and then you start to shiver with the cold. Your hands and feet start to tingle. You seem to be losing touch with reality and worry that you are having a heart attack or a breakdown. This is a *panic attack* – the extreme form of acute anxiety – and it is most unpleasant and disturbing.

panic attack sudden and apparently inexplicable experience of terror characterized by extreme physiological reactions, such as heart palpitations and feelings of impending doom

Any of us might have a panic attack under severe circumstances. We might ride it out and put it down to external factors that we are able to tackle. It then becomes an experience to look back on. But if we begin to worry about having more panic attacks, then we might be developing a panic disorder. This might lead us to start avoiding social situations that we believe might bring on an attack. We are then becoming agoraphobic.

Theories of neurotic anxiety

Freud (1975a, 1975b) had two theories of neurotic anxiety, both suggesting that it is made up of an unpleasant feeling, a discharge process, and a perception of whatever is involved with this discharge. Freud believed that anxiety develops through the trauma of birth, the loss of the caregiver, early uncontrollable threats or impulses, and, more specifically, fears of castration. In contrast to Freud's theoretical framework, subsequent work (e.g. Bowlby 1973) has stressed the importance of separation from early attachments.

For learning theorists (e.g. Mowrer, 1953), anxiety is a form of learned fear, particularly when the source of the fear is vague or repressed. Anxiety becomes a conditioned response that can then participate in new learning. Taking this a stage further, H. Eysenck (e.g. 1957) suggests that we inherit proneness to neurotic anxiety through the ANS, or learn it as conditioned fear. In searching for the physiological mechanisms that might underlie these processes, Gray (1982, 1987) states that the septal-hippocampal region of the brain mediates anxiety. This brain system functions to inhibit behaviour that is a threat to the organism.

Some recent theories of anxiety stress cognition. For example, M. Eysenck (1988) shows that those who are high or low in anxiety also differ in their cognition. So someone with a high trait anxiety (anxiety as a personality characteristic) is likely to have more worries stored in long-term memory than someone with low trait anxiety, and these worries will be much more easily accessed.

One of the most telling contributions in this area comes from Barlow (e.g. 1991), who places anxiety and depression at the centre of emotional disorder. He argues that it is difficult to distinguish between anxiety and depression. However, whilst most depressed patients are also anxious, not all anxious patients are depressed.

Barlow suggests that emotional disorders occur when chronic states of dysthymia (i.e. lowered mood) interact with briefer episodes of panic and depression. This might lead a depressed patient to misinterpret a personal or environmental event as a sign of personal inadequacy, which simply makes matters worse. Barlow's general argument is that stress, anxiety and dysthymia can interact with everyday emotions of excitement, anger, fear and sadness. When this happens, the result is one of four kinds of emotional disorder – mania, outburst of temper, panic or depression. For fully fledged emotional disorders to occur, these emotions have to be experienced unexpectedly or inappropriately, and to be seemingly out of control.

Finally, it is worth repeating that emotions can never be abnormal. Their expression or recognition may be awry, they might become too extreme for comfort, or they might contribute to mental illness, but even in these unfortunate circumstances, emotions always provide us with useful information. In the case of abnormalities, this is information that something is wrong and needs fixing.

Research close-up 2

Writing for health

The research issue

The work of James Pennebaker during the 1990s (1990; Pennebaker & Seagal, 1999) has greatly influenced our view of the role of emotion in the therapeutic process.

The aim of Pennebaker's research was to study the impact of writing about emotional experiences on a person's physical and mental health. This can be seen as a natural extension of the therapeutic process, but in a much simplified and potentially useful form.

Design and procedure

Pennebaker's procedure, as described for example in Pennebaker & Seagal (1999), involved assigning participants randomly to groups. These groups are asked to write about particular topics for between 15 and 30 minutes each day for three to five days. The writing is done in a laboratory and no feedback is given.

The experimental groups are asked to concentrate on a significant emotional issue in their lives and to explore their deepest feelings about it. They can link the issue to their closest relatives and friends, to their own characters and personalities. They can follow the same topic on each day or begin new topics. They are told that the quality of their writing will not matter and that what they write will be kept completely confidential. Control groups are asked to write about topics such as how they spend their time, what they do in the evenings, and so on.

It is interesting to note that in the experimental groups the wide variety of participants – of all ages and from all walks of life – disclose an equally wide range of traumatic experiences quite readily. Some become quite upset when they are writing, but most report it to be a very valuable experience.

Results and implications

The outcome of written emotional disclosure (in comparison with controls) is typically as follows:

- significant decreases in visits to physicians in healthy people;
- positive effects on the immune system;
- long-term improvements in mood and reductions in distress;
- improvements in grades for students; and
- fewer absences from work for university staff.

Such effects generalize across settings and cultures and are independent of feedback. Furthermore, no obvious individual or personality differences were found.

However, there are some considerations to bear in mind, as follows:

- Writing and talking about trauma both have a greater effect than writing about more superficial matters.
- Choice of topic can influence outcome: e.g. emotional issues versus traumatic experiences.
- Distributed writing seems to be more effective than concentrated writing.

Writing about trauma and emotion might have beneficial effects on mental and physical health because it helps to reduce the stress that comes from inhibition. However, Pennebaker's work shows that language usage is more important than the release of inhibition that comes from mere disclosure. So the more often people use positive emotional words in their writing, the greater the beneficial effects on their health. Also, high and low levels of negative emotional words link to poorer health outcomes, and medium levels link to better outcomes. Finally, improved health is linked to an increase in the number of causal words (e.g. 'because', 'reason') and insight words (e.g. 'understand', 'realize') used.

The major implication of this fascinating work is that the simple disclosure of an emotional problem may have an enormous therapeutic value, even before any other therapeutic work is done. Pennebaker (1999) asks the crucial question – can writing supplement or substitute for medical or psychological treatment?

Pennebaker, J.W., & Seagal, J.D., 1999, 'Forming a story: The health benefits of narrative', *Journal of Clinical Psychology*, 55, 1243–54.

FINAL THOUGHTS

The complexities of emotion are fundamental to human functioning. The subjective experience of emotion is so crucial to people's everyday lives that it should remain of importance to the psychologist despite the methodological compromises that have to be made when it is studied.

Although emotion has been researched and theorized about from every perspective psychology has to offer, some themes and issues stand out. For example, how far are emotions built in or biologically determined? To what extent are they constructed from our sociocultural background? At present, our best guess is a mixture of the two. Particular emotions, or perhaps basic dimensions of emotion, are seen as being built in biologically, with much of human emotional life being constructed on top of this from subtle and rich sociocultural influences. Moreover, a basic assumption made by most current theorists is that emotion is fundamentally adaptive, i.e. it is functional from an evolutionary viewpoint. Our emotional apparatus provides us with information that helps us to survive.

Although emotion has been studied from so many different perspectives, it is clear that no analysis of it should be made without some reference to cognition. Emotion and cognition are intertwined; together with physiological arousal, cognition might even be necessary to emotion. It also may be impossible to fully understand one without the other.

Even though emotion is largely a social phenomenon, it is usually regarded as something intrapsychic, something that is going on inside us. This 'first person' perspective is similar to that adopted by many people in the arts and humanities when writing about emotion, for example poets, songwriters and novelists. Psychologists have learned a great deal about emotion, from our experience of it, to our expression of it, and hence to our recognition of it in others. We know a lot about how emotion develops, and we are beginning to understand how we learn to regulate it. However, it should be noted that emotion is also studied by other social scientists, such as anthropologists and sociologists, who tend to see emotion not as something internal, but as a phenomenon that occurs 'out there', between people (see Strongman, 2003).

Emotion is essentially and perhaps primarily a matter of individual experience. Even though it is possible to gain useful folk psychological insights into this experience, it is the steady application of the research endeavours of psychological science that give us the most reliable information.

Summary

- Emotion colours our lives, but is difficult to define because there are at least five approaches to it, involving: feelings, behaviour, arousal (physiology), cognition and social context.
- Emotion is best understood systematically using the measurement techniques of psychological science.
- Feelings have been measured by (a) questionnaire and (b) analysis of diary entries.
- Emotional behaviour has been studied mainly in animals, with investigations of emotionality, the frustration effect and conditioned emotional responding.
- Physiological measures of emotion have been made in both the central and the peripheral nervous systems, but there has been little success in identifying distinctive patterns that correspond to discrete emotions.
- Emotion and cognition influence each other in complex ways. Appraisal, or the evaluation of the significance to us of any incoming stimuli, is particularly important.
- Emotion has communicative functions (largely nonverbal) that derive from its expression and recognition.
- Some psychologists stress the idea that specific emotions such as fear, anger, happiness and sadness should be studied as discrete entities.
- Some aspects of emotion are inherited, but emotion continues to develop throughout the lifespan. Of particular importance in the early years is attachment.
- In extreme forms, emotions can be involved in psychological disorders.

REVISION QUESTIONS

1. Discuss why emotions are central to our lives, and how they have been investigated by experimental psychologists. Which measurement techniques and research methodologies of psychological science can significantly inform the study of emotion?
2. How do emotion, cognition and appraisal interact?
3. What are the communicative functions of emotions, and how do these differ between specific emotions such as fear, anger, happiness and sadness?
4. Which aspects of emotion are inherited, which are acquired during childhood, and which aspects continue to develop throughout the lifespan?
5. How are emotions involved in psychological disorders? Why are feelings so difficult to study and measure?
6. Compare the links between cognition and emotion when a) someone is feeling sad over a friend's death and b) when they are feeling scared at a strange sound in the night.
7. Do you think that it is possible to experience emotion without physiological arousal being involved?
8. Do animals have emotions?
9. Is it possible to increase our emotional intelligence?
10. Can emotion ever be 'abnormal'?
11. Why do poets, novelists and song-writers as well as psychologists have a great deal to say about emotion?
12. For the most part, emotions seem to be useful to us, to be functional. In what way is jealousy useful?

Further Reading

Harré, R. (ed.) (1986). *The Social Construction of Emotions*. Cambridge: Cambridge University Press.
An illuminating collection of essays on various aspects of the social construction of emotion.

Lewis, M., & Haviland, J.M. (eds) (1993). *The Handbook of Emotions*. New York: Guilford Press.
An interesting collection of specialist state-of-the-art articles.

Magai, C., & McFadden, S.H. (eds) (1996). *Handbook of Emotion, Adult Development, and Aging*. New York: Plenum Press.
A collection of specially prepared articles on the course of emotion in later life.

Oatley, K., & Jenkins, J.M. (1996). *Understanding Emotions*. Cambridge, MA, and Oxford: Blackwell.
A nicely written, comprehensive coverage of emotion theory and empirical research.

Power, M.J., & Dalgleish, T. (1997). *Cognition and Emotion: From Order to Disorder*. Hove: Psychology Press/Lawrence Erlbaum and Associates.
Concerns the interplay between emotion and cognition in both normal and disordered emotion.

Strongman, K.T. (2003). *The Psychology of Emotion: From Everyday Life to Theory*. 5th edn. Chichester: John Wiley & Sons.
A popular undergraduate text that provides an overview of more than 150 theories of emotion.

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Sensory Processes 7

Learning Objectives

By the end of this chapter you should appreciate that:

- psychologists have developed rigorous, objective methods for investigating sensory processes;
- processing of sensory information relies on transduction (or transformation) of energy by sensory receptors;
- information conveyed by light differs from that conveyed by sound;
- light travels very fast and in straight lines over large distances, gives highly precise directional information, and can tell us about properties of distant objects;
- different types of light radiation are perceived differently by different animal species;
- many tasks are made much easier for humans by the way in which we process colour information;
- sound travels in lines that are not straight, so we cannot use it to determine locations in space as well as we can with light;
- sound also travels less quickly than light, so its time-of-arrival information can tell us about the direction of the sound source and the locations of sound-reflecting surfaces around us;
- the analysis of speech is one of the most important tasks of the auditory system for humans;
- we have other important senses apart from vision and hearing; for example, the perception of pain has probably been very important for human survival.

INTRODUCTION

It seems clear that in order to survive and function well in the world, an animal needs to know what is in its environment. What kinds of things it needs to know will depend on the kind of animal it is.

For example, a hawk flying high above ground and looking for prey needs some system of detecting that prey at a great distance; it seems equally obvious that it would be in the prey's interests to be able to see the hawk and take evasive action. In another situation, a dog may need to know whether another dog has been present in its territory, and therefore needs some way of detecting faint chemical traces left by the other dog. Sensing those traces will tell it that there is an intruder who needs to be persuaded to leave.

This chapter is about 'sensation' – the process of 'sensing' information about our environment. We can see from the hawk and dog examples that there are two major aspects to the process, and therefore the study, of sensation:

1. Understanding what is 'out there' to be sensed: what types of information are available that could, in principle, be used to tell us what lies around us? This first area involves thinking about the physical properties of the world.

2. How this information may be utilized by a biological system.

It is no good having information all around us if we have no means of sensing it. So a major part of this chapter will be about the sense organs and the type of information they send to the brain. This process is often placed within the domain of physiology, which is the study of the detailed functioning of biological systems in terms of their 'hardware'. We will make the link into psychology by asking how psychological techniques can be used to study the process of sensation in humans. Historically, this area is one of the first in which psychological techniques were perfected, long before the word 'psychology' was coined. This chapter shows you how these techniques allow us to study the function of mechanisms without requiring a person to describe his or her sense experiences in detail.

But first we will be moving within the realms of physical science, which might feel a little strange to students of psychology. From here, we move through physiology towards psychology.

Hopefully, what will emerge is an appreciation of the amazing cleverness of the sense organs, and the intricate nature of the information that they send for further processing by the brain.

HOW DO WE GATHER INFORMATION?

Our world is a complex place. Right now, I am sitting at a desk. I see the computer screen, and beyond that a window through which I see a garden and then a pine forest. I hear the faint whirring noise of the fan in the computer and the buzz of cicadas outside. I can smell the jasmine and pine sap from the garden – these smells become more potent if I concentrate on them. I can taste the coffee, which I recently sipped. My skin feels pleasantly warm in the summer heat, but my knee hurts where I grazed it a few days ago. I also feel the itching from some mosquito bites.

How does all this information reach me? Examining the above description in more detail, especially the physical sources of information, will help to explain what is going on when we receive information from the world.

Light

Arguably our most important perceptual ability is vision. We know that vision depends on light: when there is no light, we cannot see. What are the important characteristics of light, and how do these affect the kind of information it conveys to us?

Light is a form of electromagnetic radiation. 'Visible' light forms just a small part of the full spectrum of this radiation (see figure 7.1). The sun emits radiation over a much larger part of the spectrum than the chunk of it that we can see. Why might this be so?

To answer this question, it may help to consider why we do not see the two parts of the spectrum that border on the visible part.

Ultra-violet radiation

There is plenty of ultra-violet (UV) radiation about, especially as you get nearer to the equator and at high altitude. You will have heard about your skin being at risk of sunburn when there is a lot of UV radiation around you. Sunburn is the first stage of the process of the skin dying as a result of damage.

So we know that UV radiation is damaging to skin, and presumably other biological tissue too. This is the most likely explanation for our eyes having an in-built filter to remove UV radiation. To put it simply, if we were able to see UV rays, they would be likely to damage our eyes.

Some animals do possess UV vision, especially insects and birds. It is thought that they are less vulnerable to this hazardous radiation because they live a shorter timespan than humans. Our eyes must function throughout a long lifetime.

Other forms of short-wavelength information, such as X-rays and gamma rays, are even more damaging to tissue, but these are filtered out by the earth's atmosphere.

Infra-red radiation

Why are we unable to see infra-red (IR) radiation? Would it be helpful if we could? The answer to the second question is certainly 'yes'. IR radiation is given off in proportion to an object's temperature. This is why it is used in night-vision devices, which can locate a warm object, such as a living body, even in the absence of light. This information could be extremely useful to us. So why do we not see it?

Precisely because we are warm creatures ourselves. Imagine trying to see while holding a strong light just below your eyes. The glare from the light prevents you from seeing other objects. In the same way, we would suffer from glare if we could see IR radiation. It would be like having light-bulbs inside your own eyes.

Again, some animals do see IR radiation, but these are cold-blooded creatures, such as pit vipers, which do not suffer from this glare problem. The IR information is very useful in helping them to locate warm objects, such as the small mammals they hunt for food.

Humans build devices that transform IR into visible light – useful for armies (and the psychopath in the movie *Silence of the Lambs*) needing to 'see' warm objects at night, such as vehicles

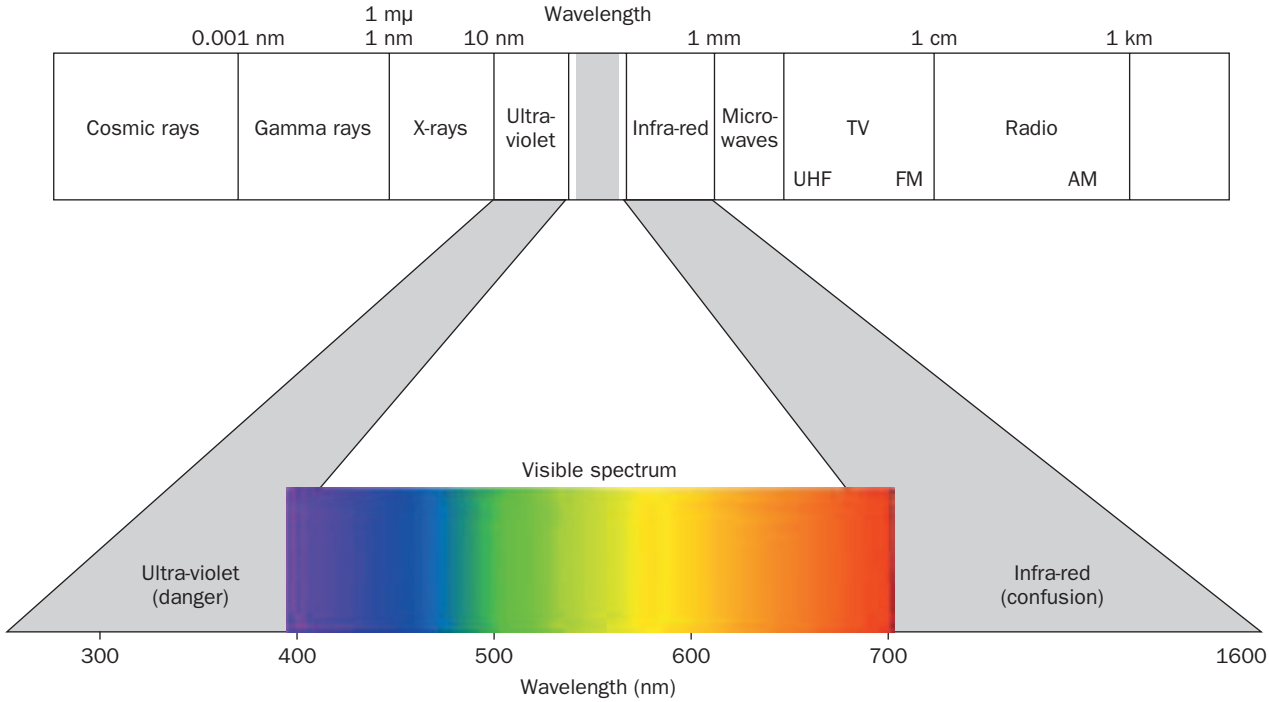


Figure 7.1

The range of electromagnetic radiation. Note the small range of this spectrum (wavelengths from about 400 nm to 700 nm, where 1 nm is 10^{-9} metres) which gives rise to visual sensation.

with hot engines and living humans. More humane uses of this technology include looking for living earthquake victims. Figure 7.2 shows an example of an IR terrain image. A Landrover is clearly visible from its engine's heat. A normal photo of this scene would simply look black.

Figure 7.2

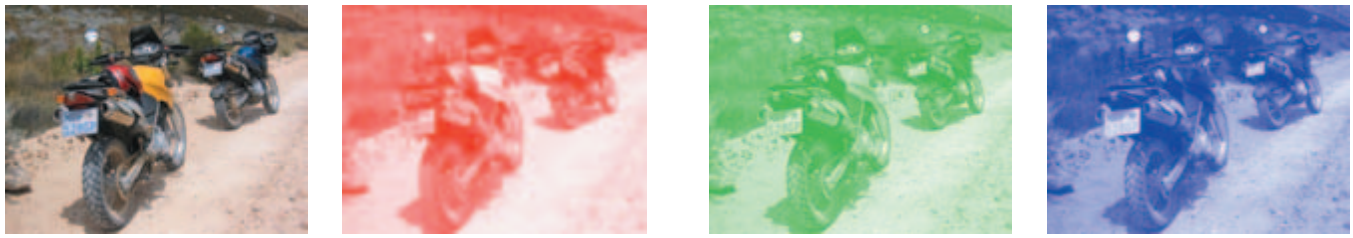
A terrain image of a scene at night in the infra-red range (approximately 1000 to 1500 nanometres). Visually, this image would be completely dark. However, because infra-red radiation is emitted by hot objects, the engine of the vehicle shows up clearly. The military use this kind of imaging device to enable night vision of such objects.

Visible light – speed and spatial precision

Light travels extremely quickly, at a rate of about 300,000 km per second. In effect, this means that light transmission is instantaneous. So we cannot determine where light is coming from by perceiving differences in arrival time. No biological system exists that could respond quickly enough to signal such tiny time intervals.

One of the fastest neural systems in humans is the auditory pathway, which can sense differences in the time of arrival of sound waves at each side of the head. Such differences are of the order 1 ms, or one-thousandth of a second (see Moore, 2003, pp. 233–67). As light travels so much faster, the equivalent difference in time-of-arrival we would need to detect would be one millionth of a millisecond. This is impossible for neurons to resolve.

Fortunately, the other major property of light means that we do not need time-of-arrival information to know where the light is coming from. In transparent media such as air, light rays travel in straight lines, enabling it to convey information with high spatial precision. This means that two rays of light coming to me from adjacent leaves on the tree outside the window, or adjacent letters on this page, fall on different parts of the retina – the part of the eye that translates optical image information into neural signals. As a result of this simple property (travelling in straight lines), we can resolve these separate details. In other



Colour image | Red | Green | Blue

Figure 7.3

A coloured scene and its decomposition into three primary-colour maps (red, green and blue). Adding these three pictures together generates the full-colour scene. The fact that three primary colours are sufficient to yield a full-colour scene is a consequence of us having three different cone types in the retina, each responding to a different range of wavelengths.

directional sensitivity similar to acuity

acuity the finest detail that the visual (or other) system can distinguish

words, we have a high degree of *directional sensitivity*, or a high *acuity*.

Without this property, the light from adjacent letters on this page would become irretrievably jumbled and we would not be able to resolve the letters.

The benefits of colour

When light hits a solid object, it can either be reflected or absorbed. An object that absorbs all the light hitting it will look black. One that reflects all light will look white. Intermediate levels of *reflectance* (the term given to the ratio of incident to reflected light) will elicit shades between black and white. Also, objects reflect different amounts of light at different wavelengths. Figure 7.3 shows how different objects in an image reflect different amounts of red, green and blue light.

reflectance the relative proportion of each wavelength reflected by a surface: the higher the reflectance, the lighter the object will look

So the ability to distinguish between the amounts of different wavelengths of light reaching us from a given surface can convey a lot of information about the composition of the surface, without us having to come close to it. This is the basis of colour vision. It is possible to tell whether a fruit is ripe or not, or whether meat is safe to eat or putrid, using the colour information from the surface of the fruit or meat. Equally, it is possible to break camouflage.

Figure 7.4 compares a monochrome and a coloured display of a scene. The ripe fruit is virtually invisible in the monochrome version because its *luminance* (the amount of light that comes to us from it) is not sufficiently different from the canopy of leaves that surround it, the canopy serving

luminance the intensity of light corrected for the degree to which the visual system responds to different wavelengths

Figure 7.4

A colour and monochrome version of the same scene – a red fruit among leaves. The fruit is very hard to find in the monochrome version, and is easily seen in the colour version. Recent theories of the evolution of colour vision suggest that, in primates, it developed partly to enable detection of fruit in leafy canopies.

as camouflage because it contains large random fluctuations in luminance. As soon as colour is added, we can see the fruit clearly.

It has been argued (Osorio & Vorobyev, 1996; Sumner & Mollon, 2000) that the need to find fruit is the main reason for primates' trichromatic colour vision. 'Trichromatic' simply means that there are three types of cone cells in the retina (see figure 7.3). Curiously, though, other mammals have only dichromatic colour vision, which means they only have two cone types – one corresponding to medium-to-long wavelengths and another responding to short wavelengths. As a result, they cannot discriminate between objects that look green or red to us. So a red rag does not look particularly vivid to a bull! Interestingly, most animals (i.e. all birds and insects) have four cone types, one responding to UV radiation.

Sound

Those cicadas are still chirping outside the window, and the computer is whirring. These sensations are clearly conveyed to me by sound. But what is sound?

The mechanical nature of sound

Like light, sound is also a form of physical energy, but this type of energy is mechanical. Sources of sound cause the air molecules next to them to vibrate with certain frequencies; these vibrations are transmitted to neighbouring molecules and cause waves of vibration to spread outwards from the source, just like waves spread on a calm pond if you throw a pebble into it.

In this way, sound can travel around corners, unlike light. So sound conveys a very different form of information than light. Since it is not constrained to travel in straight lines, it can tell us about things that are out of sight – but at a price. The price is that sound cannot tell us about spatial location with as much precision as light can; this is a consequence of its physical properties, and nothing to do with our ears.

frequency the rate at which a periodic signal repeats, often measured in cycles per second or Hertz (Hz); the higher the frequency, the higher the perceived pitch

As sound travels through the air, the air pressure at a given point will change according to the *frequency* of the sound. We are sensitive to a range of frequencies from about 30 Hz (Hertz in full, which means cycles per second) to about 12 kHz (or kiloHertz, meaning thousands of cycles per second). Figure 7.5 shows the patterns of waves reaching us from objects vibrating at a given frequency.

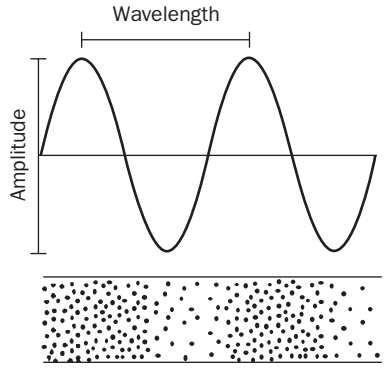


Figure 7.5

Sound waves and how they vary in wavelength and amplitude. Each wave can be measured as the pressure of air at a point in space, and the lower part of the figure depicts the density of air molecules, i.e. the pressure at each point of the wave. The frequency of a wave is the number of wavelengths passing a given point per second.

Using sound to locate objects

As we have already seen, sound also travels much more slowly than light, with a speed of about 300 metres per second. Even though this is still pretty fast, it is slow enough for our brains to process time-of-arrival information. It takes sound just under one millisecond to travel from one side of the head to the other. This information can be encoded by neurons (Moore 2003; see also chapter 3), giving information about what direction the sound is coming from.

Sound also gets reflected or absorbed by surfaces. Think about echoes in a cave. These are extreme examples of a process that happens less spectacularly, but more usefully, in everyday life. Subtle echoes give us clues about the location of large objects, even in the absence of vision. Blind people tend to develop this skill to a higher level, using sticks to tap the ground and listen for new echoes. Bats use echolocation to fly at night (see figure 7.6).

Communication

Dolphins use a similar echolocation mechanism, both for finding their way and for communication.

In general, communication is the other main use for sound, since it is generally easier for animals to produce sound than light. Speech production and recognition in humans is a spectacularly impressive process, which is crucial to our success as a species. The fact that sound can travel around corners is an added bonus – the person you are talking with does not need to be in a direct line of sight.

The Chemical Senses

Light travels virtually infinitely fast; sound travels more slowly but is still unable to linger in one spot for any length of time. In our efforts to gather useful information about the world out there, we really could use a source of information that sticks around for much longer.

This is where the chemical senses – smell and taste – prove useful. Biological systems have developed an ability to detect certain types of molecule that convey information about sources of food,

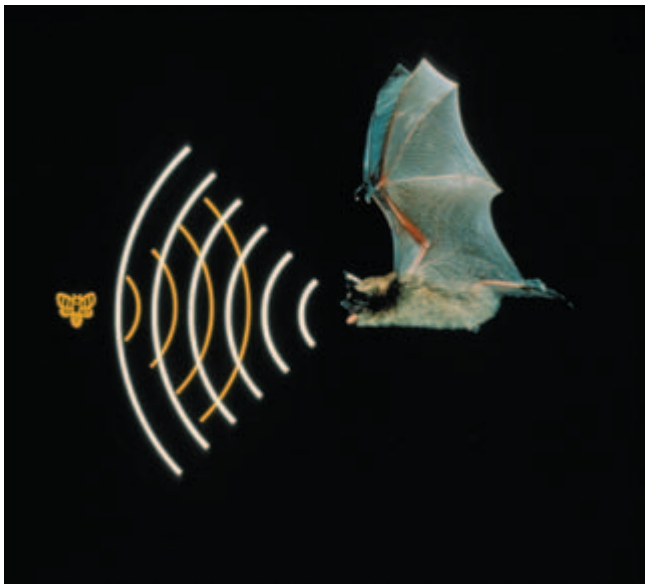


Figure 7.6

A bat uses echolocation to detect sound waves reflected off another object – in this case, a fly. The bat emits high-frequency sound waves and senses their reflection from other objects and surfaces nearby. That way, it can locate such things without light. Blind people do a similar trick when tapping their white cane – they listen to the reflected echo from nearby objects.

other animals and possible hazards and poisons. To appreciate this information, just watch a dog sniffing for a buried bone – or tracking the path taken by another dog. Here we have a source of information that comes with a level of persistence, a spatial memory of previous events.

In humans, the sense of smell seems to be less developed than in other animals. But we do have a well-developed sense of taste, which tells us about the chemical composition of the food we eat and warns us (together with smell) of toxins, for example in food that is putrid.

Clearly this is a very different type of information from that provided by light and sound. It requires physical contact or at least close proximity, but the information persists for much longer.

The somatosenses

There are senses which we use to explore the world immediately around us – just outside our bodies and also on or within our bodies. *Somatosenses* respond to:

- pressure
- temperature
- vibration
- information signalling dangers to our bodies (e.g. cuts and abrasions, corrosive chemicals, extreme heat, electrical discharges)
- possible problems inside our bodies

Exploring through touch

Our skin contains nerve endings which can detect sources of energy. Some parts of our bodies, such as our fingers, have a higher density of nerve endings than other parts, and so fingers and hands are used in active exploration of the world immediately around us. Mostly, this is to corroborate information that is also provided by other senses, such as vision; but of course we can still touch things without seeing them.

I recently played a game with some friends in New York, where there is a park with small statues of weird objects. We closed our eyes, were led to a statue, and had to tell what it was. Through active exploration lasting many minutes, we were able to give a pretty precise description of the object, but it was still a big surprise to actually see it when we opened our eyes.

This experiment shows that the sense of touch can be used to give a pretty good image of what an object is, but the information takes time to build up. Also, for the process to work efficiently, we need a memory for things that we have experienced before – in this case, a tactile memory.

Sensing pain and discomfort

The same nerve endings that respond to mechanical pressure and allow this kind of tactile exploration also respond to temperature and any substances or events that cause damage to the skin, such as cuts, abrasions, corrosive chemicals or electric shock. The sensation of pain associated with such events usually initiates a response of rapid withdrawal from the thing causing the pain.

There are similar nerve endings inside our bodies, which enable us to sense various kinds of 'warning signals' from within. An example of this is that dreadful 'morning-after' syndrome, comprising headache, stomach ache and all the other cues that try to persuade us to change our lifestyle before we damage ourselves too much!

SENSE ORGANS

The role of our sense organs is to 'capture' the various forms of energy that convey information about the external world, and to change it into a form that the brain can handle. This process is called *transduction*.

transduction the process of transforming one type of energy (e.g. sound waves, which are mechanical in nature) into another kind of energy – usually the electrical energy of neurons

As a transducer, a sense organ captures energy of a particular kind (e.g. light) and transforms it into energy of another kind – action potentials, the neural system's code for information. Action potentials are electrical energy derived from the exchange of electrically charged ions, which inhabit both sides of the barrier between the neuron and its surroundings (see chapter 3). So our eyes transduce electromagnetic radiation (light) into action potentials, our ears transduce the mechanical energy of sound, and so on.

Transduction is a general term, which does not apply only to sense organs. A microphone is a transducer, which (rather like the ear) transduces mechanical sound energy to electrical potentials –

but in a wire, not in a neuron. There are many other examples of transduction in everyday equipment.

As we gradually move away from physics and into psychology, we pass through an area of physiology – how biological transducers work.

How do we see?

We know that light travels in straight lines. It therefore makes sense for a biological transducer of light to preserve information about the direction from which a particular ray of light has come. In fact, this consideration alone accounts for a large swathe of visual evolution.

As creatures have become larger and therefore begun to travel further, they have developed an ever greater need to know about things that are far away – so eyes have developed an increasing ability to preserve spatial information from incident light. Where is each ray coming from?

photoreceptor a cell (rod or cone) in the retina that transforms light energy into action potentials

To achieve this, there must be some means of letting the light strike a particular *photoreceptor*. This is the name given to the smallest unit that transduces light. If a given photoreceptor always receives light coming from a given direction, then the directional information inherent in light can be preserved.

Pinhole cameras and the need for a lens

The simplest way to illustrate light transduction is to make a pinhole camera – a box with a small hole in it (see figure 7.7). From

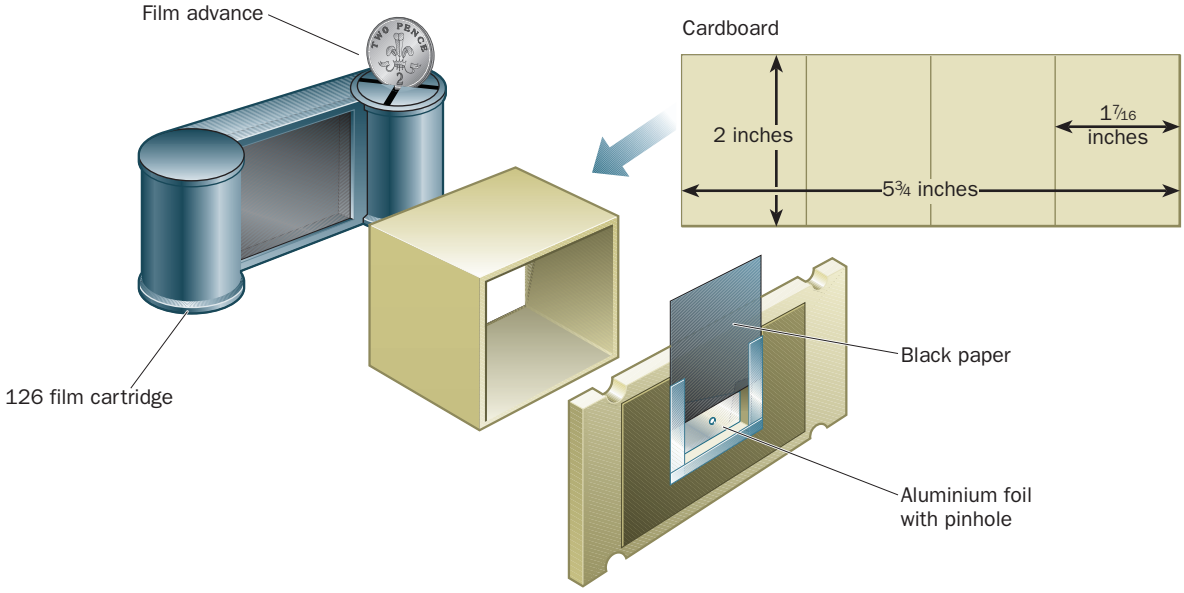


Figure 7.7

Above, a pinhole camera, which is quite simple to construct, and requires no lenses or mirrors. Below, a picture taken with this camera.

Figure 7.8

An image taken through a larger pinhole. Note that the image is brighter than that in figure 7.7, but also more blurred.

the geometry of rays travelling in straight lines, it is possible to see that a given place on the rear surface of the pinhole camera will only receive light from one direction. Of course, this is only true until you move the camera. But even then, the relative positional information is usually preserved – if something is next to something else out there, its ray will be next to its neighbour's ray on the back surface of the camera.

One of the drawbacks with a pinhole camera is that the image (the collection of points of light on the back of the box) is very dim, and can only be seen in very bright, sunny conditions. If you make the pinhole bigger to let more light through, the image becomes fuzzy, or blurred, because more than one direction of incident light can land on a given point on the back surface (figure 7.8). With this fuzziness we begin to lose the ability to encode direction.

The solution is to place a lens over the now-enlarged hole. The lens refracts (bends) the light so that the sharpness of the image is preserved even if the pinhole is large. Add film and you have a normal camera. The same construction in your head is called an eye.

Nature evolved lenses millions of years ago. We then reinvented them in Renaissance Italy in about the 16th century. Possibly the earliest description of the human eye as containing a lens was given by Arab scholar Abu-'Ali Al-Hasan Ibn Al-Haytham, often abbreviated to Al Hazen, in the eleventh century AD. Al-Haytham was born in Basra – now an Iraqi town, which has had a sadly turbulent history recently.

Pioneer

Abu-'Ali Al-Hasan Ibn Al-Haytham (965–1040) often abbreviated to Al Hazen, was born in Basra, Iraq. He studied the properties of the eye and light at a time when European science was singularly lacking in progress. He is remembered for the discovery that the eye has a lens which forms an image of the visual world on the retina at the back of the eyeball.

Looking at the eye in detail

In human vision, there are two types of photoreceptors, called *rods* and *cones*. Rods are cells that only work at low levels of illumination, at night; cones are cells that give us our vision in normal daylight levels of illumination. There is only one kind of rod, but three different kinds of cone, each responding preferentially to a different range of wavelengths of light – the basis of colour vision.

rods cells in the retina that transform light energy into action potentials and are only active at low light levels (e.g. at night)

cones cells in the retina that transform light energy into action potentials, different kinds responding preferentially to different wavelengths

Figure 7.9 shows how light travels through the cornea, pupil and lens, eventually falling on the retina, which is illustrated in more detail in figure 7.10.

When a ray of light hits a photoreceptor (a rod or a cone), it sets up a photochemical reaction, which alters the electrical potential inside the photoreceptor. This, in turn, produces a change in the firing rate of the neuron connected to that photoreceptor. There are four types of neuron in the retina (see figure 7.9) – horizontal, bipolar, amacrine and ganglion cells.

Now we meet with a problem: there are about 100 million photoreceptors but only about one million neurons in the *optic nerve*. Nobody really knows why, but the most persuasive argument is that if you made the optic nerve thick, then the eye could not move! How can all the important information be squeezed into these few neurons? The only way is to discard a lot of redundant information. Think about how you would give instructions for someone to find your home. It is usually a waste of time to describe exactly how long they need to walk in a straight line. Instead, you might say, 'turn left, then right, then second left'. What you are doing is noting the points of change in the route information.

optic nerve conveys information from the retina to the visual cortex

The retina does pretty much the same thing. It signals the points of change in the image – i.e. the places where intensity or colour alter – and ignores regions where no changes occur, such as a blank uniform surface.

Figure 7.11 shows how each retinal ganglion cell has a *receptive field* – a particular part of the visual world. If you change the amount of light in this field, you will produce a change in the cell's activity. A neuron only changes its firing rate when there is an abrupt change in the amount of light falling on

receptive field a region of the visual world where a change in the intensity of light results in changes in production of action potentials in a neuron

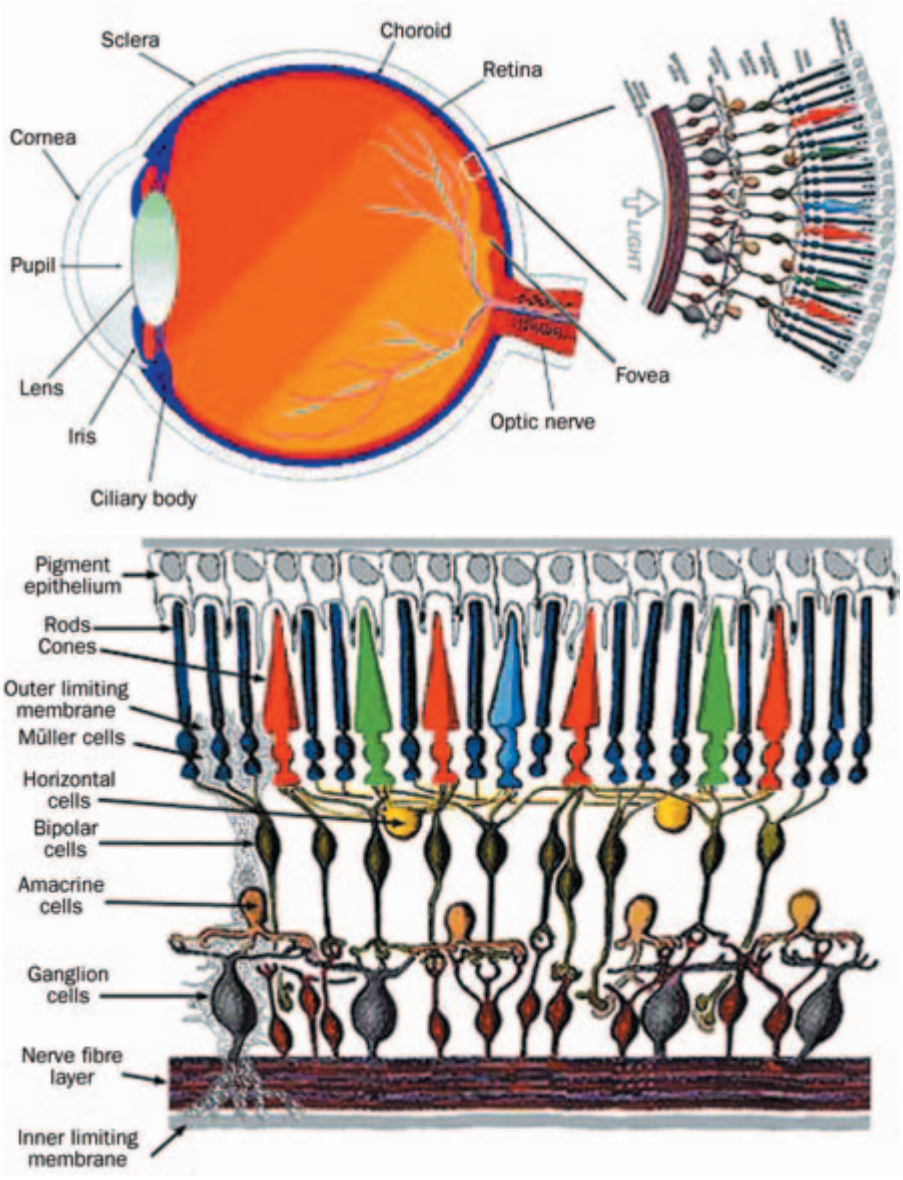


Figure 7.9

A section through the human eye which shows how light reaches the retina, which is shown in expanded section in the lower part of the figure. Note that the retina is the only piece of brain that we can observe directly in a living human. We can look into the eye with a device called an ophthalmoscope, and take pictures of the retina in a similar way. Figure 7.10 shows such images – a healthy retina, and one which is afflicted by a common illness called age-related macular degeneration. An ophthalmologist is trained to spot the onset of retinal pathology. Source: http://webvision.med.utah.edu/sretina.html

the receptive field – for example the boundary between a white object and a dark background.

The retina contains many such receptive fields in any one location, so there is a large degree of overlap between them. They are smallest in the area called the *fovea*, the high-acuity part of which occupies approximately the central one degree of the visual field. This is the part of the retina that receives light rays from the direction you are looking in. Since a receptive field cannot distinguish between different locations within it, the smaller the receptive field is, the finer the spatial detail that can be resolved. So the fovea is able to resolve the finest detail.

fovea the central five degrees or so of human vision, particularly the central, high-acuity part of this area (about one degree in diameter)

To convince yourself of this, try looking at the opposite page out of the corner of your eye and then try to read it. If you

Pioneer

Thomas Young (1773–1829) was a physicist who postulated that there are only three different kinds of photoreceptors in the retina, even though we can distinguish thousands of different colours. The basis of this argument was that, to have thousands of different photoreceptors would compromise the acuity of the eye, since the acuity is determined by the distance to the nearest neighbour of the same type. Later, Hermann von Helmholtz added the physiological basis of this argument. Thomas Young also studied the mechanical properties of materials, defining a number later known as Young's Modulus to describe how stretchable a material is. In Young's days, there was no distinction between the subjects which we now call physics, psychology and physiology.

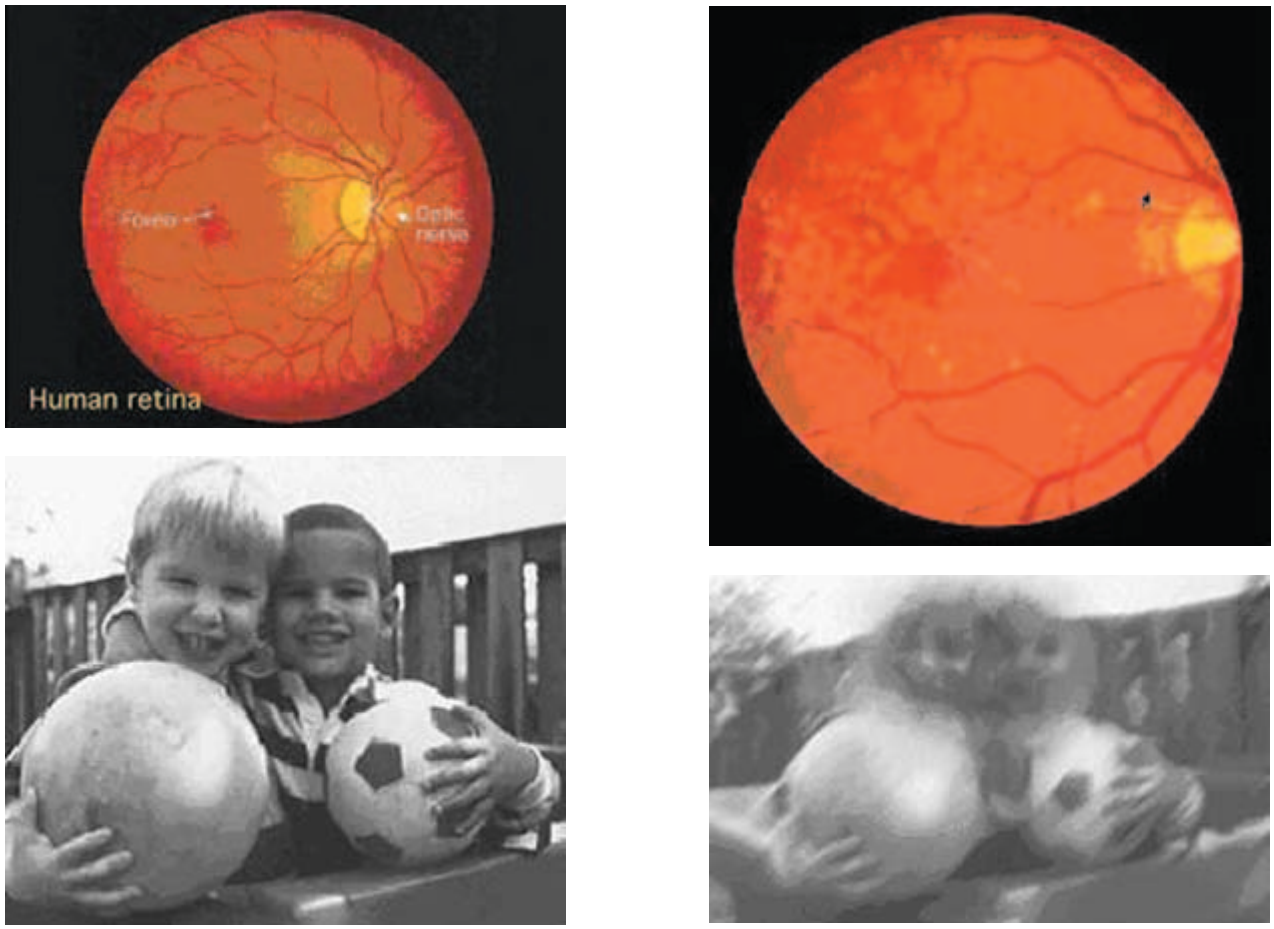


Figure 7.10

A view of a normal human retina (on the left). Note the fovea, which is the area which gives high-acuity vision with densely packed photoreceptors and no retinal blood vessels. On the right is a retina of a patient with age-related macular degeneration, a common retinal condition affecting elderly people. Note the 'splodgy' abnormal structure of the retina in the area near the fovea. Such a patient would be unable to use their central, high-acuity vision and would probably be registered blind. The images at the bottom attempt to demonstrate the vision as seen by people with normal vision and by those with age-related macular degeneration. Source: http://webvision.med.utah.edu/sretina.html

cannot do so, it is because the receptive fields in the periphery of your retina are larger and incapable of resolving the small print.

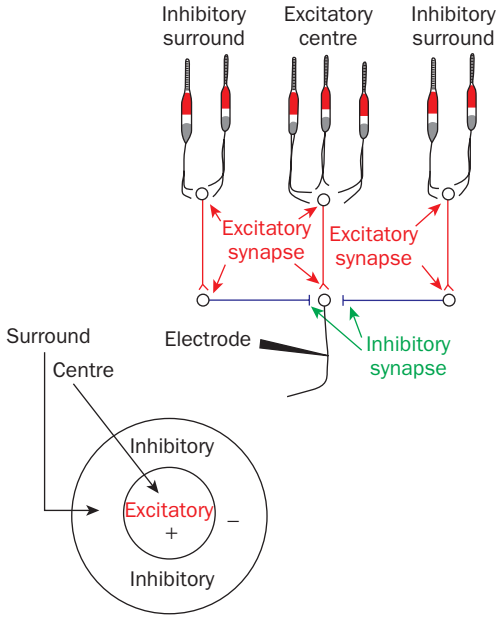
Vision as an active process

Of course, our eyes are able to move in their sockets, and this allows the visual system to choose new parts of the image to look at. These rapid eye movements, called *saccades*, occur several times per second. We are mostly unaware of them and, during a saccade, vision is largely 'switched off' so that we do not see the world moving rapidly in the opposite direction to the saccade (see also p. 255).

saccades rapid eye movements in which the fovea is directed at a new point in the visual world

Figure 7.12 presents the results of two studies. One is a classic study by the Russian psychologist Yarbus (1967), which shows how we move our eyes when looking at a visual object. The other is a study by Gilchrist, Brown, and Findlay (1997), which investigated similar scan patterns by a young woman (a female university undergraduate aged 21) who had no ability to move her eyes due to a condition called extraocular muscular fibrosis. Instead, she moved her whole head using the neck muscles. There are strong similarities between the two sets of scan patterns, indicating that, even if the eye cannot move, the image scan sequence needs to be broadly similar.

All of this raises the question of exactly why the eye needs to be moved to so many locations. Presumably it is to resolve fine detail by using the fovea with its small receptive fields. Moving the eyes in this manner is usually associated with a shift of attention.



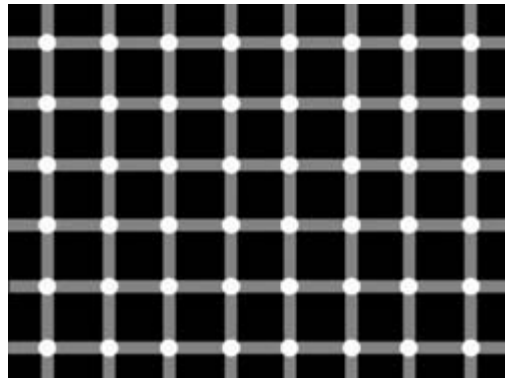


Figure 7.11

The basis of receptive fields in the retina. The diagram shows how retinal signals from different photoreceptors are combined and organized into 'excitatory' and 'inhibitory' regions, which can be mapped by placing an electrode in the ganglion cell neuron and waving a light around in different regions of the visual field. Those regions where light produces more neuronal firing are called excitatory, and those where light stimulation results in less neuronal firing are called inhibitory. The panel shows a variant of the Hermann Grid illusion, in which illusory grey spots are seen at the intersections of the light crosses. The traditional explanation for these illusory grey spots is from the action of centre/surround receptive fields. Finally, we show a natural scene and the 'edges' that are output by centre/surround receptive fields. These edges occur where there is a sudden change in intensity on the retina, which often corresponds to edges of real objects in the image, e.g. the people.

When we move our eye to a given location, we are more likely to be processing the information from that location in greater detail than information from elsewhere. This is the concept of selective attention (see chapter 8). The process is intimately related to physical action, in this case movement of the eyes (or head). This implies that vision is not just a passive process, but an active one. In fact, there appear to be two streams of visual information in the cortex – *ventral* and *dorsal*. The former processes information about the nature of objects; the latter allows you to interact with 'stuff out there' – i.e. to plan actions – without a detailed representation of objects (see Milner & Goodale, 1995).

Seeing in colour

So far, we have looked at how the retina responds to rapid spatial changes in illumination. But it also selectively signals temporal changes, such as occur when there is a flash of lightning or (more usefully) when a tiger suddenly jumps out from behind a tree

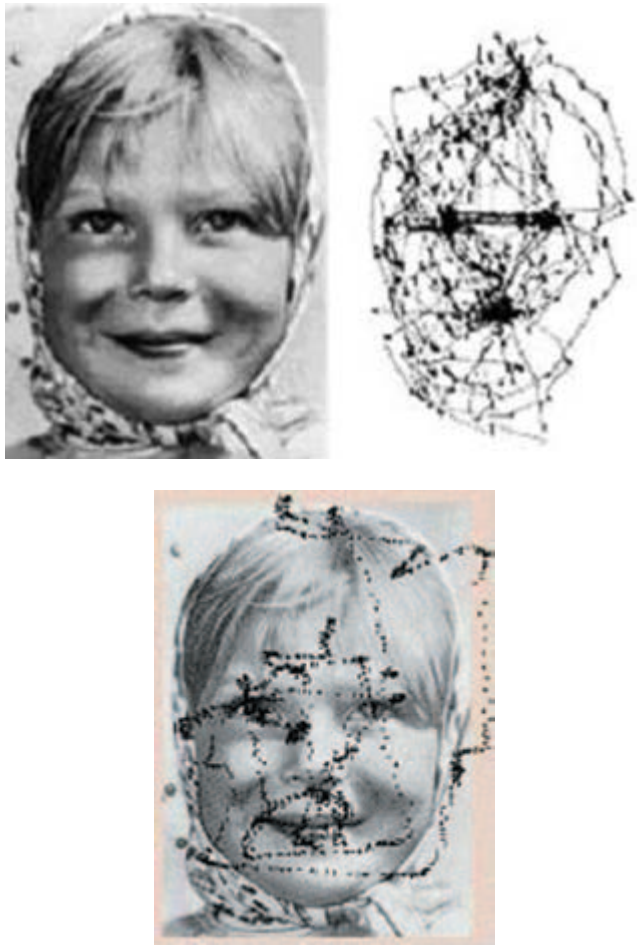


Figure 7.12

At the top, a photograph of a girl used as a stimulus by Yarbus (1967) in a study designed to measure rapid eye movements (saccades) made by the observer. The panel next to the photograph shows the locations of these eye movements, which go to regions of interest in the image and allow them to be resolved by the high-acuity fovea. At the bottom, a scan pattern measured by Gilchrist, Brown and Findlay (1997) in an observer who had no eye movements due to a failure of the ocular muscles, and instead moved her whole head with her neck muscles to scan the same image. Sources: top, Yarbus (1967); bottom, Gilchrist et al. (1997).

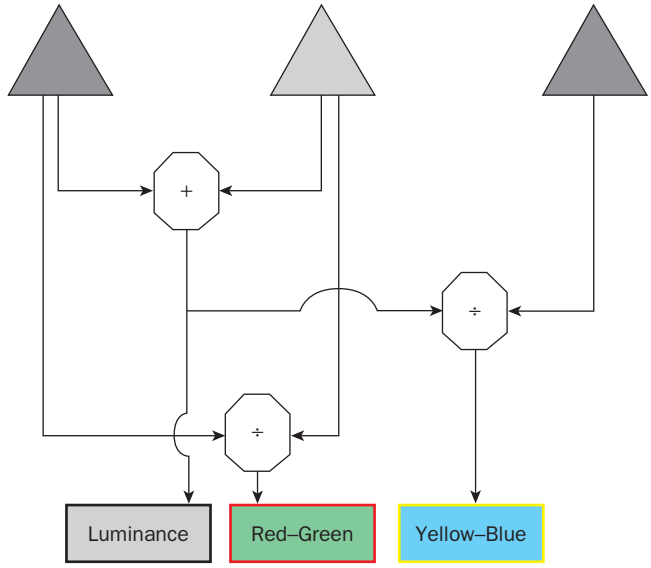


Figure 7.13

A combination of colour information from the three types of retinal cone resulting in three 'opponent' channels signalling luminance (intensity), the red–green dimension of colour, and the yellow–blue dimension of colour.

or moves against a background of long grass, so breaking its camouflage.

There are various mechanisms involved in processes of adaptation to static scenes (see chapter 8). Perhaps the best-known form of adaptation occurs when we enter a dark room on a sunny day. At first we cannot see anything, but after a few minutes we begin to notice objects in the room, visible in the faint light there. This phenomenon occurs because our receptors become more sensitive when they are not stimulated for a while, and also because there is a change from cone vision to rod vision.

You may have noticed that in a faint light all objects appear to have no colour, quite unlike our daylight vision. This is because there is only one type of rod but three different types of cone, and the cones have a dual function: they encode the amount of light present, but they also encode colour, since they are maximally sensitive to different wavelengths in the visible spectrum.

Figure 7.13 shows how the outputs of the cones are compared. It is important to realize that they must be compared, since the output of a single cone cannot unambiguously encode wavelength.

Suppose you have a cone maximally sensitive to light which has a wavelength of 565 nm. By using an electrode to measure the output of this cone (do not try this at home!), suppose you find that the cone is producing a 'medium' level of output. Can you deduce that the cone is being stimulated by a 'medium' amount of light whose wavelength is 565 nm? No – because precisely the same response would arise from stimulation by a larger quantity of light of a slightly different wavelength – say 600 nm. This is because cones do not respond in an 'all or none' manner to rays of light of a given frequency. Instead, they show a graded response profile.

We have three different types of cone in the retina. They are sometimes called 'red', 'green' and 'blue' cones. More strictly, we refer to these cones as 'L', 'M' and 'S' cones, which refers to the fact that the L cones respond most to long-wavelength light, M cones to medium-wavelength light, and of course S to short-wavelength light.

So the output of a single cone is fundamentally ambiguous, and for a meaningful colour sensation to arise, we must know how much one cone type responds compared to another

Research close-up 1

How do we know when things are moving?

The research issue

Motion blindness, also known as akinetopsia, is very rare. It is usually the result of trauma or other lesions to the parieto-temporal area of the cerebral cortex. As with many other neuropsychological conditions, it helps us to understand not only impaired functioning, but also the functional characteristics of the non-damaged system.

Zihl, von Cramon and Mai (1983) identified a patient with bilateral posterior brain damage to an area considered to be similar to the monkey brain area MT (also called V5), which is believed to be responsible for motion perception. The findings of this study indicate that the patient (M.P.) experienced disturbance of movement vision in a rather pure form.

Design and procedure

The specificity of the deficit in M.P.'s movement perception was systematically investigated. Tests included those for the perception of: colour, form, depth, movement, after-effects as well as acoustic and tactile perception. Where relevant, visual perception in both the central and peripheral regions of the visual field was evaluated.

Results and implications

Both colour perception and form perception were found to be within the normal range. But M.P. apparently had no impression of movement in depth, and she could only discriminate between a stationary and a moving target in the periphery of her otherwise intact visual fields. It was apparent that M.P. had some movement vision in the central part of her visual fields, but this was observed reliably only if the target velocity did not exceed 10 degrees of arc per second. M.P. also failed to demonstrate perceptual signs such as visual movement after-effects (see chapter 8) or apparent visual movement phenomena. Visually guided eye and finger movements were impaired too.

In contrast to the disturbance of movement perception in the visual modality, movement perception elicited by acoustic and tactile stimuli was not impaired in M.P. This suggests there was selectivity of her lesion with respect to (a) the sensory modality of vision and (b) movement perception within this modality.

On the basis of the localization of M.P.'s cerebral damage (as evaluated via brain scanning as well as the kind of neuropsychological testing just described), it was concluded that selective impairment in movement perception is due to bilateral cerebral lesions affecting the parieto-temporal cortex and the underlying white matter in this region of the brain.

The selectivity of the visual disturbance in M.P. supports the idea that movement vision is a separate visual function, depending on distinctive neural mechanisms.

Subsequently, other similar clinical cases have been reported. Other areas of research which are relevant to address the questions raised by patient M.P. include electrophysiological studies, lesion-based methodologies and functional magnetic resonance imaging (fMRI) recordings of brain activity in awake non-brain-damaged humans while they are viewing moving stimuli.

Taken together, these findings support the idea that there are bilateral regions of the parietotemporal cortex that are selectively involved in the processing and perception of motion.

Zihl, J., von Cramon, D., & Mai, N., 1983, 'Selective disturbance of movement vision after bilateral brain damage', *Brain*, 106, 313–40.

chromatic opponency a system of encoding colour information originating in retinal ganglion cells into red–green, yellow–blue and luminance signals; so, for example, a red–green neuron will increase its firing rate if stimulated by a red light, and decrease it if stimulated by a green light

cone type. This is achieved through *chromatic opponency*, a process that also explains why we can see four 'pure' colours – red, yellow, green and blue – even though there are only three kinds of cone. The 'yellow' sensation arises when L and M cones receive equal stimulation. Their combined output is then compared to that of the S cones. If L+M is much greater than S, we see yellow, and if less, we see blue. If L+M is about the same as S, we see white.

Figure 7.14 shows how these opponent processes encode detail in natural scenes. This effect was achieved using a special kind of camera, first constructed by Parraga, Troscianko and Tolhurst (2002), which produces different cone responses for each point in the scene (or pixel in the image). Parraga et al. found that the red–green system is suited to encoding not just the colour properties of images of red fruit on green leaves, but also the spatial properties of such images for a foraging primate.

We know that the receptive fields for colour are different from the receptive fields for luminance. Specifically, they lack the 'centre-surround' structure that makes the centre effectively as big as the whole receptive field. As a result, we are less sensitive to fine detail in colour than in luminance.

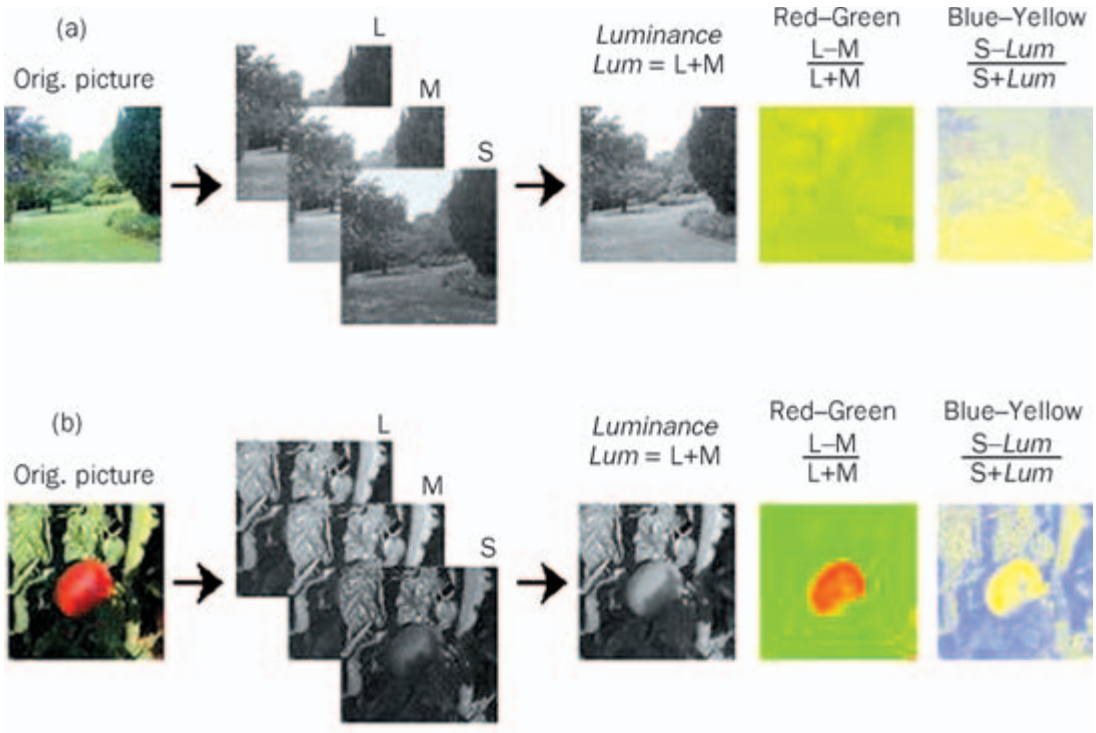


Figure 7.14

Two images encoded via the cones and opponent processes. On the left are the two images. Next, we show the L, M, and S cone responses to these images. Finally, we show the three opponent responses to these two scenes. Note that the red–green mechanism removes shadows from an image of red fruit on green leaves, and therefore allows the visual system to see a 'clean' image of the fruit and its background.

Figure 7.15 shows an early attempt to capitalize on this. Early photographs were only in black and white, but the technique of using watercolours to paint the various objects (e.g. blue sky) on top of the photograph became quite popular. The interesting point is that the paint only needed to be added in approximately the right areas – some creeping across object boundaries did not seem to matter.

About fifty years later, the inventors of colour TV rediscovered this fact. The trick is to find a way of transmitting as little information as possible. So only a sharp luminance image is transmitted. The two chrominance (colour) images are transmitted in blurred form, which means that less information needs to be transmitted without a perceived loss of picture quality (Troscianko, 1987). The main consequence of this 'labour-saving' trick in the brain is that the optic nerve can contain relatively few neurons.

primary visual cortex a region at the back of the visual cortex to which the optic nerves project, and which carries out an initial analysis of the information conveyed by the optic nerves

The optic nerve conveys the action potentials generated by the retina to other parts of the brain, principally the *primary visual cortex*, also known as Area V1, where the

Figure 7.15

A postcard of the Thames Embankment from 1904, with the colour information added by hand-tinting. Close inspection reveals that the colour tint has been added in an imprecise manner. Modern colour TV uses the same principle, based on the idea that the human visual system processes colour information at a coarser scale than intensity information.

Pioneer

John Lythgoe (1937–92), a biologist at Bristol University, studied the relationship between the sense organs and visual apparatus of an animal, and between its surroundings and the tasks it has to perform within these surroundings. Lythgoe's main research was on fish living at different depths of water, since the depth of water affects the wavelength composition of daylight reaching that point. He found a marked relationship between where the fish lived and what their cones were like. His research founded a flourishing new research discipline called 'ecology of vision' with the publication of his book in 1979 (*The Ecology of Vision*).

information is then analysed and distributed further to other visual areas (see chapter 8).

How do we hear?

Since sound does not travel in straight lines, it is not important to have a particular sound receptor pointing in a unique direction in space in the way that photoreceptors do. This considerably simplifies the design of an ear (figure 7.16).

pinna the structure made of skin and cartilage on the outer part of the ear

eardrum a membrane between the outer and middle ear that vibrates when sound waves reach it

The outer part of the ear – the *pinna* – routes the sound waves in towards the passage leading to the *eardrum*. The incoming sound waves then set up mechanical vibrations of the eardrum, which is connected via a system of tiny bones to the oval window of an organ called the *cochlea*. These bones function like a gear-box, transforming the *amplitude* of the vibration to one which is useable by the cochlea.

The cochlea (so called because its structure resembles a snail's shell), shown in figure 7.16, contains a membrane stretched along its length. This is the basilar membrane, and all parts of it are attached to very delicate elongated cells, called *hair cells*. When a given part of the basilar membrane vibrates, a deformation occurs in the group of hair cells that are attached there. This deformation is the stimulus for the production of action potentials in the neuron attached to the hair cell. The neurons are bundled together and become part of the *acoustic nerve*, which transmits information to the *auditory cortex*.

cochlea coiled structure in the inner ear responsible for transforming mechanical vibration (sound energy) into action potentials in the acoustic nerve

amplitude the difference between the peaks and troughs of a waveform

hair cells long, thin cells in the cochlea and the vestibular system, which, when bent, produce an action potential

acoustic nerve conveys information from the cochlea to the auditory cortex

auditory cortex a region of the cortex devoted to processing information from the ears

Volume, pitch and timbre

Vibrations reaching the ear can differ in amplitude and frequency. Different frequencies cause the basilar membrane to vibrate in different places, stimulating different sub-populations of hair cells. For low frequencies, the site of maximal vibration lies further from the oval window of the cochlea than for high frequencies.

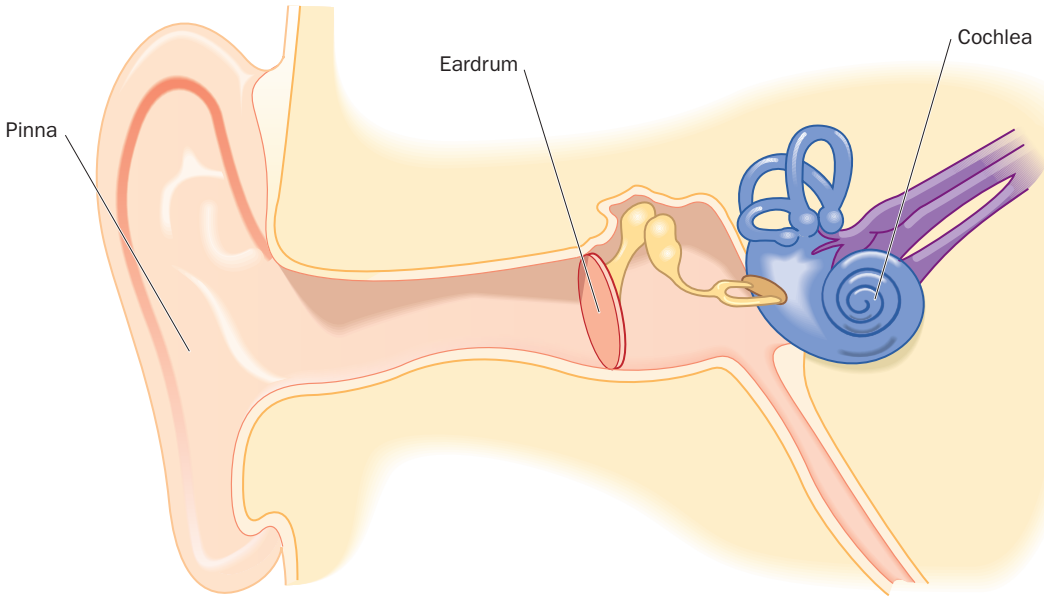


Figure 7.16

A diagram of the three parts of the ear. Source: www.iurc.montp.inserm.fr/cric/audition/english/ear/fear.htm

Everyday Psychology

Development, diagnosis and treatment of visual defects among infants

Imagine that you have recently become a proud parent. But a few months later you notice that your child is squinting in order to see. What can be done? Can psychology help?

Binocularity, the mechanism by which signals from two eyes interact, is a key feature of cortical organization. Binocular function among infants first appears between 12 and 17 weeks. Studies show that from this age onwards recordings of electrical brain activity can help us to understand the nature of the problem (see Braddick & Atkinson, 1983, for a review). When non-corresponding random dot patterns seen by the two eyes suddenly come into exact correspondence, an electrical signal can be detected from the surface of the scalp (an *evoked potential*; see chapter 3), indicating a brain response to a sensory event. These findings imply a form of selectivity: it appears that there are neurons that require a correlated input from both eyes for optimal activation to occur. In circumstances where binocularity does not develop properly, however, two abnormal conditions may arise: *amblyopia* and *strabismus*.

Amblyopia is a functional loss of visual performance, usually in one eye. Physiological studies in cats and monkeys (see Blakemore, 1978, for a review) demonstrate that if an animal has one eye covered in early life, or its image grossly blurred, that eye loses almost all connections to the visual cortex. Similarly, in humans, it appears that having a dense cataract clouding one eye produces the strongest form of human amblyopia. This might be explained in terms of a key adaptive function of the brain: nerve fibres carrying signals from the two eyes effectively compete for access to cortical neurons, the brain becoming more responsive to significant inputs at the expense of inactive ones. Essentially, if one eye is not frequently stimulated by visual input, it may become functionally disconnected from the brain.

Strabismus (squint) is a condition in which the two eyes become permanently misaligned. While both eyes retain their input to the visual cortex, the cortex lacks neurons that combine inputs from the two eyes. This suggests that to establish and maintain cortical connections requires not just activity but correlated activity that occurs when the two eyes are receiving the same stimulus (Atkinson & Braddick, 1989). If children with strabismus lack cortical neurons with binocular input, we would expect impairment in functions such as *stereopsis*. This has been confirmed in clinical and experimental studies.

stereopsis the ability to see objects three-dimensionally based on having two eyes that give us two slightly different views of those objects and their relative locations in space

But why does strabismus develop? Infants with the condition may intrinsically lack cortical neurons with binocular input. Most, however, initially have normal cortical binocularity. One explanation for why infants go on to develop strabismus is linked to hypermetropia (or hyperopia). This is a form of refractive error in which the eye, when relaxed, is focused beyond infinity, resulting in the blurring of objects at all distances. Children suffering from this disorder need to accommodate more rigorously than normal even for distant objects, but if the child has difficulty focusing with both eyes on one point, neurons that respond to binocular input may become inactive.

Fortunately, research on perception can be used to minimize abnormal visual conditions of this kind if there is early screening for vision. Hypermetropia in infancy has been found to have a high correlation with pre-school onset of both strabismus and amblyopia, and once hypermetropia is detected in infants they can be given prescription spectacles to reduce accommodation and thus prevent the development of strabismus in later childhood. Atkinson (1989) undertook a randomized controlled trial in which half the infants (aged between six and nine months) diagnosed with hypermetropia were offered a spectacle correction that brought their refraction close to the norm for their age group. Compared to a control group of uncorrected infants, the correction led to significantly better vision at three and a half years compared to the control group.

Atkinson, J., 1989, 'New tests of vision screening and assessment in infants and young children' in J.H. French, S. Harel and P. Casare (eds), *Child Neurology and Developmental Disabilities*. Baltimore: Brookes Publishing.

Pioneer

Georg von Bekesy (1899–1972) was a Hungarian physiologist working on hearing at Harvard University whose most famous discovery was that different parts of the basilar membrane in the cochlea are stimulated by different frequencies of sound. He won the Nobel Prize for medicine in 1961 for this type of work.

This is how the cochlea achieves *frequency selectivity*. Differences in the physical variable we refer to as sound frequency give rise to differences in the psychological attribute we refer to as *pitch*.

frequency selectivity the degree to which a system (e.g. a neuron) responds more to one frequency than another

The physical amplitude of the incoming wave translates into the sensation of loudness.

pitch auditory sensation associated with changes in frequency of the sound wave

This is encoded by a combination of (a) increased firing rate in auditory neurons and (b) a greater number of neurons firing. Finally, acoustic signals can vary in their complexity. The same note played on a piano and violin sound different, even though their fundamental frequencies are the same. This difference in sound quality gives rise to the sensation of *timbre*.

timbre the complexity of a sound wave, especially one emitted by a musical instrument, allowing us to distinguish the same note played on, say, a piano and a guitar

Of course, our auditory system did not evolve to hear musical instruments. More likely, it is there to make sense of complex signals occurring naturally in nature. Figure 7.17 shows how different sources of sound produce a different pattern of amplitude and frequency over time. These different patterns are recognized as different sounds – in the case of speech, as different *phonemes*. A phoneme is a speech sound, such as the 'sh' in 'rush'. The English language contains around 40 phonemes (Moore, 2003, p. 301). We can look more closely at the sounds in a word by plotting the relationship between the amplitude and frequency of the sound over time in a *spectrogram* – so called because it displays the spectrum of sound (figure 7.18).

phonemes basic building blocks of speech: English contains around 40 different phonemes

spectrogram a way of plotting the amplitude and frequency of a speech sound-wave as we speak individual phonemes

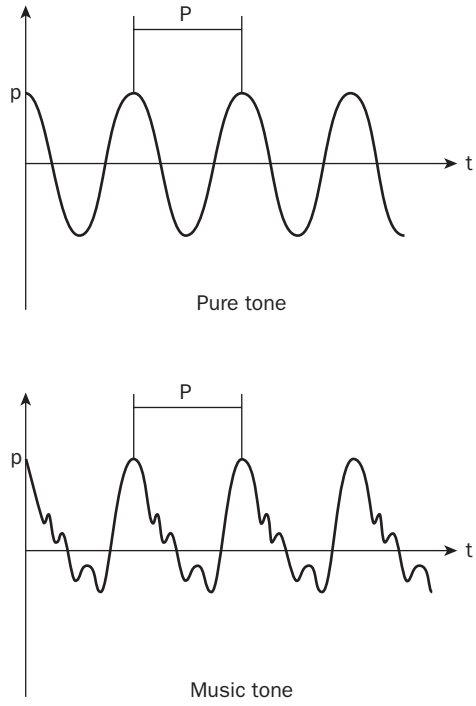


Figure 7.17

The upper diagram represents the waveform of a pure tone with period P (wavelength), which gives the pitch of the tone. p = air pressure at eardrum. The lower diagram shows the waveform produced by playing the same note (pitch) on a musical instrument – in this case, a violin. The period (wavelength) of the waveform is the same, hence the similarity in pitch. The extra complexity in the waveform gives the sound its timbre, which is what distinguishes the same note played on (say) a violin and a trumpet.

Deducing sound direction

Although sound is less directional than light, information about direction can be deduced from sound. The role of the pinna

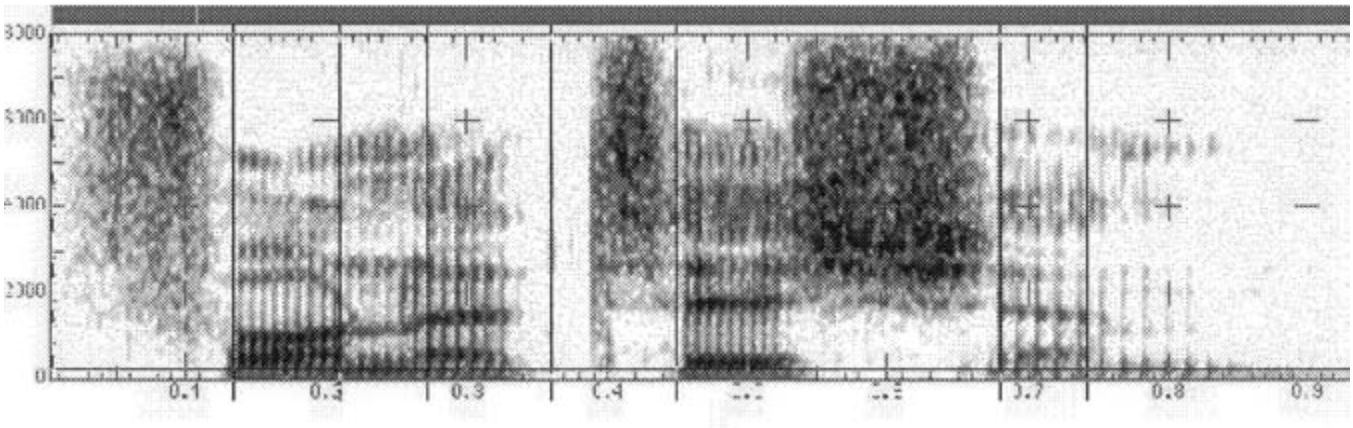


Figure 7.18

The spectrogram of the word 'phonetician', showing the individual phonemes along the x-axis and the frequencies in Hz along the y-axis. The darker the blob, the more of the frequency is present. So, for example, the 'f' sound has a much broader spectrum of frequencies than the 'o' sound – which is why the 'f' sound is more like the sound of a waterfall (noise which contains all frequencies is called 'white noise'). Each phoneme has a different frequency composition, and also varies across time. Source: www.ling.lu.se/research/speechtutorial/tutorial.html

seems to be to route the sound towards the eardrum, but they also produce small echoes, which allow us to distinguish something that is high up above us from something that is below us.

Horizontal information is given by comparing signals from the two ears. For low frequencies (up to about 1000 Hz) the time of arrival of each peak of the sound vibration contains this information. A sound wave coming from the right will reach our right ear about 1 ms before it reaches our left ear, and this 1 ms difference is detected by the auditory system. For higher frequencies, where there are too many wave crests per second for a 1 ms difference to be meaningful, it is the amplitude of the sound that matters. A source to our right will project a higher amplitude to the right ear than to the left ear, since the head attenuates sound (in other words, sound reduces in amplitude as it passes through the head by being partially absorbed). This, too, provides directional information.

Tasting and smelling

We know that information travels to our chemical senses (taste and smell) much more slowly and lingers after the stimulus has gone. Simple logic will therefore suggest that the time-course of the transduction is less critical than for hearing and vision.

A matter of taste

Gustation (taste) is relatively simple in that it encodes only five dimensions of the stimulus: sourness, sweetness, saltiness, bitterness, and 'umami', which is a taste similar to monosodium glutamate. The receptors for taste – our taste buds – are on the surface of the tongue.

Figure 7.19 shows a microscope image of mammalian taste buds. Different types of chemical molecules interact differently with the taste buds specialized for the five different taste sensations. Salty sensations arise from molecules that ionize (separate into charged ions) when they dissolve in the saliva. Bitter and sweet sensations arise from large non-ionizing molecules. Sour tastes are produced by acids, which ionize to give a positively charged hydrogen ion. The umami taste is produced by specific salts such as monosodium glutamate.

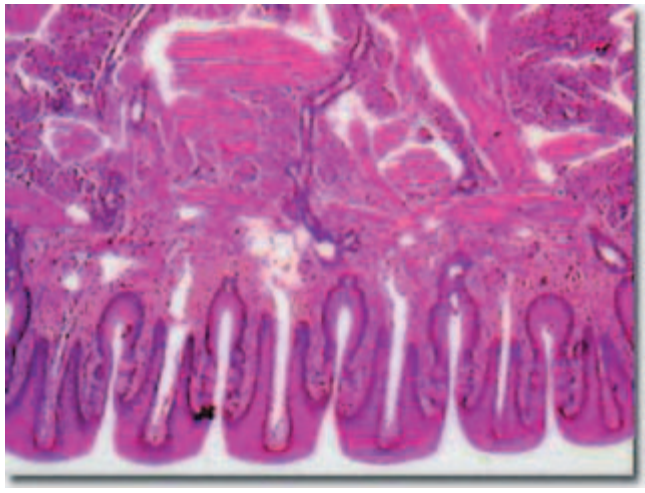


Figure 7.19

Taste buds on the mammalian tongue.

The mystery of smell

Olfaction (smell), on the other hand, is shrouded in mystery (figure 7.20 shows the olfactory system). We do not understand much about how the receptors in the nose respond to different trigger molecules carried in the air that we breathe. It seems a fair assumption that these airborne molecules interact with specific receptors to elicit certain sensations. Unlike the other senses, there is a vast array of receptor types, possibly up to 1000 (see Axel, 1995).

Subjectively, it seems that smell elicits certain memories and is notoriously hard to describe verbally. The flavour of a food

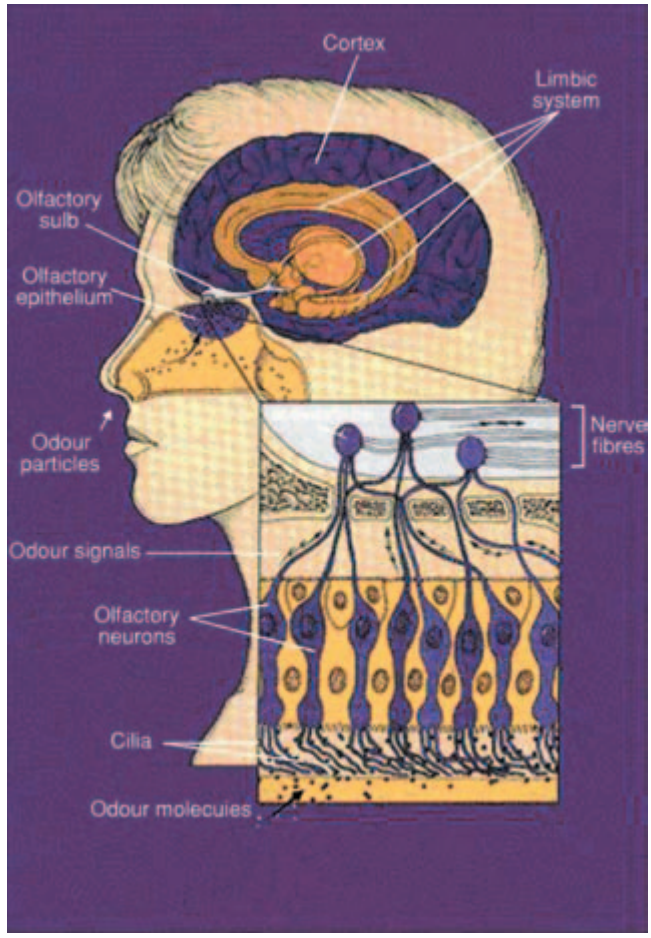


Figure 7.20

The human olfactory system. Molecules containing those chemical substances that produce the sense of odour interact with cilia in the olfactory epithelium. Source: www.sfn.org/content/Publications/BrainBriefings/smell.html

is conveyed by a combination of its smell and taste. Flavours are described by a complex set of references to substances that possess elements of these flavours. For example, wine experts talk about the 'nose' of a wine, meaning its smell; the early taste sensation is the 'palate', and the late taste sensation is the 'finish'. The tasting terminology is esoteric and has a poetic quality, with words like 'angular', 'lush', and 'rustic'.

Invisible forces and phantom limbs

The somatosenses, which detect things like pressure, vibration and temperature, are normally grouped into the skin senses, the internal senses and the vestibular senses. It is important for us to know which way up we are, and how we are moving (especially how we are accelerating). This is achieved by a part of the inner ear called the semicircular canals, which contain small lumps immersed in a viscous fluid. When we move, these lumps move within the fluid. The lumps are in contact with hair cells (like those in the cochlea), and the motion of the lumps in the fluid bends the hair cells and results in neural messages, which are relayed to the vestibular nuclei in the brainstem (see chapter 3).

vestibular system located in the inner ear, this responds to acceleration and allows us to maintain body posture

This type of sense is referred to as the *vestibular system*, and without it we could not walk without staggering. You can see impairment of this system in someone who has consumed too much alcohol. Motion sickness and dizziness are associated with unusual output from the vestibular system.

In the skin senses, the transducers are nerve endings located around the surface of the body. There are also inner senses that tell us, for example, about muscle tension and joint position, which have detectors distributed in all the muscles and joints of the body. These work together with our vestibular system to coordinate our movements and maintain balance and posture.

Many people who have had limb amputations report that they still feel that they have the amputated limb, and often say that this 'phantom limb' is causing them great pain. Research by Ramachandran and Blakesee (1999) on patients who have such feelings shows that the representation of touch by neurons in the brain can be changed, resulting in a remapping of the body's tactile representation of itself. So, for example, touching the cheek of a patient elicited an apparent sensation in the phantom thumb.

The 'motor homunculus' (see chapter 3) shows the sensory representations of different parts of the body in the cortex. The proximity of the representations of the different parts of the body in this mapping, and the remapping of neurons within this after a limb amputation, is the probable reason for these remarkable effects.

Research close-up 2

Are faces special?

The research issue

Prosopagnosia is the inability to identify familiar faces. This disorder occurs rarely as an isolated deficit, but when it does it can help us to understand whether there is a specific region of the brain devoted to the processing and identification of familiar faces.

Prosopagnosia has previously been associated with damage to the medial occipito-temporal region of the brain, especially on the right. But in brain-damaged patients it is almost impossible to locate the precise site of damage accurately. There is also a question mark over whether we can necessarily infer the functioning of any part of a complex system from the effects of damaging or removing (i.e. in surgical cases) that part. (This last point is very important conceptually and applies to the types of inferences that we can validly make in any case of brain injury; for example, it also applies to patient M.P. referred to in *Research close-up 1*.)

Fortunately, in recent years it has been possible to investigate the brain regions involved in prosopagnosia in another way: by using functional brain imaging (see chapter 3) to study neural activity in the brains of prosopagnosic patients when they are shown familiar faces and are asked to identify them. We can also compare how the brains of prosopagnosic patients become activated relative to the brains of non-prosopagnosic individuals who are given the same familiar face identification task.

Using this approach, functional imaging has revealed a focal region in the right fusiform gyrus activated specifically during face perception.

Because no investigative technique is perfect, and we want to be absolutely certain that we have identified the correct brain region, we can give similar tasks to patients with brain damage in the fusiform gyrus.

Design and procedure

This study attempted to determine whether lesions of the fusiform gyrus are associated with deficits in face perception in patients with prosopagnosia.

Five patients with prosopagnosia due to acquired brain injury were tested. The patients were asked to discriminate faces in which the spatial configuration of the facial features had been altered. Face stimuli in the study differed quantitatively with respect to vertical mouth position and distance between the eyes.

Results and implications

The findings of the study revealed:

1. that all four patients whose lesions included the right fusiform face area were severely impaired in discriminating changes in the spatial position of facial features;
2. the fifth patient who manifested more anterior bilateral lesions was normal in this perceptual ability; and
3. when participants knew that only changes in mouth position would be shown, face processing performance improved markedly in two of the four patients who were impaired in the initial test.

Finding (1) indicates that perception of facial configuration is impaired in patients with prosopagnosia whose lesions involve the right fusiform gyrus. Finding (2) indicates that this impairment does not occur with more anterior bilateral lesions, while finding (3) indicates that this impairment is especially manifested when attention has to be distributed across numerous facial elements.

The researchers concluded that the loss of ability to perceive this type of facial configuration may contribute to the identification deficits that occur in some forms of prosopagnosia. It might also be possible for the findings to be employed in developing techniques for prosopagnosic patients to identify faces more efficiently, for example by encouraging them to focus their attention on individual facial features.

Note also that the findings of this study are consistent with a study conducted by Hadjikhani and de Gelder (2003). They found, using functional neuroimaging techniques, that patients suffering from prosopagnosia showed no activation of the fusiform gyrus when viewing faces compared to normal controls.

Barton, J.J.S., Press, D.Z., Keenan, J.P., & O'Connor, M., 2002, 'Lesions of the fusiform face area impair perception of facial configuration in prosopagnosia', *Neurology*, 58, 71–8.

FINAL THOUGHTS

We have explored the nature of the information in the outside world, and the methods by which this can be transduced to neural messages by sense organs.

It remains to ask precisely what 'sensation' is and how it differs from 'perception'. In this chapter, there has been no talk of object recognition, of knowing how far away something is, or of knowing what shape it is. These are all examples of perception, which will be dealt with in the next chapter. Sensation refers to a process that occurs earlier in the stream of processing and works out general descriptions of stimuli in terms of features such as brightness, colour, loudness, smell, and so on. These features have nothing to do with a particular object, but can be used to describe any object. This seems to be the goal of early sensory processing – to reduce the incoming stream of information to a code, a set of descriptors or features, which can describe any stimulus in a way that can then drive higher-level processes such as recognition.

Summary

- There are different types of physical energy, which convey various types of information about the external and the internal world. Different forms of energy require different types of apparatus to detect them.
- Light information is instantaneous, works over large distances, gives highly precise directional information, and can tell us about properties of distant objects.
- There are good reasons why certain animals have vision that responds in the ultra-violet and infra-red light.
- Information from retinal cones in humans is processed in a manner that describes each point in the scene in terms of its colour and relative intensity.
- Sound information travels in lines that are not straight, so we cannot use it to determine locations in space as well as we can with light.
- Sound travels less quickly than light, so its time-of-arrival information can tell us about the direction of the sound source and also the locations of reflecting surfaces around us.
- We can produce sound both by tapping the ground with sticks and, even more importantly, by using our in-built speech production system. This makes sound the medium of choice for complex interpersonal communication.
- Sound information is analysed, at the moment of transduction, into frequency and amplitude components, and these give rise to the sensations of pitch and loudness. More complex sounds are analysed on this scheme as well, allowing the possibility of analysing speech and other complex signals.

REVISION QUESTIONS

1. Why do you think there are problems with asking people to describe their subjective experiences? Might it be difficult to interpret such data?
2. How does information conveyed by light differ from that conveyed by sound? For which tasks are these different kinds of information useful?
3. Why are humans unable to see infra-red and ultra-violet radiation? What animals respond to these types of radiation?
4. How does the sensation of colour arise from the cone responses to light of a given wavelength composition? What tasks are made much easier by having colour vision?
5. How does the human auditory system transpose sound energy into an internal representation? How does speech get analysed by this system?
6. Why do we have senses other than vision and hearing? What are their properties, and what happens when these senses malfunction?

Further Reading

Bruce, V., Green, P.R., & Georgeson, M. (2003). *Visual Perception: Physiology, Psychology and Ecology*. 4th edn. Hove: Psychology Press.
A detailed and up-to-date account of research on visual perception, with an emphasis on the functional context of vision.

Gazzaniga, M., Ivry, R.B., & Mangun, G.R. (2002). *Cognitive Neuroscience: The Biology of the Mind*. 2nd edn. New York: Norton.
Excellent textbook dealing with the material covered here in greater detail.

Gregory, R.L. (1997). *Eye and Brain: The Psychology of Seeing*. 5th edn. Oxford: Oxford University Press.
A very readable account of visual perception.

Moore, B.C.J. (2003). *An Introduction to the Psychology of Hearing*. 5th edn. London: Academic Press.
An excellent textbook on hearing.

Sekuler, R., & Blake, R. (2001). *Perception*. 4th edn. New York: McGraw-Hill.
A textbook which deals with all the senses covered in this chapter.

Contributing author:
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Perception

8

CHAPTER OUTLINE

LEARNING OBJECTIVES

INTRODUCTION

PERCEPTION AND ILLUSION

- When seeing goes wrong
- Theories of perception
- Spotting the cat in the grass
- Explaining after-effects

MAKING SENSE OF THE WORLD

- Grouping and segmentation
- Visual search – or finding the car
- How do we know what we see?
- Seeing without knowing

SEEING WHAT WE KNOW

- Perception or hallucination?
- Resolving visual ambiguity
- Tricks of the light
- Non-visual knowledge and perceptual set

PERCEPTUAL LEARNING

- How training influences performance
- Top-down mechanisms

FINAL THOUGHTS

SUMMARY

REVISION QUESTIONS

FURTHER READING

Learning Objectives

By the end of this chapter you should appreciate that:

- the efficiency of our perceptual mechanisms is acquired over many years of individual learning experience;
- as perceptual knowledge grows and accumulates, it enables ever more efficient interpretation of the stimuli that impinge upon our sensory receptors;
- our almost effortless ability to perceive the world around us is achieved by a number of inter-connected regions in the brain;
- corresponding to these anatomical connections, there are continual interactions between conceptually driven processes and the current sensory inflow from the environment;
- usually this two-way interaction improves the operation of the system, but sometimes this is not the case, and illusions occur;
- the study of illusions and the effects of brain injury provide valuable information about the mechanisms of perception;
- there is an important interaction between psychological and biological studies of perception.

INTRODUCTION

Which is the harder of these two problems?

1. Work out the square root of 2018 in your head.
2. As you walk past your neighbour's garden, decide whether the cat in the long grass is moving or not.

For most people, the answer is the square root problem. Indeed, the second problem does not seem like a problem at all. We usually make such judgements effortlessly every day without thinking about them. But when it comes to saying *how* we might solve the problems, the order of difficulty probably reverses.

Think of a number smaller than 2018 and multiply it by itself. If the answer is greater than 2018, choose a smaller number and try again. If this answer is smaller than 2018, choose a larger number (but smaller than the initial number you thought of), and so on. It is possible to program a computer to find the square root of any number by following rules like this.

The goal of people who study perception is to discover the rules that the brain uses to solve problems like that demonstrated by the 'cat in the garden' example. Although we have made some progress towards this goal, it is much easier to program a machine to find a square root than to program it to see. Perhaps one third of the human brain is devoted to seeing, which not only demonstrates that it must be difficult, but also perhaps explains why it seems to be so easy.

PERCEPTION AND ILLUSION

When seeing goes wrong

One way of uncovering the processes of seeing is to look at the circumstances in which they go wrong. For example, returning to the 'cat in the garden' problem, suppose that, when you were walking past your neighbour's garden, you were on your way to the station. When you arrived, you boarded your train, then you waited, and waited . . . At last you sighed with relief as the train started to move . . . but then the back of the train on the adjacent track went past your carriage window and you saw the motionless platform opposite. Your train had not moved at all, but your brain had interpreted the movement of the other train – incorrectly – as caused by your own movement, not that of the object in the world.

Why are we fooled?

How does your brain decide what is moving in the world and what is not? What can we discover from the train experience about how seeing works?

As we look at a scene full of stationary objects, an image is formed on the retina at the back of each eye (see chapter 7). If we move our eyes, the image shifts across each retina. Note that all parts of the image move at the same velocity in the same direction. Similarly, as we look through the window of a moving train, but keep our eyes still, the same thing happens: our entire field of view through the window is filled with objects moving at a similar direction and velocity (though the latter varies with their relative distance from the train).

In the first case, the brain subtracts the movements of the eyes (which it knows about, because it caused them) from the motion in the retinal image to give the perception of its owner being stationary in a stationary world. In the second scenario, the eyes have not moved, but there is motion in the retinal image. Because of the coherence of the scene (i.e. images of objects at the same distance moving at the same velocity), the brain (correctly) attributes this to movement of itself, not to that of the rest of the world.

To return to the situation in which we may be fooled by the movement of the other train into thinking that our train is moving – notice that, although the visual information produced by the two situations (your train stationary, other train moving, or vice versa) is identical, other sensory information is not. In principle, the vestibular system can signal self-motion as your train moves. However, slow acceleration produces only a weak vestibular signal, and this (or its absence, as in the present case, if we are in fact stationary) can often be dominated by strong visual signals.

Of course, objects in the world are not always stationary. But objects that do not fill the entire visual field cause patterns of movement which are piecemeal, fractured and unpredictable. One object may move to the right, another to the left, and so on, or one object may move to partially obscure another. So lack of coherence in the pattern of motion on the retina suggests the motion of objects, instead of (or as well as) motion of the observer.

Think back to what happened as you were walking past your neighbour's garden. The patterns of movement in the retinal images caused by the movements of your body and your eyes were mostly coherent. The exceptions were caused by the movements of the long grasses in the breeze and the tiny movements of the cat as it stalked a bird, which were superimposed on the coherent movements caused by your own motion.

The visual system needs to detect discrepancies in the pattern of retinal motion and alert its owner to them, because these discrepancies may signal vital information such as the presence of potential mates, prey or predators (as in the case of the cat and the bird). Indeed, when the discrepancies are small, the visual system exaggerates them to reflect their relative importance.

Contrast illusions and after-effects

Some further examples of perceptual phenomena that result from this process of exaggeration are shown in the *Everyday Psychology* box. These are known collectively as simultaneous contrast illusions. In each case the central regions of the stimuli are identical, but their surrounds differ. Panel *A* (figure 8.1) lets you experience the simultaneous tilt illusion, in which vertical stripes appear tilted away from the tilt of their surrounding stripes. Panel *B* shows the luminance illusion: a grey patch appears lighter when surrounded by a dark area than when surrounded by a light area. Panel *C* shows the same effect for colour: a purple patch appears slightly closer to blue when surrounded by red, and closer to red when seen against a blue background. There is also an exactly analogous effect for motion, as well as for other visual dimensions such as size and depth.

Suppose your train finally started and travelled for some time at high speed while you gazed fixedly out of the window. You may have noticed another movement-related effect when your train stopped again at the next station. Although the train, you, and the station platform were not physically moving with respect to each other, the platform may have appeared to drift slowly in the direction in which you had been travelling.

This is another case of being deceived by the mechanisms in our nervous systems. This time what is being exaggerated is the difference between the previously continuous motion of the retinal image (produced by the train's motion) and the present lack of motion (produced by the current scene of a stationary platform), to make it appear that the latter is moving. Such effects are known as successive contrast illusions, because visual mechanisms are exaggerating the difference between stimuli presented at different times in succession (compared with simultaneous contrast illusions, in which the stimulus features are present at the same time).

A famous example of this effect is the 'waterfall illusion', which has been known since antiquity, although the first reliable description was not given until 1834 (by Robert Addams: see Mather et al., 1998). If you gaze at a rock near a waterfall for 30–60 seconds and then transfer your gaze to a point on the banks of the waterfall, you will notice a dramatic upward movement of the

after-effect change in the perception of a sensory quality (e.g. colour, loudness, warmth) following a period of stimulation, indicating that selective adaptation has occurred

banks, which lasts for several seconds before they return to their normal stationary appearance. Because the first stimulus induces an alteration in the subsequently viewed stimulus, this and other similar illusions are often known as *after-effects*.

Several further examples of successive contrast are given in the *Everyday Psychology* section of this chapter. In each case the adapting field is shown in the left-hand column and the test field is shown on the right. Now look at figure 8.2. Panel *A* lets you experience the tilt after-effect, in which vertical stripes appear tilted clockwise after staring at anti-clockwise tilted stripes, and vice versa. Panel *B* offers the luminance after-effect: after staring at a dark patch, a grey patch appears lighter, and after staring at a white patch the grey patch appears darker. Panel *C* shows the colour after-effect: after staring at a red patch a yellow patch appears yellow-green, and after staring at a green patch a yellow patch appears orange.

Like the simultaneous contrast illusions, these after-effects demonstrate that the visual system makes a comparison between stimuli when calculating the characteristics of any stimulus feature.

These illusions are not just for fun, though. They also give us vital clues as to how we see, hear, touch, smell and taste under normal circumstances. Indeed, there are three general theories about how we perceive, and these illusions help us to decide between them.

Everyday Psychology

Illusions and after-effects

In everyday life you may encounter visual illusions and after-effects that you are unaware of. Although we rarely encounter these illusions and after-effects in their pure form, they are important components of our world and our visual experience of it. They also help us to understand how we see, hear, touch, smell and taste under normal circumstances.

The central parts of figure 8.1 are identical in each panel.

A The tilt illusion: both central circles are filled with vertical stripes, but they appear tilted in the opposite direction to the stripes in the surrounding regions.
B The luminance contrast effect: both central squares are of identical physical luminance, but the one on the lighter background appears darker than the other.
C A colour illusion: both central panels are the same shade of purple, but the one on the red background appears bluer than the other.

You have probably experienced these contrast phenomena unconsciously in your everyday life, where the perception of an object is influenced by its surroundings. In these examples you become conscious of these contrast effects because they are presented to you simultaneously – you cannot 'ignore' them!

In each panel in figure 8.2, the right-hand pair of stimuli is the test field and the left-hand pair is the adapting field. Before adapting, gaze at the central black dot between the upper and lower stimuli in each test pair and note that the latter appear identical. Then adapt by gazing at the spot (or in *A* by running your eyes slowly back and forward over the horizontal bar) between the upper and lower adapting stimuli. After about 30 seconds, switch your gaze back to the spot between the two test stimuli, and note any difference in their appearance.

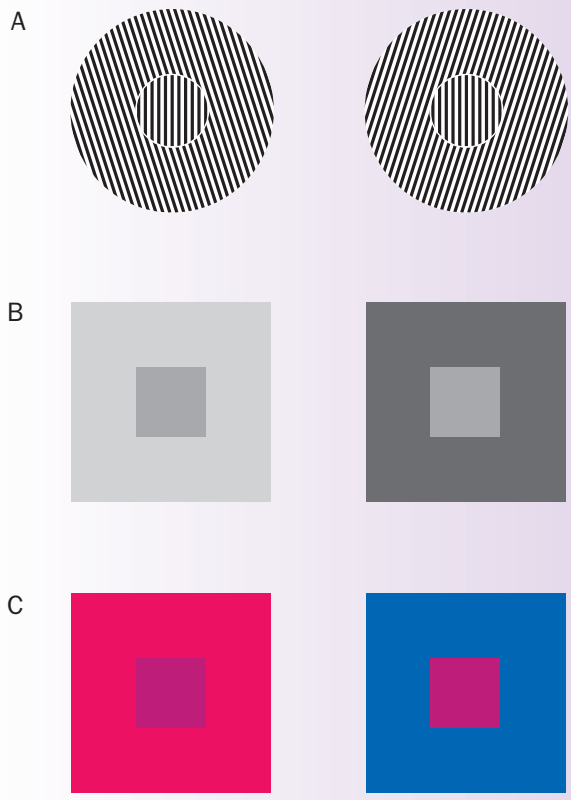


Figure 8.1
Simultaneous contrast illusions.

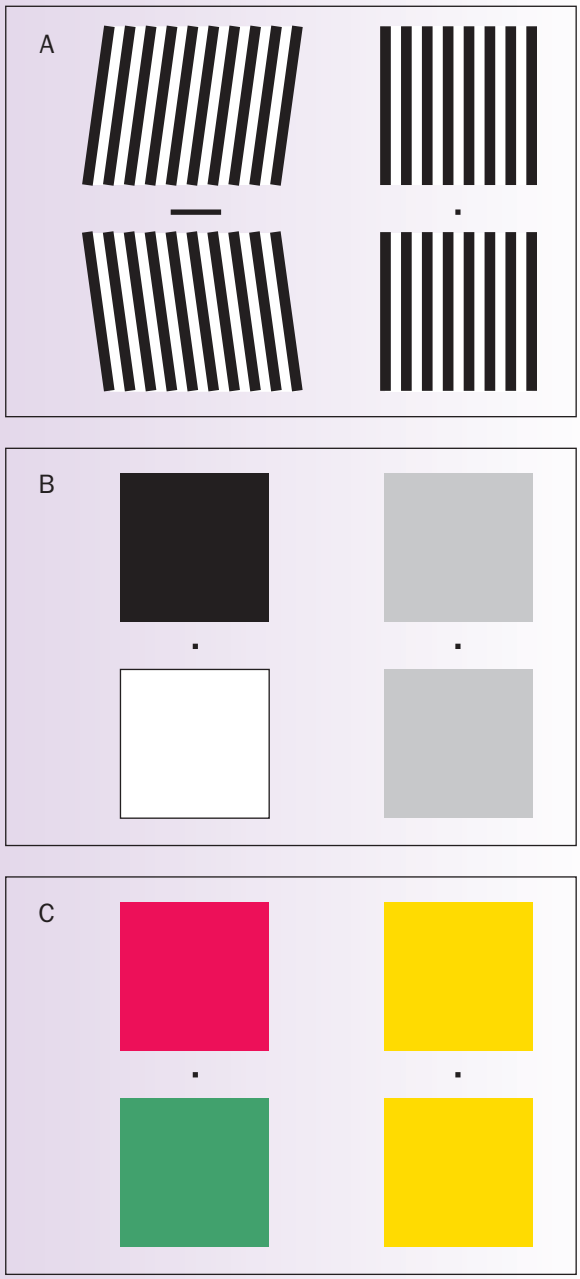


Figure 8.2

After-effects.

A The tilt after-effect: after adapting to clockwise stripes (upper stimulus), vertical stripes appear tilted anti-clockwise, and after adapting to anti-clockwise stripes (lower stimulus), vertical stripes appear tilted clockwise.

B The luminance after-effect (after-image): after adapting to a dark patch (upper stimulus), a mid-grey patch appears lighter, and after adapting to a white patch (lower stimulus), the similar grey patch now appears darker.

C The colour after-effect (coloured after-image): after adapting to a red patch (upper stimulus), a yellow patch appears tinged with green, and after adapting to a green patch (lower stimulus), a yellow patch appears orange. (Hint: try looking at a blank white area too, or the right pair of stimuli in panel *B*!)

How might we explain the tilt after-effect? Most psychologists working in this field assume that different orientations of visual stimuli are coded by visual channels with overlapping sensitivities ('tuning curves'), and that perceived orientation is coded by a combination of the outputs of these channels (see figure 8.3).

Vertical test stimuli arouse activity in three channels, whose distribution is symmetrical about the central one of those three. A stimulus tilted 5 degrees anti-clockwise generates an asymmetrical distribution. Prolonged exposure to a +20 degree tilted stimulus leads to a graded reduction in the sensitivities of the three channels that respond to it. So the channel whose preferred orientation is +20 degrees shows the greatest reduction in sensitivity, and the channels preferring 0 and +40 degrees show an equal but smaller reduction.

Because the graded reduction in channel sensitivity is not symmetrical around vertical, the vertical stimulus now evokes a pattern of activity that is asymmetrical about vertical. In this case, the pattern is identical to that caused by stimuli tilted 5 degrees anti-clockwise in normal visual systems.

So, combining the channel activities after adaptation creates a misperception of the stimulus' true orientation. Vertical lines therefore appear to be tilted 5 degrees anti-clockwise – i.e. in the opposite direction to that of the adapting stimulus.

Gregory, R.L., 1997, *Eye and Brain: The Psychology of Seeing*, 5th edn, Oxford: Oxford University Press.

Theories of perception

The serial model

It is natural to assume that sensory processing proceeds through a series of stages. Obviously, the sense organs first transduce the stimulus (convert it from one form of energy to another – see chapter 7). In the case of vision, further processing then occurs in the retina before the results of the analysis are sent up the optic nerve, to the thalamus, and then to the primary visual cortex. In other sensory modalities, the signals pass to their own 'primary' sensory areas of cerebral cortex for interpretation (see chapters 3 and 7).

serial model the assumption that perception takes place in a series of discrete stages, and that information passes from one stage to the next in one direction only

parallel processing perceptual processing in which it is assumed that different aspects of perception occur simultaneously and independently (e.g. the processing of colour by one set of neural mechanisms at the same time as luminance is being processed by another set)

recurrent processing occurs when the later stages of sensory processing influence the earlier stages (top-down), as the output of a processing operation is fed back into the processing mechanism itself to alter how that mechanism subsequently processes its next input

For all sensory modalities, there are then several further stages of processing which occur within the cortex itself. Indeed, as much as one half of the cortex is involved purely in perceptual analysis (mostly in vision). At each stage, further work takes place to analyse what is happening in the environment. Because several such steps are involved, this way of understanding perception as a sequence of processes is known as the *serial model*.

But the serial model is now known to be inadequate, or at least incomplete. So it has been replaced, or at least modified, firstly by the *parallel processing* model and then, most recently, by the *recurrent processing* model.

The parallel processing model

According to the parallel processing model, analysis of different stimulus attributes, such as identity and location, proceeds simultaneously along different pathways, even from the earliest stages. For example, the fact that there are cones (of three types, maximally sensitive to different wavelengths of light) and rods in the retina (see chapter 7) is evidence for multiple mechanisms that extract information in parallel from the retinal image.

The recurrent processing model

The recurrent model emphasizes that the effects of a stimulus on the higher centres of the brain not only influence our subjective perception but also feed back down to modulate the 'early' stages of processing. 'Higher' stages of processing are taken to be those that exist anatomically further away from the sensory receptors, and are also those with more 'cognitive' as opposed to primarily 'sensory' functions, i.e. where learning, memory and thinking enter into the processing. As we shall see, a substantial amount of evidence has now accumulated indicating that the influence of these higher functions can be seen at almost all stages of sensory analysis, thereby casting serious doubt on the existence of sharp divisions between serial stages of sensation, perception and cognition. First, however, let us look at evidence for the parallel processing model.

SPOTTING THE CAT IN THE GRASS

Selective adaptation

An important early stage of vision is finding out which bits of the retinal image correspond to what kinds of physical thing 'out there' in the world. Our visual system first needs to discover the locations of objects, their colours, movements, shapes, and so on. This process can be demonstrated by the technique of selective *adaptation*.

adaptation decline in the response of a sensory or perceptual system that occurs if the stimulus remains constant

Whenever we enter a new environment, our sensory systems adjust their properties quite rapidly (over the course of a few seconds), optimizing their ability to detect any small change away from the steady background conditions. This is because interesting and important stimuli are usually ones that deviate suddenly in some way from the background (such as a tiger jumping out from behind a tree). Remember the cat in the grass: its tiny movements had to be extracted from the pattern of coherent movement on the retina produced by your movements as you walked past.

By staring at something for a time (selective adaptation), we produce an unchanging pattern of stimulation on one region of the retina, and the visual system starts to treat this as the steady background, and lowers its sensitivity to it. When we stop staring at this same location, it takes a while for our vision to return to normal, and we can notice during this period of compensation that the world looks different. These differences represent the after-effects of adaptation.

This whole process of adaptation is described as selective because only some perceptual properties are affected. The adaptations are restricted to stimuli similar to the one that has been stared at.

Many kinds of visual after-effect have been discovered (as we can see in Everyday Psychology). These clear and robust phenomena are not confined to vision, but are found in touch, taste, smell and hearing also. For example:

1. After running your fingers over fine sandpaper, medium sandpaper feels coarser (and vice versa).
2. After listening to a high tone for a while, a medium tone appears lower.
3. Musicians often build their music to a loud and cacophonous crescendo just before a sudden transition to a slow, quiet passage, which then seems even more mellow and tranquil than it otherwise would.
4. Holding your hand under running cold (or hot) water before testing the temperature of baby's bath water will lead you to misperceive how comfortable the water will be for the baby. This is why you are always advised to test the temperature with your elbow.
5. After eating chocolate, orange juice tastes more tart.
6. When we enter a dark room, it takes a few minutes for our receptors to adapt, and we begin to notice things that had been simply too faint to activate those receptors at first.

Explaining after-effects

It can be helpful to think of an object (or visual stimulus) as having a single value along each of several property dimensions. For example, a line's orientation could be anywhere between −90 and +90 degrees with respect to vertical. And an object's colour could be anywhere between violet (shortest visible wavelength) and red (longest visible wavelength).

The general rule that describes perceptual after-effects is that adapting to some value along a particular dimension (say +20 degrees from vertical) makes a different value (say 0 degrees) appear even more different (say −5 degrees). For this reason, these phenomena are sometimes called negative after-effects. The after-effect is in the opposite direction (along the stimulus dimension) away from the adapting stimulus, rather than moving the perceived value towards that of the adapting stimulus.

What do these effects tell us about how perceptual systems encode information about the environment?

The existence and properties of channels

One implication of after-effects is that different features, or dimensions, of a stimulus are dealt with separately. Each dimension is, in turn, coded by a number of separate mechanisms, often called *channels*, which respond selectively to stimuli of different values along that particular dimension. Each channel responds in a graded fashion to a small range of neighbouring values of the stimulus dimension. So several channels respond to any given stimulus, but to differing extents. The channel that most closely processes (i.e. is most selective for) the stimulus will give the greatest output, channels selective for nearby stimuli will give a lesser output, and so on. For example, different channels may selectively code for different angles of orientation of visual stimuli, from horizontal round to vertical.

channel transmits a restricted range of sensory information (e.g. in the case of colour, information about a restricted range of wavelengths, but no information about the movement or orientation of the stimulus)

This enables us to give a simple explanation of after-effects, illustrated in this chapter using the tilt after-effect (Blakemore, 1973). Perception depends not on the output of any single channel, but on a combination of the outputs of all the active channels (see chapter 7 for a related discussion). This is because a given level of activity in any single channel might be caused by a weak (say, low contrast) stimulus of its optimal type (such as a vertical line for a channel that responds best to vertical lines) or an intense (high contrast) stimulus away from the optimal (such as a line tilted 20 degrees). So the output of a single channel on its own is ambiguous.

For the sake of simplicity, we will look at the relationship between just five channels (see figure 8.3), although in practice there are many more. In panel *A*, each bell shaped curve ('tuning curve') represents the activity in one channel produced by lines of different orientations. One channel responds most strongly to vertical lines (the channel whose tuning curve is centred on 0 degrees), and progressively less strongly to stimuli further and further from that optimal orientation of line (either clockwise or anti-clockwise). Another channel has the same degree of selectivity but responds best to lines tilted to the right by 20 degrees. A third channel is similar but 'prefers' (or is 'tuned' to) tilt in the opposite direction from vertical (−20 degrees). The orientations over which these latter two channels respond overlap, so they respond weakly but equally to zero tilt (vertical stimuli), as shown in panel *B*. Finally, we include two outermost channels, which respond best to 40 degrees (+40 deg) clockwise and 40 degrees anti-clockwise (−40 deg.). These two channels do not respond at all to vertical lines. This system of channels can signal orientations which do not correspond to the preferred orientation of any single channel. Panel *C* shows the pattern of activation produced by a line tilted 5 degrees anticlockwise. Compared with activity produced by a vertical line, activity in the −20 degree channel has increased and that in the other two channels has decreased.

How is the information from all these channels combined when a visual stimulus is presented? There is likely to be a process that combines the activities across all channels, weighted according to the level of activity in each channel. Such a process finds the 'centre of gravity' of the distribution of activity. The centre of gravity (in statistical terms, the weighted mean) corresponds to the perceived orientation of the stimulus.

The tilt after-effect

During prolonged stimulation, the activity in the stimulated channels falls – in other words, channels 'adapt'. This fall is proportional to the amount of activity, so adaptation is greatest in the most active channels. After the stimulus is removed, recovery occurs slowly. We can see the effects of adaptation by presenting test, or 'probe', stimuli in the period shortly after the adapting stimulus has been removed. For example, think back to the waterfall illusion: when you gaze at a waterfall and then transfer your gaze to a point on the banks of the waterfall, you notice an apparent dramatic upward movement of the banks.

So we can explain the tilt after-effect as follows. Initially, all channels have equal sensitivity (as in panel *A*, figure 8.3). During presentation of a vertical stimulus, the distribution of active channels is symmetrical about zero, so the perceived orientation corresponds to the actual stimulus orientation – i.e. vertical (panel *B*, figure 8.3). A stimulus that falls between the optimal values of two channels is also seen veridically (that is, true to its actual orientation) by taking the centre of gravity of the activity pattern; this is how we see, for example, a small degree of tilt away from vertical (panel *C*, figure 8.3). With stimuli tilted 20 degrees clockwise, the active channels are also symmetrically distributed and have a centre of gravity at 20 degrees, so perception is again veridical (panel *D*, figure 8.3).

But during a prolonged presentation of such a stimulus (for, say, 60 seconds), the 20 degree channel adapts and its sensitivity declines. The reduction in each channel's sensitivity is proportional to the amount that it is excited by the stimulus, so the 0 degree and 40 degree channels are also adapted and have become

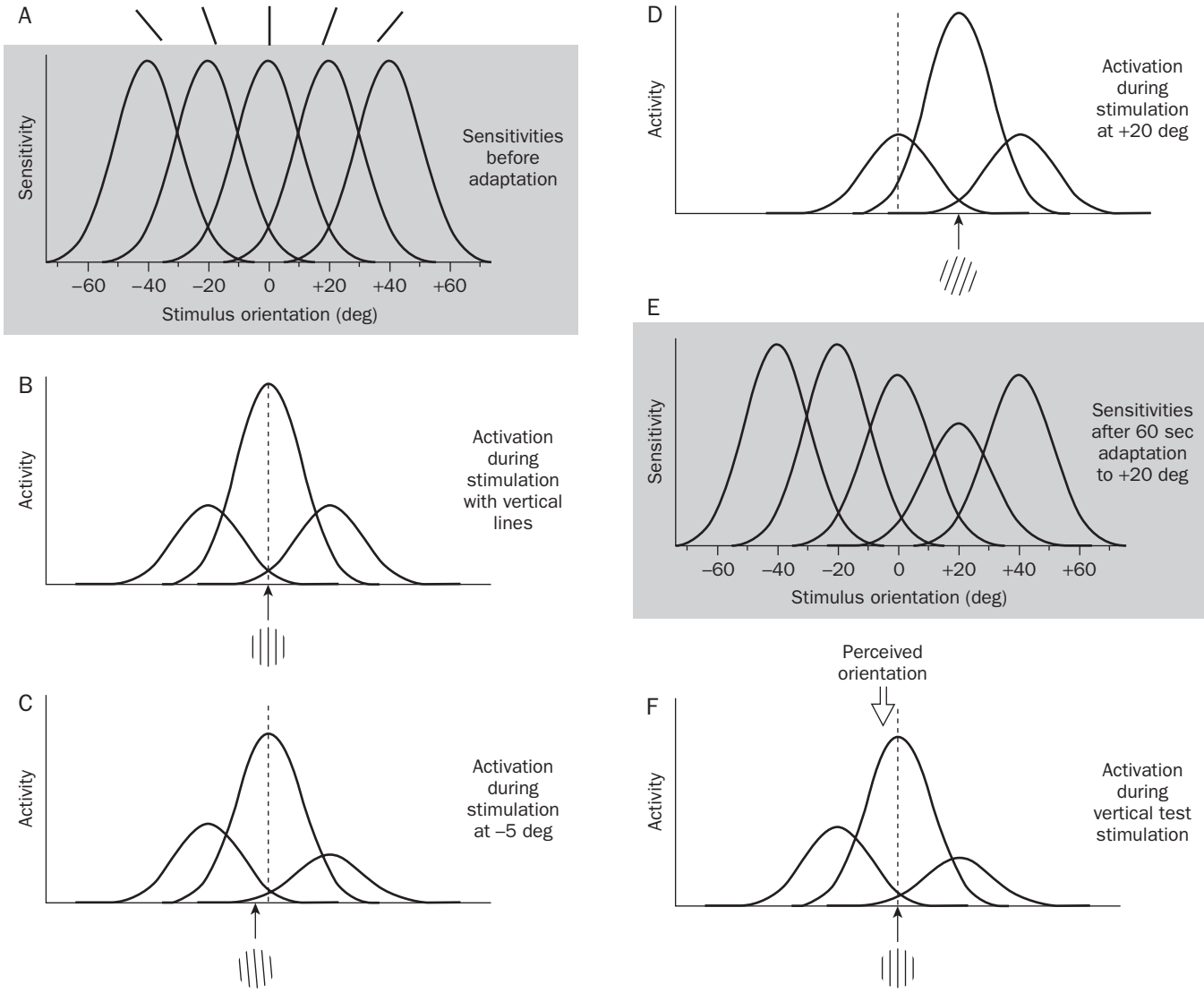


Figure 8.3

An explanation for after-effects.

less sensitive due to the presentation of this stimulus tilted 20 degrees clockwise, although to a smaller extent than the 20 degree channel. (The two channels that respond best to anti-clockwise tilts are not adapted at all.) The effects on sensitivity in the channel system of adapting to +20 deg stimulus are shown in panel *E*, figure 8.3. Sensitivity is reduced most in the +20 deg channel, and to a lesser but equal extent in the 0 and +40 deg channels.

What happens when we present a test stimulus whose tilt is zero (panel *F*, figure 8.3)? The −20 degree channel will give a small output, as normal, because the stimulus is away from the channel's optimal orientation, although within the range of tilts to which it is sensitive. But the output of the +20 degree channel will be even smaller, not only because the stimulus is not optimal for the channel, but also because the channel's sensitivity has been reduced by the prior adaptation to a 20 degree stimulus. So the −20 degree channel will clearly be more active than the +20 degree channel, although its normal optimal is equally far from the vertical orientation of the stimulus. The distribution of activity across channels will therefore be asymmetrical, with its mean shifted towards negative tilts. So, after adaptation to a +20 deg stimulus, the pattern of activity in the channel system produced by a vertical test stimulus will be identical to that produced before adaptation by a −5 deg stimulus (compare panels *C* and *F*, figure 8.3). So the observer's percept is of a tilt at 5 degrees to the left. Finally, as the channel's sensitivities return to normal after adaptation, so the apparent orientation of the test bar changes back to vertical.

This general idea can explain other after-effects too, such as those for luminance and colour, for texture, pitch, and so on.

Localization and inter-ocular transfer

Other characteristics of the underlying mechanisms can also be inferred from the properties of after-effects. For example, visual after-effects are usually confined to the adapted region of the visual field. So staring at a small red patch does not change the perceived colour of the whole visual field but only of a local region. This point is emphasized in figures 8.1 and 8.2, which demonstrate that opposite after-effects can be induced simultaneously above and below the fixation point in each panel.

inter-ocular transfer the adaptation or learning that occurs when a training stimulus is inspected with one eye and a test stimulus is subsequently inspected with the other eye

In addition, most visual after-effects show *inter-ocular transfer*. This means that if the observer stares at a stimulus with only one eye, the tilt and other after-effects can be experienced not only with the adapted eye but also with the corresponding retinal region in the other eye, which is not adapted. These two properties suggest that such after-effects are mediated by mechanisms that are linked to a particular region of the visual field and can be accessed by both eyes. In other words, they suggest that the mechanisms underlying these after-effects are located centrally (i.e. within the brain) after information conveyed from the two eyes has converged, rather than peripherally (i.e. within each eye or monocular pathway).

Neurophysiologists recording the electrical activity in single nerve cells in the visual systems of cats and monkeys have discovered that in area V1 (the cortical area where information from the eyes first arrives – see figure 8.10, below), many neurons have properties that would enable them to mediate visual after-effects. Different neurons in V1 respond to the orientation, size, direction of motion, colour and distance from the animal of simple stimuli such as bars or gratings.

Many of the neurons in V1 are binocular, meaning their activity can be changed by stimuli presented to either eye. And they are linked to particular and corresponding places on each retina, which means that a stimulus has to fall within a particular region (receptive field) on one or both retinas to affect them. Neurons in V1 also, as you would expect in a mechanism which mediates the tilt after-effect, adapt to visual stimulation, so their response to a stimulus declines over time with repeated presentation (Maffei et al., 1973).

The localized receptive fields and binocular characteristics of these neurons correlate very well with the perceptual characteristics of after-effects described above. Although adaptation occurs in other visual cortical areas, the neurons in area V1 are prime candidates for the mechanisms that underlie visual after-effects in people.

One implication of this account of early visual processing is that the images of complex objects (trees, houses, people) are initially analysed by mechanisms that respond to their local physical characteristics and have no connection with the identity of the objects themselves. From the point of view of a neuron in V1, the vertical blue edge moving to the left might as well belong to a train as to the shirt of the frustrated passenger who has just missed it and is running along the platform in desperation after it. In other words, the visual system appears initially to decompose the scene into its constituent parts and to analyse these separately (i.e. in parallel).

MAKING SENSE OF THE WORLD

GROUPING AND SEGMENTATION

The patches of light and shade that form a retinal image are produced by a world of objects. The task of the visual system is to represent these objects and their spatial relationships. An important step towards this goal is to work out which local regions of the retinal image share common physical characteristics, and which do not. These processes are known as grouping and segmentation, respectively.

Many of the stimulus attributes that give visual after-effects, and are probably encoded at an early stage of cortical processing, are also important in segmentation and grouping. Figure 8.4 shows a display used in a classic study by Beck (1966), who presented his observers with three adjacent patches of texture. Their task was to decide which of the two boundaries between the three regions was most salient, or prominent. They chose the boundary between the upright and tilted Ts, even though, when presented with examples of single texture elements, they said that the reversed L was more different from the upright T than was the tilted T.

This suggests that similarities and differences in orientation between elements of different textures, rather than their perceived similarity when presented in isolation, govern whether elements of different types are grouped or segregated. Segmentation and grouping can also be done on the basis of motion (Braddick, 1974), depth (Julesz, 1964, 1971) and size (Mayhew & Frisby, 1978) as well as colour and luminance. Figure 8.5 shows (*A*) an array of randomly positioned identical vertical lines, in which no sub-regions or boundaries appear, and (*B*) the same array but with a sub-set of the lines coloured red. The region of red texture now appears as a figure against a background of black lines. In (*C*) the figure is defined by making the same sub-set of lines

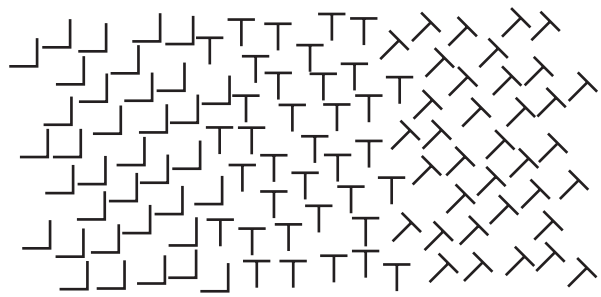


Figure 8.4

Grouping and segmentation by orientation.

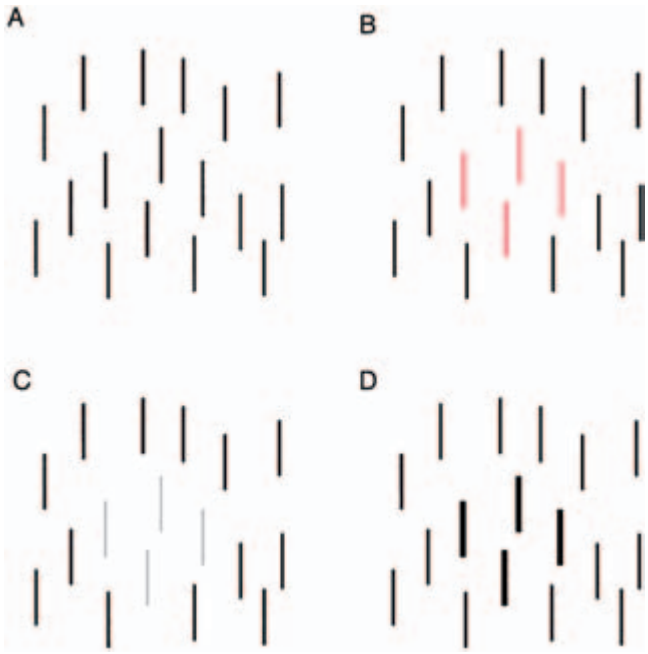


Figure 8.5

Grouping and segmentation by colour, luminance and size, showing how similarities and differences in physical characteristics are powerful cues to seeing isolated elements as belonging together or as separate.

as in (*B*) of a different luminance rather than a different colour from those forming the background. And in (*D*) the figure is defined by making the local elements of a different width to those in the background.

In addition to the nature of the elements within a display, their spatial arrangement can also contribute to grouping. Figure 8.6 shows how proximity can interact with shape. In panel *A*, the equi-spaced circular dots can be grouped perceptually either in rows or in columns. The dots are all physically identical and their vertical and horizontal separations are the same, so there is no reason for one or the other possible grouping to be preferred. This ambiguity may be resolved so that the elements are grouped as columns either by reducing the vertical separation of the dots (panel *B*), or by changing the shapes of alternate columns of dots (panel *C*).

Gestalt psychologists a group of German psychologists (and their followers) whose support for a constructionist view of perception has been enshrined in several important principles, such as 'the whole (in German, *Gestalt*) is more than the sum of the parts'

The *Gestalt psychologists* first drew attention to effects of this type and attributed them to the operation of various perceptual laws (though they were really re-describing the effects rather than explaining them). Figure 8.6*B* illustrates the Law of Proximity and figure 8.6*C* the Law of Similarity.

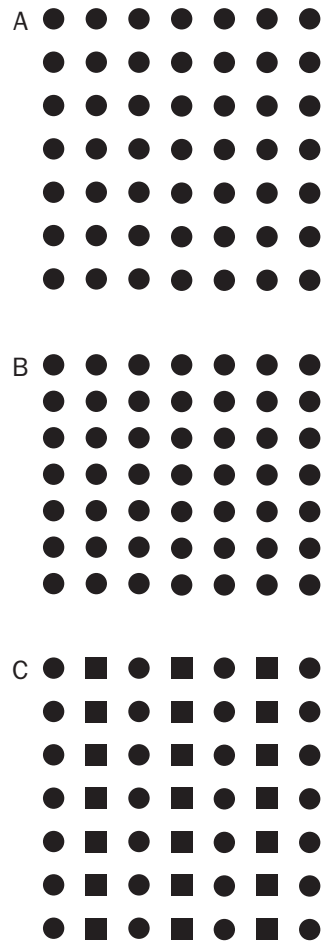


Figure 8.6

Grouping by proximity and similarity.

Visual search – or finding the car

visual search a type of experiment in which the observer typically has to report whether or not a target is present among a large array of other items (distractors)

Look for a tilted line in figure 8.7*A*. Carrying out a *visual search* for a target in an array of distractors (in the present case, vertical lines) is effortless and automatic: the target practically pops out from the array. In the same way, the region of texture formed from tilted Ts in figure 8.4 seems to stand out at first glance from the other two textures.

Parallel search

Performance on visual search tasks is often measured by the time it takes to complete the search. Psychologists then examine the effects of varying the nature of the difference between target and distractors, and the number of distractors. When the target differs

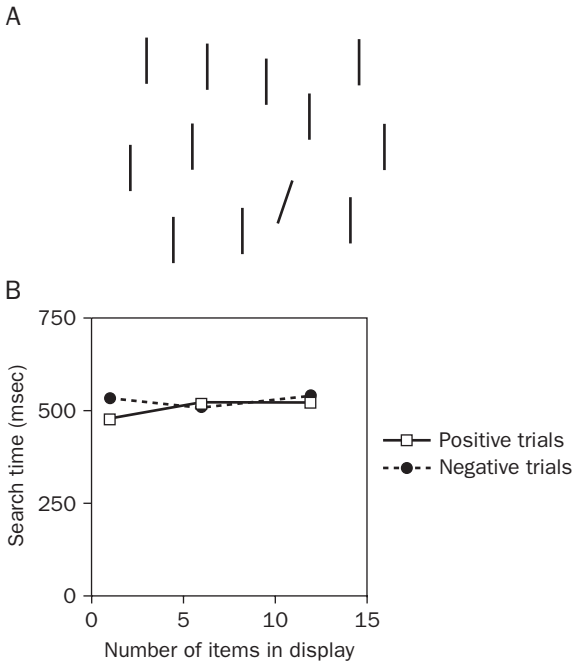


Figure 8.7

Pop-out and parallel visual search. Source: Based on Treisman and Gormican (1988).

from the distractors on only a single feature (such as tilt), the search time involved in making a decision whether or not a target is present is about the same whatever the number of distractors, and whether or not there is a target in the array (see figure 8.7*B*; Treisman & Gormican, 1988). In positive trials the target is present in the display, whereas in negative trials the target is absent in the display. This pattern of performance is described as *parallel search*, as items from all over the display are analysed separately and simultaneously.

parallel search a visual search task in which the time to find the target is independent of the number of items in the stimulus array because the items are all processed at the same time (in parallel)

As well as tilt, stimulus dimensions on which target/distractor differences allow parallel search include luminance (Gilchrist et al., 1997), colour (Treisman & Gelade, 1980), size (Humphreys et al., 1994), curvature (Wolfe et al., 1992) and motion (McLeod et al., 1988). This list of features is very similar to those that give after-effects and govern grouping and segmentation.

conjunction search visual search for a unique conjunction of two (or more) visual features such as colour and orientation (e.g. a red tilted line) from within an array of distractors, each of which manifests one of these features alone (e.g. red vertical lines and green tilted lines)

Conjunction and serial search

Search tasks of this type can be contrasted with a second type, *conjunction search*, in which the target/distractor difference is not based on a single feature, but on conjunctions of features. For example, the target might be a vertical red line in an array of vertical blue lines and tilted red lines (see figure 8.8*A*). In this scenario, search time for the target is not constant, but instead rises with the number of distractors. The observer apparently searches through the display serially, scanning each item (or small group of items) successively (*serial search*).

serial search a visual search task in which time to find the target increases with the number of items in the stimulus display, suggesting that the observer must be processing items serially, or sequentially

This kind of task might arise in real life when you have forgotten the location of your car in a large car park. You have to find a blue Ford amongst an array of cars of many makes and colours, where, for example, red Fords and blue Volkswagens are the distractors. The target does not pop out, but finding it requires effortful attentive scrutiny (Treisman & Gormican, 1988). When search times are compared for scenes in which a target is or is not present, the times rise with the number of visible items, but they rise twice as steeply when there is no target (see figure 8.8*B*). This is probably because, when there is a target present (which can occur anywhere in the visual display), on average, the observer has to scan half the items in the display to find it. When there is no target, on the other hand, the observer has to scan all the items in the display in order to be sure that no target is present.

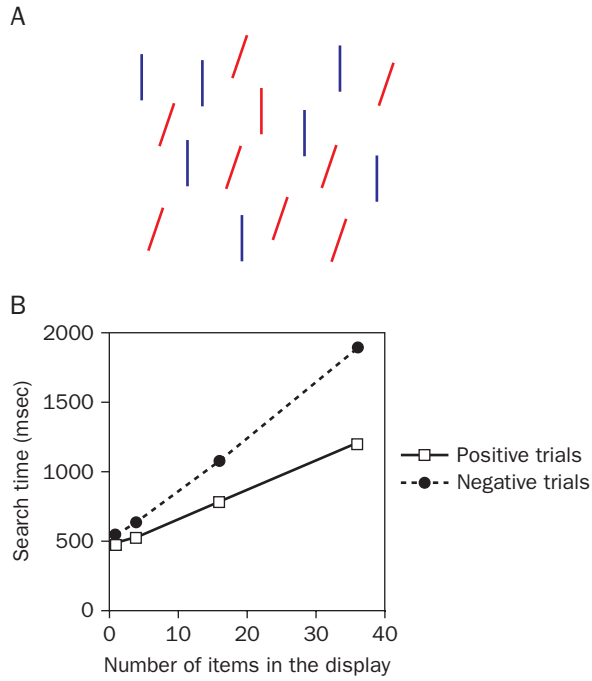


Figure 8.8

Conjunction search. Source: based on Treisman & Gormican (1988).

Feature integration theory

feature integration theory different features of an object (e.g. colour, orientation, direction of motion) are thought to be analysed separately (and in parallel) by several distinct mechanisms, and the role of attention is to 'glue together' these separate features to form a coherent representation

Based on findings from parallel search and conjunction search tasks, Treisman and colleagues put forward a theory – the *feature integration theory* – which sought to explain the early stages of object perception. This theory has become very influential (Treisman & Gelade, 1980; Treisman & Schmidt, 1982). These authors suggested that the individual features that make up an object (its colour, motion, orientation, and so on) are encoded separately and in parallel by pre-attentive cognitive mechanisms. However, in order to perceive a whole object, the observer needs to 'glue together' (or integrate) these separate features, using visual attention.

One interesting prediction from the theory (which has been borne out by experiments) is that, if attention is diverted during a conjunction search task, there would be nothing to hold the features of an object together, and they could then change location to join inappropriately with features of other objects. For example, if observers are distracted by requiring them to identify two digits during the presentation of a display like that in figure 8.9, they often report seeing dollar signs, even though the S and the straight line which make up the sign are never in the same location. It is as though, pre-attentively, the S and the parallel lines are 'free-floating' and are able to combine to present objects that are not physically in the display. These so-called *illusory conjunctions* provide support for feature integration theory (Treisman & Schmidt, 1982; Treisman, 1986).

illusory conjunctions perceptual phenomena which may occur when several different stimuli are presented simultaneously to an observer whose attention has been diverted (e.g. the perception of a red cross and a green circle when a red circle and a green cross are presented)

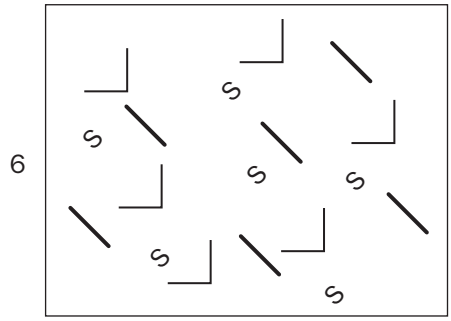


Figure 8.9

'Illusory conjunctions' occur when features from one object are erroneously combined with features from another object. Source: Treisman (1986).

Pioneer

Anne Treisman (1935–), one of the pioneers of the empirical study of selective attention, went on to develop the influential feature integration theory. This theory suggests that attention involves the binding of feature information about an object across a network of parallel processing mechanisms, each of which handles separate and distinct features of the object (such as its colour, motion and orientation).

How do we know what we see?

Treisman's ideas suggest that image features like colour and motion are analysed separately at an early stage of visual processing. As we shall see, this is consistent with evidence from anatomical and physiological studies of the visual system, and studies of humans with certain kinds of brain damage.

Up to now we have discussed visual neurons as *feature detectors*, responding best to certain aspects of the retinal image, such as the orientation or direction of movement of an edge. But recent studies suggest that, rather than forming part of a single homogeneous visual system, the feature detectors are embedded in several different sub-systems, in which information is processed separately, at least to some extent.

feature detector a mechanism sensitive to only one aspect of a stimulus, such as red (for the colour dimension) or leftwards (for direction of motion) and unaffected by the presence or value of any other dimension of the stimulus

Magno and parvo cells

The rods and cones in the retina function in dim and bright light, respectively. The cones are of three types, which are selective to different, if overlapping, ranges of light wavelength. The information from the cones is reorganized in the retina to give green–red and blue–yellow opponent channels (see chapter 7).

There is, in addition, a group of large retinal cells alongside the smaller colour-opponent cells. These large cells respond to the difference between the luminances (of any wavelength) in their centre and surrounding regions. They could be described as black–white opponent channels. The large cells are known as the *magno* or *M cells*, contrasting with the colour-sensitive

magno (M) cell a large cell in the visual system (particularly, the retina and lateral geniculate nucleus) that responds particularly well to rapid and transient visual stimulation

parvo (P) cell a small cell in the visual system (particularly, the retina and lateral geniculate nucleus) that responds particularly well to slow, sustained and coloured stimuli

parvo or *P cells* (the names are taken from the Latin words for 'large' and 'small' respectively). The M cells differ from the P cells not only in their lack of colour selectivity and their larger receptive field sizes, but in being more sensitive to movement and to black–white contrast. M and P cells both receive inputs from both cones and rods, but M cells do not distinguish between the three cone types and so respond positively to light of any wavelength, whether dim or bright.

The motion properties of M cells are exceptionally important. They respond to higher frequencies of temporal flicker and higher velocities of motion in the image than P cells do. Indeed M cells signal transients generally, while the P channels deal with sustained and slowly changing stimulus conditions. For example, a dim spot of white light switched on or off seems to appear or disappear suddenly, whereas a dim spot of coloured light seems to fade in or out gradually (Schwartz & Loop, 1983). This supports the hypothesis that different flicker/motion sensations accompany activation of M and P channels.

Most famously, Livingstone and Hubel (1987) ascribed colour sensations to P cell activity, motion and distance (depth) to M cell activity, and spatial pattern analysis to a combination of both. This tripartite scheme was based on a reorganization of the retinal information that subsequently occurs in the cerebral cortex. The optic nerve carries signals to a pair of nuclei near the centre of the brain called the LGN (lateral geniculate nuclei), and from there the signals are sent on to the primary visual cortices (area V1) at the back of the brain (see figure 8.10). There are perhaps 100 million cells in each of the left and right areas V1, so there is plenty of machinery available to elaborate on the coded messages received from the retina.

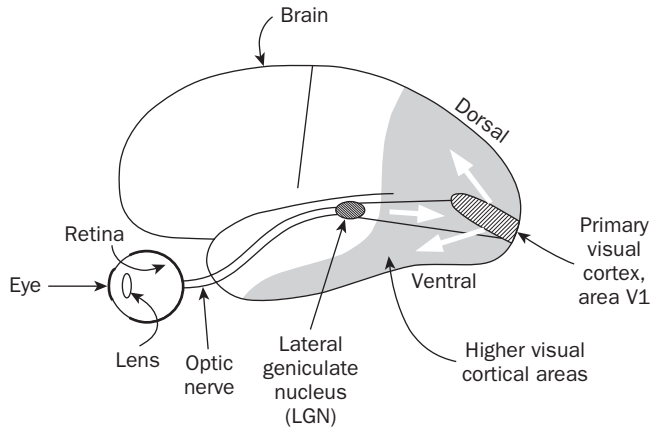


Figure 8.10

The early stages of the neural pathways for analysing the visual stimulus. The lateral geniculate nucleus (LGN) and the primary visual cortex (area V1) pass information on to the 'higher' areas of cortex (shown shaded). The latter can be divided into the dorsal and the ventral streams leading to the parietal and the inferior temporal lobes respectively.

Cortical pathways

In the cortex, the general flow of information runs vertically – that is, to cells in other layers above and below the activated cells.

column a volume of cells stretching the entire depth of the cerebral cortex, which all have some physiological property in common (e.g. the preferred orientation of the bar or edge stimulus to which they respond, in the case of a column in the primary visual cortex)

The cortex contains *columns* of cells, which respond to similar properties of the stimulus and lie alongside other columns that respond to different aspects or features of the world.

The earlier work of Hubel and Wiesel (1968) emphasized this vertical organization. They discovered that, unlike the retina and LGN, where neurons respond best to spots of light, many cortical neurons respond best to straight lines or edges. Some cells respond best to vertical lines (figure 8.11), others to diagonals, others to horizontals, and so on for all orientations around the clock.

There is a very fine-grained, high-resolution representation of image-edge orientation at this stage of sensory processing. Moreover, each cell is sensitive only to lines in a relatively small area of the retinal image – the cell's receptive field. The cells are also selective for the spacing between parallel lines (the spatial frequency), and in many cases also for the direction of stimulus movement, the colour of the stimulus and its distance.

These cortical cells form the basis for the tilt after-effect and the other after-effects described above. The activity in these cells probably also underlies our perception of orientation, motion, etc. Even if we knew nothing about the neural organization of the visual system, we could suggest the existence of mechanisms with some of the properties of these cortical neurons, which we would infer from the properties of visual after-effects. However, the further evidence that has been obtained by researchers regarding these brain mechanisms gives us greater confidence in their actual reality, and shows how psychology and neurophysiology can interact to form a satisfyingly interlocking pattern of evidence.

Pioneer

David Hubel's (1926–) discovery, with Torsten Wiesel, of the orientation tuning of cells in the primary visual cortex initiated an entire industry investigating how the visual scene can be encoded as a set of straight-line segments. Their theory also became a cornerstone for serial processing models of visual perception. Later, though, with Margaret Livingstone, he supported the theory that visual features are processed in parallel streams stemming from magno and parvo cells in the retina.

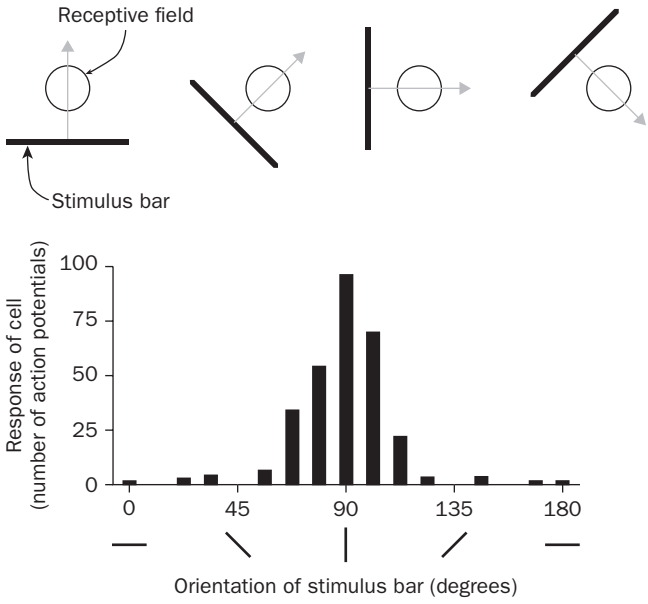


Figure 8.11

Orientation tuning of a typical nerve cell in area V1. In each of the four diagrams at the top, a circle indicates the receptive field. A bar stimulus is moved across the receptive field at different angles in each diagram. At the bottom is plotted the magnitude of the response of the cell to the bar at each of these angles and to other angles around the clock. The cell is highly selective for the orientation of the bar, responding only to near-vertical bars.

Pioneer

Horace Barlow (1921–) is a physiologist whose insights into the possible relationships between perception and neural activity have guided much thinking in the field. Barlow is especially well known for his discussion of whether we possess 'grandmother cells'. These are single neurons whose activity would reflect the presence of an elderly female relative. More generally, do we possess cells within our brain that respond selectively to very specific familiar visual experiences in our environment, such as the sight of our car, our house or our grandmother?

Serial versus parallel theories of perception

The research on visual cortical neurons was at first thought to support serial hierarchical theories of perception (Selfridge, 1959), in which perception is thought to proceed in a sequence of stages, starting at the retina and ending (presumably) somewhere in the cortex, with information flowing in just one direction.

Such frameworks can be called 'hierarchical' because a unit in each successive stage takes input from several units in the preceding stage. This kind of organization could be likened to the Catholic church, in which several parish priests report to a bishop, several bishops to a cardinal, and several cardinals to the pope. In the same way, general features of the retinal image, such as lines, were thought to be extracted by early visual processing, while whole complex objects were recognized later in the sequence by the analysis of combinations of these features. For example, the capital letter 'A' contains a horizontal line and two opposite diagonals, the letter 'E' contains three horizontals and a vertical, and so on. These letters can therefore be defined with respect to a combination of their elementary perceptual features. Representations of corners, squares, and then three-dimensional cubes, were thought to be built up by combining the outputs of these early feature detectors to form more complex object detectors in 'higher' regions, such as the cortex of the inferior temporal lobe.

However, more recently there has been an increasing emphasis on the parallel organization of the cortex (Livingstone & Hubel, 1987). So in V1, M and P cell signals (projected from the magno and parvo components of the retina, respectively) arrive in different layers of the cortex. These messages are processed in V1 and are then carried by axons out of V1 and into several adjacent regions of the cortex, called V2, V3 and V5 (see figure 8.12). In V2, Livingstone and Hubel argued that the M and P signals are kept separate in different columns of cells. Consistent with our previous discussion these columns represent information about motion and distance (magno system) and colour (parvo system), respectively.

This theory became complicated by Livingstone and Hubel's description of activity in a third type of column in V2, where the cells receive converging input from the magno and parvo systems. They suggested that these columns are used for spatial pattern analysis. However there are problems with this scheme. For example, Livingstone and Hubel claimed that images in which the different regions are red and green, but all of the same brightness appear flat. They attributed this to the insensitivity of cells in the magno/depth system to differences purely in hue, which are detected primarily by the parvo system. Quantitative studies,

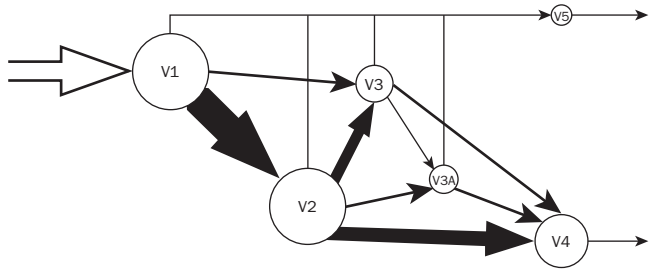


Figure 8.12

Ascending connections between some of the major areas of visual cortex. The size of each circle is proportional to the size of the cortical area it represents, and the width of each arrow indicates the number of nerve axons in the connection. Although the arrows show information flowing principally from left to right in the diagram, hence from 'lower' to 'higher' areas, in fact most of the connections are reciprocal, which is to say information passes in both directions along them. Source: Adapted from Lennie (1998); Felleman and van Essen (1991).

however, found that perceived depth is not reduced at all in such images (Troscianko et al., 1991). It appears, then, that depth percepts can be derived from both magno and parvo information, though not necessarily equally well at all distances (Tyler, 1990).

In fact, there are many more visual areas in the cerebral cortex than are shown in figure 8.12. Some two dozen or so have now been discovered by neuroanatomists and by brain imaging studies (see chapter 3). The functions of these areas are still being studied intensively by physiologists and psychologists, and we do not yet have the complete picture.

Zeki (1993) has put forward the most influential theory of cortical visual functioning. According to this scheme, area V3 is important for analysing stimulus shape from luminance or motion cues, V4 is important for the perception of colour and for recognising shape from colour information, and V5 is critical for the perception of coherent motion. But this theory is still controversial. Recent physiological studies have found fewer differences between the properties of the various cortical areas, emphasizing that many areas co-operate in the performance of any given task. For example, Lennie (1998) points out that most information flow in the brain is from V1 to V2 to V4, and that area V4 is not specialized for colour in particular, but for finding edges and shapes from any cue or feature. Lennie argues that only the small stream through V5 is specialized, to monitor image motion generated by self-movement of the body and eyes (optic flow). This would therefore be the area activated in the illusion of self-motion we experience when the other train moves, as described at the very beginning of this chapter.

Seeing without knowing

Destruction of small parts of the cortex, for example after stroke, tumour, surgery or gunshot wounds, can result in bizarre and unexpected symptoms.

Colour and motion awareness and the strange phenomenon of blindsight

In the syndrome known as cerebral achromatopsia, for example, patients lose all colour sensations, so the world appears to be in shades of grey (see Sacks, 1995, for a good example, and Zeki, 1993, for historical details). If the damage is restricted to a small portion of the lower surface of the occipital lobes, the loss of colour vision can occur without any other detectable anomaly: visual acuity is normal, as are depth perception, shape understanding, and so on.

Recently, another syndrome has been associated with damage to a lateral part of the occipital lobe: akinetopsia. Someone with akinetopsia loses motion awareness, so that visual stimuli all look stationary even when they are moving. These patients notice if there is a change of stimulus location, but there is no sense of pure motion occurring between the two successive locations (Zihl et al., 1983).

Syndromes like this support the theory that humans possess many specialized processing areas, as do monkeys and other primates. These specialisms contrast with the general loss of subjective vision that follows lesions of the primary visual cortex, area V1. This has been strikingly demonstrated by rare cases of damage to V1 in one hemisphere of the brain. Vision is then affected in one half of visual space, so if your right visual cortex is damaged and you look straight ahead, everything to the left of you is in some way visually absent or missing.

Interestingly, though, there are some visual stimuli that can still evoke behavioural responses in the 'blind' half of the visual field. For example, if you hold a stick in the blind field and ask the person, 'Am I holding this stick vertically or horizontally?' they will say, 'What stick? I can't see anything over there at all.' So you say, 'Well, I am holding a stick, so please guess what the answer is.' Amazingly, these patients will answer correctly most of the time, and much more often than they would by chance guessing. Their behavioural responses to large visual stimuli, including the location, motion and orientation, presented in the blind half of the visual field will be correct more than nine times out of ten. They cannot respond to the fine details of the scene, and they cannot initiate movements towards stimuli they have not been told are there, but something remains of their previous visual capacities within the blind half of the field. This phenomenon has been termed 'blindsight' (Weiskrantz et al., 1974). It has been of great interest in recent studies on how subjective awareness of the visual world arises (e.g. Zeki, 1993; Weiskrantz, 1997).

The ventral and dorsal streams

Leading away from area V1, a distinction is generally made between two broad streams of parallel visual processing (see figures 8.10 and 8.12 above). These were initially known as the 'what' and the 'where' stream, but there has been some dispute over the exact role of the latter, since some researchers believe it is also involved in the visual control of movements (the 'how' stream), not simply in locating objects. Partly for this reason, the streams have since become known as the 'ventral' and 'dorsal' streams, emphasizing their (uncontroversial) anatomical locations, not their more controversial functional roles.

The ventral stream takes mainly parvo retinal input from V1 and flows towards the inferotemporal cortex, where cells respond to the sight of whole, complex three-dimensional objects (or at least to the constellations of features that characterize these objects). Damage to this stream impairs object recognition and knowing what objects are for (Milner & Goodale, 1995; Newcombe et al., 1987). This stream includes a specialized area that deals selectively with face recognition (see chapter 7), and which is damaged in the syndrome called prosopagnosia (as in the example of the man who mistook his wife for a hat: Sacks, 1985).

The dorsal stream, in contrast, takes magno input and runs into the parietal lobe. It deals with locating objects and with sensorimotor coordination, mostly occurring subconsciously. Damage to the parietal lobe can hamper the ability to grasp something with the hand or post a letter through the slot in a mailbox (Milner & Goodale, 1995). With right parietal lesions particularly, it becomes difficult to recognize objects from unusual points of view (such as a bucket from above), rotate an object mentally,

read a map, draw, use building blocks, and pay attention to spatial locations especially on the left side of space (a phenomenon known as spatial 'neglect'; Robertson & Halligan, 1999).

In summary, these different lines of evidence strongly support the idea of parallel processing. However, they do not explain why our behaviour is not a bundle of reflex reactions to sensory stimuli. In the next sections, we consider the role of different types of cognitive knowledge in perception.

SEEING WHAT WE KNOW

Various kinds of knowledge about the world can be shown to influence perception. One class of perceptual processes seems to reflect an assessment of what it is that particular features of the stimulus are most likely to represent.

PERCEPTION OR HALLUCINATION?

What do you see in Figure 8.13? Most observers perceive an inverted 'whiter-than-white' triangle with clearly defined edges filling the space between the black discs, each with a sector removed. This inverted triangle is illusory, since the white paper on which it is perceived is of the same luminance as that outside the triangle. It is as though, faced with the incomplete black discs and line corners, the visual system makes the best bet – that this particular configuration is likely to have arisen through an overlying object occluding complete black discs, and a complete outline triangle. In other words, since the evidence for an occluding object is so strong, the visual system creates it.

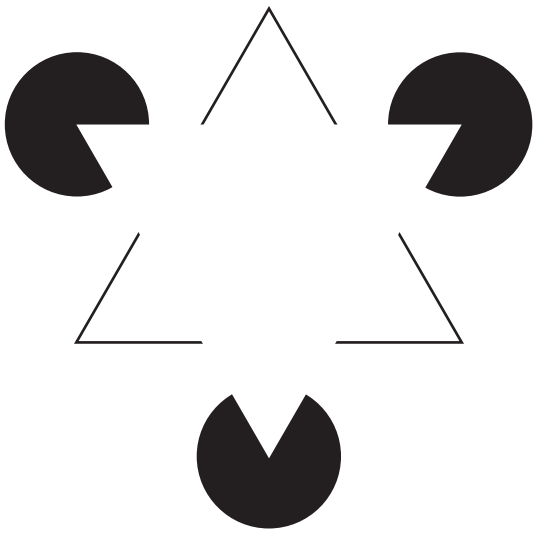


Figure 8.13

A Kanizsa figure. Most observers report perceiving a white triangle whose corners are defined by the 'cut-outs' on the black discs and whose edges touch the free ends of the Vs.

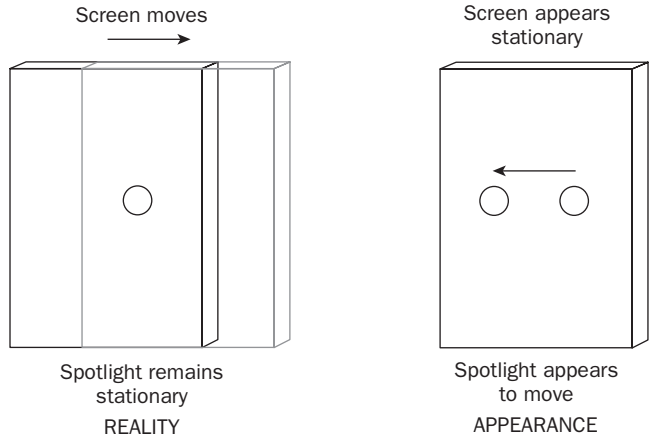


Figure 8.14

Schematic representation of induced movement. A stationary spot is projected on a screen which moves from side to side. Source: Adapted from Gregory (1997).

A rather different example is depicted in figure 8.14. A small spot is projected onto a large frame or screen, which is then moved. What the observer sees is the spot moving on a stationary screen. Again, this appears to reflect an assessment of relative probabilities. Small foreground objects are more likely to move than large background objects, and so this is what the observer sees.

RESOLVING VISUAL AMBIGUITY

What happens when alternative probabilities are about equal? The outline (Necker) cube in figure 8.15 appears to change its orientation spontaneously. Sometimes the lower square face of the cube appears nearer, and sometimes the upper square face. This reflects the absence of depth information from shading, perspective or stereopsis (3-D vision based on differences in the visual information received by each eye) that would normally reveal the orientation of the cube. Faced with two equally good interpretations, the visual system oscillates between them.

But why does our visual system fail to generate a single stable percept, which is veridical (i.e. matches the characteristics of the scene exactly), namely a flat drawing on a flat sheet of paper? The reason that the brain chooses to interpret the scene as 'not flat' seems to reflect the power or salience of the depth cues provided by the vertices within the figure.

Further evidence for this comes from the fact that we can bias the appearance of the cube by changing our point of view. So if you fixate the vertex marked 1 in figure 8.15, the lower face will seem nearer. Fixate the vertex marked 2 and the upper face tends to appear nearer. But why does this happen? Again, the answer brings us back to probabilities. When we fixate a particular vertex, it is seen as protruding (i.e. convex) rather than receding (concave). This is probably because convex junctions are more

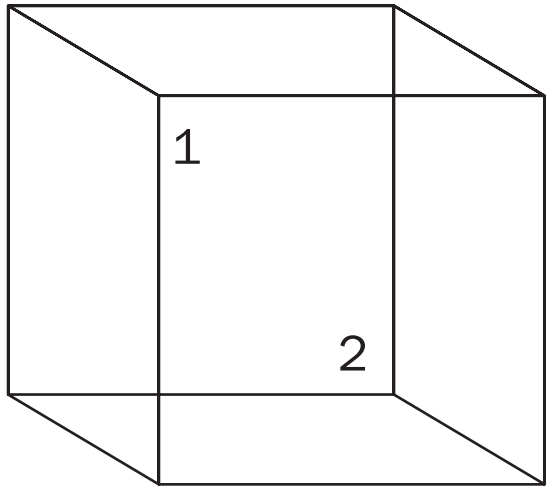


Figure 8.15

The Necker cube. This wire-frame cube is perceptually ambiguous or multi-stable, so that sometimes the upper square face appears nearer and sometimes the lower square face appears nearer.

likely in the real world. To be sure, you will see concave corners (for example, the inside corners of a room), but most concave corners are hidden at the back of an object and therefore outnumbered by convex corners at the front. You can easily test this out by simply counting how many of each type you can see from where you are sitting now.

Tricks of the light

Another powerful example of the effects of knowledge in perception is illustrated in figure 8.16. In the upper half of the figure, the circular blobs, defined by shading, appear convex, whereas in the lower half they appear concave. Rotating the page through 180 degrees reverses the effect. The blobs that appeared concave now appear convex, and vice versa (Ramachandran, 1995). Why?

Notice that the pattern of shading of the blobs is ambiguous. In the upper part of the figure, it could be produced if protruding blobs were illuminated from above, or if receding blobs were illuminated from below (and vice versa, for the lower half of the figure). Yet we tend to perceive them as protruding blobs illuminated from above. This is because our visual system tends to 'assume' (on the basis of previous probabilities) that objects in our world are lit from above (as they are in natural surroundings by our single sun), and this assumption governs the perception of ambiguous shading. Presumably, someone who lived on a planet where the only illumination came from luminous sand on the planet's surface would see the blobs on the upper part of figure 8.16 as receding and the blobs on the lower part as protruding.

If the gradient of shading is switched from vertical to horizontal (figure 8.17), then all the blobs, whether on the top or bottom, tend to be seen as protruding. This suggests that, once the direction of illumination is clearly not vertical, it tends to be ignored. Instead, another assumption dominates perception, namely that ambiguous blobs protrude (the same assumption about vertices that governs perception of the Necker cube).

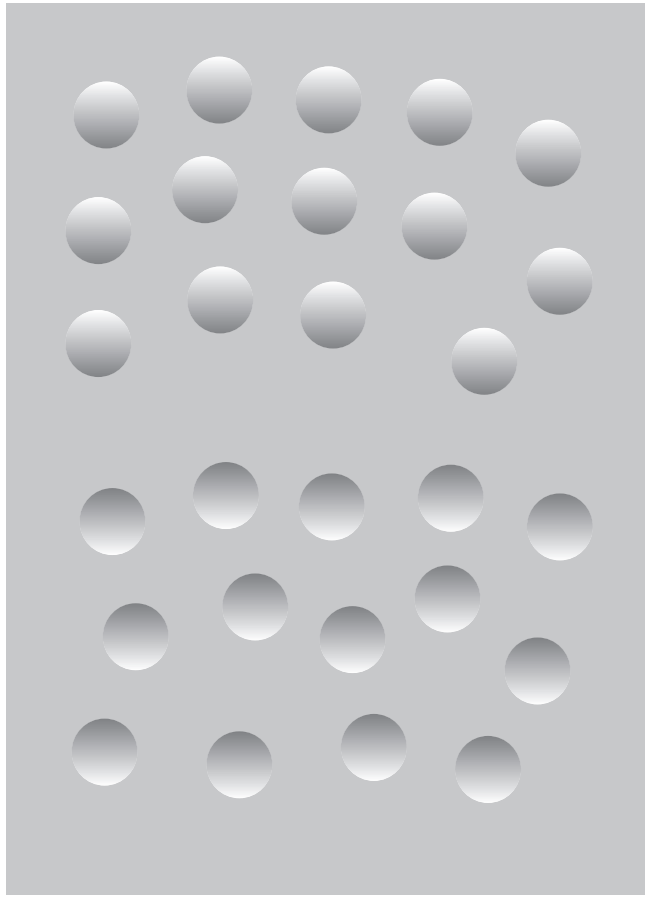


Figure 8.16

Shape from shading. The blobs in the upper half of the figure appear to protrude, and those in the lower half appear to recede.

Although the assumption that objects are lit from above by a single light source is important, it does not always govern our perceptions, even when it is clearly applicable. Gregory (1997) has pointed out that it may be defeated by other knowledge about very familiar objects – in particular, human faces. Gregory drew attention to the fact that the hollow mask of a face does not usually appear hollow (figure 8.18*A*). Instead, the receding nose appears to protrude. It is only when the mask is viewed from a short distance that stereoscopic depth information (i.e. information from both eyes) is able to overcome the 'assumption' that noses always protrude.

What would happen if this assumption about noses were to conflict with the assumption that objects are lit from above? When the rear of a hollow mask is lit from below, the nose appears to protrude and to look as though it is lit from above, in line with both assumptions (figure 8.18*B*). But when the lighting

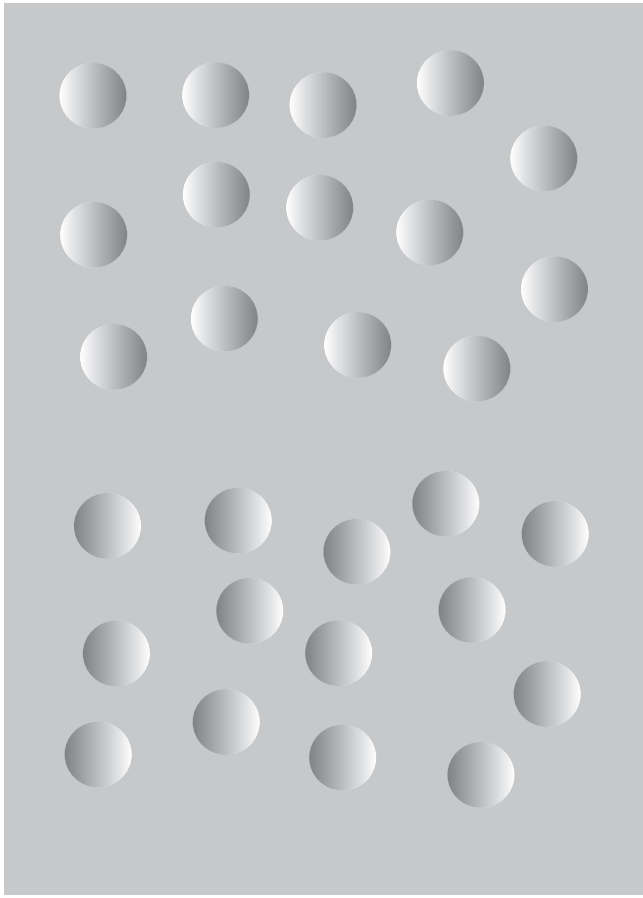


Figure 8.17

Shape from shading with lighting from the side.

Pioneer

Richard Gregory (1923–) is a well-known supporter of cognitive constructionist approaches to understanding perception. Originally trained in philosophy as well as psychology, he has summarized and reviewed much experimental evidence (some of which he has provided himself) for the 'intelligence' of the visual system in interpreting its input, and related this 'top-down' view of perception to its philosophical context. His books, especially *Eye and Brain*, have fired generations of students with an enthusiasm for the study of perception

is from above, the nose still appears to protrude, even though it also appears to be lit from below (figure 8.18*C*). Clearly the assumption that noses protrude is stronger than the assumption that objects are usually lit from above. This is probably because we have no day-to-day experience of non-protruding noses, but we occasionally experience objects lit from below by reflected or artificial light.

Non-visual knowledge and perceptual set

Perceptual assumptions about lighting and noses are probably common to all humans. But there are other kinds of knowledge affecting perception which depend on linguistic, graphic and other cultural conventions.

The central symbol in figure 8.19*A* is perceived as 'B' if the vertical set of symbols is scanned, and as '13' if the horizontal set of symbols in scanned. Similarly, the central letter in the two words shown in figure 8.19*B* is perceived as an 'H' when reading the first word, and as an 'A' when reading the second. Such effects depend on knowledge of a particular set of alpha-numeric conventions and of the graphology of the English language (and so would presumably not be experienced by someone who spoke and wrote only Arabic). They illustrate that non-visual knowledge can be important in visual perception.

There are other situations in which the role of past experience and verbal clues become apparent. Figure 8.20*A* shows a dappled pattern of light and shade, which at first glance may appear meaningless. But consider the clues 'leaves and a Dalmation dog', and you will probably see the dog nosing among the leaves almost instantly. Similarly, the pictures in figure 8.20*B* have been transformed into black blocks and black lines, so that the identity of the objects they represent may not be obvious. But again, verbal clues such as 'elephant', 'aeroplane' or 'typewriter' are often sufficient for the observer to identify the objects.

Interestingly, once you perceive the Dalmation and the elephant, it is impossible to look at the pictures again without seeing them. These effects are sometimes described as examples of *perceptual set*: the verbal clues have somehow 'set', or programmed, the individual to interpret or perceptually organize ambiguous or impoverished stimuli in a certain way.

Perceptual learning

How training influences performance

Although the role of knowledge and assumptions in perception is now quite clear, the detailed ways in which past experience influences perception are less clear.

Recently, experimenters have begun to examine these questions by studying how training can influence performance on apparently simple visual tasks, such as judging whether the lower line in figure 8.21 is offset to the left or right of the upper line (a *vernier acuity* task). Humans can discern the direction of very tiny offsets,

vernier acuity the ability to see very small differences in the alignment of two objects, which becomes particularly obvious when the objects are close to one another

A

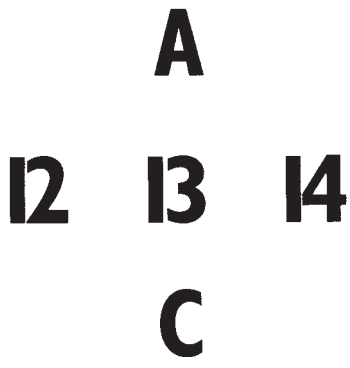
B

C

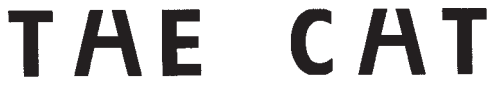
Figure 8.18

Opposing assumptions: 'light comes from above' vs 'noses protrude'.
(*A*) A hollow mask seen from the front and lit from below. (*B*) The same hollow mask seen from behind, with the lighting coming from below. (*C*) The same hollow mask seen from behind, but with the lighting coming from above.

A



B



but can improve even more with practice, though this may require thousands of presentations (Fahle & Edelman, 1993). The nature of the learning can be studied by measuring the extent to which it transfers from the training stimulus to other stimuli and conditions. Thus if, after training, the vernier stimulus is rotated through 90 degrees, performance on the new task is no better than it was at the start of the experiment. Similarly, performance falls if observers are trained on one retinal location and tested on others, or trained using one eye and tested on the other.

Figure 8.19

Effects of linguistic knowledge on the perception of objects.
(*A*) How the central symbol is read depends on whether one is scanning from left to right or from top to bottom. (*B*) How the central symbol in each cluster is read depends on the surrounding symbols.

A

B

Figure 8.20

What are the hidden objects?

Findings like these suggest that some of the training occurs at a site where the neurons are driven by one eye, receive input from restricted regions of the retina, and are orientation-specific. Fahle (1994) speculated that the learning might reflect changes occurring in orientation-specific neurons in V1, some of which are monocular (driven by only one eye). Others have questioned the extent and nature of the specificity of learning, and suggested that there might be a general as well as a stimulus-specific component to the observed learning effects (e.g. Beard et al., 1995). This general component might reflect, for example, a change in the ability to direct attention to particular regions of the visual

Figure 8.21

In a vernier acuity task, the observer has to decide whether the lower line is to the left or to the right of the upper line. Performance on this task can improve dramatically with practice.

Research close-up 1

Can people learn to modify their visual search strategies?

The research issue

In a typical laboratory visual search task, the subject searches an array of items for a pre-defined target, pressing one key if the target is present, and a second key if the target is absent. Some visual search tasks seem easy and effortless, regardless of the number of items in the display. So the tilted line in figure 8.7*A* 'pops out' immediately, and search time to find the tilted target stays the same, regardless of the number of vertical distractors in the visual array, as though all items are being processed simultaneously (parallel search).

Other tasks are harder: for example it requires scrutiny of each item successively to find the vertical red line in figure 8.8*A* (serial search). Ellison and Walsh (1998) asked whether the mechanisms underlying these two types of search were fixed and immutable, or whether participants could learn to search in parallel for targets that initially required serial search.

Design and procedure

Observers sat in front of a computer screen. On each presentation, a number of items (which on half the trials included a target, and on the other half did not) appeared on the screen. The number of items that appeared in the search array was systematically varied. Observers carried out search tasks repeatedly in several training sessions spread out over several days (so that each subject experienced more than 2000 presentations of the search array).

One group of participants was trained on target search tasks that were initially serial (i.e. in which target search time increased with the number of distractors), and the other group on tasks that were initially parallel (i.e. in which target search times did not change with the number of distractors).

Results and implications

The experimenters found that, as training proceeded, performance on the initially serial task became parallel, so that search times no longer increased with the number of distractors. But this only occurred for those presentations on which a target was present. Although search time was reduced by training when there was no target present, it still rose with the number of distractors.

The performance of the group who were trained on parallel search tasks also improved with training. When they were tested on serial search tasks after training on parallel tasks, their performance was better when there was a target present than if they had previously had no training. But for presentations on which there was no target present, they were worse than if they had not been trained.

So, training can lead to a change in search strategies, but this does not seem to be a generalized improvement in performance. In parallel search tasks, the observers may learn to distribute their attention more evenly over all regions of the display, so that they can respond quickly to the signal from pre-attentive mechanisms wherever the target occurs, and to the absence of a signal when there is no target. When transferred after training to a serial task, this strategy will allow faster detection of items likely to be a target, which then receive attentional scrutiny. But it may delay the serial scrutiny of items needed to eliminate non-targets.

Conversely, during training on serial tasks, observers may develop across the course of testing new templates (or feature detectors) for the very *conjunctions* for which they are searching. In other words, they may acquire new feature detectors as a consequence of their experience. Activity in these feature detectors then seems to allow parallel search when a target is present (i.e. after participants have received a sufficient amount of training with this target). But these new detectors must be different in some way from those that underlie the usual parallel search, found without training, since they do not confer an advantage when a target is absent.

Ellison, A., & Walsh, V., 1998, 'Perceptual learning in visual search: Some evidence of specificities', *Vision Research*, 38, 333–45.

field. This idea receives further support from studies into visual search conducted by Ellison and Walsh (1998).

Different types of visual search not only have different behavioural characteristics, but also depend on different brain regions. So some patients with attention deficits (due to damage to the part of the brain where the temporal, parietal and occipital lobes of the brain join) may be able to perform normally on *feature search* tasks but are markedly impaired in conjunction search tasks (Arguin et al., 1993). Also, Ashbridge et al. (1997) used transcranial magnetic stimulation (TMS) to study the role of

feature search visual search for a unique feature such as a particular colour or orientation (e.g. a red spot) in an array of distractors defined by different features along the same visual dimension (e.g. green spots)

different brain regions in visual search. In this technique, a strong magnetic field is applied briefly to the surface of a localized region of the skull, temporarily disrupting neural activity in the underlying brain region. These researchers found that stimulation of the right parietal lobe did not affect initially parallel searches, but did affect initially serial searches. Moreover, a related study found that right parietal stimulation did not affect initially serial searches once they had become parallel through training. But when the observers were switched to another task, which they initially had to perform serially, right parietal stimulation could disrupt search again (Walsh et al., 1998).

Walsh et al. (1998) suggest that the right parietal lobe may be involved in setting up new *templates* in the temporal lobe for processing conjunctions of, say, colour and form. Once the learning is complete, the right parietal lobe no longer plays a role in the task and so stimulating this region no longer impairs performance.

template an internally stored representation of an object or event in the outside world, which must be matched with the pattern of stimulation of the sensory systems before identification, recognition or naming of that object or event can occur

Top-down mechanisms

Perceptual processes that are concerned solely with sensory input are often called 'bottom-up'. But perception also depends on 'top-down' processes, which reflect our personal goals and past experience.

'Bottom-up' processes are governed only by information from the retinal image. 'Top-down' is a vaguer concept, since it is not clear where the 'top' of the visual pathway is or what it does. But 'top-down' certainly involves the voluntary components of perception, such as moving the eyes. For example, when we discussed conjunction search, earlier in the chapter, remember the observer moving their attention around a display to search for a target (such as a tilted red line or a blue Ford car). This kind of deployment of attention to locate a target is generated internally rather than externally, and is therefore considered to be 'top-down' (in contrast to, say, the sudden appearance of an object in peripheral vision, which will capture the observer's attention and gaze automatically).

Additional support for this idea comes from studies showing that selective adaptation phenomena can be affected by changes in attention. As we saw earlier in this chapter, adaptation can occur at relatively early stages of visual processing, perhaps including V1.

A major finding of the anatomical studies we discussed earlier, in the section *Serial versus parallel theories of perception*, is that almost all the connections between the visual areas of cortex (e.g. figure 8.12) are reciprocal. In other words, information passes not only serially up the system but also backwards, from 'higher' regions, down towards (but not reaching) the sense organs. For example, just as area V1 projects to V2, so area V2 also sends messages to V1.

How might these reverse connections mediate the perceptual functions that involve top-down influences? The idea that attention to different aspects of the world is mediated by top-down connections is supported by several recent brain scanning studies indicating that relevant regions of the visual cortices alter their activity levels when the person is attending (Kastner & Ungerleider, 2000; Martínez et al., 2001). The idea is that 'higher' parts of the brain decide what to concentrate on, causing messages to be sent back down to prime the relevant parts of the visual cortex. This facilitates cell responses to expected stimuli and improves cell selectivity (tuning), so there are now increased differences in the output of a cell when it is tested with its preferred and some non-preferred stimuli (e.g. Dosher & Lu, 2000; Lee et al., 1999; Olson et al., 2001). It has been further noted that even the LGN can be affected when attention changes (O'Connor et al., 2002).

Another idea is that perceptual learning, recognition and recall depend upon these top-down connections. The hippocampus is important in laying down new long-term memories (see chapter 3). Feedback connections from the hippocampus to the cortex, and within the cortex, appear to be responsible for building these new memories into the fabric of the cortex (Rolls, 1990; Mishkin, 1993; Squire & Zola, 1996). Physiological studies of cells in area V1 of the monkey support theories (Gregory, 1970; Rock, 1983) that memory for objects interacts with the early, bottom-up stages of sensory processing. So the selectivities of the cells in V1 change in the first few hundred milliseconds after a stimulus is presented (Lamme & Roelfsema, 2000; Lee et al., 1998). As activity reaches the 'higher' visual centres, it activates neural feedback, which reaches V1 after a delay. The latency of this feedback is caused by the limited conduction velocity of the messages along the nerve axons (see chapter 3) and by the time taken to process the information in the 'higher' cortical areas.

Recent studies of practice on perceptual tasks indicate that the learning triggered by these feedback projections is so specific for the relevant stimuli that it can only be taking place in the 'early' processing areas of the visual cortex (Ahissar & Hochstein, 2000; Fahle, 1994; Lee et al., 2002; Sowden et al., 2002). Moreover, scans taken of observers' brains when they are recalling or imagining a visual scene show activation of the same early areas of visual cortex that are activated during stimulus presentation itself (Kosslyn et al., 1993; Le Bihan et al., 1993).

As indicated by this discussion, the old division between sensory and cognitive processing by early and higher neural centres has recently been replaced by a new dynamic model. Incoming sensory information interacts with task-relevant knowledge, acquired during the development of the individual concerned, and has been built into the neural network structures in several different cortical areas. Acting together, these influences create an integrated and dynamic representation of the relevant aspects of the environment (e.g. Friston & Price, 2001; Hochstein & Ahissar, 2002; Lamme & Roelfsema, 2000; Schroeder et al., 2001).

Research close-up 2

How early in visual processing does attention operate?

The research issue

In our interactions with the environment, we attend to some things and ignore others. An important question has been at what level of processing this selection operates. For example, it might be that, at one extreme, only a small part of the visual input receives full perceptual processing ('early selection'), or, at the other, that all visual stimuli receive full processing, and selection occurs when a response has to be chosen ('late selection').

This research addressed the question in a novel way, using a visual *after-effect* – the motion after-effect (MAE). To obtain such an after-effect, the observer fixates, for at least 30 seconds, a small spot in the centre of an adapting display of randomly scattered dots drifting, say, to the left. When the physical motion is stopped, the now stationary dots appear to drift slowly to the right (the MAE). The strength of the MAE is often measured by timing how long it lasts – i.e. how long before the stationary dots appear to stop moving.

Physiological studies have shown that motion-sensitive neurons in the first stages of cortical processing (area V1) reduce their activity when repeatedly stimulated. It seems likely, then, that the selective adaptation thought to underlie the MAE occurs early in visual processing. Can it be affected by variations in attention?

Design and procedure

In a groundbreaking study, Chaudhuri (1990) showed that diverting attention from the moving pattern during adaptation could reduce the duration of the MAE. To do this, he modified the usual adapting display by using as the fixation point a letter or digit whose identity changed about once a second. During adaptation, the participants' attention could be diverted from the moving dots by getting them to strike a computer key when a numeral rather than a letter appeared.

Chaudhuri measured MAE duration after diverting attention in this way, and compared it with MAE duration after participants' adaptation to the same display but without the requirement for them to report the letter/digit characters. In another condition, participants were required to strike a key when the colour of the moving dots changed (in this condition participants fixated a stationary unchanging point).

Results and implications

In the conditions in which attention had been diverted from the drifting dots during adaptation by the letter/digit discrimination task, the durations of the MAEs on the stationary stimulus fields that followed were significantly shorter. But MAE durations were not affected by the requirement to attend to the colour of the moving dots while fixating a stationary unchanging point.

So, a secondary task during adaptation does not affect the MAE, if this involves attention to the adapting stimulus (as when participants are required to discriminate the colours of the moving dots). But when the secondary task diverts attention away from the moving dots (for example, by requiring participants to discriminate changing letter/digit characters at the fixation point), subsequent MAEs are weaker. So attention can affect a process, namely selective adaptation, that is thought to occur at an early stage of vision. This finding supports the early selection account of attentional processing.

Chaudhuri, A., 1990, 'Modulation of the motion after-effect by selective attention', *Nature*, 344, 60–2.

FINAL THOUGHTS

The original idea about perception was that perceptual systems are organized serially, with perception proceeding in a series of ordered stages. As we have seen, various experimental and observational techniques have been devised to study different stages of perception, including selective adaptation, perceptual grouping and segmentation, and target search. However, there are at least two reasons why the serial model of perception is too limited:

1. Physiological studies of single neurons in animals and clinical studies of humans with brain damage suggest that perception is performed by sub-systems, which, for example, analyse colour and motion separately and in parallel.
2. In addition to the 'bottom-up', stimulus driven, processing suggested by the serial model, we have seen that 'top-down', conceptually driven processes are important in perception. These top-down processes apply knowledge to information conveyed by the senses, based on assumptions about the nature of the world and objects in it. They can select various aspects of the perceptual input for processing, depending on current attentional demand, and can influence the development of early perceptual mechanisms. Our perceptual experience depends on complex interactions between the sensory input and various types of stored knowledge of the world.

Summary

- We have seen in this chapter that our almost effortless ability to perceive the world around us is in fact achieved by a mass of complicated machinery in the brain.
- The efficiency of our perceptual mechanisms is acquired over many years of individual learning experience, which continues through adulthood.
- As perceptual knowledge grows and accumulates, it enables ever more efficient interpretation of the stimuli that impinge upon our sensory receptors.
- There is continual, recurrent interaction between our knowledge base ('top-down', conceptually driven) and the current sensory inflow from the environment ('bottom-up', stimulus driven).
- Repetitive occurrences of the same environmental phenomena can change the very fabric of the perceptual-sensory systems.
- Bottom-up processing occurs both serially and in parallel. Top-down influences are demonstrable both psychophysically and physiologically.
- Psychological investigations of perceptual phenomena and biological studies of the neural hardware interact with each other to provide a deep understanding of perception.

REVISION QUESTIONS

1. What causes illusions, and why? What does this tell us about the mechanisms of 'normal' perception?
2. How is information coded in the visual system?
3. If the visual system breaks the visual scene up into its various features, how does it keep track of actual objects in the real world?
4. If I am looking for something in the world, how does my visual system find it?
5. How are the features belonging to the same object linked together?
6. How does knowing what you expect (or want) to see influence visual processing?
7. How does knowledge of what the world is like aid (or harm) our interpretation of what we are seeing now?
8. What brain mechanisms could underlie top-down influences on perceptual functions?
9. What happens when the brain machinery under-pinning different elements of visual perception is damaged?

Further Reading

Bruce, V., Green, P.R., & Georgeson, M.A. (2003). *Visual Perception: Physiology, Psychology and Ecology*. 4th edn. Hove: Psychology Press.
An up-to-date and research-orientated textbook on vision, linking ecology (i.e. how the environment and lifestyle of a species influence its perceptual processes) with physiology and psychophysics.

Goldstein, E.B. (2001). *Sensation and Perception*. 6th edn. Pacific Grove, CA: Wadsworth.
A very clear introductory text, covering all the senses.

Gregory, R., Harris, J., Heard, P., & Rose, D. (eds) (1995). *The Artful Eye*. Oxford: Oxford University Press.
Chapters on many of the topics introduced here, with links to the fascinating interface between art and perception.

Sekuler, R., & Blake, R. (2001). *Perception*. 4th edn. New York: McGraw-Hill.
Clearly written textbook covering hearing and other senses. The sections on motion and depth perception are especially good.

Wade, N.J., & Swanston, M.T. (2001). *Visual Perception. An Introduction*. 2nd edn. Hove: Psychology Press.
A very readable introduction to the phenomena and mechanisms of vision, particularly the historical background to our modern understanding of what vision is and what it does.

Zeki, S. (1993). *A Vision of the Brain*. Oxford: Blackwell.
The development of the parallel processing model in vision, from the point of view of its central proponent, integrating anatomical, philosophical, perceptual, physiological and clinical studies.

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Infancy and Childhood

9

CHAPTER OUTLINE

LEARNING OBJECTIVES

INTRODUCTION

INFANCY
- Physical and sensory development
- Cognitive development
- The beginnings of language and communication
- Social and emotional development

THE PRESCHOOL YEARS
- Perceptual and motor development
- Cognitive development
- Language and communication
- Social and emotional development

THE SCHOOL YEARS
- Perceptual and motor development
- Cognitive development
- Language and communication
- Social and emotional development

FINAL THOUGHTS

SUMMARY

REVISION QUESTIONS

FURTHER READING

Learning Objectives

By the end of this chapter you should appreciate that:

- there are arguments for and against stage theories of development;
- progression through the various domains occurs concurrently but at different rates;
- infants need other people for more than food and physical care;
- a toddler might use the same word to convey several different meanings;
- the child's social development and sense of gender are influenced by stereotyping and peer conflict;
- preschoolers are egocentric in that they tend to see the world only from their point of view;
- children's cognitive development can be reflected in the nature of their friendships.

INTRODUCTION

Think about tadpoles for a moment. There are clearly some important differences between tadpoles and children, but they have some interesting features in common. It is remarkable how much change a frog undergoes as it develops. Its whole physical shape is transformed dramatically from its fishlike, long-tailed infancy to pot-bellied, pop-eyed, strong-legged adulthood. It has little to say for itself initially, but as a grown-up it can croak for hours.

Although the human infant has more in common, visibly, with mature humans, it will also change in appearance substantially over the course of its lifespan. For example, the body-to-head ratio changes, the limbs elongate and strengthen, the child becomes able to stand upright and move about independently, and it continues to increase in size over a period of about two decades. The child also has a modest vocal repertoire at the start, but in due course can sing songs or discuss the sports results.

As for our mental and social capacities, a moment's reflection tells us that these change dramatically, too. The emergence of language during childhood presages a far more remarkable metamorphosis than the tadpole's emerging legs. The social life of a six-year-old is much more diverse than that of an infant. And the reasoning powers of a ten-year-old provide for intellectual activity unimaginable in a toddler.

The changes our bodies undergo are largely preordained by nature. There may be some variations as a function of nutrition, exercise or exposure to environmental hazard but, by and large, the physical progress of a young human follows a predictable course, as in tadpoles or the young of other species. Can we say the same of the human child's mental progress?

The tadpole's social future is dictated largely by nature – the need to find food, survive and reproduce. Are human lives so predictable? Clearly, some of children's major early tasks will be influenced by the surrounding culture. The language a child begins to learn reflects the language of his community. Whether a child spends her leisure time surfing the Internet or gathering

witchety grubs depends on which society she is born into. Does this mean that developing minds are shaped by the environment?

These are the kinds of questions that are investigated by developmental psychologists. As we examine specific aspects of development in infancy and childhood (this chapter) through adolescence and adulthood (chapter 10), some general themes will recur. How much is given by nature, and how much by experience? How does change come about? In particular, is change gradual or stage-like?

INFANCY

What leads to one young person growing up to beg on the streets, while his peer starts a career in the central business district?

The influential early behaviourist John B. Watson once proclaimed: 'Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select – doctor, lawyer, artist, merchant-chief, and, yes, even beggar-man and thief, regardless of his talents, penchants, tendencies, abilities, vocation, and race of his ancestors' (1924, p. 82). But are people really empty vessels to be filled up or shaped by their environments?

People often think of infants as helpless and malleable. Clearly, in some quite fundamental respects, they are dependent upon others. They are unable to meet their own physical needs (feeding, cleansing, finding shelter) or to move around or engage in discussion. Observations such as these have led to a traditional belief that the child is shaped by experience. The strongest expressions of this assumption have been provided by behaviouristic psychologists, like Watson, who assert that the child is the product of its reinforcement history (see chapter 4).

However, more recent research by developmental psychologists has radically altered our understanding, and the traditional notion of babies as empty vessels waiting to be filled by experience has now been abandoned. In this section, we will examine an array of evidence pointing to the remarkable complexity and competencies of the normal human infant.

PHYSICAL AND SENSORY DEVELOPMENT

You and I experience the world via our senses, and our everyday negotiation of the environment depends upon our skills in exploiting and coordinating the information they provide (see chapters 7 and 8). But these abilities did not emerge suddenly. We have enjoyed the benefits of sensory equipment since we first came into the world (and maybe before).

Babies have a rich array of perceptual and physical capacities, which enable them to engage with the world in more complex ways than was once believed. Some of these capacities seem to be present at birth, some develop rapidly during the first year or so, and some vary according to the opportunities for exercising them.

Figure 9.1

Sam is one hour old. What does he make of the world? How does he deal with the information from his senses: sight, hearing, touch?

Vision

The human infant's visual system provides a crucial means of exploring and reacting to the environment (Slater & Johnson, 1998). Although newborns' visual acuity is less than perfect, they can certainly take in a great deal of visual information, and they soon show signs of pursuing it actively (von Hofsten, 2001).

If you hold an object about 30 cm from a neonate's face, he can focus on it and may track it if you move it slowly from side to side. At this stage, the baby's visual attention is likely to be concentrated on the object's edges, but over the next few weeks he will begin to explore its whole surface (Aslin, 1987). Within the first couple of months, infants can switch visual attention from objects immediately in front of them to events (such as a light flashing) on the periphery of their visual field (Maurer & Lewis, 1998). By three or four months, they are able to organize complex visual configurations, distinguishing

Research close-up 1

How developmental psychologists study newborns

The research issue

Rigorous psychological research calls for careful control of test procedures. This is difficult enough to arrange even with adult participants, but how can we get infants to participate usefully in an experiment? Infancy researchers exploit many ingenious techniques, such as monitoring babies' visual attention, heartbeats or sucking rates in response to changes in their sensory environments. In a good example of such work, Laplante, Orr, Vorkapich, and Neville (2000) investigated whether newborns can attend simultaneously to more than one dimension of visual stimuli. This is an important question: do babies perceive objects holistically from the outset or do they operate analytically, attending to only one component at a time?

Design and procedure

Babies just two to four days old were positioned to look into a visual chamber (see figure 9.2), where they saw an opening in which a 2 cm × 13 cm stripe appeared. The stripe was either horizontal or vertical. During each trial, the stripe moved: either right-left-right or down-up-down (each infant seeing only one direction). The researchers filmed the infant's visual attention during a series of 30-second trials.

First, the researchers established how long the baby watched the stimulus, and then kept on presenting it until the infant showed habituation (this was defined as a 40 per cent or more decrease in visual attention, as indicated by the baby's eye movements). In other words, they waited until the baby had got used to the stimulus and how it moved. Next, the orientation of the line was changed, or the direction in which it travelled was changed, or both orientation and direction were changed simultaneously. The researchers were keen to know whether the baby's amount of looking changed, as this would indicate that the child was taking note of the altered visual environment.

Results and implications

The newborns exposed to the changes showed increases in looking times, while control infants (who were exposed to no changes) did not. Furthermore, the pattern of results indicated that looking time increases were greatest in the conditions in which two changes in the stripe occurred (orientation *and* movement). These findings suggest that, from the first days of life, stimuli involving modifications on two dimensions are processed differently from stimuli containing a change in only one dimension. These very young participants could not speak – but they could tell us a lot about how they perceive the spatial world from the way in which they behaved nonverbally.

Laplante, D.P., Orr, R.R., Vorkapich, L., & Neville, K.E., 2000, 'Multiple dimension processing by newborns', *International Journal of Behavioral Development*, 24, 231–40.

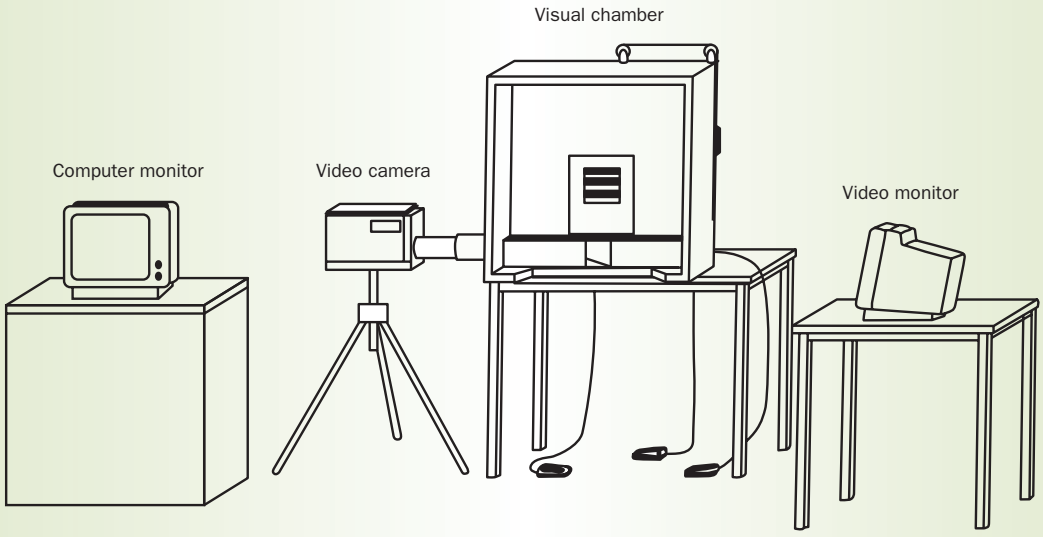

Figure 9.2

Visual chamber and equipment used to assess newborns' looking behaviour. Source: Laplante et al. (2000).

between intersecting forms (Quinn, Brown & Streppa, 1998) and exploiting illusory contours to perceive boundaries and depth (Johnson & Aslin, 1998).

Babies appear to be particularly interested in faces, which hold their attention and elicit smiles (Fantz, 1961). Some evidence indicates that even neonates less than one hour old prefer illustrations of a human face to other patterns of similar complexity, and they prefer regularly organized representations to pictures that jumble the facial features (Johnson & Morton, 1991). Such early preferences raise the serious (if controversial) possibility that infants have innate 'face detectors', which direct their attention to this aspect of the visual environment (Slater et al., 2000).

Hearing, taste and smell

The infant exploits all her senses as she learns about and reacts to her world. Hearing, although not fully developed at birth, is well developed at this stage, enabling young infants to discriminate among sounds that vary in volume, duration and repetitiveness, and to organize their perception of and responses to the spatial environment (Kellman & Arterberry, 1998). So when exposed to the 'approach' of an illusory object (a sound increasing in volume), quite young infants lean away as the noise gets louder (Freiberg, Tually & Crassini, 2001).

Perhaps one of the starkest pieces of evidence against the 'empty vessel' theory of human nature comes from the infant's discrimination among tastes (Mennella & Beauchamp, 1997). Babies are not passive when it comes to food and drink, and display clear preferences. Their sucking rate increases for sweet liquids, but decreases for salty or bitter liquids (Crook, 1978). They show by their facial or vocal expressions whether they like or dislike a particular taste, and will protest vigorously if offered something they find unpalatable (Blass, 1997).

These preferences are by no means arbitrary and may well have survival value. Infants do not have conscious nutritional information to help them decide whether a foodstuff is good or bad for them, but they know what they like. For example, alcohol is potentially harmful to infants, and research suggests that they would prefer not to drink it. Mennella and Beauchamp (1994) compared babies' consumption of breastmilk when their mothers had been drinking either alcoholic beer or non-alcoholic beer. In the alcohol condition, the babies drank significantly less milk. Babies' taste preferences can also be exploited by adults – certain tastes, such as milk or sweetened drinks, help to calm down a crying infant (Blass, 1997).

Infants react to smells in similar ways. Their facial expressions or head orientations reveal whether they find a smell pleasant or unpleasant (Soussignan, 1997). Again, the sensory preferences may have survival value. For instance, there is evidence that infants are attracted to the smell of amniotic fluid and to milk (Marlier, Schaal & Soussignan, 1998).

Motor development

The neonate has several reflexes (automatic physical responses to external stimulation), including:

- the rooting reflex – a tendency to orient the head and mouth towards an object touching the face;
- the sucking reflex – a tendency to suck on objects placed in the mouth;
- the grasping reflex – a response to stimuli (such as a finger) placed in the open palm;
- the Moro reflex – a reaction to sudden loss of support to the neck and head in which the baby thrusts out his arms and legs as if striving for support; and
- the stepping reflex – the infant attempts to take 'steps' if held upright with feet touching a surface.

Some of these reflexes have important benefits. For example, the rooting and sucking reflexes ensure that the normal infant will respond to contact with the mother's breast by seeking out the nipple and feeding (Widstrom & Thingstrom, 1993).

Although biology provides the reflexes, early experience is important insofar as it can affect their manifestation. In one study, neonates who were separated from the mother during the first hour after birth were less likely to demonstrate correct sucking techniques, and babies whose mothers were sedated during the birth did not suck at all during the first two hours (Righard & Alade, 1990).

COGNITIVE DEVELOPMENT

'Cognition' is a broad term encompassing reasoning abilities, knowledge and memory (see chapters 11, 12 and 17). The study of cognitive processes is fundamental to many topics in psychology. Developmental psychologists are interested in the origins and course of cognitive capacities, with a great deal of interest therefore being paid to their manifestation in infancy.

Infants react to information provided by their senses by attempting to organize experience, make sense of phenomena, and anticipate events or outcomes. In fact, when we examine what infants do with the data they obtain from the world, we find that they appear to behave in much the same way as scientists. They try things out, they collect more evidence (by exploring and by trial and error), and they start to develop theories.

The idea that babies, without the benefit of a formal education and not even able to speak, could generate theories about the world seems surprising on first consideration. Yet, one of the most influential psychologists of the last century has argued exactly this, and his account has attracted enormous interest from other psychologists and educators.

The sensorimotor stage of development

Jean Piaget (1896–1980), a Swiss psychologist, developed a model of cognitive development which holds that children's thinking progresses through a series of orderly stages. According to Piaget, each stage reflects qualitative differences in the way the child understands and acts upon the world relative to its status at another developmental phase.

Later in this chapter, and in the next, we will consider the other stages of Piagetian development, but for the moment we will

sensorimotor stage the first stage of cognitive development, according to Piaget, extending from birth to approximately two years, when the child constructs an elementary understanding of the world and thought is tied closely to physical or sensory activity

focus on the first, *sensorimotor stage*, which Piaget described as extending from birth to approximately two years.

Piaget saw the child in this stage as acting to learn about itself and its relations to the environment. A key emphasis here is on the child's actions. Piaget believed that children learn by doing, and that they advance their understanding by testing what they know to its limits (much as scientists do).

Piaget argued that initially infants lack the ability to reflect consciously on their experiences, but they do have a set of reflexive capacities (including those that we considered earlier in this chapter) that cause them to react to environmental stimuli. These are simple, but important processes. If something is placed near an infant's mouth, she will attempt to suck it. If you place your finger in a baby's hand, she will grasp it. The baby can also make vocal sounds. All of these actions can be repeated, and babies do indeed repeat them, generally becoming more proficient with practice.

The actions can also be modified to cope with new experiences. As well as grasping your finger, infants will respond similarly if you place a rattle or toy in their hand, or if they find a bar on the side of their crib. In this way, the infant develops action-based schemes – organized patterns of behaviour that she comes to rely on in dealing with her world.

Before long, the infant discovers interesting new consequences from her initially reflexive schemes. Grasping some objects (toys) causes the infant to produce interesting noises (squeaks or music). Sometimes a shake (of a rattle) or a push (of a mobile) yields other appealing sounds or movements. The infant repeats the action, and the same thing happens. In these ways, babies are learning about cause–effect relations, and their own ability to influence the world. Infants show delight as they learn how to control things, and repeat the actions frequently – until it becomes too easy, and then they seek new challenges.

Pioneer

Jean Piaget (1896–1980) was one of the most influential psychologists of the twentieth century. Born in Neuchâtel, Switzerland, in 1896, he published his first paper (a short note on an albino sparrow) at the age of 11. He studied zoology at the University of Neuchâtel, but his interests in biological change and the origins of knowledge led him into psychology. In 1920, he moved to the Alfred Binet laboratory in Paris, where he undertook research on intelligence testing, leading to a fascination with the reasons that children suggested for their answers to standard test items. This resulted in some 60 years' ingenious research into the development of children's thinking. In 1955, Piaget established the International Centre for Genetic Epistemology in Geneva.

Object permanence

In the course of all this seemingly playful activity, infants are learning a great deal. But at any one stage, there are limits to what they know. For example, in the first few months of life, although babies get better at manipulating objects, the stability of objects in their lives is generally beyond their control – things (such as toys) come and go. Piaget maintained that very young infants have no conception of the durability of objects: according to Piaget, at this age, while something is within reach or sight, it exists, but 'out of sight is out of mind'.

The notion that an object can continue to exist even when we cannot see it is termed *object permanence*. Piaget believed that this is a relatively late achievement of the sensorimotor period (around nine months). Other developments during this sensorimotor stage of development include greater experimentation with the things the infant can do with objects, learning to use objects as tools, and systematically copying others' behaviour to achieve new skills.

object permanence understanding that an object continues to exist even when it cannot be seen or touched

Piaget challenged

Piaget's descriptions and explanations of infant activities are persuasive and continue to have a great deal of influence upon developmental psychology. But they have been challenged. Subsequent research has demonstrated that Piaget tended to underestimate infants' abilities. For example, several studies have shown that object permanence is available earlier than Piaget believed to be the case. Hood and Willatts (1986) presented five-month-olds with objects within their reaching distance. The researchers turned off the lights, removed the objects and released the babies' arms. The infants tended to reach towards the place where the object had been located before the lights went out, indicating that the infants could maintain a representation not only of the object but also of its location.

Some of the perceptual abilities that have been described in infants (e.g. face perception, discrimination among speech sounds) also present a problem for Piaget's theory. One of his core assumptions was that children have only a limited amount of innate knowledge and that they construct their understanding of the world through active and general developmental processes.

By 'general', Piaget has in mind that changes are proceeding at roughly the same pace in most areas of the child's knowledge. There is a broad sweep improvement going on in mental capacities that is reflected in different areas of understanding roughly simultaneously. This seems to make sense: after all, we know that babies can do a lot more at 15 months than they can at five months.

But if some abilities are 'built in', then considerably more is innate than Piaget maintains. As well as face perception and speech discrimination, there is also intriguing evidence that infants as young as five months can add and subtract with small numbers, leading to speculation that humans are born with the capacity to

perform simple arithmetical operations (Wynn, 1992). There is little basis for explaining the development of these abilities by the outcome of general changes resulting from continuous activity.

Furthermore, whether these abilities are innate or not, they seem to develop at different times. Some emerge quite early, such as face perception, which is well developed (though not complete) in the preschooler. Others take a bit longer, such as language, which starts during the first year but progresses into middle childhood. Arithmetic ability is still developing into the teens.

Maybe, then, Piaget is mistaken to conceive of development as one all-embracing general process, with changes occurring at about the same time across all areas of knowledge. On the basis of observations like these, some psychologists believe that it may be better to regard the growth of knowledge as involving specific domains, each with its own developmental course (Keil, 1999).

This debate – between those who (like Piaget) favour domain-general theories and those who favour domain-specific theories – highlights fundamental questions about the nature of the human mind and is central to much of contemporary developmental psychology (see Garton, 2004; Hatano & Inagaki, 2000).

constructivist theorist who attributes the acquisition of knowledge to the active processes of the learner, building on increasingly complex representations of reality

Piaget made a key contribution to psychology by highlighting the importance of the infant's actions as a source of development. Piaget was a *constructivist*: he saw development as a kind of self-directed building process, in which the individual constructs schemes of action, applies them repeatedly until reaching their limits, and then improves upon them in the light of new discoveries. Although details of his theory have been challenged, in the light of Piaget's contributions most researchers agree that infants are active cognitive beings, not the blank slates supposed by the early behaviourists.

The beginnings of language and communication

The word 'infant' means literally 'without speech'. Babies cannot join us in verbal conversation, cannot answer our queries, and cannot articulate all of their needs and interests. Yet they can certainly communicate.

Communication between the infant and others does not await the emergence of language but proceeds throughout the first year. Very young infants tell us about their feelings and needs by crying and smiling. They show responsiveness to voices, orienting their attention to speakers, and even their larger body movements indicate sensitivity to the rhythm of speech. Caregivers are usually very responsive to the infant's sounds, treating vocalizations – even the humble burp – as though they were contributions to a conversation (Kaye, 1982). Initially, caregivers have to do much of the work to sustain the to-and-fro of the interchange, but gradually the infant comes to take an increasingly active role (Rutter & Durkin, 1987; Schaffer, 1996).

Infants' ability to discriminate among speech sounds appears to be quite general at first. In their first few months, they can discriminate among sounds that are critical in the language of their own community but, interestingly, they can also distinguish sounds in foreign languages that are not used in their own (Hernandez, Aldridge & Bower, 2000; Werker & Tees, 1999). But this capacity does not last, which is why you (depending on your linguistic background) may now experience difficulties with some of the sounds of, say, Cantonese or Estonian. Sometime during the second half of your first year of life, you probably began to lose your sensitivity to phonetic contrasts in languages other than the one(s) you were learning. Polka and Werker (1994) found that while four-month-old American infants could discriminate vowel contrasts in German, six-month-old Americans could not.

In due course, the child becomes able to understand some of the things that are addressed to him. Labels for key objects or events (e.g. 'biscuit', 'bedtime') are repeated frequently in meaningful contexts, and many parents try to coax words out of the infant (e.g. 'Da-da. Say "da-da"').

Around the end of the first year, normally developing children typically have a few words available (Barrett, 1995; Barrett, Harris & Chasin, 1991). At this stage, these words may not always conform perfectly to the structure of the adult language (e.g. 'da' for 'daddy', 'mi' for 'give me'), but they are typically used appropriately, and people familiar with the child usually know what is meant. At this stage, the child's utterances typically consist of just single words, but, by changes in intonation, and coupled with gesture, these can be used to express a variety of meaningful relations, including possession, location, negation and interrogation. For example, 'da', in different situations, could mean 'It's daddy's', 'Daddy has it', 'Not daddy', or 'Did daddy do it?'

Exactly how the child begins to master language presents many mysteries, but two things are clear: the process begins well before overt speech appears, and it occurs in a social context.

Social and emotional development

Human beings are social creatures (see chapters 17 and 18). Connecting to the social world is all the more crucial for the infant, because without the attention and care of others, she would not survive. Fortunately, others (particularly parents) tend to be strongly motivated to involve children in the social world, and to attend to their needs. Just as importantly, the infant is well equipped to participate in the social world from the beginnings of life.

Perceptual abilities are closely implicated in the infant's early social experiences. For example, we noted earlier that infants reveal a very early interest in the human face. This is an interesting perceptual preference, but it is still more important as a social characteristic. After all, faces are one of the best means of differentiating between people, and a valuable source of information about how others are reacting to us or the environment. There is evidence that infants can gather information about faces remarkably swiftly. Researchers using visual preference techniques or measurements of sucking rates have shown that newborns only days or even hours old prefer their mother's face to that of a female stranger (Bushnell, Sai & Mullin, 1989; Walton, Bower & Bower, 1992). The other senses are exploited

Figure 9.3

Babies as young as one or two weeks can recognize the smell of their own mother's breasts.

similarly. For example, infants as young as one or two weeks of age can discriminate the smell of their own mother's breasts from those of other breastfeeding women (Porter et al., 1992).

Fear of strangers

Anyone with an interest in babies and a little patience could provide much of the stimulation (coos, cuddles, facial displays, gentle handling) that infants enjoy, and babies will generally respond to opportunities for interaction with others. However, quite early in life, infants begin to show one of the distinguishing features of human social behaviour – selectivity (Schaffer, 1996). During the first few months, much of the infant's early social experience takes place in the microcosm of the family, and the most intensive interactions will usually be with the primary caregiver(s). But other people appear from time to time (healthcare professionals, visitors, neighbours) and the infant's social world gradually broadens. However, before long, it becomes very clear that the infant prefers the company of particular individuals – not surprisingly, but importantly, the primary caregivers.

Schaffer and Emerson (1964) followed a sample of Scottish infants during the first year, observing them in various social situations at home with their primary caregivers (mother, father, grandparents, etc.) and with female strangers. By monitoring the babies' nonverbal reactions, they found a gradual increase in preference for specific individuals from around the age of five months. It appears from research such as this that, by at least the middle of the first year, the child has formed an attachment (or attachments) to a specific person (or persons). At around the same time, the child begins to show a quite different reaction – anxiety – when approached by unfamiliar people.

At this point, spare another thought for the tadpole. One of the gravest problems about being a tadpole is that fish consider them a gourmet delight. As a result, tadpole survival rates are poor. But evolution has given tadpoles a chance of escaping the unwelcome attentions of passing fish. Tadpoles respond to chemical and tactile cues from predators, and swim fast to get as far away from them as they can (Stauffer & Semlitsch, 1993). This response appears to be built in, as it has been observed in laboratory-reared tadpoles, which have had no opportunities to learn about escape tactics.

What does this have to do with the human infant? At around five to eight months, human infants begin to display a form of behaviour that has much in common with that of the cue-sensitive tadpole: they start to show wariness of strangers and strive to maximize their distance from them.

Human infants also seem to be sensitive to a number of cues emitted by the stranger. All of their perceptual capacities seem to

Figure 9.4

This child was playing happily until a stranger appeared.

help them to determine that 'this person is not mum or dad'. But, unlike the tadpole, the human infant's reaction also entails a cognitive component. The child tends to cease other activity and monitors the stranger carefully. If the stranger attempts direct interaction (e.g. by picking the child up), there may be resistance, protest and distress on the part of the infant. When this happens, the infant can usually be calmed only by being returned to the caregiver.

Forming a relationship model

The development of the two aspects of social selectivity – attachment and wariness of strangers – are closely related in onset and developmental significance (Schaffer, 1996; Schaffer & Emerson, 1964; see also chapters 1 and 6). Many social developmentalists believe that the formation of attachments is a vital aspect of early relations. Through attachment, the infant maximizes opportunities for nurturing and protection, establishing a secure base from which to explore the rest of the world (Bowlby, 1988).

According to Bowlby (a British psychiatrist who developed an influential theory of attachment and its consequences), through the course of the first attachment (i.e. to the principal caregiver) the infant also begins to formulate an *internal working model* of what a relationship involves. If this is correct, early attachment could be the most important relationship that the child ever forms. In fact, a great many studies by attachment researchers indicate that the type of attachment formed during this first relationship has long-term implications.

internal working model a set of basic assumptions (a schema) about the nature of relationships

Mary Ainsworth, an American colleague of Bowlby's, proposed that there are three main types of attachment relationship formed by infants and their caregivers (Ainsworth et al., 1971). She tested her typology by observing infants' reactions to a laboratory test – the 'strange situation'. The baby is initially playing with his mother and is then approached by a stranger. After a while the mother leaves, and later she returns. This departure–return sequence may be repeated.

Based on a careful coding system for scoring details of the child's responses throughout the session, Ainsworth identified the following three types of relationship:

Type A Insecurely attached/avoidant. This infant is relatively indifferent to the mother's presence, does not seem greatly disturbed by her departure, and does not show enthusiasm for contact on her return.

Type B Securely attached. The infant plays happily in the new environment, shows some distress when the mother departs (especially for a second time), but responds positively to her return.

Type C Insecurely attached/resistant. The infant tends to explore less, is greatly distressed by the mother's departure, is difficult to console upon her return, and may struggle to be released from her embrace.

Pioneer

Mary D. Salter Ainsworth (1913–99) was one of the leading scientists in the study of human attachment. Born in Ohio, she grew up in Toronto, Canada, where she studied, and then taught, psychology. In 1950, she joined John Bowlby at the Tavistock Clinic in London, initiating a lifelong interest in the relationship between child and caregiver. She moved in 1954 to the East African Institute for Social Research, Uganda, where she conducted a longitudinal study of mother–infant attachment. In 1962, she began the Baltimore longitudinal study, which proved a seminal investigation and introduced new techniques for classifying attachment types.

Much subsequent research has supported this classification, which has been used in studies of early child development around the world (Van Ijzendoorn & Sagi, 1999). Ainsworth and colleagues (1978) found that approximately 70 per cent of infants form Type B relationships, about 20 per cent fall into the category referred to as Type A, and around 10 per cent of infants form Type C relationships.

If it is true that the primary attachment is the base from which the infant begins to tackle the rest of life's challenges, then you can see at once that the Type B child appears to have an advantage. Feeling secure and supported, she is ready to explore and learn. If problems occur, the caregiver is there, but the child feels confident to try things out. Furthermore, because the basic relationship is a positive and enjoyable one, the child should expect (i.e. have an internal working model) that other relationships will be enjoyable, and hence respond favourably to opportunities to interact with other people. Many studies show that Type B infants tend to demonstrate higher levels of cognitive and social skills during their preschool or later years (Meins et al., 1998; Suess, Grossman & Sroufe, 1992; Youngblade & Belsky, 1992). The topic is controversial (see Schaffer, 1996), but it does appear that the quality of the infant's initial relationship can help predict aspects of subsequent development.

THE PRESCHOOL YEARS

During infancy, children develop considerably and learn a great deal about themselves and the world. In some respects, the child has already undergone major transformation, from the relatively dependent neonate to an individual capable of expressing and meeting many of her own needs. Nevertheless, there is much development ahead. In this section, we consider some of the developments of the preschool years, from approximately age two to five years.

Perceptual and motor development

By the end of the second year, the child's perceptual abilities have developed considerably. In many respects, they are now on a par with those of an adult. But there is still a long way to go in terms of motor skills and coordination, and substantial progress will take place over the next few years.

By the age of two, many children have begun to walk unaided and can manipulate objects independently, but their gait is unsteady and their manual dexterity is limited. Over the next couple of years, they gain competence in these respects, becoming more certain of their control over their bodies. A three-year-old is likely to be quite mobile (e.g. able to run) but may find it difficult to respond to a need to change direction or stop – leading to mishaps with inconveniently placed furniture or walls – and may have difficulties with balance (Grasso et al., 1998). A four-year-old is more agile and beginning to develop skills such as throwing and catching, jumping and hopping. And a five-year-old is quite competent in basic movements.

Motor development during these years reflects an interaction between biological maturation, experience and cognition (Thelen, 2000).

Cognitive development

When we left the infant towards the end of the sensorimotor period, he had attained object permanence, was increasingly able to manipulate objects as playthings and tools, and was exploiting the greater skills of others by copying behaviours that appeared successful.

These kinds of developments enable the child to engage in a higher level of representation. While the early sensorimotor infant's schemes consisted of concrete actions, towards the end of this stage he becomes able to develop mental schemas.

Figure 9.5

By the age of two, many children have begun to walk unaided, but their gait is unsteady. Over the next couple of years, they become surer of their control over their bodies. By the age of four, the child is more agile and beginning to develop skills such as throwing and catching, jumping and hopping.

preoperational period the second major phase of cognitive development, according to Piaget, extending from approximately two to six years, when the child begins to represent the world symbolically but remains intuitive and egocentric

The child can now use objects to symbolize others, and is beginning to use sounds (words) for the same purpose. These skills are very useful, and the child exploits them increasingly. This leads to a new stage in development, which Piaget called the *preoperational period*.

The preoperational period

This stage of development extends from approximately two to six years, and a number of important cognitive developments are achieved during this time. Foremost is the ability to symbolize – to represent the world in images and language. This enables children to extend their understanding fundamentally. The child becomes able to represent past and future, and to think about objects or events that are not immediately present. This soon becomes evident in forms of activity like pretend play (figure 9.6). If the sensorimotor child disappoints her parents by playing more with the wrapping than the present, the preoperational child will surprise them with the news that the box is actually a helicopter and it plans to land on the building – represented by the coffee table.

Although Piaget saw the preoperational period as a time of important cognitive advances, he also emphasized the limitations of the child's thought processes at this stage. He believed that one of the most profound limitations during this phase is *egocentrism* – a tendency to see the world from our own point of view, along with an inability to take another person's perspective. Piaget found many illustrations of egocentrism in his interviews with children, in his studies of their language in preschool settings, and in his experiments.

egocentrism inability of the preoperational child to distinguish between his/her own perspective on a situation and the perspectives of others

Figure 9.6

Abel uses building blocks as traffic lights: he is clearly capable of forming mental representations of objects not immediately present, and of making one object stand in for another.

The next time you get an opportunity to listen to the language of preschool children, consider the extent to which they are conversing in the way you and I would understand a conversation, such as exchanging a series of linked remarks about the same topic. A typical preschooler in one of Piaget's major studies, Lev, engaged regularly in monologues, talking about his own activities to no one in particular:

> (Sitting down alone at a table): I want to do that drawing, there . . . I want to draw something, I do. I shall need a big piece of paper to do that.
> (After knocking over a game): There! Everything's fallen down.
> (Upon finishing his drawing): Now I want to do something else.
> (**Piaget, 1926, p. 14**)

Preschoolers like Lev accompany their actions with words in this way when alone and when in the presence of audiences. Close connections to others' utterances do not appear to be essential to the activity:

> Pie (aged 6y 5m): Where could we make another tunnel? Ah, here, Eun?
> Eun (4y 11m): Look at my pretty frock.
> (**Piaget, 1926, p. 58**)

Pie (the older child) is trying to establish coordinated efforts but Eun has her own concerns. In a major study of the language of preschoolers (1926), Piaget noted that, although the children were being studied in close proximity to their peers, more than one-third of their utterances were either not directed to anyone or were so esoteric that nobody else could understand them.

So, according to Piaget, the preoperational child tends to be dominated by his perceptual experiences and finds it difficult to imagine other aspects of an experience, such as how another person perceives things. The preschooler talks but does not always link her remarks to those of others. In an experimental task, the child centres attention on one aspect of a task, and fails to consider the relevance of other dimensions. Piagetians call this cognitive bias *centration*.

centration when a preoperational child focuses on only one aspect of a problem at a time

Probably the best known example of this is Piaget's famous *conservation* test. A preoperational child is presented with two beakers of the same shape and size. The equivalent amount of water is poured into each beaker, and the child is asked whether the amount in each is the same. Once this is agreed, a new beaker, taller and thinner than the original, is produced. The liquid from one of the original beakers is transferred to the third. The child is asked again whether the amount is the same. Preoperational children often insist that the amount has changed. They might

conservation ability to recognize that an object or amount remains the same despite superficial changes in appearance

Figure 9.7

Piaget's famous conservation test is the best-known example of an experimental task in which the child centres attention on one aspect of a task and fails to consider the relevance of other dimensions. Piagetians call this cognitive bias 'centration'. Source: Slater & Bremner (2003).

see it as more than before, or less than before, but certainly not the same. Although the amount of liquid is actually unchanged, the child's perceptual experience indicates otherwise – it *looks* taller – and this tends to dominate the child's judgement. The child appears to have centred on one aspect of the transformation in the liquid (the increase in height) but has failed to take account of the other (the decrease in width).

Another example is the 'three mountains' perspective task (see Research close-up 2).

Piaget challenged

Piaget's account of the limitations on preschool children's thinking has been subject to many challenges. Some researchers have objected that the standard conservation task induces the child to give erroneous responses by asking the same question – 'Are they the same or different?' – twice. In between, the experimenter has changed the display, and, in any case, every child knows that when a grown-up asks you a question twice, it usually means you gave the wrong answer the first time. When the question is asked only once, higher proportions of preschoolers give the correct (conserving) answer (Rose & Blank, 1974).

The task demands also appear to bear heavily on children's performance. Borke (1975) provided three- and four-year-olds with a perspective task, which involved viewing a set of familiar objects on a turntable. The task was to rotate the set to show how the objects would look from the perspective of a *Sesame Street* character, Grover, as he drove around the display. A majority of the children performed well, and only a small proportion made egocentric errors. It seemed as if the combination of more familiar materials and a more motivating task appeared to enable these preschoolers to demonstrate competencies that Piaget believed are attained much later in development.

Other research has also shown that preschool children are able to incorporate complex ideas into their pretend play, to follow successive actions and to make predictions about their consequences. For example, Harris, Kavanaugh, and Meredith (1994) had two- and three-year-olds watch puppets pour pretend cereal into a bowl. Children could understand this idea, and could also follow the next step, in which the puppet pretended to use the pretend cereal to feed a toy animal. They could anticipate that if a puppet poured pretend milk or powder into a bowl and then tipped the bowl over an animal, the animal would get wet or powdery. This seems simple enough to us, but it points to impressive representational abilities in the child, who creates a mental image of the cereal, milk or powder and then operates on the mental image to imagine subsequent transformations. These are cognitive skills that Piaget maintained were not available during the preoperational stage.

Piaget certainly pointed to some intriguing aspects of child thought, indicating that preschoolers may sometimes interpret the world quite differently from adults. Subsequent research indicating that he may have underestimated the competence of the preschooler (see also Bryant, 1974; Donaldson, 1978) qualifies rather than invalidates his work. After all, even if the conservation task and the 'three mountains' task do have methodological limitations, these tasks do appear to pose problems for preschoolers

Research close-up 2

Piaget's three mountains experiment

The research issue

Can young children appreciate how the world appears from someone else's perspective? Or are they bound by their own outlook (egocentrism)? One of Piaget's best known demonstrations of egocentrism comes from his 'three mountains' experiment (Piaget & Inhelder, 1956).

Design and procedure

One hundred children were tested, aged between 4 and 12 years. Each child was asked to stand in front of a model of three mountains. The mountains differed in height, colour and other characteristics. Once the child was familiar with the layout of the mountains, a doll was placed at another location (say, at the opposite side).

The children were tested in various ways. First, they were given three miniature cardboard mountains, and asked to lay them out in the way the doll saw them. The children then looked at a set of pictures taken from various positions around the mountains and had to decide which one represented what the doll would see from its current position. Finally, the children were shown a picture and asked where the doll would have to stand to get that view of the three mountains.

The doll was moved to different positions and the children tested again. The children were also moved to different positions and asked to select the picture that represented their new perspective.

Results and implications

Children aged around four years find this task very difficult and do not appear to understand the instructions.

Children below about age seven seem to fail to discriminate between their own perspective and that of the doll: instead, almost invariably, they pick the picture that represents their own point of view. For example, one six-year-old boy selected his own point of view, even though the doll was to his right, and announced: 'It's this one because the green [mountain] is here [points to his right] and so is the little man [also on his right]' (Piaget & Inhelder, 1956, p. 219).

At around eight years, children show awareness that people in different locations have different perspectives on the mountains, but they are not very consistent in working out exactly how things look from positions other than their own. For example, in the situation described above, they might realize that an object to their own right would be to the left of the doll, or that an object that is in front from their perspective is behind from another's perspective, but they find it difficult to process these cues simultaneously.

You might be thinking this would be hard for an adult too. It is certainly a challenging task, but by around ages eight and a half to nine, Piaget and Inhelder found that most children were able to handle it successfully. They concluded that the transition from egocentric thinking to being able to coordinate relations in space is a lengthy process, developing over several years in middle childhood.

Piaget, J., & Inhelder, B., 1956, *The Child's Conception of Space*, London: Routledge & Kegan Paul.

Figure 9.8

The three mountains task. The child walks around the display and is then asked to choose from photographs to show what the scene would look like from different perspectives.

Pioneer

Paul L. Harris (1946–) is currently based at the Harvard Graduate School of Education. Harris is interested in the early development of cognition, emotion and imagination. His recent book, *The Work of the Imagination*, gathers together several years of research carried out at Oxford University, where he taught developmental psychology. Currently, he is studying how far children rely on their own first-hand experience or alternatively on what people tell them – especially when they confront a new domain of knowledge.

Pioneer

Margaret Donaldson (1926–), author of the highly influential book *Children's Minds*, worked as a child development psychologist at Edinburgh University. Donaldson challenged Piaget's method of studying egocentricity in children, after producing different results when she applied a social dimension to Piagetian tasks given to preschoolers. Donaldson argued that the preschoolers' inability to perform Piaget's tasks was due to their difficulties with understanding (or abstracting) the questions, and not to their egocentricity or lack of logical skills.

but not for older children. If you can, try the tasks out yourself with a few children aged three to eight. Invite the children to explain their responses, and judge for yourself whether Piaget has provided us with fascinating (or misleading) insights into developmental changes in children's thinking.

Theory of mind

Another important aspect of early cognitive development is a capacity that we take for granted. And yet it is a distinctive human ability whose origins and developmental course prove difficult to uncover. This is the phenomenon of theory of mind.

Theory of mind refers to the understanding that people (oneself and others) have mental states (thoughts, beliefs, feelings, desires) and that these mental states influence our behaviour. It seems pretty obvious to you and me that we have minds. But how do we know? We can never see or touch a mind; we cannot directly observe mental processes in action. The 'mind' is quite an abstract concept. Indeed, perhaps you are studying psychology because you would like to find out more about this intriguing but elusive possession.

Preschoolers cannot read psychology textbooks. So how do they find out about minds? Do young children appreciate that they and other people are thinking beings? Do they understand that what a person thinks or believes can affect what she does?

Imagine this scenario, put to young children by the developmental psychologists Wimmer and Perner (1983):

> Maxi has a bar of chocolate, which he puts in the green cupboard. He goes out to play, and while he is out his mother moves the chocolate to the blue cupboard. Then Maxi comes in, and he wants to eat some chocolate. Where will he look for the chocolate?

Would you expect Maxi to look in the green cupboard, where he last saw his chocolate and where he believes it still to be? Or would he look in the blue cupboard, where *you* know the chocolate is now? If you have a theory of mind – so you understand that people act according to what they believe to be the case – then you will answer that Maxi will look in the green cupboard.

Interestingly, Wimmer and Perner found that children under the age of about five or six often answer, with great confidence, that Maxi will look in the blue cupboard. So preschoolers seem to be dominated by their own knowledge and find it difficult to grasp that Maxi would be guided by his own false belief. Slightly older children are more likely to take account of Maxi's mental state. They know that he is wrong, but they can understand that, on the evidence available to him, he is likely to think that his chocolate should be where he stashed it. The researchers also checked whether the preschool participants could remember where this was: they could, yet they still insisted that Maxi would look in the new location.

This experiment led to a great deal of discussion about young children's grasp of mental processes. It seemed to indicate that preschoolers have serious difficulties understanding that people's behaviour is an outcome of their mental states (in this case, their beliefs). Because the difficulty could not be explained merely as a problem with memory, Wimmer and Perner suggested that some special cognitive skill must be emerging around the period between four and six years of age: the child is developing a theory of mind.

This topic excited a great deal of subsequent research. Other investigators showed that, if the task is simplified a little, four-year-olds demonstrated understanding of false belief (Baron-Cohen, Leslie & Frith, 1985). In non-experimental settings (such as everyday conversations), others found that even younger children do make spontaneous and contextually appropriate references to mental states, which suggests that they do have some early awareness of the relevance of mind to human behaviour (Flavell, 2000). For example, Dunn (1999) reports that a three-year-old participant turned to her four-month-old sibling and said: 'You don't remember Judy. I do!' This brief remark indicates not only that the child had some understanding of the phenomenon of memory but also that she could simultaneously (and accurately) appraise the relevant contents of her own mind and that of her baby sister.

The emergence of theory of mind raises some fascinating questions and has provoked a lot of ingenious research (see Smith, Cowie & Blades, 2003). For our purposes, it is enough to state that important developments in children's understanding of mental states seem to occur at around age three to four years. Given the complexity of the concept of mind, this is remarkably early. Yet, given the centrality of mind to our everyday interactions with

other people, it is clearly an essential capacity, and it would be hard to imagine life without it.

In fact, there are people who do have particular difficulty with theory of mind tasks – children with *autism* (Baron-Cohen et al., 1985). Interestingly, one of the defining characteristics of people with autism is that they have severe difficulties communicating and interacting with other people. Could this be because they lack a theory of mind? The nature of children's theory of mind, and its implications for other aspects of their reasoning and social behaviour, are central topics in contemporary developmental psychology.

autism early onset, biologically caused disorder of communication and social interaction, usually accompanied by obsessive and stereotyped behaviour and intellectual disability

Language and communication

By the end of infancy, children are beginning to attempt words. They add to these first efforts slowly for a while, but then during their second year (usually between 18 and 24 months) they enter a period that some developmental psycholinguists call the *naming explosion* (Barrett, 1995). During this time, vocabulary increases rapidly, with children adding between eight and forty new words to their productive lexicon each month (Goldfield & Reznick, 1990).

naming explosion a period, usually in the second half of the second year after birth, when children's early vocabulary development accelerates rapidly

To put this in perspective, imagine you were to take a class in Gujarati or Russian, and your instructor expected to hear you using around 40 new words each month over the next year. Then remember that the infant does not have your advantage of already knowing at least one language, and of being able to use explicit tools (dictionaries, pronunciation guides, tape recordings). You would be surprised to see an 18-month-old sitting beside you in the language laboratory. Yet she is already performing much more impressive feats at home.

Putting words together

Learning a lot of words is useful, but it is only one component of language acquisition. Children also have to discover how to put words together, and this proves to be a still more remarkable process. Researchers who have compiled detailed observational records of children's early language have found that after a period of single word utterances, many children undergo a transitional period in which they begin to place separate utterances in close and meaningful juxtaposition.

Hoff (2001) describes a girl she was studying who woke up with an eye infection. The child pointed to her eye and said, 'Ow. Eye.' Hoff-Ginsberg reports that each word was spoken as if it had been said by itself, and there was a pause between them. This is not a sentence, but the meaning is conveyed as effectively as if the child had said, 'Darn it! My eye hurts.' The child has begun to exploit the potential for language to express relationships by placing words next to each other.

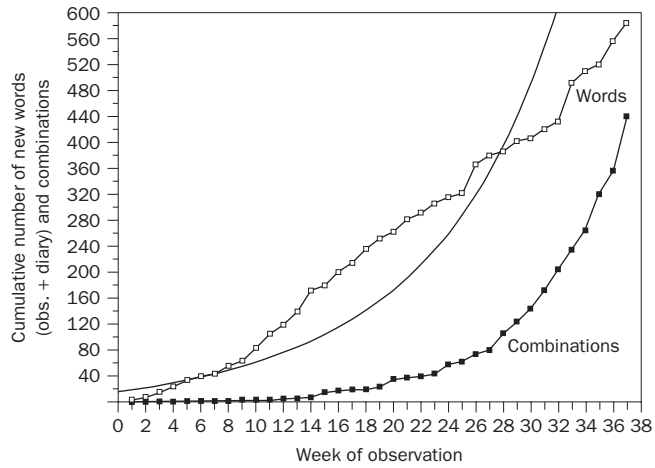

Figure 9.9

Cumulative plots, at weekly intervals, of the number of new words and new word combinations of a boy learning American English (studied from 15–24 months). An exponential function has been fitted to the lexical curve. Source: Anisfield et al. (1998).

These transitional efforts are soon replaced by frequent uses of longer word strings – usually two-word utterances at first, and then lengthier combinations (Braine, 1976; Brown, 1973). There is evidence that the increase in word combinations in turn prompts the child to learn more words – perhaps because the child is compelled to search for more specific ways of expressing more complex meanings (Anisfeld et al., 1998; see figure 9.9).

These early language structures can tell us a great deal about developmental processes. Firstly, they display regularity – children tend to use particular words in particular locations. For example, a child studied by Braine (1976) produced the following utterances (at different times):

daddy coffee
daddy shell
daddy hat
daddy chair
daddy cookie
daddy book
daddy bread

In each case, the child appeared to be expressing a possessive relationship – talking about daddy's coffee, daddy's hat, etc. Very occasionally, the child produced possessives with a different structure ('juice daddy'), but showed a clear preference for the order given above.

The child's early utterances are also revealing for what they omit. The examples above convey possessive relationships but do not include the conventional inflection ('s), and there are no articles, pronouns or verbs.

As children's utterances increase in length, there are clear consistencies in terms of what they include and omit (Brown, 1973). Children select the words with high informational content ('daddy', 'book', 'cookies'), and economize on the minor (function) words and inflections. They produce occasional over-regularizations – 'mans', 'foots', 'runned', 'shooted' – in which a regular rule (such as add –s to get the plural, or add –ed to get the past tense) is applied to an irregular word.

Three main points have emerged from research conducted in this field so far:

1. Children are selective and structured in their early attempts at language.
2. Children sometimes commit errors, but their errors suggest that they are trying to convey meanings as effectively as they can, and they are sensitive to grammatical rules.
3. Progress is quite rapid, from a handful of words at 12–15 months to large vocabularies and complex word combinations at age three or four.

Chomsky and the innate nature of language

We have only touched upon a few examples of how language is acquired, but they speak directly to the debate about the nature of child development.

Many laypeople and some psychologists have assumed that language is learned by observation, imitation and reinforcement (Skinner, 1957; Staats, 1968). But the examples given above pose some fundamental challenges to this account. Whom is the child imitating when she says, 'Ow. Eye', 'daddy bread', 'I brush my toothes' or 'Me don't want none'? The child is very unlikely to have heard adults produce these strings of words. In fact, even when adults produce a sentence deliberately and invite the child to imitate it, toddlers and preschoolers frequently respond with versions of the original sentence that reflect the processes of selectivity and omission discussed above (Fraser, Bellugi & Brown, 1963).

An influential American linguist, Noam Chomsky (1965, 1972), argued that it is impossible to account for children's language acquisition in terms of traditional learning theories (see chapter 4). As we have seen, children are learning many aspects of language quickly. Chomsky points out that the rules of language children have to master are very complex, and most parents are not able to articulate them. In fact, in much of everyday adult speech we do not even reveal the rules very clearly – we make errors, false starts, inject 'er's and 'um's, leave sentences incomplete. Yet not only do children make rapid progress in their language development (mastering most of the basic rules by about age five), but they are able to create and understand novel linguistic expressions. Chomsky argues that language acquisition in the normal child constitutes 'a remarkable type of theory construction' (1959, p. 58).

Chomsky seems here to be agreeing with Piaget, who also saw the child as constructing theories (see above). But Chomsky took the argument in a different direction. He maintained that any theory involved in coming to grips with a human language has to be extraordinarily complex. It must be general enough to accommodate any language that a child is exposed to, and it must be shared by all normal humans (because we all learn a language, and we all do so at roughly the same pace).

Where could such a theory come from if parents are not able to teach it or even model it? How does everybody get access to it? Chomsky's controversial answer is that it must already be there: the child must have some innate knowledge of what the structure of language will be like. In fact, Chomsky insists that language is not learned at all – it grows and matures, rather like limbs and organs grow.

Chomsky challenged

Chomsky has many supporters, but also many critics. There is much research to confirm that language acquisition is complex and relatively rapid. On the other hand, there is plenty of evidence that parents do play a role in their children's language acquisition. Consider, for example, the research we discussed above concerning the social context of early communication, and the ways in which adults modify their speech for the benefits of the learner (see Durkin, 1995).

There are also objections from Piagetians, who regard language not as an innate, highly specific ability, but as one aspect of the child's broader representational capacity, which emerges during the preoperational period (Sinclair-de-Zwart, 1969).

Social and emotional development

The family is the primary social environment for children during the preschool years, but it is also the base from which they venture into new social contexts. The family is influential in several ways, particularly in the kinds of social behaviour it fosters, and with respect to the kinds of social contacts it offers for the preschooler (Dunn, Creps & Brown, 1996; Schaffer, 1996).

Making friends

Many researchers believe that the patterns of behaviour predominant in the preschooler's home influence the behaviour the child manifests outside the home (Barth & Parke, 1993; Rubin et al., 1998). A good illustration of this principle is Russell and Finnie's (1990) study of Australian preschoolers and their mothers in situations where the child had to join unfamiliar peers. The researchers found that the mothers guided their children towards strategies that affected the child's acceptance. Mothers of popular children suggested ways in which they might join in with peers' current activity, while mothers of children neglected by their peers were more likely to guide them to focus on the materials to hand. There is also evidence that children with a Type B (securely attached) attachment relationship in infancy tend to score higher on measures of social participation with peers at preschool (LaFreniere & Sroufe, 1985). In other words, aspects of the relationship with the primary caregiver are

reflected subtly but influentially in how the preschooler begins his peer relations.

Peer relations among preschoolers show another continuity with early relations: they are selective. Although children of this age will play with a wide array of peers if given the opportunity, they do demonstrate clear preferences (Hartup, 1999). Individuals identify others with whom they play more frequently; they seek out each other's company and they become friends (Hartup, 1999). These early friendships serve a number of important functions, including fostering the growth of social competence and providing sources of emotional support (Asher & Parker, 1989; Erwin, 1993).

The value of these relationships is made clearer by the problems suffered by children who lack them. Unfortunately, some children do not establish friendships and are either neglected or rejected by their peers. Children who experience difficulties like this in the preschool years are at risk of continuing problems in peer relations and personal adjustment throughout childhood and even into adulthood (Coie et al., 1995).

Learning about gender

One of the major areas of social development during the preschool years is learning about gender.

Even in the preschool years, children tend to segregate by gender and to show different behavioural preferences. Boys tend to be more physical and active in their play, while girls often like to play with dolls (Maccoby, 2000). One theory is that these differences reflect biological pre-programming. We know that the young of other species – such as tadpoles – are pre-programmed to develop particular patterns of behaviour according to their gender, and these behaviours underpin later social and reproductive activities, such as patterns of aggressiveness or how they call out to attract mates (Emerson & Boyd, 1999; Summers, 2000). It has been argued that, in a similar way, evolution has designed human males and females for different functions ('males as providers', 'females as caregivers'), and children's play behaviours are early emerging signs of this 'biological imperative' (Hutt, 1978).

An alternative view is that children are 'shaped' by the surrounding culture. Unlike tadpoles, human young receive a lot of direct and indirect advice from their parents about gender expectations. This could serve to reinforce some behaviours (see chapter 4) and extinguish others (e.g. by dressing daughters in pink or telling sons not to cry). Children themselves try to influence each other's gender behaviour, too. Even preschoolers develop strong opinions about how boys and girls should behave. For example, boys might intervene to stop a peer playing with 'girls' toys' (Bussey & Bandura, 1992). Finally, children also receive many stereotyped messages from the larger community and the mass media about gender role expectations (Durkin, 1985).

But some developmentalists have argued that both of these explanations (biology versus environment) overlook a still more basic question: how does a child know that he or she is a male or female in the first place?

This brings us to another aspect of gender role development – cognition, or the child's active search for and interpretation of information about what is expected of males and females (Kohlberg, 1966). Unlike tadpoles, by the end of infancy most children know whether they are a boy or girl and can distinguish men from women (Thompson, 1975). During the next few years, they begin to appreciate how fundamental this distinction is. For example, preschoolers discover an interesting fact about gender that is not apparent to the infant: whichever gender one belongs to, it is going to be a lifelong commitment. While this seems obvious to an adult, it is not understood instantaneously by toddlers.

Children learn the labels for male and female and begin to apply these during their third year of life (Fagot & Leinbach, 1993). Over the next couple of years, they build up an increasing amount of knowledge about what it means to be a male or a female (Martin, 2000), and this learning appears to be linked to broader cognitive development (Szkrybalo & Ruble, 1999). Rather than simply absorbing messages from parents or the mass media, by age four or five children can predict accurately the gender of a person stereotypically associated with a particular activity (such as fixing a car or doing the sewing) before they have actually seen the person (Durkin & Nugent, 1998).

It is clear that, even at this early age, gender is a fundamental category around which the social world is organized, and that children are active in determining their own social experiences.

Figure 9.10

Children receive many messages from the larger community and the mass media about gender role expectations. In the past, these messages have been more stereotyped than they are today.

THE SCHOOL YEARS

Although the school years extend right through to the mid to late teens, we will focus here on the period from around age five to twelve, turning to adolescence in chapter 10.

Middle childhood is a period of relatively steady growth in physical terms, but great progress in cognitive and social development. It is also a period in which individual differences in the rate and extent of development become more evident.

PERCEPTUAL AND MOTOR DEVELOPMENT

By the early school years, children's sensory capacities are generally well developed and, in many respects, functioning at adult levels. Physical development is well advanced, too, though of course the child is still growing and there are certainly many skills that undergo further development. Children are now capable of a wide range of physical activities, and development tends to consist of increasing control and integration of movements (Cleland & Gallahue, 1993; Gallahue, 1989; Krombholtz, 1997).

Individual differences in physical growth and development are influenced by genetic and environmental factors. Some evidence indicates that some disadvantages can persist throughout middle childhood. For example, high proportions of children born prematurely exhibit perceptual–motor problems at age six (Jongmans et al., 1998). Dowdney, Skuse, Morris and Pickles (1998) studied a sample of British children who were exceptionally short at age four. Very small stature tends to be associated with delayed cognitive development. These children also came from economically disadvantaged homes. At age 11, many of these children continued to fare poorly on tests of cognitive abilities compared to a normal comparison group.

COGNITIVE DEVELOPMENT

Once again, researchers' perspectives on this period have been influenced strongly by Piagetian theory – but once again, this is not to say that all researchers accept the details of Piaget's account.

The period of concrete operations

concrete operations period the third major phase of cognitive development, according to Piaget, lasting from approximately seven to 11 years, when the child's problem solving is more logical but his/her reasoning is largely dependent on application to immediate physical entities and tasks

Early in the school years, at around age six or seven, children undergo another major stage transition, entering what Piaget called the *concrete operations period*.

The child can now handle the kinds of intellectual problems that the preoperational child struggled with (such as perspective taking). For example, the concrete operational child is capable of decentration, i.e. taking into account more than one aspect of a problem. He is likely to dismiss scornfully the kinds of responses that a preoperational child gives to a conservation task; for example, on the beaker task the concrete operational child can explain readily that the amount of liquid remains the same, despite changes in visual appearance.

The concrete operational child is able to draw upon logical abilities that Piaget thought were unavailable during the preoperational stage. With respect to the liquid conservation task, these include the ability to:

- reverse the operation mentally (reversibility) – 'If the water filled this much of the first beaker, it must fill the same amount when it is poured back';
- maintain identity (identity) – 'Nothing has been added or removed, so it must be the same amount'; and
- compensate to take account of combined changes (compensation) – 'It's higher, but it's also thinner – these changes cancel each other out, so there's no change in amount.'

The ability to deal with experimenters asking you how much liquid there is in different shaped beakers may in itself seem to be of limited value. However, what is much more important is the breadth of applicability of the underlying cognitive changes mediating performance on these tasks. Conservation ability is fundamental to many other intellectual tasks, and children's education would not proceed far without it. For instance, the achievement of reversibility, identity and compensation underpins much of elementary mathematical and scientific understanding. Consider, for example, how these skills could be used in relation to tasks such as simple numerical operations (e.g. comprehending that if $3 \times 2 = 6$, then $6 \div 3 = 2$), and investigating the interaction of key variables (e.g. comparing the eventual progress of two moving objects, one moving very fast for a short time and the other moving very slowly for a long time).

Other developments and some limitations

There are many other advances during these concrete operational years, too. Children now have greater facility in classifying objects and sorting them into sets and subsets. They appreciate that the same objects could be sorted differently if different criteria were applied (e.g. boys and girls, or blue-eyed and brown-eyed children). They find easy the kinds of seriation (or ordering) tasks that thwarted preschoolers. Their improved grasp of cause–effect relations enables them to comprehend a greater range of phenomena in the natural and social environments. Their greater ability to take other perspectives into account means that they can produce and understand spatial representations, such as maps and diagrams.

All of these cognitive skills afford the child new means of acting upon the world to build greater understanding. But there are still some important limitations. In particular, Piaget saw the concrete operational child's newfound intellectual organizational abilities as restricted to readily accessible (i.e. concrete) contexts, such as immediately present objects and events or easily imagined circumstances. According to Piaget, dealing with abstract ideas and contemplating alternative explanations in the absence

of practical examples came later, in the formal operational period (see chapter 10).

Language and communication

By the school years, typically developing children have mastered the basic grammar of their language and are generally able to make themselves understood as well as understand others. Nevertheless, important developments continue through middle childhood. These include improving phonological skills in co-ordinating speech production, pronouncing multisyllabic words, and understanding speech in noisy contexts (Dodd et al., 2003; Hoff, 2001).

Vocabulary growth continues at an impressive pace (Biemiller & Slonim, 2001), and children become increasingly competent at using and understanding complex grammatical constructions (Hoff, 2001). There are marked improvements in the ability to construct and understand narratives (Hoff, 2001; Low & Durkin, 2000).

As well as improving their use and understanding of language during school years, children also get better at reflecting on language. In other words, they develop metalinguistic awareness – the ability to think and talk about language and its properties (Bialystock, 1993). Ask a preschooler which is the bigger word – 'horse' or 'caterpillar' – and she is likely to answer 'horse'. Young children find it difficult to conceive of the word as an object in its own right. But school age children become increasingly competent in such tasks. During middle childhood, they learn to distinguish words according to whether they obey the phonological rules of their language ('kerpod' versus 'kzkdff') (Edwards & Kirkpatrick, 1999). The emergence of metalinguistic awareness is important because it facilitates many other cognitive and educational processes. For example, once a child knows what words are and is able to conceive of manipulations upon them ('What does "cow" sound like if we take away the "c"?'), he is better equipped to handle the demands of learning to read and write (Tunmer & Chapman, 2002; Wood & Terrill, 1998).

Social and emotional development

While the family remains the principal context of social relations for most children during the school years, interactions with others become much more extensive. Children are learning more about themselves while participating in increasingly complex social networks.

Consider the range of tasks to be met in the course of middle childhood. The young person has to figure out who she is – what makes her unique. This involves discovering her own capacities and limitations (during a period of continual change) and coming to terms with the emotions that these assessments provoke (pride, shame, anxiety, ambition). It also involves comparison with others – we discover ourselves partly through measuring how we stand relative to our peers. In fact, during this phase of life, children come to assess themselves and their peers in increasingly profound ways.

Gender role development

We saw above that during the preschool years, children begin to organize their social worlds around gender and to accumulate information about what it means to be male or female. These processes continue during middle childhood.

By this stage, children know quite a lot about the traditional expectations of their society concerning gender. For example, by the age of five or six years, children have firm views on who will be most competent as a car mechanic or aeroplane pilot, or as a clothes designer or secretary (Levy, Sadovsky & Troseth, 2000; see figure 9.11).

Yet there is a broad difference in terms of how boys and girls conform to traditional roles. During middle childhood, boys tend to follow the requirements of masculinity more rigidly than girls follow the requirements of femininity (Archer, 1992). Cross-sex activities are disapproved of by most boys, while girls are often happy to participate in leisure activities that are perceived as masculine (e.g. some girls of this age will play soccer, climb trees, ride skateboards, wear 'male clothes').

A large study of North American women of different generations found that a clear majority recalled engaging in 'tomboyish' activities during their childhood, with the mean age of starting these activities being five years and the mean age of concluding them being around 12 and a half (Morgan, 1997). This type of behaviour therefore appears to be normative for females and socially accepted as such, whereas the corresponding cross-sex behaviour in boys (e.g. taking an interest in sewing, playing with dolls, dressing up) results in peer hostility and parental concern (Archer, 1992; Raag, 1999).

Seems unfair? Indeed, but this pattern of behaviour during middle childhood seems to reflect a social advantage for males. Archer (1992) argues that because males have traditionally been the most powerful gender, socialization patterns have developed

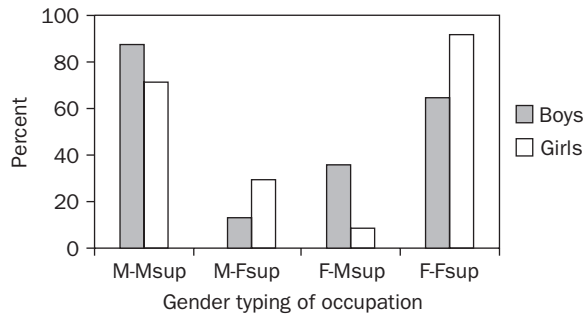

Figure 9.11

Five- to six-year-olds' judgements of who will be most competent in masculine stereotyped occupations (car mechanic, pilot) and feminine stereotyped occupation (clothes designer, secretary).
Key:
M-Msup: Masculine occupations, men rated more competent
M-Fsup: Masculine occupations, women rated more competent
F-Msup: Feminine occupations, men rated more competent
F-Fsup: Feminine occupations, women rated more competent
Source: Based on Levy, Sadovsky & Troseth (2000).

to ensure that young males are prepared for their ultimately dominant role in society. As a result, their gender role may become more rigid during the school years, whereas females are seemingly allowed a longer period of 'gender flexibility', although not an indefinite one, as Morgan's (1997) findings reveal (see also chapter 10).

Peer relations

Middle childhood is also a time of increasing peer interaction. The school years present a dramatic increase in the amount of time spent with peers, and the relationships themselves become more complex as cognitive development progresses and social demands increase.

We saw earlier that preschoolers begin to demonstrate selectivity and preferences among their peers. Although some of these relationships are close and enduring, many are short-lived. If five-year-olds are asked to identify their friends, they will most likely mention whichever peer is nearby, or children with whom they have played recently (Damon, 1983; Erwin, 1993). These affiliations may be quite transitory and subject to termination when disagreements occur. During middle childhood, however, friendships become more enduring, more dependent upon personality compatibility, and characterized by a greater degree of mutual expectation (Damon, 1988; Erwin, 1993; Hartup, 1998).

Researchers have investigated children's concepts of friendship using interview techniques. Typically, interviewers ask questions such as: 'What is a friend?' 'How do you make friends?' 'How do you know someone is your friend?' (Damon, 1983). Younger children (aged four to seven) tend to define friendships in terms of mutual liking and shared activities. Children at this age do have interpersonal expectations (like being nice to each other and sharing toys), but they rarely express psychological dimensions of the relationship. In middle childhood, by contrast, there is more emphasis on provision of mutual support and trust (Erwin, 1993). For example, at around the age of seven or eight, children still tend to describe friends in relatively concrete terms, but they

Everyday Psychology

Gender identity: when boys want to be girls (and vice versa)

Adults often make the throwaway comment that 'boys will be boys' to account for rough-and-tumble games or permanently grazed knees.

But when during childhood does our gender identity become fixed? And what if there is a mismatch between our gender self-identity and the biological sex we have been allocated through our genes?

For most children, their gender identity conforms to the physical body they are born in. But for a small minority of children, this question can raise important issues. When someone's biological sex does not match their gender identity, we use the term gender identity disorder (GID).

People with GID often describe themselves as 'trapped inside the wrong body'. They often have a strong conviction or a wish to belong to the opposite gender. Nobody really knows what determines this self-perception. It could depend on a range of factors working together, such as significant environmental events, hormonal influences or different life experiences at critical points of brain development (these events may occur after birth or in utero).

It is common for children to face gender issues while they are growing up. For example, plenty of girls adopt stereotypically boyish traits, such as cutting their hair short or climbing trees – what we often refer to as being a 'tomboy'. They do not identify themselves as boys or struggle with emotional issues related to their gender.

But in some children, GID becomes a permanent feature of their personality that stays with them into adulthood. Some adults may even elect to have surgery in order to seek to resolve the discrepancy between their appearance and their gender identity.

Children with GID may insist they belong to the opposite sex. Boys may show a preference for cross-dressing or playing the female role, while girls may wear masculine clothing and be drawn towards rough games and contact sports. Children with GID may also choose friends of the opposite sex and show signs of unease about their own body.

To date, GID has been identified more in children who are biologically boys than girls. According to research, roughly six times more boys than girls seek guidance on how to respond to GID. As noted in this chapter, Western society is much more accepting of girls being tomboys than of boys engaging in 'girlish' behaviour. So adults may detect differences in boys' gender-related behaviour much sooner than they would in a girl. So the prevalence of GID may in fact be similar for both sexes, but occurrence in girls is less often picked up.

Most of us feel at ease with our gender, and we tend to assume that other people do, too. But individuals with GID remind us that there is a range of experiences and perspectives even in something as fundamental as which sex people feel they belong to. Developmental–clinical psychologists play an important role in understanding and ameliorating the obstacles and ostracism that some individuals with GID may face.

Bradley, S.J., & Zucker, K.J., 1997, 'Gender identity disorder: A review of the past 10 years', *Journal of the American Academy of Child and Adolescent Psychiatry*, 36 (7), 872–80.

increasingly make references to shared activities and cooperation ('we play soccer together', 'we take turns in goal'). Over the next few years, there is an increasing emphasis on reciprocity, the obligations of friendship and the psychological characteristics of friends ('she's kinda shy, but she stands up for me and I'd do the same for her').

This is not to suggest that friendships are invariably harmonious. In fact, during middle childhood relations with friends can involve a great deal of conflict – more so than relations with 'non-friends' (Hartup, French, Laursen et al., 1993). Children at this age learn that relationships have a strong emotional aspect, and that sometimes friendships can be volatile. In short, relationships during middle childhood become more complex as children come to understand more about the nature of people and their interdependencies. In this way, social development is closely interwoven with cognitive development.

FINAL THOUGHTS

Many questions about human psychological development remain challenging and controversial. We do not have all the answers yet, but developmental psychologists are addressing issues that are fundamental to our understanding of the nature of the human mind.

We asked at the beginning of this chapter: how much is given by nature and how much by experience? The most convincing answer would seem to be: a lot of both.

Some capacities emerge very early in human infants, and almost all children do some of the same things on roughly the same schedule, suggesting that development is a natural and predetermined process. For example, we have seen that children can distinguish speech sounds in infancy, their vocabularies explode in the toddler years, and they are quite fluent with complex grammars by the age of four or five.

But what would happen to a child who had no opportunities to talk to other people (i.e. no language experience)? It would scarcely be possible for children to progress in understanding the complex characteristics of other people's attributes, behaviours, thoughts and emotions without extensive experience of the diversity of people and relationships. Nature and nurture are both important in child development – and often so interwoven that they are indistinguishable.

We also asked: how does change come about? Is it gradual or stage-like? For some early psychologists, the answer seemed obvious: children change as a result of learning and the additive effects of experiences. For psychologists of this persuasion, change is externally driven and gradual. Others maintain that the processes are internally driven but responsive to and building on lessons derived from experience. For them, change is domain general and involves radical, stage-like transformations. Yet others see development as domain specific – each domain involving its own structures and principles.

Many of the developments that take place during infancy and childhood remain mysterious, but this makes our investigations all the more exciting. And, as we will see in the next chapter, the developments do not end with childhood.

Summary

- We began in this chapter considering the developmental progression in the tadpole, and reflecting on how the human child's development may be compared to the progression from tapdpole to frog.
- The progression through infancy, the preschool years and the school years takes place concurrently in several important domains: physical and sensory development, cognitive development, language and communication, and social and emotional development. Progression in these separate domains occurs at different rates as the child develops.
- One of the most salient issues that we tackled was the extent to which the human infant's capacities are determined (a) by innate abilities, (b) via interaction with the environment or (c) via a complex interaction of innate abilities and environmental input.
- Piaget proposed a series of orderly sequences (sensorimotor, preoperational, concrete operational) through which the infant and child progresses. Piaget's framework has been very influential, but it has been criticized for underestimating the developing child's abilities because of the way in which Piaget's tasks (such as the conservation task) are presented.
- Language acquisition is one of the most complex and impressive feats that the child achieves. Given the complexity of human language acquisition, Chomsky proposed that this was dependent upon an innate language acquisition device. However, Chomsky's views have been challenged as under-representing the role of the environment in language acquisition.
- Children's emotional and social development can be turbulent, as they face gender stereotyping and peer conflict. Boys develop a more rigid gender role during childhood and adolescence, whereas girls enjoy a longer period of gender flexibility. As friendships become more complex, children begin to understand concepts such as trust, cooperation and obligation, bringing a cognitive aspect to emotional development.

REVISION QUESTIONS

1. What are the arguments for and against stage theories of children's development?
2. When does the infant begin to make sense of the visual environment?
3. Do infants need other people for anything more than food and physical care?
4. Why might a toddler use the same word to convey several different meanings?
5. Are preschoolers egocentric?
6. In what ways do the cognitive abilities of the school age child differ from those of the preschooler?
7. How do children's friendships reflect their cognitive development? Why is acquiring language important for the child?

Further Reading

Durkin, K. (1995). *Developmental Social Psychology: From Infancy to Old Age*. Oxford: Blackwell.
Emphasizes the social contexts of development and the developmental aspects of social reasoning and social behaviour.

Goswami, U. (1998). *Cognition in Children*. Hove: Psychology Press.
A clear account of theory and research on children's developing knowledge and reasoning, covering topics such as learning, memory, problem solving, reasoning and conceptual development.

Hoff, E. (2001). *Language Development*. 2nd edn. Belmont, CA: Wadsworth/Thomson Learning.
An excellent introduction to the study of language acquisition in normal and exceptional children.

Messer, D., & Millar, S. (eds) (1999). *Exploring Developmental Psychology*. London: Arnold.
A useful overview of recent developmental psychology, covering topics in infancy, cognitive and representational growth, atypical development, intelligence, social relations and adolescence.

Muir, D., & Slater, A. (eds) (2000). *Infant Development: The Essential Readings*. Oxford and Cambridge, MA: Blackwell.
Reviews key theoretical issues, and presents an invaluable set of research papers concerned with perceptual, cognitive, social and communicative development in infancy.

Slater, A., & Muir, D. (eds) (1999). *The Blackwell Reader in Developmental Psychology*. Oxford and Cambridge, MA: Blackwell.
Contains accessible and informative articles on a wide range of developmental topics.

Smith, P.K., Cowie, H., & Blades, M. (2003). *Understanding Children's Development*. 4th edn. Oxford: Blackwell.
The ideal next step up for psychology students who wish to pursue the topics introduced here in more detail.

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Adolescence and Adulthood

10

Learning Objectives

By the end of this chapter you should appreciate that:

- the journey from adolescence through adulthood involves considerable individual variation;
- psychological development involves physical, sensory, cognitive, social and emotional processes, and the interactions among them;
- although adolescence is a time of new discoveries and attainments, it is by no means the end of development;
- there is some evidence of broad patterns of adult development (perhaps even stages), yet there is also evidence of diversity;
- some abilities diminish with age, while others increase.

INTRODUCTION

Development is a lifelong affair, which does not stop when we reach adulthood. Try this thought experiment. Whatever your current age, imagine yourself ten years from now. Will your life have progressed? Will you have attained any goals? What state will your body be in, and how will you feel about it? Where will you be living? Will your cognitive and occupational skills have improved and broadened, or started to slow down? Do you anticipate changes in your financial status? Will you have gained/retained/replaced a partner? How will you adjust to new responsibilities (at work, at home)? Will your leisure activities differ? Will you have had children/seen existing children grow up and leave home? Would you expect other people to regard and treat you differently from the ways they do now? What changes in the larger world (technological, political, economic) might affect you in a decade's time?

If ten years ahead is an awesome prospect, imagine yourself 20, 30 or more years from now and repeat the exercise.

Did you find this an easy or difficult task? Is your life course planned and your intention to follow it unshakeable, or do you see it as open to the decisions of others, or governed by pure chance? Do you look forward to change (and ageing), or does the prospect unnerve you?

It soon becomes clear when we contemplate our own futures that change is inevitable. But to what extent is development in adulthood due to intrinsic, fundamental changes in the organism, to accumulating experiences in complex environments, or to social and community pressures to adapt? Is change continuous and gradual, or is it marked by major transitions? You will notice that these are similar issues to those questions we considered in chapter 9.

In this chapter, we follow developments beyond childhood, beginning with adolescence and then moving into the phases of adulthood – early, middle and late.

Although there are many aspects to development during adolescence and adulthood, and wide individual variation in circumstances and achievements, the core issues, psychologically speaking, continue to revolve around the themes covered in chapter 9. So, once again, we will follow each phase of development from physical, cognitive and social perspectives.

ADOLESCENCE

It is difficult to decide exactly when adolescence begins or ends, as both boundaries are subject to individual variation. Is a person an adolescent when he or she reaches a particular age – say, the teens? Some people at this age are already relatively mature sexually, whereas others are still pre-pubertal. Intellectual maturity can vary just as widely.

And when is adolescence complete – at the end of the teens, at 21, or later? Some people have adult responsibilities – perhaps a job and family – by their late teens, while others can be found skateboarding around university campuses, free of commitments and still quite unsure of where they are heading in life, into their mid 20s.

For these reasons, psychologists working on adolescence tend to define the period broadly, as a time of transition between childhood and adulthood, acknowledging that the timing and pace of development is subject to considerable variation.

PHYSICAL DEVELOPMENT

Through most of childhood, people grow at a fairly steady pace – about 5–10 cm and 2–3 kg per annum. But with the beginnings of adolescence, most individuals undergo another radical change, often called a growth spurt. In girls, this typically occurs at around age 10 to 13; in boys, it occurs between 12 and 15. Growth is quite rapid compared to earlier in the lifespan – a girl may add around 9 kg in a year, and boys around 11 kg (Tanner, 1962). Remember the tadpole in chapter 9? The transformations of puberty – as the developing body commences the changes that allow it in turn to contribute to the reproductive process – are almost as radical.

Secondary sexual characteristics

A particularly important physical change during puberty is the emergence of secondary sexual characteristics. In girls, this means an increase in subcutaneous fat and rounding of the body, the beginnings of breasts and, towards the end of the spurt, pubic hair and the menarche (the first period). In boys, the penis, testes and scrotum begin to enlarge, pubic hair appears, the voice begins to deepen, and muscles grow and strengthen. At around 13 to 14, most boys experience ejaculations or nocturnal emissions (wet dreams). Underlying all of these external changes, there are important hormonal developments, due to the increased production of oestrogen (in girls) and androgen (in boys). Young people are now heading towards their mature size and form, but the pace of development varies markedly across individuals.

These developmental changes are important from a psychological perspective, because they affect the young person's sense of self and relations with others (Brooks-Gunn & Paikoff, 1992; Durkin, 1995). Unlike the tadpole, human adolescents are very much consciously aware of the changes they are undergoing. The emergence of the secondary sexual characteristics prompts them to think of themselves as young adults, and to change their appearance and activities accordingly.

Figure 10.1

During puberty, secondary sexual characteristics, such as facial hair in males, begin to emerge.

The effects of variation

Variations in the pace of development lead to complex outcomes. In some respects, those who mature early tend to have an advantage in that they are seen – and treated – as more adult-like. Some young people, especially males, gain from this, developing greater popularity and confidence that can endure into adult life (Jones & Bayley, 1950). In contrast, late maturers may experience some insecurities as they compare themselves with their peers who are ahead of them in the prized achievement of growing up (Alsaker, 1992).

But there can be drawbacks to early maturation, too. For example, some early maturing boys are drawn into activities (like truancy or delinquency) that get them into trouble with parents, teachers and other authorities (Ge et al., 2001). Some early maturing girls report higher levels of psychosomatic distress during their teens. This is perhaps because their earlier involvement in activities such as dating and other people's expectations of them to behave as adults lead to pressures they are not yet equipped to handle (Ge, Conger & Elder, 1996; Graber et al., 1997).

COGNITIVE DEVELOPMENT

Less immediately visible is an intellectual growth spurt during this period (Andrich & Styles, 1994). The young person is becoming capable of thinking about the world, and dealing with the challenges it presents in new and more powerful ways.

The period of formal operations

In Piaget's view, the cognitive advances of middle childhood (the concrete operational period) are limited because they can only be applied to relatively accessible problems, i.e. tasks concerned

period of formal operations the last of Piaget's stages of intellectual development, when thought is no longer dependent on concrete operations tied to immediately present objects and actions, but is based on reasoning about abstract propositions and the evaluation of alternative possible outcomes

with the physical 'here and now', or easily imagined scenarios (see chapter 9). During adolescence, many individuals progress beyond this limitation, and are able to deal with more abstract cognitive tasks. Piaget calls this (the final stage in his model) the *period of formal operations*.

Once again, Piaget and his collaborators studied this phase of development in great detail (Inhelder & Piaget, 1958). They set a number of tasks for children and adolescents, designed to illuminate changes in their reasoning processes. In one task, participants were presented with a set of pendulums, with objects of different weights suspended from strings of different lengths (figure 10.2). The task was to determine what influences the speed with which the pendulum swings: is it the weight of the object, the length of the string, the height from which the object is dropped, the speed with which it is pushed, or some combination of factors?

Children still in the concrete operational stage set about the task rather haphazardly. They tried guessing and random combinations of actions but were unable to isolate the effects of a single factor. Adolescents (aged 14–15) who had reached formal operations worked in a much more systematic fashion. They tested the effects of varying a factor (e.g. length of string) while holding the other factors constant (e.g. using the same weight for each trial), keeping track of the different manipulations and possibilities. In due course, they came up with the correct answer. (What do you think? Test your own formal operational reasoning. The answer is given on p. 222.)

Another problem devised by Inhelder and Piaget (1958) was a chemistry task, which involved creating a yellow solution from five unidentified liquids, each initially in its own test tube. Some combinations of colours achieved this outcome, and others removed it. How would you set about finding which combinations work, and then how to make the colour disappear?

Concrete operational children favoured a trial-and-error approach: they kept trying random mixtures. Some children never worked it out, some hit occasionally on a combination that worked but were not sure exactly how they had done it, or how to reverse the process (i.e. make the colour disappear). The formal operational thinkers were much more systematic. They contemplated the range of possible combinations, formulated hypotheses, and tested them sequentially; they also kept a record of the combinations they had tried and the outcomes.

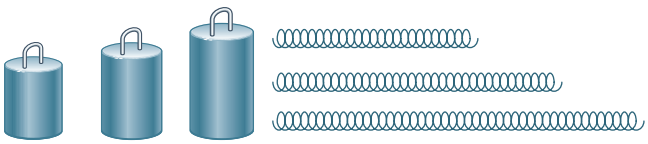

Figure 10.2

Materials for the pendulum task.

In these (and many other) tasks, formal operational thinkers demonstrate not simply that they are systematic and able to keep track of their attempts, but that they are able to formulate abstract hypotheses about possible outcomes. They are able to conceive of different propositions about the same set of factors, and to work out means of testing them to achieve a resolution.

Formal operational thought is not restricted to tackling science education puzzles. Again, from a Piagetian perspective, the important point is that this higher level of reasoning enables young people to deal with many aspects of the world more profoundly. They now have access to more abstract ideas and principles, and some become very interested in the principles governing the broader social environment. For example, many adolescents develop an interest in political issues, human rights, feminism, the environment or spiritual matters (Klaczinski, 2000) – all concerns that reflect their ability to conceive of alternatives to the present reality. This is a time of 'great ideals' (Piaget & Inhelder, 1966).

Piaget challenged

Although most developmental psychologists would agree that adolescent thought reflects important advances beyond childhood, not all agree with Piagetians about the nature of the changes, and not all of the evidence is consistent with the theory.

For example, large-scale studies have reported that only small proportions of adolescents perform sufficiently well to meet the criteria for formal operational reasoning (Neimark, 1975; Shayer, Kuchemann & Wylam, 1976). The comprehensiveness of Piagetian theory is in doubt if it fails to characterize a majority.

Contemporary researchers agree with Piaget that cognitive development does proceed during the adolescent years, but they disagree with him about the patterns and processes entailed (Byrnes, 2003; Klaczinski, 2000). During this period, young people show improved abilities in several areas, including deductive and inductive inferences, objective thinking, mathematical operations and decision making (Byrnes, 2003). But the developmental evidence does not support the Piagetian assumption of domain-general transitions (see chapter 9).

For example, participants' scores on different reasoning tests do not correlate highly during adolescence, and there are greater age differences on some tests than on others (Csapo, 1997). If a general improvement were underway, we would expect to find comparable and simultaneous improvements across cognitive domains. Instead, adolescents appear to function better in cognitive tasks where they have an existing strong knowledge base (Byrnes, 2003) or have received specific training designed to accelerate performance (Iqbal & Shayer, 2000).

These findings lead many researchers to favour domain-specific models of cognitive development in adolescence. According to such models, developmental progress depends at least in part on the cognitive opportunities, tasks and challenges to which adolescents are exposed (Byrnes, 2003).

Alternative accounts of adolescent reasoning have been advanced more recently, drawing upon information-processing theories, and arguing that what really underpins development in

adolescence is not so much changes in formal logical skills as changes in processing capacity or efficiency – such as improved memory skills or attention span (see Keating, 1990). These capacities may also be linked to ongoing neural developments, as there is now substantial evidence that the frontal lobes continue to develop during adolescence (Byrnes, 2003).

Social and emotional development

The adolescent's social world is changing fast. The changes reflect the biological and cognitive developments summarized above, as well as new opportunities and the impact of other people's expectations.

Gender and sexual development

During adolescence, gender becomes of much more central importance for most individuals. The biological changes discussed above make gender all the more salient – to the adolescent and to others.

One consequence is that societies' expectations about gender-appropriate behaviour are brought home more powerfully than ever before. During childhood, cross-sex interests are tolerated to some extent in girls (although, as we have seen in chapter 9, this is less the case for boys). But in adolescence, parents and peers tend to provide stronger messages about acceptable and unacceptable behaviour – there is a narrowing of the gender 'pathways' as we move closer to our adult roles (figure 10.3; Archer, 1992). In some cultures, the sexes are increasingly segregated in adolescence, although in others (such as many Western societies) many adolescents are particularly keen to socialize with the opposite sex.

In societies that do allow for mixed gender interactions in adolescence, a number of factors bear on young people's sexual development. Increased hormonal levels are associated with heightened interest in sex in both boys and girls. For boys, this tends to lead to involvement in sexual activity (though much of this is solitary), while girls tend to be more influenced by social factors, such as parental attitudes and friends' sexual behaviour (Crockett, Raffaelli & Moilanen, 2003; Katchadourian, 1990). Whatever the specific influences and motivations, the outcome is that a lot of adolescents have apparently experienced sexual relations. For example, in America, about two-thirds of 12th graders (16- to 17-year-olds) report having had sexual intercourse (Crockett et al., 2003) – although this figure may be somewhat inflated by peer pressure.

The importance of peers

There is no doubt that peers are very important to adolescents. During this phase of the lifespan, people spend increasing amounts of time in the company of their peers (Brown & Klute, 2003; Collins & Laursen, 2000) and increasingly focus on peer relations as crucial to their sense of identity (Pugh & Hart, 1999).

Figure 10.3

Adolescents become interested in adult appearance. There is a narrowing of gender 'pathways' and an increased interest in sex.

You are probably aware of strong popular assumptions about the effects of peers on adolescents. Peers are often regarded as a potentially harmful influence, leading impressionable teenagers into dangerous experimentation (e.g. with drugs and sex), dereliction of responsibilities (e.g. schoolwork) and hostility to adults and adult society. Peer values are often assumed to be the antithesis of parental values. But were these your own experiences?

Certainly, friends' behaviour does tend to be correlated with adolescents' choices and actions in many areas (Durkin, 1995). But, as you already know from reading chapter 2, correlation does not equal causation. In fact, we *choose* our friends – and adolescents tend to choose friends who have similar interests. If you are a smoker, you probably will not choose to hang out most of the time with the sports crowd. More generally, adolescents themselves report that, although they are subjected to peer pressures sometimes, they do not generally experience this as a major influence on their behaviour or as something that they find particularly difficult to handle (du Bois-Reymond & Ravesloot, 1994; Lightfoot, 1992).

Furthermore, perceived peer influence tends to vary across different domains of life. It is quite strong with regard to appearance (e.g. hairstyle, clothing) and socializing (e.g. dating, finding out

Research close-up 1

Studying adolescent development: What a bedroom wall can reveal

The research issue

Have you ever experienced an attraction to a movie star? Pinned a poster of a rock hero above your bed? Dreamed of a date with your idol? If you have, you are not unique. These are quite common experiences in adolescence. Some teenagers even describe themselves as 'in love' with these glamorous but remote characters, whom they will probably never meet. Some report jealousies about their idols' on-screen and real-life relationships. What developmental psychological processes are involved in the adornment of a bedroom wall?

To find out, Rachel Karniol (2001) studied 13- and 15-year-old girls' reasons for hanging posters of media stars in their bedrooms. Karniol reasoned that girls at this age are subject to conflicting pressures as their sexuality emerges. On the one hand, they are maturing physically and developing emotional needs for attachments. But on the other hand, boys of the same age tend to be less mature because they have entered the growth spurt later. Furthermore, there are strong societal values that limit the expression of sexuality in young females.

Karniol hypothesized that posters of their idols provided these young teenagers with convenient but safe love objects, providing a transition into sexuality that precedes their physical relationships with boys. At the stage when girls are still ambivalent about sex, Karniol expected that they would prefer idols with relatively feminine features (for example, relatively large eyes, heart-shaped face, small jaw, petite nose), such as Leonardo Di Caprio, Brad Pitt or Nick Carter of the Backroom Boys, to hyper-masculine stars, such as Arnold Schwarzenegger, or Sylvester Stallone. She also hypothesized that posters would serve a social function – something to talk about with other girls.

Design and procedure

Fifty teenage girls completed questionnaires about their favourite stars, including whether they had posters of them on their bedroom wall (and, if so, how many). Examples of questionnaire items include:

Do you look for information about the star in newspapers and magazines?
How excited are you when you think of the star?
What percentage of your conversations with your friends is devoted to talking about the star?
How jealous are you of the women that the star has relations with in movies or performances?
How jealous are you of the women the star has relations with in real life?

Results and implications

All but one of the participants indicated that she did have an idol, and about 40 per cent hung posters of their favourite(s) on their bedroom wall. Most of the idols were males.

Consistent with Karniol's hypothesis that the bedroom wall is a location for the safe love object, the girls who did not yet have or want boyfriends tended to favour male stars with feminine features, whereas those who were already dating all chose more masculine looking stars. The girls who were already dating also reported becoming more excited when thinking about their favourite stars and being jealous of their stars' screen or real relationships. Presumably these girls (whose sexuality was more advanced than that of the girls who favoured more feminine-looking stars) experienced vicarious sexual involvement with their heroes.

The results also showed a positive correlation between the number of posters a girl displayed of her favourite star and the amount of time she spent talking to friends about him – consistent with the hypothesis that the posters do serve a social function.

While Karniol's study was limited in sample size and gender, it yields intriguing preliminary findings. The findings indicate that the seemingly mundane aspects of everyday life can be valuable sources of information to the psychologist, and may reveal patterns in our thought processes and behaviour that are not obvious on first sight.

From these findings, what would you predict about the posters on teenage boys' bedroom walls?

Karniol, R., 2001, 'Adolescent females' idolization of male media stars as a transition into sexuality', *Sex Roles*, 44, 61–77.

Figure 10.4

Parents are often the earliest models for smoking and, more surprisingly, they are often the first to offer adolescents the opportunity to try cigarettes for themselves.

where it is cool to be seen), but peer pressure is less influential when it comes to moral values, antisocial behaviour and career decisions (Brown, 1999). And when they do try to exert influence, peers are not invariably aiming to promote bad habits: for example, peers often try actively to dissuade their friends from smoking (Paavola, Vartiainen & Puska, 2001).

Rather than peers providing the antithesis of parental influences, research suggests that the relationship is more complex. In early adolescence, some patterns of adolescent behaviour (such as drug use) tend to show a greater association with parental than peer practices (Bush, Weinfurt & Iannotti, 1994). Parents are often the first models in terms of drug use (smoking, drinking and other substances) and often the first to offer the young person an opportunity to try (Bush et al., 1994; Engels et al., 1994).

Older adolescents perceive peer influence in matters of drug use as greater than parental influence (Bush et al., 1994). But this perception may not take into account that, by this age, individuals tend to have already chosen their peers. Evidence suggests that an adolescent's choice of peers is itself influenced by his parents (i.e. the parents encourage or discourage particular friendships) and that the impact of friends' behaviour is moderated by parental guidance (Blanton, Gibbons, Gerrard et al., 1997; Mounts & Steinberg, 1995). So peers are important, but not omnipotent.

As you can see in table 10.1, the 'peer pressure' issue is not the only aspect of adolescent development about which there are strong folklore beliefs that are not actually borne out by the research evidence. These discrepancies remind us once again that 'common sense' does not always provide a reliable basis for psychological analysis.

EARLY ADULTHOOD

It makes sense to divide adulthood into three broad phases: early (from approximately 18 to 40 years of age), middle (41–65), and late (66+). Clearly, this is only a rough breakdown, and there are substantial differences within each phase, but it does serve as a preliminary framework for the study of the largest period of human development – our adult lives.

By the time we reach early adulthood, we have spent a long time developing. Like the young frog hopping to a new pond, the young person setting up a first home is physically and mentally transformed from the infant first presented to his or her parents.

Just as it is difficult to determine precisely when adolescence begins and ends, determining exactly when adulthood commences proves elusive. There are some rough formal markers, such as reaching a particular birthday, gaining the vote or becoming eligible to join the military services, but these markers vary across and within societies. Other criteria, such as gaining financial autonomy, getting married or establishing a home, are met by different people at widely differing ages, if at all. In fact, no single event in and of itself establishes an individual as 'adult' in all areas of his or her life.

Table 10.1 Myths and realities of adolescence.

Myth	*Reality*
Adolescence is a period of storm and stress	Only a minority of adolescents experience serious psychological disturbances
There is a huge 'generation gap' between adolescents and their parents	Most adolescents continue to value their parents as companions and as sources of advice
Adolescents are dominated by peer pressure	Adolescents tend not to rate peer pressure as a major problem and feel able to resist it
Adolescents are dominated by television viewing	Adolescents spend less time in front of the television than other age groups
Adolescents are irresponsible	Many adolescents undertake substantial responsibilities at home, at school and at work
Adolescents are reckless drug takers	Most adolescents experiment with legal and illegal drugs, but for the majority this is a short-lived experimentation that does not lead to dependency
Adolescents are all the same	This is patently not true: adolescence covers a large developmental period, and there are enormous individual differences among people in this age group as in others

This is part of the challenge of studying adult development. Not only are the boundaries difficult to identify, but the experiences are widely varied too.

Physical development

Early adulthood is, for most people, the time of peak physical capacity. The body reaches full height by the late teens, and physical strength increases into the late 20s and early 30s (Whitbourne, 2001). Manual agility and coordination, and sensory capacities such as vision and hearing, are also at their peak.

But change is imminent, even in these basic capacities. Some decline in the perception of high-pitched tones is found by the late 20s (Whitbourne, 2001), and manual dexterity begins to reduce in the mid 30s.

In general, people in early adulthood feel robust and energetic, although it is not unusual to see fluctuations around deadlines and exam periods! On the other hand, people in this age group are also legally able to use damaging substances, such as alcohol and tobacco, and many can obtain access to illegal stimulants or narcotics. Young adults also have increasing responsibility for organizing their own eating habits and exercise regimes. Not surprisingly, the health status and prospects of young adults are dependent more than ever before on their own behavioural choices.

Cognitive development

By the end of adolescence, most people are capable of the levels of reasoning that we would expect for normal functioning in adult society. Although there are wide individual differences in attainment, most young adults are able to deal with cognitive tasks in a more abstract way than before, and to attain solutions to problems by comparing possible explanations.

Does this mean that cognitive development has reached a plateau? Many investigators of adult cognition think not.

Riegel's theory of postformal thought

Riegel (1975) proposed that adult experiences expose us to a new level of cognitive challenge – the discovery of dialectical (opposing) forces. In other words, we find that many aspects of our environment can manifest contradictory features. This is especially so in the human environment. For example, someone we love can be warm and generous at times, but on other occasions the same person can be self-centred and aloof. Are they generous or selfish, affectionate or remote?

There are many other contexts in which we experience contradictory information about a person, group or organization, or we encounter strongly differing points of view on the same issue. There may be no absolute resolution of the conflicts. We simply have to integrate our understanding into a more complex picture. Life, we discover, is often ambiguous and complicated. Riegel argued that achieving the intellectual ability to deal with the contradictions that confront us in our everyday life requires progress to a fifth stage of reasoning – the stage of dialectical operations, now more commonly called postformal thought.

Research into *postformal reasoning* indicates that development continues well into adulthood (Sinnott, 1998). Research participants are often presented with problems relating to complex topics (e.g. in science, education, religion, politics or personal relationships) and encouraged to provide and justify decisions. Their reasoning is coded and categorized into stages.

postformal reasoning a level of thought beyond Piaget's period of formal operations, characterized by the understanding that there may be multiple perspectives on a problem and that solutions may be context-dependent

Kramer's three stages

Kramer (1983, 1989) proposed that people progress through three broad stages: *absolutist*, *relativist* and *dialectical*. In early adulthood, many people are in the absolutist phase: they are capable of addressing many problems, but they tend to believe that all problems have a correct answer. For example, a young person might commence university study believing that it will be a matter of learning facts and procedures, that the lecturers know everything and will tell you what is right and wrong.

absolutist reasoning that assumes there is always a single, clear answer to a given problem

relativist reasoning in which the individual has become aware that there are often different perspectives on any given issue, and that the 'correct' answer may depend on the context

dialectical reasoning in which competing positions are integrated and synthesis achieved

People in the relativist stage have become aware that there are often different perspectives on any given issue, and that the 'correct' answer may depend on the context. Students now appreciate that there are many theories and much conflicting evidence – but awareness of the diversity of perspectives can lead them to assume that very little is dependable. So, for example, your lecturer could spring a new theory on you at any time, and could herself be wrong.

There is evidence that the undergraduate experience (where one is regularly dealing with conflicting theories and ideas) can facilitate the development of relativist thinking (Benack & Basseches, 1989). If the idea of relativism seems strange at this stage, make a note to return to this chapter towards the end of your degree!

Eventually, in the dialectical phase, people become able to integrate competing positions and achieve synthesis. They can understand why there are diverse views, and they can appreciate that the overall progress and contributions of their chosen discipline derives from efforts to resolve its internal

contradictions. Basseches (1984) found that this type of reasoning is more characteristic of people studying at higher degree level or of university staff. Although aspects of dialectical reasoning can be found in adults in their 20s and 30s, Kramer's (1989) research led her to the conclusion that this stage is only fully realized in late adulthood.

Measuring intelligence

Other approaches to the investigation of intellectual development in adulthood are grounded in the psychometric tradition (see chapter 13). By applying standardized IQ tests, researchers have sought to discover whether there are age-related differences in intelligence during adulthood.

There are many different ways to measure intelligence. K. Warner Schaie and his colleagues have conducted major longitudinal studies of the evolution of primary mental abilities among several thousand adult Americans (Schaie, 1996, 2000). They focused on five primary abilities:

1. numeric facility
2. verbal recall
3. verbal ability
4. inductive reasoning
5. spatial orientation

Figure 10.5 presents a summary of scores on the five tests as a function of age. For the moment, note the data for early adulthood (up to age 40). As you can see, there are modest gains on most of the tests during the participants' 20s and 30s. Whether we measure this in terms of performance on the qualitative reasoning tasks favoured by investigators in the postformal thought school, or in terms of more traditional psychometric techniques, it appears that intelligence is still increasing well into adulthood.

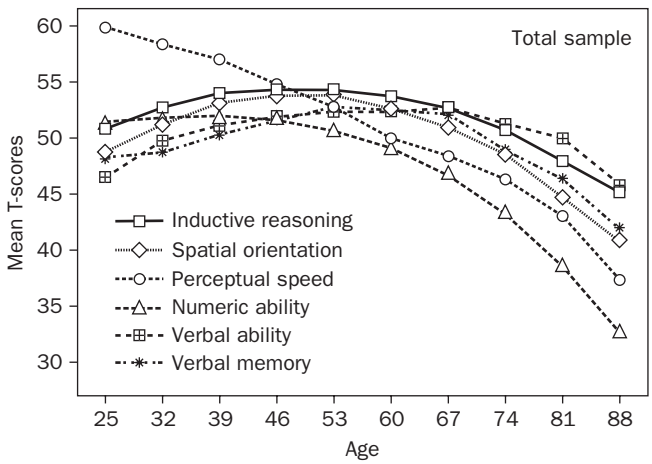

Figure 10.5

Longitudinal patterns of cognitive abilities. Source: Schaie (1996).

Pioneer

K. Warner Schaie (1928–) was born in Germany and moved to the US in the 1930s. He is now the Evan Pugh Professor of Human Development and Psychology and Director of the Gerontology Center at the Pennsylvania State University. His doctoral research into cognitive flexibility led to the initiation, in 1956, of the Seattle Longitudinal Study. This large-scale study tracks the mental abilities of people of different age groups every seven years, which enables Schaie and colleagues to chart individual differences in cognitive ageing across the lifespan, examining the influence of health, demographic, personality and environmental factors. The study, which still continues today, has also led to important investigations of family similarity in cognition and cognitive training effects in older adults. The participating families are now being followed into a third generation.

It seems, therefore, that this important dimension of human development certainly does not cease at the end of adolescence.

Social and emotional development

Young adults face some formidable developmental tasks. Many people at the beginning of this stage are concerned with launching a career. They may be studying to gain the critical qualifications, or training at the entry level of an organization. Some will not be so lucky. In many countries, youth unemployment rates have been very high during the last century and appear set to continue.

Studying, employment and unemployment each presents its stresses. At the same time, young adults tend to be finding their way through the world of romance, which can also lead to stress and anguish. All of this happens alongside changes in relationships with parents, and the increasing expectation that the young person will take responsibility for her own life – including, perhaps, a shift to a new home.

It would be an unusual person indeed who proceeded through these developmental tasks without at least occasionally wondering who she is, or who she is becoming, and how she is faring compared to her peers. For most people, facing these issues brings a range of emotional reactions.

A stage model for personal development

Several different theories have been put forward to account for personal development during early adulthood. From a psychoanalytic perspective, Erikson and Erikson (1997) see the dominant focus of this stage as the development of intimacy – the ability to love and trust another person.

Levinson (1978) extended some of Erikson's ideas, but drew also on social psychological theory to explain the relationship

between the developing individual and the demands of society. He emphasized the social role requirements at different life stages, and the interaction between personal growth and relationships. He maintained that all normally developing adults progress through the same stages in the same sequence, and at roughly the same pace.

Early adulthood begins with the sub-stage of early adult transition (approximately 17–22 years), in which young people are working towards autonomy from their parents and formulating a '*Dream*' of what they hope to become in life. The Dream is important because it guides their efforts and choices in both the occupational and personal spheres. Do you have your own Dream, or did you have one during this phase of life, and how does/did it relate to your current occupation and plans?

Dream Levinson's term for an individual's vision of his life goals, formed around 17 to 22 years of age and contributing to the motivation for subsequent personal development

The next sub-stage is the period of entering the adult world (22–28), and is organized around forging a pathway at work and attaining a special personal relationship.

This is followed by the 'age 30' transition (28–33), in which people undergo a moderate degree of self-questioning – reviewing their Dream, the choices they have made and the problems in their lives.

The rest of this decade (33–40) is the 'settling down' period, when people have usually found their niche in life and are striving to consolidate their professional and domestic roles – they are basically getting their lives in order.

Levinson arrived at his account on the basis of a series of intense individual interviews with a group of American men in mid-life. Although they came from a variety of backgrounds and had a range of careers and family histories, similar patterns appeared to emerge. Although Levinson's original sample was relatively limited, subsequent work has shown that the model fits many American women reasonably well, too (Levinson, 1996; Roberts & Newton, 1987).

Pioneer

Erik Erikson (1902–94) was born in Germany. His biological father, a Dane, abandoned Erik's mother before their child was born. When Erik was aged about three she married the family doctor, who happened to be Jewish. Erik was raised as a Jew, but his ethnicity was mixed – like his biological father, he was blond and blue-eyed. With the rise of Nazism in Europe, Erik moved to Boston, where he adopted the surname Erikson and took up a position at the Harvard Medical School. One of his early and most influential books, *Childhood and Society* (1950), contains an analysis of Adolph Hitler, wide-ranging discussions of America (including Native Americans) and the framework of his version of psychoanalytic theory. This combination of topics encapsulates his interests in the impact of culture on personality development.

Figure 10.6

The period of entering the adult world (22–28) is partly organized around the world of work.

Intimacy – are you secure, anxious or avoidant?

According to developmental models such as Erikson's and Levinson's, young adults are developing a sense of personal identity along with a need for closeness to others. They have also progressed through the biological developments of adolescence, and are now fully matured sexual beings. Not surprisingly, finding and developing relationships with an intimate partner, or series of partners, becomes a priority for many young adults.

Interestingly, there are strong similarities in the ways people develop early relationships with caregivers during infancy and intimate adult relationships later on. This would not surprise John Bowlby (1988), who saw the initial attachment relationship as providing the crucial foundation of much later development (see chapter 9).

Clearly, as adults we form attachments to other people and, just as in infancy, these relationships are intensely emotional. Just as in infancy, our adult attachments motivate us to seek proximity to the person we feel we need, to engage in extensive eye contact, to hold – and, just as in infancy, we tend to become distressed at separation. Some social psychologists (Mickelson, Kessler & Shaver, 1997; Shaver & Clark, 1996) have gone further, to argue that the types of attachments we form as adults can be classified using the framework Ainsworth and others developed to account for infant attachments – namely, 'secure', 'anxious/ambivalent' and 'avoidant' (see chapter 9).

'Securely' attached lovers find intimate relationships comfortable and rewarding. They trust their partner and feel confident of his or her commitment. 'Anxious/ambivalent' lovers experience uncertainty in their relationships. Sometimes, they fret that their

Everyday Psychology

The development of the university student

Consider some of the developmental tasks that you have already faced as a university student. You got past Day One (and not everyone does), so you have made a start on determining the 'goodness of fit' (Lerner, 1995) – the extent to which a person's characteristics and behaviour are compatible with the demands of a life situation. We know you have the intellectual capacity to profit from the experience (you passed the entry test, and not everyone does), but you also have to decide how you feel about the new institution and people surrounding you. Will you stick around? Not everyone does.

Whether you are an 'on time' (young) or a 'late entry' (mature) student, you will experience rapid changes in your identity, skills, values and personal relationships during the university years. The contents of the course you elected to study may change your ways of looking at the world, and have fundamental consequences for your reasoning style. At university, you are going to learn a lot about your work habits. Money matters may become more salient than ever before. You might well be dealing with issues such as relocation and the impact that has on personal attachments (e.g. issues of homesickness and missing family members are very common among first-year university students). And your future role as an autonomous adult member of the workforce may loom large.

You will be an unusual student if you do not experience some heightening of anxiety and stress levels at key times (such as exams or the arrival of bank statements). Moreover, recent reports indicate that about 30 per cent of university students find themselves overwhelmed by academic demands (Montgomery & Côté, 2003). You might change your political beliefs – or acquire political beliefs for the first time (Pascarella & Terenzini, 1991). You are likely to have to handle issues related to drugs, especially alcohol (Park, 2004), and concerning sexual activity.

So, in a very real sense, at university you are living out a developmental psychology field study!

Developmental psychologists have investigated most of the issues mentioned above. Montgomery and Côté (2003) provide an excellent review of the findings, which indicate that going to university has substantial and long-term developmental consequences.

The research also raises a controversial question. Are you going to change at university holistically (i.e. in a domain-general sense) or only in particular aspects (i.e. a domain-specific sense)? For example, we would expect some cognitive benefits from receiving an advanced education, and the evidence does show that most students make cognitive gains during their university years. But what about other aspects of life – dealing with people, developing a more mature and complex sense of self, or moral reasoning capacity? Here, the evidence is more mixed, but some researchers have reported greater changes in self-concept, personal adjustment and psychological wellbeing in university students than in age-matched peers. Changes in political and moral thinking are quite common at university, too.

In areas such as general personality development, though, it is less clear that all students undergo significant changes. Some findings indicate that mature age students are more likely to experience more personality/ego changes at university than younger students. This may be because people who already have considerable experience of the world and of themselves perceive the opportunities and stimulation of university in a different way. In this context, the challenges of university life may therefore be more personally salient and more powerful for them (Manners & Durkin, 2000).

The extent to which you experience domain-general or domain-specific changes over your next few years at university will depend at least in part on who you are – your background, your current stage of personal development, your coping style and what you are prepared to put into your education.

Finally, when all of this is over and you are maybe qualified as a psychologist, you might consider becoming a clinical or counselling psychologist specializing in student concerns. Psychological support services are an important feature of any higher education institution, and they represent one way in which psychologists can and do make a difference to society. Furthermore, becoming involved in worthwhile activities such as this may well also create a feeling of 'generativity' about your life and its developmental course (i.e. you feel that you have contributed usefully to subsequent generations).

Montgomery, M.J., & Côté, J.E., 2003, 'College as a transition to adulthood' in G.R. Adams & M.D. Berzonsky (eds), *Blackwell Handbook of Adolescence*, Oxford: Blackwell.

partner does not love them enough and might leave, and they may respond to this anxiety by putting pressure on the partner, running the risk of causing the very outcome they fear. 'Avoidant' lovers find getting close to others uncomfortable, find it difficult to trust others, and are reluctant to commit themselves fully to a relationship.

Shaver and colleagues found that the proportions of adults who fall into these types is very similar to those of infant attachments, with (approximately) 59 per cent secure, 11 per cent anxious/ambivalent and 25 per cent avoidant (Mickelson et al., 1997). Other research indicates that adults who fall into these different categories recall their childhood relationships with their parents in ways that are consistent with these patterns. So, 'secure' individuals report relaxed and loving parents, 'anxious/ambivalent' people feel their parents were over-controlling, and the 'avoidant' adults reported lower levels of communication

and emotional support from their parents (Rothbard & Shaver, 1994).

Students make for interesting participants in attachment research, because many are dealing with the issues of finding and maintaining relationships at the time the study takes place. In an Australian study, Feeney, Noller and Patty (1993) investigated the romantic relationships of heterosexual students of different attachment types. They found that the relationships of 'secure' individuals tended to be more stable and loving, while those of 'anxious/ambivalent' people were less enduring and more numerous. 'Avoidant' individuals tended to be more accepting of casual sex, presumably because they are less interested in maintaining commitments to others.

MIDDLE ADULTHOOD

Once again, it is difficult to define this phase of life precisely. The variety of human life courses means that individuals can be in very different stages of their personal development at the age point (i.e. turning 40) that we have taken as a rough measure of entry to middle age.

PHYSICAL DEVELOPMENT

During mid-life, people experience a range of external and internal physical changes. External changes include the appearance of grey hair and hair thinning, increases in facial wrinkles, and a tendency to put on weight around the waist or lower body. Internal changes include reductions in the efficiency of the cardiovascular, respiratory and nervous systems (Whitbourne, 2001).

There are changes to the sensory capacities, too. One of the most noticeable for most middle-aged people is the onset of *presbyopia* – a condition of farsightedness due to progressive changes in the shape of the lens of the eye (Glasser & Campbell, 1998). This leads to difficulty in reading small print – you may notice people of this age holding printed matter further away than a younger reader does (figure 10.7). Hearing, particularly sensitivity to higher frequency sounds, is also prone to weaken during middle age (Brant & Fozard, 1990; Wiley et al., 1998).

menopause the time in a woman's life when menstruation becomes less regular and then ceases

This is the time when women experience the *menopause* – the cessation of menstruation. Many women suffer some level of physical and psychological discomfort as a result, such as hot flushes, mood changes, loss of libido and insomnia. But the intensity of these symptoms varies considerably among individuals (Leiblum, 1991; Notman, 1998), and menopausal status is not a strong predictor of psychological distress (Avis, 1999; Becker et al., 2001). There is some evidence that the physical symptoms associated with menopause vary across some cultures (Avis et al., 2001). This may reflect variations in diet and/or social expectations about the nature of the menopause.

LEADING domestic power producer Huadian Power International Corp. set a lower-than-expected price range for its initial public offering (IPO), fueling a drop in local shares Thursday to near six-year lows.

Huadian said it would be offering yuan-denominated A shares at 2.30 yuan to 2.52 yuan a share, below the 2.50 yuan to 3 yuan range market participants had forecast earlier this week.

The IPO is China's first since regulators suspended new share offerings in late August last year to revise pricing rules.

The price range underscores concerns that the new rules would lead to weaker share prices, as more supply of stock comes in and new offerings are priced lower than they would have been under the old practice.

Prior to the new rules, IPO prices were already approved by China's securities regulator and set by the time a company issued its prospectus.

The key Shanghai Composite Index fell 1.1 percent to end at 1204.39 Thursday, after hitting a low of 1199.17, the lowest level since May 1999.

"The market sentiment is now very fragile," said Zhou Ji, an analyst at Haitong Securities in Shanghai.

Concerns about market liquidity being squeezed were heightened by news the China Securities Regulatory Commission had approved Baoshan Iron & Steel Co.'s plan to offer additional A shares.

"Even with ample funds on hand, players were reluctant to enter the market, fearing there may be more declines ahead," said Grace Lin, an analyst at CSC International Holding in Shanghai.

In Hong Kong, the H shares of Huadian, which were listed there six years ago, ended flat at HK$2.30.

Huadian's IPO price range, the first of the new two-step pricing process that went into effect this year for IPOs in China, was finalized just after midnight Wednesday, and 77 institutional investors participated in its price discovery, a person involved in the deal said Thursday.

Based on the set price range, Huadian would raise between 1.76 billion (US$212.56 million) yuan and 1.93 billion yuan, assuming all 765 million shares on offer are sold.

The lowest ... in by the 77 ... tors was 1.90 yuan ... a share, respect... to a statement ... by China Inter... Corp., the lead ... Huadian's offeri...

Among the p... three were Qu... Institutional I... 36 fund man... accounted for the ... of participants. ... ages, 14 financin... eight investment ... up the remainde...

Huadian's pri... after the offerin... IPO price range... ings, would be l... 14.8 times, CIC... 2004 financial re... have yet to be re...

A listing date f... shares to trade ... Stock Exchange ... set after the IP... Several domest... reporting Thurs... could occur in ... before the Feb. 9 ... holidays.

Figure 10.7

Text as it appears to a middle-aged adult with presbyopia. If you notice an adult at this stage of life holding printed matter further away in order to read it, this is the most likely explanation.

As at other stages of the lifespan, physical changes are closely interwoven with psychological changes. Signs of ageing prompt many people to review their lives (see below) and some begin to feel dissatisfied with their bodies. In a large sample of middle-aged and older Swiss women, for example, Allaz, Bernstein, Rouget et al. (1998) found that a majority expressed dissatisfaction about their weight and many had dieted to control it, even though their weight fell within the normal range.

Individuals' own behavioural choices can moderate the effects of biological changes. For example, menopausal women who take regular aerobic exercise report more positive moods and less somatic discomfort than non-exercising peers (Slaven & Lee, 1997). The reactions and support of partners can also influence women's experience of menopause (Leiblum, 1991).

COGNITIVE DEVELOPMENT

In terms of primary mental abilities, Schaie's (1996) data depict mid-life as a relatively stable period (see figure 10.5). In fact, on most measures, middle-aged adults perform as well as or slightly better than younger adults. Schaie did find a decline in numeric skill, and other researchers have obtained evidence of a modest decrease in reaction time (Wielgos & Cunningham, 1999) and a reduction in conscious processing efficiency (Titov & Knight, 1997) during this period. However, in terms of psychometric measures of intellectual functioning, middle-aged people perform well overall.

Life skills

There are some tasks on which middle-aged adults tend to fare worse than young adults. For example, Denney and Palmer (1981) gave people between the ages of 20 and 80 a traditional problem-solving test – a game of 'Twenty Questions'. (The goal is to identify an object known to the tester by asking a series of indirect questions about it: 'Is it a plant?' 'Can you eat it?' etc.) The older people got, the worse they did.

But this could well be because this type of test was more familiar to the younger participants, who were therefore likely to do better. This interpretation of the findings is perhaps borne out by another series of tests administered by Denney and Palmer. These 'real world' tests related to practical applications of reasoning, such as how to deal with faulty purchases, flooding in the basement, or a child returning late from school. On these practical tests, middle-aged people scored significantly higher than young adults. In other research, Denney and Pearce (1989) found that the number of solutions people generate in response to everyday practical problems peaks in middle age.

Emotion and clear thinking

Researchers who focus on qualitative developments in adult reasoning have found evidence of continuing development through the lifespan. The progression through absolutist, relativist and dialectical reasoning may continue for decades (Kramer, 1989). Some researchers argue that there is an important reorganization of thinking in middle adulthood, as people achieve an integration of information-processing and emotional self-regulation (Labouvie-Vief, 1999).

A good illustration is provided by Blanchard-Fields (1986). She tested adolescents, young adults and middle-aged adults on three hypothetical problems, each involving a conflict of perspectives. One problem concerned competing historical accounts of a civil war, with different historians taking different sides. Another problem concerned a dispute over a proposed visit to grandparents, with parents in favour of the visit and their adolescent children against. The third problem concerned a pregnancy dilemma, with the female and male taking different views over whether to terminate. The participants' task was to explain the conflict in each case.

Blanchard-Fields analysed the quality of the participants' reasoning. She found that the middle-aged adults performed at a higher level than each of the younger groups. The younger participants tended to take sides, especially in the emotionally engaging 'visit' and 'pregnancy' problems, leading to distorted, one-sided accounts. The middle-aged participants were more likely to try to understand why each party felt the way they did, and to provide more balanced descriptions, taking all perspectives into account. In other words, it seemed that the younger participants tended to be swayed by their own emotions about the conflicts, while the middle-aged participants appeared to integrate emotional understanding with other problem-solving skills.

SOCIAL AND EMOTIONAL DEVELOPMENT

Each phase of life brings new challenges, and for many people mid-life brings a multiplicity of them – from all quarters. By this time, people's histories are very varied. In their personal and occupational lives, many different options may have been chosen and many different events and circumstances will have affected their progress. So can we pin down any particular patterns of social and emotional development associated with middle age? Despite this variety in individuals' personal background, some lifespan developmentalists maintain that we can.

The 'mid-life crisis' . . .

generativity the feeling in mid-life that one has made or is making a contribution to the next generation

stagnation the feeling experienced by some individuals in mid-life that they have achieved relatively little and have little to offer to the next generation

Erikson (1980) saw middle age as a period when adults have to face a conflict between *generativity* and *stagnation*. Generativity – the process of making a contribution to the next generation – can be realized in a variety of ways through personal (family) or career attainments that provide a basis for others to progress. For example, a businessperson in mid-life might find satisfaction in her professional achievements to date and in the scope now to pass on skills to younger colleagues. Another person might find a sense of generativity through having reared children that she is proud of and who are now entering the adult world well equipped to meet challenges. A 'link between the generations', maintained Erikson, is 'as indispensable for the renewal of the adult generation's own life as it is for the next generation' (1980, p. 215).

Stagnation is the opposing feeling of having achieved relatively little and of having little to offer to the next generation. Some people in mid-life, for example, conclude that they have not met the family or occupational goals that once motivated them. Some respond to this sense of 'standing still' with a period of self-absorption, and an acute awareness that time is limited.

Individuals are likely to experience both types of feeling – generativity and stagnation – and the core developmental process of mid-life, according to Erikson, is the resolution of this conflict. Those who resolve it successfully attain a sense of care (about both the present and the future), and those who fail to do so develop a sense of rejectivity (i.e. they turn away from society and have little interest in contributing to it).

Recent research has supported Erikson's claims that generativity is positively associated with subjective well-being in middle-aged people, while a preoccupation with ageing ('time running out') is negatively associated with well-being (Ackerman, Zuroff & Mostkovitz, 2000; Stewart, Ostrove & Helson, 2001).

Levinson (1978) also depicts mid-life as a period of inner conflict. Recall that Levinson saw the period from approximately 33 to 40 as the 'settling down' period (see above). But settling

Figure 10.8

Erikson argued for the importance of a 'link between the generations', enabling the older generation to contribute skills and knowledge to younger people – a process known as generativity.

down is not the end of the story. Levinson found that most of his interviewees next underwent a major new phase, during a period of mid-life transition (40–45). Many of the men he interviewed reported that this was a time of personal crisis. They began to review their lives, asking themselves what they had achieved and where they were heading. Many wondered whether their personal and career struggles had been worthwhile, and some contemplated or underwent radical changes in direction (changing career paths, divorcing). Although Levinson's sample was all male, other research indicates that many women report similar periods of reassessment during middle age (Koski & Steinberg, 1990; Waskel & Phelps, 1995).

These kinds of reassessment are popularly associated with the notion of the 'mid-life crisis'. The visible signs of aging, changes in the family structure as children become adolescents or young adults, and frustrations in the workplace may all serve to remind the middle-aged person that life is passing by – and this might precipitate a personal 'crisis'. Levinson argued that this is a normative process, and that successful adult development beyond mid-life requires facing up to and resolving the crisis.

. . . debunking the myth

Appealing as the idea may seem (and much as newspaper writers and TV dramatists relish it), subsequent research shows that it is an oversimplification to assume that everybody undergoes a mid-life crisis. For example:

1. Periods of turbulence and self-doubt can be experienced by adults of most ages (Soldz & Vaillant, 1999), and some individuals – especially those who score highly on measures of neuroticism (see chapter 14) – may be prone to develop crises at any age (Kruger, 1994).
2. In larger samples than Levinson's (1978), only a minority of middle-aged people feel they have experienced a crisis (Shek, 1996; Wethington, 2000).
3. Substantial proportions of middle-aged people report better mental health and self-esteem during this phase of life than ever before (Jones & Meredith, 2000; McQuaide, 1998).

The mid-life crisis therefore does not appear to be as widespread as once thought, and there is no guarantee that you will have any more (or less) crises during your middle years than in other phases of your life.

But there is no doubt that there are many pressures on middle-aged people (Lachman & James, 1997). Some of these pressures relate to domestic and family life, and others to the world of work. For many middle-aged people, there are new parenting challenges as their children reach adolescence or early adulthood. At a time when adults are becoming aware of their own physical decline, their children may be gaining the attractions of youth. Often, these demands coincide with increasing anxieties about and responsibilities towards the older generation (Belsky, 1997; Cavanaugh, 1998). For some middle-aged people, usually women, looking after both their own children and their aging parents can cause 'caregiving pile-up' – an experience of overload due to too many competing demands (Doress-Waters, 1994).

As in earlier phases of life, the quality of a person's attachment to his or her partner has important implications for adjustment, personal satisfaction and dealing with life stresses (Diehl et al., 1998; Fraley & Shaver, 1998; Fuller & Fincham, 1995; Kirkpatrick & Hazan, 1994). For example, in a longitudinal study of middle-aged people, Kirkpatrick and Hazan found that those with secure relationship attachment styles were less likely to experience a break-up of their partnership.

LATE ADULTHOOD

Late adulthood is perhaps the most difficult of all to define precisely – mainly because there is very wide individual variation in the physical, cognitive and social processes of aging.

PHYSICAL DEVELOPMENT

In late adulthood, external physical changes include changes in the skin (wrinkling, loss of elasticity), loss of subcutaneous fat, thinning of the hair, and changes in general posture due to the loss of collagen between the spinal vertebrae (Cavanaugh, 1997; Whitbourne, 2001). There are also many internal changes, less apparent to the onlooker but important to the functioning of the aging individual. These include changes to the cardiovascular

system and loss of cardiac muscle strength, decline in muscle mass and reductions in the efficiency of the respiratory, digestive and urinary systems (Whitbourne, 2001).

But, although physical change is inevitable, the timing and extent are highly variable (and, to some degree, influenced by the behavioural choices and lifestyle of the individual). For example, aging of the skin is affected by exposure to sunlight, physical strength and fitness decline less in people who exercise regularly, and the well-being of the digestive system is influenced by diet and drug use (Whitbourne, 2001).

Physical and sensory capacities, so important in our earliest encounters with the world (see chapter 9), also tend to decline with age. Manual dexterity is reduced (Francis & Spirduso, 2000), and the visual system becomes less effective (Glasser & Campbell, 1998). The older person's pupils become smaller, and the lens of the eye becomes less transparent (and so less sensitive to weak lights, and less able to adapt to darkness) and less able to accommodate. Hearing, taste, olfaction and touch all become less sensitive during later adulthood (Marsh, 1996; Whitbourne, 2001).

Figure 10.9

Although physical change with age is inevitable, physical strength and fitness decline less in people who exercise regularly.

If perceptual abilities were so vital at the outset of life, what are the psychological consequences of beginning to lose them? Imagine becoming less able to listen to music, experiencing difficulties in attending to conversations, or finding that food and drink seem less interesting. Research indicates that our physical senses remain important at this end of the lifespan, too. There is a strong connection between sensory functioning and intelligence in old age (Baltes & Lindenberger, 1997). Gradual deficits in hearing can affect older people's ability to process speech in the context of other noise, which in turn affects how easily they interact with other people.

Certainly, the decline of abilities that were once taken for granted can lead to a reduced sense of competence for the older person (Whitbourne, 2001). And the curtailment of activities that were previously enjoyed can affect people's assessment of their quality of life. But, once again, the extent of the impact of biological decline varies from person to person, and is influenced by both the rate of change and the individual's coping skills (which are, in turn, influenced by personality and social circumstances).

Cognitive development

Does intellectual capacity decrease with age?

Let us return again to Schaie's data on primary mental abilities across the lifespan (figure 10.5). Look at the average performance of 67-year-olds compared to adults in mid-life, and you will see evidence of some decline. At this stage it is not particularly dramatic, but our eyes are drawn to the right of the figure, where we see more marked reductions in the performance of people in their 70s and 80s. It seems that by the mid 60s, the downward trend is set.

But take another look. If we compare the performance of the 67-year-olds with the 25-year-olds, it turns out that they are very similar on three of the measures, and only slightly poorer on two of them. On average, people in their mid 60s are performing on these tests at roughly the same level as those in their mid 20s.

Schaie's and other research (Powell, 1994; Rabbitt et al., 2001) also shows that while there is variation between age groups on some measures of intellectual performance, there is also great variation within groups – and this variation within groups increases with age (figure 10.10).

Older people do tend to perform less well than younger adults on tasks dependent upon reaction time and processing speed (Bashore, Rindderinkof & van der Molen, 1997; Rabbitt, 1996). Some researchers have also reported that older adults perform less well on Piagetian-type tasks measuring formal operations (Denney, 1984).

But these differences do not necessarily support the conclusion that intellectual capacity in the elderly is pervasively inadequate. Intelligent behaviour in everyday life typically involves several capacities, and people may be able to compensate for reductions in one ability (such as processing speed) by placing greater weight on another (such as judgements based on experience).

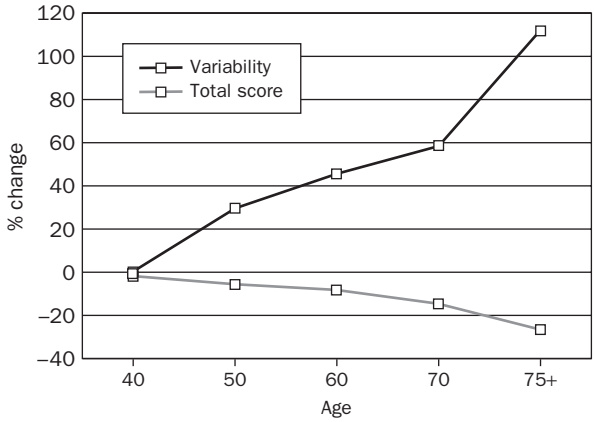

Figure 10.10

Variance within age groups on tests of cognitive function. Source: Powell (1994).

Pioneer

Patrick Rabbitt (1934–) was born in India but spent the majority of his working life in the UK, studying at Cambridge University and working predominantly at the Universities of Oxford and Manchester, where he established an Age & Cognitive Performance Research Unit (funded by the Medical Research Council). Rabbitt developed a large longitudinal cohort, shared between Manchester and Newcastle. He has published widely and influentially, and has been especially interested in the source of inter-individual ability in adult development and ageing (focusing on issues such as speed of intellectual processing and IQ).

Another myth debunked

Many of the studies that point to age-related differences are based on different cohorts – that is, groups of people who were born at different times, and experienced different educational systems (see Baltes, 1987). Some studies compare young adults at university with older adults drawn from the broader community, which confounds education with age. Hooper, Hooper and Colbert (1985) addressed this issue by comparing students of different age groups, and found that older participants' (aged 61–80) performance on formal reasoning tasks was comparable to those of the young people.

Returning to figure 10.5 once more, it is tempting to interpret the declining slope from the 70s to 80s as confirming an inevitable and irreversible decline in performance. But suppose we intervened by providing training to show (or remind) older people how to perform the kinds of tasks being tested? Schaie and Willis and their colleagues have done exactly this – with impressive results! In a number of studies, they have found that older people's performance can be significantly improved by training, and that these benefits endure (Schaie & Willis, 1986; Willis & Nesselroade, 1990). Even reaction time can be improved in the elderly, as Goldstein et al. (1987) demonstrated by the imaginative technique of training a group of older people on video games.

Social and emotional development

Theorists such as Erikson and Erikson (1997) and Levinson (1978) regarded late adulthood as another major stage of adult development.

Erikson and Erikson again saw the individual as facing a conflict – this time between integrity and despair. They maintained that as people realize they are coming towards the end of their life, they reminisce about their past and review how they feel about themselves. Have I met life's challenges successfully/achieved goals that I value/contributed to the wellbeing of those I care about? Or have I failed to realize my potential/wasted time in pointless work or futile relationships/been a burden to others? Erikson and Erikson believed that individuals who arrive at a predominantly positive view (i.e. regarding their life as integrated and successful) experience a more contented late adulthood.

Levinson saw the period from approximately 60 to 65 as the late adult transition, when the individual has to deal with intrinsic changes in capacity and performance, as well as changes in relations with others and in society's expectations. One of the key aspects of many people's adult life – their job – is now approaching its end, or has already concluded. All of these changes pose challenges.

How do older people cope with the demands of ageing and their changing social status? Not surprisingly, the answer is that there is considerable variation.

Relations with others

As in all other parts of the lifespan, relationships are important to the older person's adjustment (Johnson, 2001). For some people, the marital relationship may become more rewarding during old age. Some research has found that satisfaction with marriage tends to be rated higher in retired people than in middle-aged adults (Orbuch, House, Mero & Webster, 1996).

This may be partly because older married people tend to be those whose marriages have been successful (i.e. they have stayed together because they were satisfied with the relationship). But it could also be because partners now provide each other with a degree of companionship and support that may not always have been so apparent or so appreciated in busier earlier years, when many other types of relationship were competing with the person's time. On the other hand, it may be that older people of today grew up in times when marriages were expected to last, and so their more positive ratings may reflect a more traditional determination to 'see things through' (Norris, Snyder & Rice, 1997).

Other social roles – such as grandparenting or great-grandparenting – are also enjoyed by many older people, and allow them to feel that they contribute to their family and to a new generation (Barer, 2001; Smith, 1995). Sibling relationships often become particularly important (Cicirelli, 1995) – by this stage, our most long-lasting relationships are usually those with our brothers and sisters. And the many positive benefits of friendships (see chapter 9) remain at least as important in the later years as they are earlier in the lifespan (Antonucci, 2001).

Overall, when asked to identify the most important considerations affecting quality of life, older people consistently place personal relationships and social networks high on their lists (Antonucci, 2001).

Successful ageing

Although there are losses and declines with age, we have already seen that many people respond to them adaptively – one of the remarkable characteristics of human beings throughout the lifespan is our resilience (Baltes & Mayer, 1999). For example, there is little evidence among older people of a direct link between physical decline and psychological problems such as depression (Lenze et al., 2001; Penninx, Guralnik, Simonsick et al., 1998; Shmuely-Dulitzki & Rovner, 1997). Many older people adjust well to the changes associated with ageing, and report high levels of enjoyment of life in their later years (Penninx et al., 1998).

What factors promote successful aging? In many respects, this is one of the final developmental issues facing us all. In recent years, lifespan developmental psychologists have begun to provide valuable insights. As you might expect, social support and social networks emerge as primary considerations: people with better levels of social support from family and friends tend to enjoy better physical and mental health in the later years (Antonucci, 1994; Johnson, 2001; Lang & Baltes, 1997; Pearlin & Skaff, 1998).

Paul and Mary Baltes and their colleagues have investigated the processes of successful aging among participants in the large-scale Berlin Aging Study (Baltes & Lindenberger, 1997; Baltes & Mayer, 1999; Marsiske et al., 1995). They have proposed a model of 'selective optimization with compensation', according to which people face problems associated with aging by finding ways to handle cognitive tasks that minimize their dependency on their declining biological capacities.

A concrete example is provided in a study of younger and older golfers conducted by Over and Thomas (1995). The younger players (average age 34 years) were stronger than the older (average age 62 years), and they had better vision, so they had the advantage when it came to driving off and striving for distance. But the older golfers had certain advantages of their own: they were less prone to be affected by negative emotions and cognitions about the game, they were better able to prepare mentally, and they were more cautious. The two age groups in fact performed to the same handicap level, but did so via different combinations of abilities.

The older golfers were apparently exploiting the fact that there are some areas of intellectual performance that improve with age. Such improvements are usually connected with pragmatic reasoning rather than with mechanical/motor abilities. For example, researchers have found that older people show evidence of increasingly complex reasoning about interpersonal issues, life planning and moral dilemmas (Pratt, Golding & Kerig, 1987), and they perform better than younger adults with respect to oral narrative production (Pratt & Norris, 1994).

The good news for aspirant psychologists is that a professional life involved in cognitively challenging and stimulating work appears to promote the prospects for successful aging. Indeed, Hogan (2000) points out that there are over 30 former presidents of the American Psychological Association who have lived into their 90s, often continuing their work and enjoying social and leisure activities until very late in life.

Figure 10.11

Although there are losses and declines with age, many people respond to them adaptively; indeed, many older people adjust well to the changes associated with ageing, and report high levels of enjoyment of life in their later years.

Research close-up 2

Perceptions of ageing and the will to live

The research issue

At the beginning of this chapter, you thought about your own attitudes towards ageing. Think carefully about your answers – they may predict how long you will live.

Life is a biological process, but its course, quality and duration are influenced by psychological factors. Among these factors are the expectations and beliefs that we hold about ageing. If you expect ageing to be a largely negative process, then there is a reasonable chance that – for you – it will be.

The importance of perceptions and stereotypes of ageing was demonstrated in an intriguing longitudinal study by Becca Levy, Martin Slade, Suzanne Kunkel and Stanislav Kasl (2002).

To appreciate the magnitude of their investigation, we need to travel back to 1975, to the small town of Oxford, Ohio. At that time, another researcher, Robert Atchley of Miami University, set up the Ohio Longitudinal Study of Aging and Retirement (OLSAR).

Design and procedure

All Oxford citizens aged 50 or over were invited to take part in OLSAR, and almost 80 per cent agreed to do so. Participants provided demographic details (age, gender, socioeconomic status), and then completed a number of measures, including general health, as well as a scale measuring their 'self-perceptions of ageing' and another measuring their 'will to live'.

The 'self-perceptions of ageing' scale had five items, including:

Things keep getting worse as I get older.
I have as much pep as I did last year.
As I get older, things are better than/worse than/the same as I thought they would be.

Respondents received one point for every answer that indicated a positive attitude towards ageing (e.g. saying 'No' to 'Things keep getting worse' and 'Yes' to 'I have as much pep as I did'). Total scores on this scale could therefore range from 0 to 5, with a higher score indicating that the respondent had a more positive self-perception of ageing.

The 'will to live' measure employed the 'semantic differential' method. Participants were given a series of adjectives, paired to form opposite ends of a seven-point scale (e.g. empty–full, hopeless–hopeful, worthless–worthy), and asked to check one box that 'best describes what you think about your life in retirement'. Consider, for example, the responses of Persons A and B. What can we conclude about their respective feelings about what retirement has in store for them?

Person A								
Empty	☐	☐	☐	☐	☐	☐	☐√	Full
Hopeless	☐	☐	☐	☐	☐	☐√	☐	Hopeful
Worthless	☐	☐	☐	☐	☐	☐√	☐	Worthy
Person B								
Empty	☐√	☐	☐	☐	☐	☐	☐	Full
Hopeless	☐	☐√	☐	☐	☐	☐	☐	Hopeful
Worthless	☐√	☐	☐	☐	☐	☐	☐	Worthy

Now we move forward to 1998. At this point, Levy and colleagues were able to collect some additional, very important data on the original OLSAR participants – how long they had actually lived.

Levy et al. examined the survival rates of the original OLSAR participants as a function of 'self-perceptions of ageing' scores. They achieved this by splitting the sample into two groups – those individuals whose scores fell above the sample's mean score on this scale, and those that fell below the mean score.

Results and implications

The results are quite striking (figure 10.12), suggesting that the benefits of having a positive outlook on ageing can be enormous. Levy et al. point out, for comparison, that the extra lifespan to be won from a regular exercise programme is approximately 1–3 years.

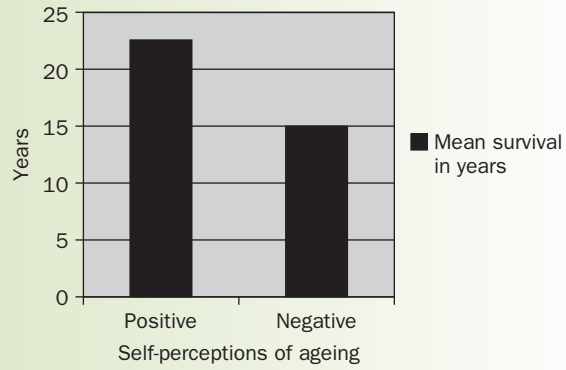

Figure 10.12

Mean survival in years of middle-aged participants as a function of positive vs. negative perceptions of ageing. Source: Based on Levy et al. (2002).

What could be going on to bring about this apparent leap from people's mental outlook to their physical wellbeing? The researchers suggest that an important intervening variable is the 'will to live'. In further statistical analyses, Levy et al. showed that controlling statistically for scores on the 'will to live' scale reduced the relationship between 'self-perceptions of ageing' and survival.

So the implications of these findings are that Person A (above) who regards his or her latter years as empty, hopeless and worthless, is not going to relish the latter part of her life. Person B, in contrast, sees life as full, hopeful and worthy – for him or her, every day is worth getting up for. In short, it seems that if people have a positive outlook on what getting older involves, they are more likely to look forward to the remainder of their lives, and to respond to change with energy and optimism.

Levy et al. believe that their study carries two crucial messages: 'The discouraging one is that negative self-expectation can diminish life expectancy; the encouraging one is that positive self-perceptions can prolong life expectancy' (p. 268). Do we know from this study whether a positive outlook on ageing extends life, a negative outlook shortens life, or are both processes operating together? Drawing on the arguments about methodology in Chapter 2, how could we test a hypothesis about these possible effects?

Levy, B.R., Slade, M.D., Kunkel, S.R., & Kasl, S.V., 2002, 'Longevity increased by positive self-perceptions of aging', *Journal of Personality and Social Psychology*, 83, 261–70.

FINAL THOUGHTS

In chapter 9 we considered our own developmental past: how did we get to become who we are today, with the social and cognitive competencies we take for granted? In this chapter, we have moved into our developmental present and future. As adults, we are still developing and will continue to develop throughout the remainder of our lives. As in childhood, much depends on the opportunities, guidance and challenges that we encounter along the way.

How much of our personal development is given by nature and how much by experience? There is evidence that both contribute extensively. We have seen, for example, that during adolescence cognitive competencies continue to develop. These changes may be underpinned by biological developments in the brain and information-processing capacities, but they also appear to depend crucially on what we experience, the knowledge bases that become available to us, and the kinds of education we enter.

Is change gradual, or stage-like? We have seen that some lifespan developmentalists believe there are predictable stages of adulthood through which each of us passes on a predictable time course. Others regard development as more domain specific, with each domain involving its own structures and principles. Lifespan developmentalists also take into account that many of the factors influencing an adult's development are less predictable, such as the characteristics of our social and occupational world, or random events, accidents and opportunities.

Development interacts with just about every psychological topic, so whatever human psychological capacity you study, bear in mind that it is likely to have developed through childhood and will continue to change through adulthood. Our understanding of developmental issues is fundamental to an understanding of ourselves.

Summary

- The journey from adolescence through adulthood involves many changes and adjustments, and entails considerable individual variation from one person to another.
- Psychological development involves physical, sensory, cognitive, social and emotional processes, and the interactions among these. For example, the age at which a person enters puberty can have implications for their personality which can extend all the way through their lives.
- Although adolescence is a time of new discoveries and new attainments, it is by no means the end of development. Indeed, according to some theorists, there are stages of potential adult psychological development which some of us may never attain.
- There is some evidence of broad patterns of adult development (perhaps even stages), yet there is also evidence of diversity and the potential to affect our own development by the life choices that we make.
- Some abilities diminish with age, while others increase; successful aging appears to involve skilful re-balancing of the resources and opportunities available to us, such that we learn to make the most of our strengths at the same time as coping with our limitations.

REVISION QUESTIONS

1. What individual variations occur during the journey from adolescence through to adulthood?
2. Discuss the physical, sensory, cognitive, social and emotional processes (and the interactions among them) that occur during psychological development.
3. Does adolescence represent the end of individual development? (In formulating your response to this question, draw upon the issues raised in this chapter.)
4. Consider the contrast between the established patterns of adult development and patterns of inter-individual diversity.
5. Which abilities diminish with age and which, if any, improve?
6. What are the consequences of individual differences in the pace of pubertal development?
7. Do university students have longer adolescences than their peers who enter the workforce early?
8. What are the benefits of becoming capable of formal operational reasoning?
9. Do adults develop in stages?
10. Romantic movies tell us that couples live happily ever after. Does it matter what attachment style the individuals have?
11. Is there really such a thing as the 'mid-life crisis'?
12. Does cognitive functioning change in early adulthood?
13. Does cognitive functioning change in late adulthood?

Further Reading

Cavanaugh, J.C. (1998). *Adult Development and Aging*. Pacific Grove, CA: Brooks/Cole.
An excellent textbook, covering most aspects of adult psychological development in a clear and thoughtful style.

Erikson, E.H., & Erikson, J.M. (1997). *The Life Cycle Completed*. New York: Norton.
One of the major accounts of Erikson's theory of the stages of adult development, extended in this book to consider development in very old age.

Pratt, M.W., & Norris, J.E. (1994). *The Social Psychology of Aging*. Oxford: Blackwell.
A rich account of developments in social reasoning and communication in later life.

Schaie, K.W. (1996). *Intellectual Development in Adulthood: The Seattle Longitudinal Study*. New York: Cambridge University Press.
A detailed research report, and a very readable account of some of the key psychological changes of adulthood.

Skinner, B.F., & Vaughan, M.E. (1983). *Enjoy Old Age: A Program of Self-management*. New York: Norton.
A practical guidebook on how to ensure positive reinforcement, productive activity and rewarding social relationships in old age.

Whitbourne, S.K. (2001). *Adult Development and Aging: Biopsychosocial Perspectives*. New York: John Wiley & Sons.
Combines laboratory and applied perspectives on successful aging, covering biological, social, cognitive and personality factors.

Answer to the pendulum problem on p. 205

It is the length of the string that determines the speed of the pendulum swing.

Contributing author:
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Memory 11

CHAPTER OUTLINE

Learning Objectives

By the end of this chapter you should appreciate that:

- memory plays a role in comprehension, language, perception, social relationships and many other aspects of life;
- memory of a past event or information is indicated whenever the event or information influences someone's thoughts, feelings or behaviour at some later time;
- there is an important difference between 'aware' and 'unaware' forms of memory;
- we can observe memory in many different ways – through free recall, cued recall, recognition, familiarity and other behavioural changes, such as priming;
- there is evidence that different sorts of memories can be influenced differently by specific manipulations or variables;
- rather than creating a veridical copy of a past event, remembering involves the active reconstruction of the event or information;
- mnemonic strategies can help us learn and remember information.

INTRODUCTION

You have undoubtedly seen thousands of pennies in your lifetime. Without looking at a coin, take a few seconds to sketch the front of a penny. Do not be tempted to look at a penny – spend a moment or two trying to remember and making a sketch.

Now compare your drawing with an actual penny. How accurate was your memory? Was the head facing the right way? How many of the words did you recall, and did you put them in the right place?

Nickerson and Adams (1979) and Morris (1988) found that most people have very poor memories for very familiar things – like pennies. Why might this be?

This chapter gives a sense of why memory and its study are central to psychology, and always have been. Memory can be studied in many fascinating ways, from laboratory research on nonsense syllables to studies of everyday memory, including autobiographical memory and eyewitness testimony. The extensive research has led to the proposal of several key models of how memory works.

We explore all of these issues in this chapter, which illustrates the richness and diversity of psychological research and why memory is such an important topic for the field of psychology.

WHAT IS MEMORY?

MUCH MORE THAN CONSCIOUS REMEMBERING

To a psychologist, memory is far more than simply bringing to mind information encountered at some previous time. Whenever the experience of some past event influences someone at a later time, the influence of the previous experience is a reflection of memory for that past event.

It is easy to see the role of memory in the case of a student who attends a lecture and later brings to mind what was taught. It may be less obvious that memory still plays a role even when the person does not 'remember' the lecture or the information, but merely uses information from the lecture, possibly without thinking about the lecture itself or the specific information at all.

There are even more subtle and less obvious effects of memory. If the same student later develops an interest (or a marked disinterest) in the topic of the lecture, that interest may reflect memory for the earlier lecture, even though the student might not be able to recall having ever attended a lecture on that topic. Memory plays a role to the degree that the student's attitudes about the topic were influenced by the lecture.

In the same vein, memory plays a role whether or not we intended to learn during the 'past event'. In reality, comparatively little of our time is spent trying to 'record' events for later remembering; most of the time we are simply getting on with life. But past events only have to influence our thoughts, feelings or behaviour to provide evidence of our memory for them.

Just as memory is not dependent upon an intention to record events, it also plays a role regardless of our intention to recall or draw upon those past events. Many of the influences of past events are unintentional; indeed, they may even be quite counter to our intentions (e.g. Jacoby, Woloshyn & Kelley, 1989).

INFERRING MEMORY FROM BEHAVIOUR

There are many sorts of behaviour that suggest memory for some past event. Suppose you heard a poem some time ago. Later, you might recall the words of the poem, or recognize them when you hear them again. Alternatively, the words might sound familiar without your explicitly recognizing them. Finally, you might even be influenced by the message of the poem without having any sense of familiarity, recognition or recall.

Recall

cue information that initiates and/or aids recall

To recall information is to bring it to mind. Usually there is some *cue* that initiates and/or aids the recall. Examination questions, such as 'Contrast Piaget's developmental stages with those of Erikson', contain content cues that direct recall to information relevant to the examiner's aims. Questions such as 'What did you do on Friday night?' contain time cues. Cues such as these are very general and do not provide a great deal of information. Recall in response to these sorts of non-specific cues is generally termed *free recall*.

free recall recall in response to non-specific cues

Some cues may also be more informative and direct us to more specific events or information. Short answer examination

Figure 11.1

Memory plays a role when students remember information from a lecture and also when they do not 'remember' but are still able to use the information without bringing it knowingly to mind.

questions, such as 'What ages are associated with Piaget's concrete operational stage?', target a specific response by providing more information in the cue. A question like 'Where did you go on Friday night after you left the pub?' differs from its counterpart above by providing more information in an effort to extract some specific material. As cues become more directive, the recall is termed *cued recall*. Many factors influence the effectiveness of cues; one such factor is the amount of targeted information. The *cue overload principle* (Mueller & Watkins, 1977) states that as more information is tied to each cue a smaller proportion of that information will be recalled.

cued recall recall in response to directive cues

cue overload principle as more information is tied to each cue, a smaller proportion of that information will be recalled

Recognition

Our ability to identify some past event or information when it is presented again is termed recognition. In examinations, true–false, matching and multiple-choice questions typically target the student's ability to recognize information (e.g. 'Traits are relatively stable personality characteristics – true or false?'). In real life, questions like 'Did you go to see a film after you left the pub?' suggest some event or information and ask the rememberer whether it matches the past.

Familiarity

Effects of memory can be observed without the ability to bring to mind (that is, recall or recognize) a past event or information. Feelings of familiarity are often based on memory.

You have probably encountered someone who seemed familiar although you were unable to recognize them; often this familiarity is due to a past encounter with that person. One of the reasons for advertising is to make particular products more familiar to you, because people tend to prefer familiar things to more unfamiliar ones (Zajonc, 1968). Hence the old adage, 'All publicity is good publicity.'

Unconscious influence

Even in the absence of recall, recognition or feelings of familiarity, memory may still be detectable. If information has been previously encountered, subsequent encounters with the same information may be different due to that encounter, even in the absence of any overt signs of memory.

Unconscious effects of memory can be problematic because they may lend credibility. When people were asked whether they believed assertions such as 'The largest dam in the world is in Pakistan', they were more likely to believe these assertions if they had been encountered in a previous memory experiment, even if they could not remember these assertions in any other way (Arkes, Hackett & Boehm, 1989; Hasher, Goldstein & Toppino, 1977). Perhaps these unconscious effects of memory are the key to the effectiveness of propaganda.

Priming describes the (often unconscious) effects of a past event. It can be measured by comparing behaviour following some event with behaviour that arises if that event did not occur. In the above example, belief in those assertions may be primed by having encountered them. If two groups of people are compared – some who encountered an assertion and some who did not – the difference in their belief is a measure of the priming from the earlier encounter.

priming the effect of a previous encounter with a stimulus

Here is another example of priming. Consider the word fragment 'c _ _ p u t _ r'. A psychologist might measure how long it takes people to solve or complete the fragment to make a real English word (i.e. to say 'computer') and compare the time required by people who have recently encountered the word or idea with the time required by people who have not. Even when people have encountered 'computer' (or recently used a computer) but do not remember the experience, they can generally solve the word fragment more quickly than people without the experience. The difference in the time needed to respond is an example of priming – one type of evidence for memory (i.e. some lingering effect) of the previous experience.

Not as simple as it seems

We might consider the behaviours from which memory is inferred as existing along a continuum:

free recall . . . cued recall . . . recognition . . . feeling of familiarity . . . unconscious behavioural influence

This view suggests that differences among these manifestations of memory are due to the memories having different strengths or different availability. It would follow that where memory is strong and available, free recall is possible, along with all of the other demonstrations of memory. As memory weakens or is otherwise less available, free recall would not occur but memory might still be observable at 'lower' points (i.e. recognition, familiarity, unconscious influence).

This approach is appealing in its simplicity, but there are potential difficulties with a simple continuum. The ability to recall information does not always mean that the information will be correctly recognized (Tulving & Thomson, 1973). Also, some variables have the opposite effect on recognition and recall performance, such as word frequency. Frequently used words, such as 'table', are better recalled than lower frequency words like 'anchor', but strangely enough, the lower frequency ones are better recognized (Shepard, 1967).

Similarly, information that has been intentionally learned is generally better recalled than information that was acquired incidentally, but information that is learned unintentionally is sometimes better recognized (Eagle & Leiter, 1964). Some research suggests that a distinction between intentional and unintentional effects of memory is fundamental (e.g. Jacoby, 1991; Wegner, 1994).

The important point here is that different outcomes may be obtained when memory is inferred from different behaviours. There is no single, straightforward measure of memory, which therefore suggests that the effects of memory are not the result of a single straightforward system or process.

Constructing the past

A memory is not a copy of the world, like a video recording. It is more helpful to think of memory as an influence of the world on the individual.

A constructivist approach describes memory as the combined influences of the world and the person's own ideas and expectations. (For some classic constructivist approaches to memory, see Bartlett, 1932/1995; Bransford, 1979; Neisser, 1967, 1976.)

When two people see the same film, their reported memories of the film will be similar, but there will often be notable differences as well. Why might their reports be different? The experience of each person while they are watching the film will be somewhat different because they are different people, drawing upon different pasts with different values and goals. They might have been seated next to one another, but in some senses they actually saw (or experienced) different films.

In this way the past event as it occurred was constructed by the person who experienced it. This construction was greatly influenced by the external event (the film screening), but it was also a product of the person. The thoughts, feelings, expectations, mood, health, past experience and other characteristics of the person play a large role in how the event is experienced.

Matters are further complicated when we consider the act of remembering. Try to recall a film or television programme that you have seen recently. Some parts of the film come readily to mind; other parts you may sense yourself constructing based on the parts that you remember and what you know or believe must have happened to connect them. One of the trickiest things about remembering is that people are so good at this sort of construction that they are often unaware that it has happened. The 'constructed' memory often seems as real as the 'recollected' memory (see Neisser, 1981).

Neisser (1967) has likened remembering to the task of a paleontologist who constructs a dinosaur from an incomplete set of bones and a great deal of knowledge about dinosaurs. The past event leaves us with access to an incomplete set of bones (with occasional 'foreign' bones that are not from the past event at all). Our knowledge of the world directs our efforts to assemble those bones into something resembling the past event. The memory we construct, like the dinosaur in the natural history museum, may contain some actual elements of the past, but it is a construction that belongs to the present.

No wonder that people often find their memories to be somewhat unreliable, or that the accounts of two different people who have observed the same event may be quite different. For a summary with respect to eyewitness testimony, see Buckhout (1974).

How we study memory

Memory can be studied in many ways, in many situations. It can be manipulated and observed in the 'real world' (e.g. Cohen, 1996; Gruneberg, Morris & Sykes, 1988; Searleman & Herrmann, 1994; Neisser, 1982). But most research has been experimental work, comparing controlled conditions in a laboratory setting.

The manipulated conditions might include any variable that is expected to influence memory, such as the familiarity of the material, the degree of similarity between study and test conditions, and the level of motivation to learn. Traditionally, researchers have studied memory for lists of words, non-words (i.e. nonsense words like 'argnop' or 'DAL'), numbers or pictures, although many other sorts of materials have been used as well, including texts, stories, poems, appointments and life events.

So most systematic investigations of memory have been experimental, conducted in a laboratory, and involving a set of to-be-remembered words or other similar materials. This description applies well to much of Ebbinghaus's (1885) work; he was the first psychologist to study memory systematically (see chapter 1).

Observation vs. inference

Remember that memory is evident to the degree that a past event influences later behaviour. So how can we know whether the later behaviour was influenced by the past event?

Try this: write down the first 15 animals that come to mind – do not read ahead – stop now and jot down a list. Next, compare your list to that on page 246. You probably had several matches. Does that mean that you correctly recalled those words? Obviously not! If you had studied the list first, could I infer that your report of an animal name was influenced by the past event? Some items you might consciously recall, some you might think of due to an unconscious influence from studying the list, and some you might think of just because they are animals – not as a result of studying the list. Would the number of matches between your list and the study list be a good measure of your memory for the list? No – the matches might occur for any of the above reasons.

The demonstration with the animal list captures an important issue in memory research. Memory is not *observed* directly – it is *inferred* from performance on a task. But performance on the task will be influenced by other factors as well as memory for the original event.

So it is clearly important to be careful about what is observed and what is inferred in memory research.

Overcoming the problem

To address this problem, memory is often studied by comparing two groups of participants or information, organized such that the 'past event' occurs for one group but not for the other. Because the only known difference between the groups is the presence or absence of the event, differences observed at the later time are assumed to reflect memory for that event. It is therefore

essential to determine that there are no other differences between the groups.

The sleep learning experiment

Suppose you played tapes of information to yourself in your sleep. Would you remember the information later? (For a review of 'sleep learning', see Druckman & Bjork, 1994.) To answer the question, you might present some information to people while they sleep, wake them up, and then observe whether their subsequent behaviour reflects any memory for that information.

Wood, Bootzin, Kihlstrom and Schacter (1992) did just this. While people slept, the researchers read out pairs of category names and member names (e.g. 'a metal: gold'), repeating each pair several times. After ten minutes, the sleepers were awakened and asked to list members of named categories – such as metals – as they came to mind. The assumption was that if participants had any memory for having 'a metal: gold' read to them while they slept, then they would be more likely to include gold in their list of metals.

Comparison groups

But it clearly is not enough to observe how often 'gold' appeared in the lists. Many people, when asked to think of metals, would include gold, even without having it read to them while they slept. Researchers can overcome this type of problem by examining the difference between the performance of a comparison group or condition and an experimental group or condition (see chapter 2). So Wood et al. (1992) made two comparisons.

One comparison was between groups. Some participants were awake while the words were read to them, and some were asleep. Because people were randomly assigned to the groups, comparing how often the target words appeared in each of the groups showed whether people were more influenced by presentations while they were awake or by presentations while they were asleep. In figure 11.2, the pale bars show how often the presented words were reported. People who were awake during the presentations were more than twice as likely to report the target words as people who slept. This comparison shows that learning while awake is better than learning while asleep, but it does not rule out the possibility that the sleepers' performance was influenced by the presentations.

So the other comparison involved repeated measures (see chapter 2). Multiple observations were made for each participant and then compared. There were actually two different lists of words – one included 'a metal: gold' and the other included 'a flower: pansy'. Each participant was read only one of the lists, but all participants were tested on both categories. This allowed the experimenters to measure how often people produced words that had been read to them compared to words that had not been read to them.

The pair of bars furthest to the right in figure 11.2 shows the results for the sleepers. There was no real difference between individuals' subsequent reports of key words when the words had been read to them and when the words had not been read to them. The pair of bars furthest to the left provides the same comparison for people who were awake during the word presentations. It is pretty clear that if people were awake during word presentation, then the presentations of the lists had a big effect on subsequent memory for those key words.

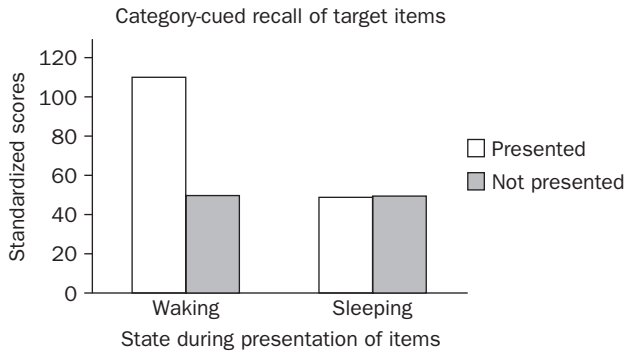

Figure 11.2

Learning while awake vs. learning while asleep: production of target items following waking and sleeping presentations. Scores were standardized on a list-by-list basis to have a mean of 50 and a standard deviation of 10. Source: Wood et al. (1992).

MEMORY MODELS

Kinds of remembering

Psychologists have applied a number of techniques in their efforts to understand memory. One approach has been to subdivide the vast field of memory into areas that seem to function differently from one another.

Cast your mind back to the last time you arrived home. How does that memory differ from remembering how to spell 'table', or that there are 11 players in a soccer team, or remembering how to ride a bicycle?

Our intuition would suggest that there are different kinds of remembering. But what is the evidence?

Episodic and semantic memory

One distinction made by psychologists is between episodic and semantic memory (Tulving, 1983). *Episodic memory* can be defined as memory for the personally experienced events of your life. Such memories naturally tend to retain details of the time and situation in which they were acquired. *Semantic memory*, by contrast,

episodic memory memory for personally experienced events

semantic memory abstract knowledge that is retained irrespective of the circumstances under which it was acquired (e.g. 'the world's largest ocean is the Pacific')

is knowledge that is retained irrespective of the circumstances under which it was acquired.

For example, your memory of eating breakfast this morning will be an episodic one involving when, where and what you ate. On the other hand, remembering the meaning of the term 'breakfast' involves semantic memory. You can describe what 'breakfast' means but you probably have no recollection of when and how you learned the concept.

Autobiographical memory – the recall of events from our earlier life – has become a particular aspect of episodic memory that has attracted considerable interest in recent years (Cohen, 1996; Conway, 1996).

autobiographical memory the recall of events from our earlier life – a type of episodic memory

Declarative and procedural knowledge

Another sub-division of memory is between declarative and procedural knowledge (Anderson, 1976; 1995). Declarative knowledge is explicit knowledge that people are consciously aware of and can report. For example, you can probably remember eating breakfast this morning. Ryle (1949) described this type of memory as 'Knowing That'.

Procedural knowledge is a knowledge of how to do things, such as riding a bicycle or typing. Ryle referred to it as 'Knowing How'. The skills of typing, driving and so forth may be well learned and highly developed, but it is generally not easy to describe in detail how to carry them out. So an accomplished typist might find it difficult to identify each finger movement required to type this sentence, while being quite capable of typing it quickly and correctly.

Explicit and implicit memory

Another common distinction is between explicit and implicit memory. *Explicit memory* involves conscious awareness of the original information or the situation in which the learning occurred, and recollection of the original information or experience that is subsequently recalled. As these experiences involve a recollective experience, Baddeley (1997), among others, prefers to refer to 'recollective', rather than explicit, memory.

explicit memory memory with conscious awareness of the original information or the situation in which the learning occurred

Implicit memory refers to an influence on behaviour, feelings or thoughts as a result of prior experience, but without conscious recollection of the original events. For example, if you pass the fish counter in a supermarket, you might later think of having fish for dinner without being aware that 'fish' had been primed by the supermarket experience. Baddeley (1997) argues that, rather than a single implicit memory system, there is probably an array of learning mechanisms that are similar in that they influence subsequent behaviour but they do not generate recollective memories.

implicit memory influence on behaviour, affect or thought as a result of prior experience but without conscious recollection of the original events

Demonstrating the distinction

Distinctions between implicit and explicit memory are sometimes demonstrated by studies that measure priming. One task used in many priming studies is completion of word fragments (described previously for the word 'computer'). Solutions are generally faster or more certain for recently encountered words than for new ones, even when the words are not consciously recognized.

One source of evidence for the implicit/explicit distinction comes from studies involving patients with amnesia. Their amnesia means that they cannot consciously recognize words or pictures that have been previously presented, but they are nevertheless better at completing the corresponding word fragments later on (Warrington & Weiskrantz, 1968). Tulving, Schacter and Stark (1982) found a similar difference between priming and recognition test results for healthy participants not suffering from amnesia. The effect of studying a list of words on later recognition of those words declined considerably over a seven-day period, but there was no similar decline in the effects of priming of the presented words. These studies suggest that there is a fundamental difference in the functional nature of memory, depending upon whether the test requires conscious awareness of the previous event.

Jacoby (1983) provided further evidence for this view. As in the previous studies, there were two types of test: recognition (involving conscious remembering) and unconscious remembering (in this case tested via perceptual identification, i.e. identifying a word that appeared in a brief flash). Jacoby also manipulated how the words were studied. Each target word was shown with no context (e.g. 'woman'), or shown with its opposite as a context (e.g. 'man – woman'), or generated by the participant when shown its opposite (e.g. 'man' shown and 'woman' generated by the participant).

Subsequently, the explicit memory test involved showing a mixture of target words and new words to participants and asking them to identify which words they had studied ('Studied' words included both read and generated words, as described above). The implicit memory test was a perceptual identification test: a mixture of targets and new words were shown very briefly (40 ms) one at a time, and the participants attempted to identify the word.

Figure 11.3 shows the different influences of the study condition on the implicit memory measure of identification and the explicit memory task of recognition. Explicit recognition improved from the 'no context' condition to the 'generate' condition, but the reverse was the case for the implicit perceptual identification task. Because the pattern of results is reversed for the two tests, it suggests that the underlying processes (i.e.

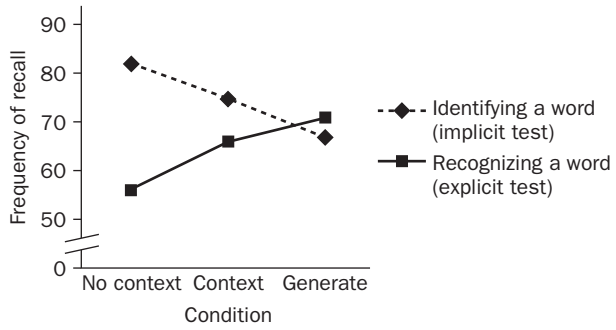

Figure 11.3

Ability to recognize a word (explicit test) vs. ability to identify it (implicit test) as a function of how the word was studied. Source: Jacoby (1983).

implicit and explicit memories) are distinct and involve possibly independent memory mechanisms.

The nature of the task

The implicit/explicit memory distinction is often tangled up (and therefore potentially confused) with two different types of task. Some tasks require people to think about meanings and concepts; these are called concept-driven tasks. Others require people to focus on the materials in front of them; these are called data-driven tasks (Roediger, 1990).

For example, if you are asked to remember words from a list that you studied, you would be explicitly recalling words and you would be likely to recall the meanings of the words as well. On the other hand, if your task was to complete word fragments, without reference to the studied list, then the influence of the study session would be implicit rather than explicit, and you would be working with the visual patterns of letters, but less so (if at all) with the meanings.

It is challenging to separate the nature of the task (i.e. concept- or data-driven) and the nature of the memory being tested (i.e. explicit or implicit) (see Roediger & Blaxton, 1987). Roediger, Buckner and McDermott (1999) review the debate between explanations based upon memory systems and memory processes.

The experience of remembering (or knowing)

Related to the explicit/implicit memory distinction is the experience that accompanies performance on the memory task. A participant may remember having seen the item under test in a recognition experiment at the original learning trial, or they may simply 'know' that the word was in the original list without specifically recalling it.

This 'remember/know' distinction was first used by Tulving (1985). He required each response in the memory test to be judged as being accompanied by an experience of remembering having studied the item, or, alternatively, of knowing that the item had been presented without specifically remembering the event. Gardiner and associates have since carried out extensive investigations of 'remember/know' judgements under a range of different conditions (reviewed by Gardiner & Java, 1993).

A number of conditions have been shown to influence 'remember' and 'know' judgements differently. For example, semantic processing (where the meaning of the items is foremost) leads to more 'remember' responses than does acoustic processing (which emphasizes the sound of the words studied). In contrast, 'know' responses do not differ between the semantic and acoustic conditions.

THE INFORMATION-PROCESSING METAPHOR

In the 1960s subdivisions of memory based upon information-processing models became popular. Following postwar developments in information technology, there had been a substantial growth in understanding the requirements of information storage during computer processing.

A three-stage model of memory processing developed, reaching its fullest elaboration in the version proposed by Atkinson and Shiffrin (1968). In these stage models, information was considered to be first held very briefly in sensory memories before a selection of this information was transferred to a *short-term store*. From here, a yet smaller amount made its way into a *long-term memory store*.

short-term store hypothetical memory store holding information for a few seconds

long-term memory store holds information relatively permanently

Sensory memories

Evidence for *sensory memory* stores came from experiments such as Sperling's (1960). He presented displays of 12 letters very briefly (e.g. 50 ms) to participants. Although they could report only about four letters, Sperling suspected that they might actually be able to remember more letters, but they could not hold them in mind long enough to report them.

sensory memory hypothetical large capacity memory store holding incoming sensory information for a brief period of time

To test this hypothesis, Sperling briefly presented the letters as a matrix containing three rows, and then sounded a tone (see figure 11.4). Participants had been instructed to report only part of the array – which part depended on the pitch of the tone. Using this *partial report procedure*, Sperling found that people could recall about three letters from any row of four, which meant that they

partial report procedure technique for inferring the capacity of a memory store, even when the memories do not last long enough to inform a complete report

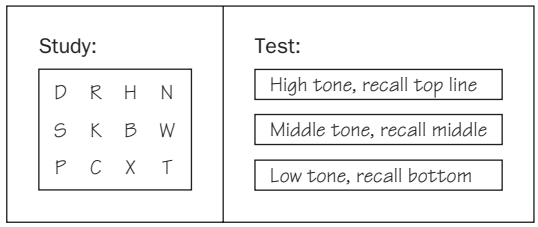

Figure 11.4

Sperling's (1960) partial report technique.

could actually potentially recall (for just a very brief period) about nine out of the twelve letters.

Psychologists inferred from research such as this that there is a sensory memory store which holds a large amount of incoming perceptual information very briefly while selected elements are processed. This sensory memory for visual information was termed *iconic memory* by Neisser (1967). Sensory memory for auditory information was referred to as *echoic memory*. Sensory memories are generally characterized as being rich in content, but very brief in duration.

iconic memory visual sensory memory

echoic memory auditory sensory memory

Short- and long-term memories

Beyond the sensory memories, the information-processing models hypothesized one or more short-term stores that held information for a few seconds. The verbal short-term store has received the most research attention, its existence being inferred in part from the *recency effect* in free recall.

recency effect the better recall of the last few items of information encountered

For example, Postman and Phillips (1965) asked their participants to free recall lists of 10, 20 or 30 words. With immediate recall, the participants tended to be much better at recalling the last few words that had been presented than words from the middle of the list (see the top part of figure 11.5.) But this recency effect disappeared if testing was delayed by as little as 15 seconds, so long as the delay involved verbal activity by the participant (see the middle and bottom parts of figure 11.5.) The interpretation of the recency effect was that the last few items were being retrieved from a short-term store of rather limited capacity.

The short-term store was believed to retain information primarily in an acoustic or phonological form (Baddeley, 1966) – a view that received additional support from the errors that appear during short-term retention, even when the material to be retained is presented visually. Conrad and Hull (1964), for example, showed that visually presented sequences of letters that are similar in sound (e.g. P, D, B, V, C, T) were harder to recall correctly than were sequences of dissimilar-sounding letters (e.g. W, K, L, Y, R, Z).

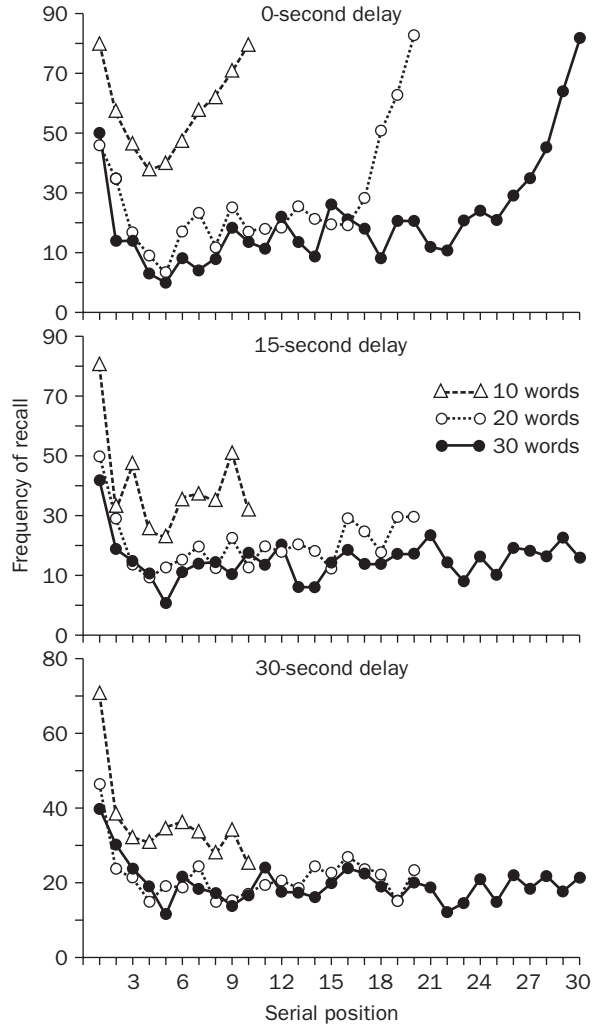

Figure 11.5

Recency effect (with no delay) and removal of recency effect by introducing a delay between presentation and test. The top panel shows high levels of recall for items near the end of the lists (recency effect) when there is no delay between presentation and test. The middle and bottom panels show that recall for items near the end of the list suffers far more than for other items in the list as a result of introducing even a very short (15-second) delay. Source: Postman and Phillips (1965).

On the other hand, long-term memory was believed to be stored primarily in terms of the meaning of the information. So, when asked to remember meaningful sentences, people usually cannot reproduce the exact wording, but they can generally report the meaning of what has been encountered (e.g. Sachs, 1967).

Developing the models

While models like Atkinson and Shiffrin's (1968) are useful ways to simplify and represent aspects of complex systems, this very complexity requires ongoing adjustment to enable these models to account for additional observations.

For example, the information-processing model made two assumptions:

1. that information could only reach long-term memory by passing through the short-term store; and
2. that rehearsing the information in the short-term store would both retain it in this store, and increase its chance of being selected for transfer to the long-term store.

The first of these assumptions was challenged by the identification of patients who had grossly impaired short-term memory spans and therefore (in terms of the model) severely damaged short-term memory stores, but who appeared to have no impairment in their long-term learning ability (Shallice & Warrington, 1970).

The second assumption was called into question by studies where participants rehearsed the last few words of free recall lists for a longer time without showing improvement in the long-term recall of those words (Craik & Watkins, 1973). Under some circumstances, it became clear that encountering the same information on many occasions (which may also be assumed to lead to increased rehearsal) was not sufficient to lead to its retention. For example, people do not remember the details on the faces of the coins that they handle daily (Morris, 1988; Nickerson & Adams, 1979), as you discovered when you tried to sketch a penny at the beginning of the chapter.

Other evidence that previously formed the basis for distinguishing between short-term and long-term memory stores has also come into question. For example, the recency effect in free recall had been attributed to the operation of a short-term store because it disappeared when the last few seconds before recall were filled with a task such as backward counting. But when recall was studied under different conditions, recency effects reappeared even without a contribution from short-term memory. When participants studied words and counted backwards after each word in the list, the last few items were better recalled than the middle of the list (as illustrated at the top of figure 11.5). This pattern was at odds with the model, because the short-term store should have been 'filled' with counting, and so no recency effect should have been observed (e.g. Baddeley & Hitch, 1977; Tzeng, 1973).

Semantic encoding was also demonstrated in short-term learning under suitable conditions (Baddeley & Levy, 1971), showing that phonetic encoding was not the only form of coding relevant for the short-term store.

Two major responses followed recognition of the problems with the Atkinson and Shiffrin (1968) information-processing model. One approach, especially associated with Baddeley et al. (e.g. Baddeley, 1986), was to enhance the short-term memory model in the light of its known limitations, along with more consideration of the functions that short-term remembering plays in cognition. This change in perspective led to Baddeley's (1986, 1997, 2001) working memory model.

The other response was to question the emphasis on memory stores and their capacity limitations, and to focus instead on an alternative approach based on the nature of the processing that takes place, and its consequences for remembering.

Baddeley's working memory model

Baddeley's (1986, 1997) model of working memory involves three main components: a *central executive*, and two so-called 'slave' systems – the *phonological loop* and the *visuo-spatial sketch pad*. To these Baddeley (2001) has added an *episodic buffer*.

The central executive controls attention and coordinates the slave systems; the phonological loop contains a phonological store and an articulatory control process and is responsible for inner speech; the visuo-spatial sketch pad is responsible for setting up and manipulating mental images; the episodic buffer integrates and manipulates material in working memory.

central executive the component of Baddeley's working memory model that controls attention and coordinates the slave systems

phonological loop the part of Baddeley's working memory model that contains a phonological store and an articulatory control process – responsible for 'inner speech'

visuo-spatial sketch pad the part of Baddeley's working memory model that is responsible for setting up and manipulating mental images

episodic buffer the component in Baddeley's working memory model that integrates and manipulates material in working memory

The phonological loop

Much research has been concentrated on the phonological loop. By using a technique known as *articulatory suppression*, in which research participants repeat aloud (or silently) a simple sound or word, such as 'la la la' or 'the the the', the phonological loop can be prevented temporarily from retaining any further information. So contrasting performance with and without articulatory suppression demonstrates the contribution of the phonological loop.

articulatory suppression a research technique in which participants repeat aloud a simple sound or word, preventing the phonological loop from retaining any further information

Like any loop, the phonological loop has a finite length. That length could be specified as a number of items or as a length of time. Baddeley, Thomson and Buchanan (1975) investigated this question. They showed that *memory span* – the number of words that you can hear and then repeat back without error – is a function of the length of time that it takes to say the words. A word list like 'mumps, stoat, Greece, Maine, zinc' is much easier to remember in a short-term memory test than 'tuberculosis, hippopotamus, Yugoslavia, Louisiana, titanium', even though the two lists are matched in terms of the number of words and the meaning. This word length effect is eliminated if the participants have to carry out articulatory suppression while they study the list.

memory span the number of words that you can hear and then repeat back without error

Another example comes from the varying speed with which the digits 1 to 10 can be pronounced in different languages. The size of the memory span for people who speak each language is highly correlated with the speed with which the digits can be spoken in that language (Naveh-Benjamin & Ayres, 1986). These and other observations demonstrate that the phonological loop must be time-limited.

The central executive and the sketch pad

More recently, Baddeley and his associates have turned to studying the central executive. Their technique is to ask people to perform two tasks at the same time. One of the tasks (the first task) is designed to keep the central executive busy, while the second task is being evaluated for whether the central executive is involved in its performance. When performance on the second task suffers due to the presence of the first task, they conclude that the central executive is involved in performing the second task.

One task used to engage the central executive is the generation of random letter sequences. Participants generate letter sequences taking care to avoid sequences of letters that fall into meaningful orders, such as (T, V), (B, B, C) or (U, S, A). Participants must attend carefully to their letter choice, and this monitoring occupies the central executive.

Robbins et al. (1996) showed that the memory of expert chess players for positions taken from actual chess games was impaired by the letter generation task but not by articulatory suppression, indicating that the central executive was involved in remembering the chess positions. These researchers also found that another task which is believed to interfere with the visuo-spatial sketch pad also reduced chess performance, reflecting the contribution of spatial short-term memory in the reproduction of the chess layouts.

The episodic buffer

Information that is retrieved from long-term memory often needs to be integrated to be appropriate for the current demands upon working memory. This is an important function of the episodic buffer proposed by Baddeley (2001). Baddeley gives the example of imagining an elephant who plays ice-hockey. We can easily go beyond the information about elephants and ice-hockey our long-term memory supplies us to imagine how the elephant holds the hockey stick and what position it might play. The episodic buffer allows us to go beyond what already exists in long-term memory, to combine it in different ways, and to use it to create novel situations on which future action can be based.

Levels of processing

Another alternative to the continuing development of structural models has been to emphasize the importance of processing in memory, rather than structure and capacity.

Craik and Lockhart (1972; Craik, 2002) argued that how well we remember depends on how we process information. They described different *levels of processing*, from 'superficial' levels that deal only with the physical properties of what is to be remembered, through 'deeper' processes involving phonological properties, down to yet deeper processes that involve semantic processing of the material (i.e. perhaps involving elaboration of the material).

levels of processing – the theory that there are superficial, intermediate and deeper levels of processing new information that will influence what can later be remembered

So, for example, if we see the word 'SHEEP', we might simply process it shallowly by noting that it is written in upper case. On the other hand, we might process it phonologically by registering that its sound rhymes with 'leap' and 'deep'. Alternatively, we could think about the meaning of the word: 'sheep' refers to domesticated, woolly, grazing animals. Further semantic processing – elaboration based on the meaning of the word – is deeper processing, and should lead to better memory (for example, we might think about the grazing of sheep, the uses of sheep – for example, in providing food and material for clothing – and the large number of sheep in some parts of the world, such as Australia and New Zealand).

Demonstrating the power of this approach, Craik and Tulving (1975) showed that the probability of the same word being recognized in a memory experiment varies from 20 per cent to 70 per cent, depending on the type of processing that is carried out on the word (see figure 11.6). When the initial processing involves only decisions about the case in which the word is printed, correct recognition occurs at the 20 per cent level. Performance is better following the rhyming (i.e. phonological) decisions, and far better (almost 70 per cent correct recognition) when processing involves decisions about whether the word fits meaningfully into a given sentence.

Although many studies support the model, the details of the original 'levels of processing' model have been criticized (e.g. Baddeley, 1978). For example, it has been argued that a level of processing cannot be identified independently of the memory performance that it produces (in other words, it has been

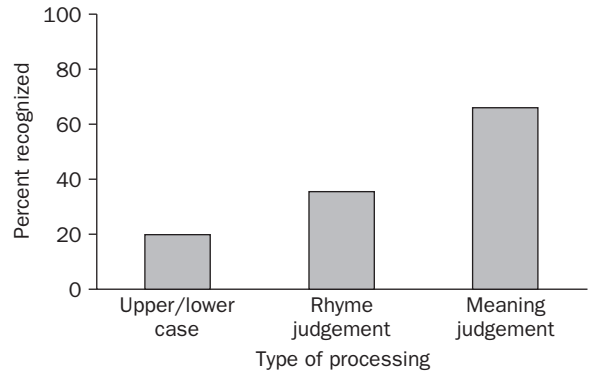

Figure 11.6

Percentage of words correctly recognized as a function of processing type (i.e. level). Performance is based on both studied items and distractors. Source: Craik and Tulving (1975).

suggested that the definition of what constitutes 'deep' and 'shallow' processing is circular). More recently, though, Craik (2002) has pointed to physiological and neurological methods that may provide an independent measure of depth.

Thoughtful discussion about the viability of the model continues. Wherever it leads, it is clear that a 'levels of processing' approach draws attention to important memory-related issues including the type of processing, elaboration of materials, and the appropriateness of this processing (in terms of 'transfer' to the later task). A key message from this research is that what we remember depends on what we ourselves do when we encounter a thing or an event, as well as the properties of the thing or event itself.

The link between study and test

The encoding specificity principle

encoding specificity principle states that what is remembered later depends on the similarity of the retrieval situation to the original encoding conditions

Tulving (1983) developed the *encoding specificity principle*, which emphasizes the relationship between what occurs at study time (encoding) and what occurs at test time (retrieval).

What is encoded in any particular situation is selective – it is determined by the demands on the individual at study time. According to the encoding specificity principle, what will be remembered later depends on the similarity between the memory test conditions and the original study conditions.

Pioneer

Endel Tulving (1927–) has been a dominant figure in research on memory for several generations and a pivotal figure in the late twentieth century. His work on subjective organization demonstrated that participants in memory studies are not passive but impose their own organization and expectations upon the material they study. He drew attention to a distinction, originally made by Plato, between the availability of items in memory and their accessibility. Tulving is even better known for his work on the relationship between what is encoded and what can be retrieved. He developed the encoding specificity principle and collaborated with Craik in exploring the 'levels of processing' framework. He was also the first psychologist to suggest that episodic and semantic memories were two separate memory systems. More recently, with Schacter, he has been involved in a considerable body of research and theorizing on the distinction between implicit and explicit memories and in research on the neuropsychological correlates of memory.

An experiment by Barclay et al. (1974) nicely illustrates encoding specificity. They required participants to study a series of sentences with key words embedded in the sentences. So, for example, the word 'PIANO' was presented in one of two sentences: 'The man tuned the PIANO' or 'The man lifted the PIANO.' Recall of the sentences was cued by phrases that were either appropriate or inappropriate to the particular attributes of the named object (the piano).

Cued with the phrase 'something melodious', participants who had received the sentence about tuning the piano remembered 'PIANO'. Participants who had studied the sentence about the piano being lifted were less likely to recall 'PIANO' after the 'something melodious' cue, because the melodious aspect of the piano had not been emphasized in their sentence. Conversely, participants who had studied the sentence about lifting the piano were more effectively cued at test by the phrase 'something heavy' rather than the cue 'something melodious'.

This experiment demonstrates two important aspects of encoding specificity:

1. Only those aspects of our experience that are specifically activated by the study situation are certain to be encoded.
2. For information to be optimally recalled, test cues need to target the particular aspects of the information that were originally encoded. In other words, remembering depends on the match between what is encoded and what is cued.

Transfer appropriate processing

To achieve the best recall, the type of processing involved when studying needs to be appropriately matched to the type of processing that will be required for the test.

transfer appropriate processing for the best recall, the type of memory encoding needs to be appropriately matched to the type of cueing information that will be available at recall

Morris, Bransford and Franks (1977) demonstrated the effect of *transfer appropriate processing* in an extension of the Craik and Tulving (1975) 'levels of processing' experiments. In the original Craik and Tulving studies, participants were encouraged during encoding to focus on the physical, phonological (e.g. rhyming) or semantic aspects of the to-be-remembered word. Under typical testing conditions, semantic processing during encoding led to the best level of recall during testing. But in the Morris et al. study, a condition was added in the test phase: participants had to identify words that rhymed with the words presented earlier during encoding. In this new condition there was a closer match between the task carried out in the learning phase (identifying words that rhymed) and the task carried out in the test phase (identifying the words that rhymed with words presented in the learning phase). Recall for rhyming words was best when rhyming had been the focus of the learning task.

WHAT DO WE KNOW ABOUT MEMORY?

MEMORY AND THE BRAIN

Psychologists' study of memory has focused, appropriately, on what people do, say, feel and imagine as a result of their past experiences. But how are these activities of remembering reflected in our brain (see chapter 3)?

The study of amnesia has been important in recent years, not only as a way of discriminating between certain types of memory processes, but also in linking deficits in remembering with localized brain damage in patients who have sustained injury. In addition, the development of techniques such as functional magnetic resonance imaging (fMRI) has added significant new information by allowing us to study the parts of the brain that are active when ordinary people remember. For an excellent review of this research, see Parkin (1997).

Making generalizations about memory and the brain is difficult because remembering is a complex process, involving most other cognitive and emotional aspects of a person. So many parts of the brain will be active when someone is remembering. We cannot just remember something without also feeling and thinking, so it is very hard to isolate any neural activity that might be unique to remembering. But certain parts of the brain do seem to be important to memory in particular.

For example, damage to the hippocampus and the thalamus can prevent new episodic memories being formed (Squire, 1992). Patients with hippocampal damage can learn new skills without forming episodic memories. So the patient H.M. (see chapter 3), who had had his hippocampus surgically removed, was eventually able to solve a complicated puzzle that he attempted over many days. Yet each time he was given the puzzle, he denied having ever seen it before (Cohen & Corkin, 1981). This tells us that the hippocampus appears to play an important part in the formation of episodic memories.

THE IMPORTANCE OF MEANING

Remembering names

Meaning plays a major role in determining what we can remember. Consider the case of remembering (or rather forgetting) names. People who feel they have a bad memory commonly complain that they find names especially difficult to remember. In fact, people are generally poor at dealing with a new name. When introduced to a new person, our minds are usually occupied and so we fail to attend to their name. Then we most likely do not use or try to think of the name until much later, by which time memory often fails. But there is more to the problem of remembering names than merely not paying attention and not using the names until much later.

Cohen and Faulkner (1986) presented participants with information about fictitious people: their names, the places they came from, their occupations and hobbies. The participants remembered all of the other attributes better than the names. Why? Not merely because names are unfamiliar words – many names are also common nouns (e.g. Potter, Baker, Weaver, Cook).

McWeeny, Young, Hay and Ellis (1987) tested people who studied the same set of words; sometimes the words were presented as names, sometimes as occupations. The same words were remembered much better when presented as occupations than as names. It is apparently easier to learn that someone is a carpenter than that they are named Mr Carpenter!

Nevertheless, names that are also real words do have an advantage over 'non-word' names. Cohen (1990) showed that meaningful words presented as names (e.g. Baker) are better remembered than meaningless words presented as occupations (e.g. ryman). Even so, names are often treated as being meaningless – think for a second how it sometimes comes as a surprise when we recognize that they are also occupations (for example, the names of the former British prime ministers Thatcher and Major). We know that attending to the meanings of names can improve memory for them, especially when combined with practice in recalling them (Morris & Fritz, 2002, 2003).

One aspect of what makes a word meaningful is the associations that it has with other terms (Noble, 1952). Words that trigger more associated words (e.g. 'kitchen') certainly seem more meaningful than unusual words (e.g. 'rostrum') and these, in turn, seem more meaningful than non-words (e.g. 'gojey'). The lack of associations to some names may be one of the main reasons they are hard to learn. Cohen and Burke (1993) point out that many names lack semantic associations, while occupations have many semantic associations.

Nonsense and droodles

Meaning has a major influence on memory. Ebbinghaus (1964/1885) recognized that the study of material which already had

Pioneer

Hermann Ebbinghaus (1850–1909), a German philosopher, read Fechner's work on the study of sensation and perception in the late 1870s and decided to adapt these methods to the study of memory. He devised a systematic way of simplifying memory tasks so that aspects of memory could be manipulated and measured. Ebbinghaus invented syllables made up of two consonant sounds separated by a vowel (e.g. 'tir', 'kam', 'dol') in an attempt to avoid the contaminating effects of prior familiarity, and then measured the number of repetitions required to learn them. He also devised a clever way of measuring forgetting. He counted the number of repetitions required to re-learn the material and found that it usually took fewer repetitions to re-learn something than to learn it in the first place. Ebbinghaus's experimental method for the study of memory established a major field of psychology and continues to influence our understanding of memory today.

Everyday Psychology

Learning people's names

'I have problems remembering people's names!' We hear this complaint regularly. Higbee (2001) found, when questioning people about the aspects of memory they would most like to improve, that remembering people's names was by far the most popular choice. It is a problem that probably becomes even greater as we get older: Bolla, Lindgren, Bonaccorsy and Bleecker (1991) found that the memory problem most frequently reported by older people was forgetting names.

Psychological research has confirmed that names are particularly hard to remember. Cohen and Faulkner (1986) found that, after studying biographical sketches, recall of person names was poorer than recall of any other type of information from the sketches. McWeeny, Young, Hay and Ellis (1987) taught participants names and occupations in association with photographs of faces. They chose words such as Cook, Porter and Carpenter, sometimes using the words as names and sometimes as occupations. McWeeny et al. found that the words were much easier to learn when presented as occupations than when presented as names.

Why should names be difficult to learn? In everyday life, we often pay insufficient attention to a name when we are introduced to a new person. Also, we do not usually repeat the name right away or use it during the initial conversation. After half-hearing the name once, it may be some time before we try to recall it – only to find it has been forgotten.

Another problem may be that names are generally perceived as meaningless. Even so, names are better recalled than meaningless non-words (Cohen, 1990).

How can we improve our learning of names? The section on mnemonics (pp. 243–4) includes an imagery mnemonic that Morris et al. (1978) showed to be effective under laboratory conditions. Unfortunately, imagery mnemonics demand creativity and attention and can be distracting when used for the first time. Perhaps these demands explain why Morris et al. (in press) found the mnemonic to be unsuccessful when people attending a party were encouraged to use it to learn the names of those present. The mnemonic probably requires considerable practice and motivation before it can be used successfully in everyday life.

Are there memory improvement strategies to improve name learning that can be easily and successfully adopted under real-world conditions? Fortunately, the answer is yes. To improve your memory for people's names, simply test yourself. Try to recall the person's name shortly after being introduced and again after a minute or so, and again later after somewhat longer delays. In one experiment students at a party who used this method were better at remembering names days later. Under laboratory conditions, combining this technique with trying to identify meaningful associations to the name makes it even more successful (Morris & Fritz, 2003).

In classes and meetings it is common for everyone to introduce themselves during the first meeting, but the names are rarely well remembered. An alternative activity, called the 'Name Game', has proved effective in a series of experiments (Morris & Fritz, 2000; 2002; Morris, Fritz & Buck, 2004). As each person introduces themselves, they must also attempt to recall the names of the other people present. The people who introduce themselves first, and so have few names to recall, are asked to recall everyone later on. This activity is often used in real meetings and seminars, sometimes with a few test rounds in the second meeting. People who play the 'Name Game' are better at remembering their colleagues' names, even after several weeks or months.

Morris, P.E., & Fritz, C.O., 2000, 'The name game: Using retrieval practice to improve the learning of names', *Journal of Experimental Psychology: Applied*, 6, 124–9.

meaning for the learner would be influenced by that meaning. So it seemed to Ebbinghaus that if he was to discover the fundamental principles of memory, then he would need to study the learning of simple, systematically constructed materials. He created syllables by stringing together a consonant sound, a vowel sound and a consonant sound. Some of these were words or meaningful parts of words but most were simply syllables. He made lists of these syllables and learned them in order – often requiring many trials to learn them perfectly (see also chapter 1). In contrast to his experience learning poetry, learning these syllables was slow.

A demonstration of the importance of meaning for the recall of very different material was provided by Bower, Karlin and Dueck (1975). They studied memory for droodles – simple line drawings of nonsense pictures (see figure 11.7). Some participants

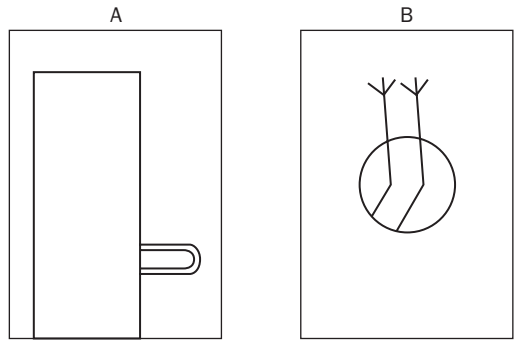

Figure 11.7

Examples of two droodles. Source: Bower, Karlin and Dueck (1975).

were given a meaning for each droodle (e.g. a midget playing a trombone in a telephone booth; an early bird who caught a very strong worm). These individuals were able to sketch the pictures from memory far better (70 per cent correct) than participants who were not given these meanings (51 per cent correct).

The effects of previous knowledge

Schemas – what we already know

Bartlett (1932) asked English participants to read and then recall a Native American folk tale, *The War of the Ghosts*, which came from a culture that was very different from their own. When they attempted to recall the story, their reports were obviously based on the original tale, but they had added, dropped and changed information to produce stories that seemed more sensible to them – what Bartlett termed an 'effort after meaning'.

schemata (**schemas**) knowledge structures that help us make sense of familiar situations, guiding our expectations and providing a framework within which new information is processed and organized

Bartlett proposed that we possess *schemata* (or *schemas*), which he described as active organizations of past experiences. These schemas help people to make sense of familiar situations, guiding expectations and providing a framework within which new information is processed. For example, we might possess a schema for a 'typical' day at work or at school.

People seemingly have trouble understanding things if they cannot draw upon memory, or schemas, for previously acquired knowledge. This point was nicely illustrated in a study by Bransford and Johnson (1972). They gave participants a passage to remember, which began as follows:

> The procedure is actually quite simple. First you arrange items into different groups. Of course one pile may be sufficient depending on how much there is to do. If you have to go somewhere else due to lack of facilities that is the next step; otherwise you are pretty well set. It is important not to overdo things. That is, it is better to do too few things at once than too many. . . . (p. 722).

Recalling the passage proved difficult, even if a title was given after the passage had been read. Bransford and Johnson (1972) found that it was only when the title ('Washing Clothes') was given in advance that recall was improved. The title explained what the passage was about, cued a familiar schema and helped people to make sense of the statements. With the title provided first, the passage became meaningful and recall performance doubled. So it seems that memory aids understanding; and understanding aids memory.

It is possible to remember without understanding, though – especially with extra aids, such as having the information presented for verification. Alba, Alexander, Hasher and Caniglia (1981) demonstrated that, although recall of the 'Washing Clothes' passage was much improved when the title was known in advance, recognition of sentences from the passage was equivalent, with or without the title. Alba and colleagues concluded that the title allowed the participants to integrate the sentences into a more cohesive unit, but that it affected only the associations among the sentences, not the encoding of the sentences themselves (which is why recognition performance was apparently preserved).

The research with the 'Washing Clothes' passage illustrates how our previous knowledge helps us to remember. Bower, Clark, Lesgold and Winzenz (1969) provided another demonstration. They asked participants to learn sets of words that were presented either as a random filled hierarchical chart or in a well-organized one: see, for example, the hierarchy in figure 11.8.

Pioneer

Sir Frederick C. Bartlett (1886–1969) was one of Britain's greatest psychologists. Although he began his research using Ebbinghaus's methods and materials, he was dissatisfied with the limits of simple artificial materials and turned his attention to how people recall stories and pictures. His studies remained experimental and carefully controlled, but he began to use materials 'of the type which every normal individual deals with' (1932, p. v). Whereas Ebbinghaus tried to limit the effects of meaning and studied the effect of other variables on memory, Bartlett's emphasis was on the role of meaning and social influences upon remembering. Even today, his work is often cited and is the basis of much contemporary research.

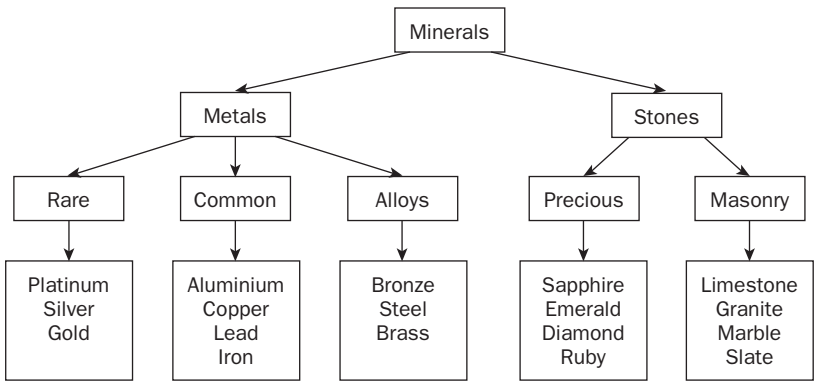

Figure 11.8

Organized hierarchical information used by Bower et al. (1969).

Research close-up 1

Hierarchical retrieval schemes in recall of categorized word lists

The research issue

The focus of research by Bower et al. (1969) was the influence of presenting words in a structured hierarchy (see figure 11.8), compared with presenting the same words in a random structure.

The first experiment was a simple comparison of free recall of hierarchical word lists presented in a blocked as opposed to a random fashion. Four word hierarchies were learned concurrently. The participants in the blocked condition were exposed to the four conceptual hierarchies organized as vertical trees, as shown in figure 11.8. For participants in the random condition, the same words were thoroughly scrambled, then assigned randomly to the nodes of four special trees.

Design and procedure

Sixteen undergraduates served as participants, eight in each of two conditions, blocked and random. In each condition, four hierarchies were presented, with an average of 28 words in each. The hierarchies were presented on large cards, with a study time calculated at 2s per word on the card. In the random condition, the same set of 112 words was used with the words randomly positioned.

After seeing the four cards, the participants recalled the words aloud in any order they preferred.

Results and implications

Table 11.1 shows the number of words presented and the level of recall on each of four trials for the blocked and random conditions. The mean recall on trial 1 was 3.5 times better in the blocked than the random condition. In the blocked condition, recall was almost perfect by trial 2. The structural organization of the blocked words had a statistically significant effect on free recall in this situation.

Table 11.1 Average words recalled over four trials.

	Trials			
Condition	*1*	*2*	*3*	*4*
Words presented	112	112	112	112
Blocked	73.0	106.1	112	112
Random	20.6	38.9	52.8	70.1

The researchers concluded that the blocking of the words had a substantial effect on recall. In four later experiments reported in this paper, they continued to investigate similar tests of memory. They explored recognition performance, and investigated associative rather than conceptually organized word hierarchies.

Bower, G.H., Clark, M.C., Lesgold, A.M., & Winzenz, D., 1969, 'Hierarchical retrieval schemes in recall of categorized word lists', *Journal of Verbal Learning and Verbal Behavior*, 8, 323–43.

Bower and his colleagues found that presenting the words in meaningful hierarchies reduced the learning time to a quarter of that required for the same words when they were randomly positioned in the hierarchy. The organization of the hierarchy apparently emphasized aspects of the words' meanings, which appeared not only to simplify the learning of the lists but also to provide a framework within which the participants could structure their recall.

How knowledge promotes remembering

Experts in any area find it easier and quicker to learn new information within their expertise than do novices. This indicates that what we learn appears to depend heavily on our existing knowledge.

For example, Morris, Tweedy and Gruneberg (1985) showed that there was a very strong relationship between how much their participants knew about soccer and the number of new soccer

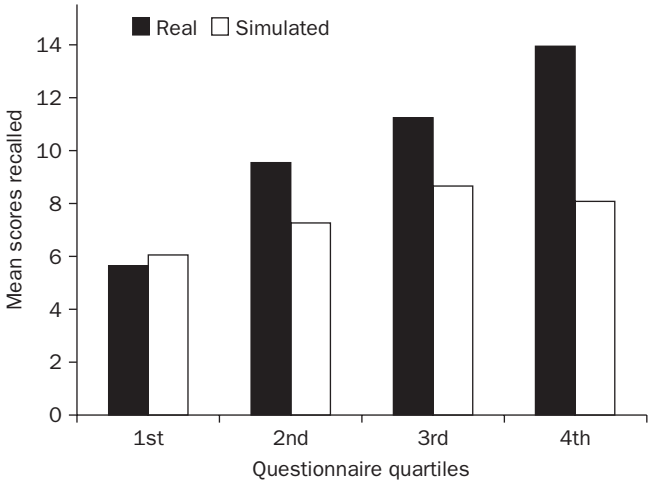

Figure 11.9

Recall of real and simulated soccer scores as a function of relative expertise, measured by a questionnaire on soccer knowledge. Recall of real soccer scores increased with expertise; for simulated soccer scores, it did not. Source: Morris, Tweedy and Gruneberg (1985).

scores they could remember after hearing them just once. Participants were read a new set of soccer scores as they were being broadcast. One set of scores were the real scores, and another set was simulated by constructing plausible pairs of teams and assigning goals with the same frequency as had occurred in an earlier week. Participants in the study were told whether the scores they heard were real or simulated.

Figure 11.9 illustrates the recall of the participants, with the first quartile (the first of four groups) knowing the least and the fourth quartile the most about soccer. Only the real scores seemed to activate the knowledge and interest of the soccer experts. For real scores (the darker bars in the figure), level of memory recall was clearly related to expertise – so more knowledgeable fans recalled more. For simulated scores (the pale bars), where the scores were highly plausible but not the genuine results, expertise had little effect on recall performance. These results illustrate the interaction of memory capacity with existing knowledge (and, presumably, also interest and motivation) in determining what is remembered.

How knowledge leads to errors

Our previous knowledge is a very valuable asset, but it can also lead to errors. Owens, Bower and Black (1979) illustrated this point well. They gave their university student participants a description of the activities performed by a character. For example, one of the sketches was about a student named Nancy. Here is the first part of that sketch:

> Nancy went to the doctor. She arrived at the office and checked in with the receptionist. She went to see the nurse who went through the usual procedures. Then Nancy stepped on the scale and the nurse recorded her weight. The doctor entered the room and examined the results. He smiled at Nancy and said, 'Well, it seems my expectations have been confirmed.' When the examination was finished, Nancy left the office. (p. 186)

Half of the participants were told in advance that Nancy was worried that she was pregnant. These participants included between two and four times as many pieces of incorrect information when tested on their recall of the sketch. For example, some of them recalled 'usual procedures' as 'pregnancy tests'. The errors were made in both recognition and recall tests.

People have many expectations about how conventional activities (going to the doctor, a lecture, a restaurant) will proceed, and these provide schemas or scripts that can both aid and mislead. Bower, Black and Turner (1979), for example, studied the influence of such scripts on subsequent recall. In another part of their study, they also gave their participants stories based on normal expectations, but including variations from the norm. So, for example, a story about eating in a restaurant might refer to paying the bill at the beginning. When recalling these stories, participants tended to reorder them back to their schematic form or script. Other common errors involved including actions that would normally be expected in that context, but which had not been mentioned in the original story, such as looking at the menu.

In general, the findings of these and similar studies indicate that people tend to remember what is consistent with their schemas or scripts and to filter out what is inconsistent.

Real vs. imagined memories

Even when we believe that we are 'playing back' some previous event or information in our mind, as if it were a videotape, we are actually constructing a memory from bits and pieces that we remember, along with general knowledge about how these bits should be assembled.

This strategy is usually very adaptive, minimizing our need to remember new things that are very similar to things we already know. But sometimes there can be a blurring between what actually happened and what has been imagined or suggested.

Reality monitoring

The issue of reality monitoring – identifying which memories are of real events and which are of dreams or other imaginary sources – has been addressed by Johnson and Raye (1981). These researchers maintain that the qualitative differences between memories are important for distinguishing *external memories* from internally generated ones. They argue that external memories have stronger sensory attributes, are more detailed and complex and are set in a coherent context of time and place. By contrast, they argue that internally generated memories have more traces of the reasoning and imagining that generated them.

external memories memories of events that really occurred

Although Johnson (1988) found support for these differences, applying them as tests can lead to accepting memories as real, even when they are not. Morris (1992), for example, asked participants to recall details from a videotape and to report both their confidence and the presence or absence of clear mental imagery and detail. Although clear images and details were found to occur more often with correct reports, their presence led people to be overly confident: incorrect details accompanied by mental images were reported with greater confidence than correct details that lacked these images. So there does not seem to be any sure way of distinguishing between 'real' and 'imagined' memories.

Related to the concept of reality monitoring is *source monitoring* – being able to successfully attribute the origin of our memories (e.g. being able to state that we heard a particular piece of information from a friend rather than hearing it on the radio news broadcast). Errors in attributing memories can have important consequences – for example, during eyewitness testimony (Mitchell & Johnson, 2000).

Research close-up 2

When might a witness be misled?

The research issue

Eyewitnesses to an event can be misled by false information or suggestions they encounter after the event. Elizabeth Loftus and her colleagues (Loftus & Loftus, 1980; Loftus, Miller & Burns, 1978) identified this *misinformation effect*, and, along with many other psychologists, they have continued to explore when and why it occurs.

Saunders and MacLeod (2002) suggested that misinformation influences memory only when the witness is unable to consciously recall the original, correct information. They used a phenomenon known as *retrieval-induced forgetting* (Anderson, Bjork & Bjork, 1994) to test their hypothesis. Retrieval-induced forgetting occurs when some parts of a set of information are practised (i.e. repeatedly tested and recalled), then the parts that are not practised become temporarily more difficult to recall. Saunders and MacLeod predicted that people would adopt misinformation for forgotten parts, but not for information they remember, so they used retrieval-induced forgetting to make people remember or temporarily forget parts of a story.

retrieval-induced forgetting when some parts of a set of information are practised (i.e. repeatedly tested and retrieved), the parts that are not practised become temporarily more difficult to recall

Design and procedure

Participants were 100 undergraduate volunteers. Each participant studied short stories containing information about two burglaries and later received misinformation about one aspect of one burglary. Participants in the key experimental conditions practised (i.e. repeatedly tested and recalled) half of the information about one burglary. Misinformation was given to conflict with one aspect of that burglary – either:

- practised information – Later these facts should be very easily recalled, so misinformation should have little effect.
- unpractised information – Later these facts would often be temporarily forgotten, so misinformation was predicted to have a substantial effect.

The participants first studied information about both burglaries. A practice session followed where half the information about one of the burglaries was tested several times. All participants were then asked to recall as much as they could about both burglaries – this allowed the experimenters to see what was remembered and what was forgotten. Next the participants were asked a few more questions about the burglaries; one of the questions included one piece of misinformation (e.g. necklace was replaced with earrings). Finally they took a forced choice recognition test, in which the critical question required the person to choose between the original information, the misinformation and one other alternative.

Results and implications

In the free recall test that preceded the misinformation, retrieval-induced forgetting occurred: participants were best at remembering practised information and worst at remembering the unpractised information.

As Saunders and MacLeod predicted, people were more likely to be misled when the misinformation applied to the items they were least likely to remember – the forgotten information from the practised burglary. For unpractised (i.e. forgotten) information, 60% of the people were misled whereas only 16% were misled on practised information.

In real life, witnesses to crimes are often questioned more than once, so it is important to be aware that repeated questioning about some aspects of an event could leave them more susceptible to accidental misinformation about other, related aspects.

Saunders, J., & MacLeod, M.D., 2002, 'New evidence on the suggestibility of memory: The role of retrieval-induced forgetting in misinformation effects', *Journal of Experimental Psychology: Applied*, 8, 127–42.

The misinformation effect

The distortion of memory through the incorporation of new information has been an important research topic for psychologists concerned both with the practical implications for eyewitness testimony, and with theoretical accounts of the nature of memory.

misinformation effect recall of misleading information presented after an eyewitness experience

Loftus and colleagues have explored in depth the *misinformation effect* (Fruzzetti et al., 1992; Loftus & Loftus, 1980). This arises when misleading information is introduced indirectly. For example, Loftus, Miller and Burns (1978) showed participants a series of slides along with the story of a road traffic accident. Later, the participants were questioned about the event. One of the questions was slightly different for half of the participants, in that it referred to a Stop sign instead of a Yield (Give Way) sign. Participants who were asked the question with the misleading information were more likely to identify falsely that particular slide in a later recognition memory test. These participants tended to choose the slide with the road sign that had been mentioned in the misleading question, rather than the one they had actually seen.

Loftus and colleagues have repeatedly demonstrated similar distortions of memory reports after intervening, misleading questioning. The findings are robust and have implications for the sort of questions that eyewitnesses of crimes and accidents should be asked if their recall is to be as accurate as possible. However, the basis of the misinformation effect is disputed (see Chandler & Fisher, 1996, for a review). It is possible that the participants' original memories are permanently distorted by the questioning, but it is also possible that the questions supply information that the participants would not otherwise be able to remember (see Saunders & MacLeod, 2002).

False memories

Related to the misinformation effect, but with more potentially serious consequences, are recovered and false memories (Ceci & Bruck, 1995; Loftus & Ketcham, 1994). Under therapy, some adults have recovered memories of alleged abuse in childhood that have led to criminal convictions (Loftus & Ketcham, 1994).

But substantial research has shown that, under certain circumstances, false memories can also be created. Sometimes these are benign (Roediger & McDermott, 1995). However, it is also possible to create, using suggestions and misleading information, memories for 'events' that the individual believes very strongly happened in their past but which are, in fact, false (Ceci & Bruck, 1995; Loftus & Ketcham, 1994). So it remains at least plausible that some abusive events that people 'remember' are in fact false memories.

Learning strategies

What we remember depends, in part, on how we were thinking and acting at the time of the original experience. This knowledge can allow us to develop strategies that help us modify what we remember.

The role of rehearsal

An early strategy often adopted by children is to repeat material over and over again. The mere repetition of information, with no additional thought about meaning or associations, can help us to retain information for a few seconds, but it is a very poor method of learning for the longer term, as demonstrated by Craik and Watkins (1973). Their participants learned lists of words. In one condition, they were encouraged to repeat the last few words over and over again for some time before recall. These participants recalled the repeated words well in the immediate test, but at the end of the experiment all of the different lists that had been presented were tested. In the final test, the words that had been rehearsed repeatedly (and remembered better in the immediate test) were recalled no better than other words.

This rehearsal was described as *maintenance rehearsal* – maintaining the memory temporarily but doing nothing for longer-term memory.

maintenance rehearsal repeating items over and over, maintaining them in short-term memory but not increasing their long-term recall

In contrast to maintenance rehearsal is *elaborative rehearsal*. Rather than simply repeating information in an effort to maintain its availability, in elaborative rehearsal the meaning of the information is considered and elaborated. Although both types of rehearsal can keep information available for a short time, recall after a delay is much better when the information has been rehearsed elaboratively than when it has merely been rehearsed in a maintenance fashion (Bjork & Jongeward, 1975).

elaborative rehearsal considering the meaning of information

Expanding retrieval practice

Regardless of the type of rehearsal, later recall of information benefits from spaced retrieval practice – a technique for maximizing learning with the minimum of effort applied at the optimal moment. The underlying principle here is that memory is strengthened most when recall is attempted just before it becomes too difficult to accomplish (Bjork & Bjork, 1992).

When we first encounter some information, it may be relatively fragile in terms of memorability. By successfully recalling the information correctly a short while after studying it, we are more likely to recall it again later, so we can allow a somewhat longer delay before our next successful retrieval effort. With each successful effort, the delay can increase and still lead to further successes.

The effectiveness of this expanding schedule for retrieval practice was demonstrated by Landauer and Bjork (1978). They showed fictitious first and last names to their participants, who were then asked to recall the last names when the first names were shown again. The tests were scheduled to explore a range

Trial n+	1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4
Short	P n T n T n T
Moderate	P n n n n T n n n n T n n n n T
Long	P n n n n n n n n n n T n n n n n n n n n n T n n T n n n n n n n T
Expanding	P n T n n n n T n n n n n n n n T

Figure 11.10

The testing conditions from Landauer & Bjork (1978). Short, moderate, long and expanding schedules are illustrated. The numbers across the top count the trials, starting at 1 for the initial presentation. *P* represents the presentation of a first and last name, *n* stands for an intervening trial with another name and *T* is a test of retrieval of the last name when the first name is presented.

of possibilities, including testing after short, moderate and long intervals filled with intervening items, and a further condition, the expanding schedule, in which the tests were at first introduced after a short delay and then the interval was steadily increased. For the expanding schedule, the first test took place immediately, the second test after three intervening items and the third after ten further items. The testing conditions are illustrated in figure 11.10. Landauer and Bjork found that any retrieval practice was beneficial (relative to the control unpractised condition), but that the greatest benefit was found for the expanding schedule, which produced recall at approximately twice the level of unpractised items.

Expanding retrieval practice is an excellent strategy for students. It is relatively undemanding in terms of the effort and creativity required, and can be applied to virtually any material (Morris & Fritz, 2002).

The benefits of spaced study

It is natural to plunge intensively into trying to learn new information, but this strategy has been shown repeatedly to be misguided (Dempster, 1996). The benefits of spacing study trials were observed by Ebbinghaus (1885/1964), who found that spreading his study sessions over three days approximately halved the amount of time actually spent in actively studying the lists. In fact, two spaced presentations of material to be learned are often twice as effective as two massed presentations (Dempster, 1996).

Bahrick and Phelps (1987) demonstrated the robustness of the spaced study effect. They compared the performance of participants who had originally learned and then relearned Spanish vocabulary by testing them eight years after the teaching session. One group had originally learned and relearned the vocabulary with an interval between learning and relearning of 30 days. Another group had learned and relearned on the same day. Eight years later, the participants who had learned and relearned with a 30-day interval performed at a level 250 per cent higher than the same-day learning/relearning group!

Mnemonics

Many students are familiar with rhymes such as '30 days hath September . . .', whose rhythm and rhymes provide structures that aid recall (Morris & Gruneberg, 1979) and with first-letter *mnemonics* such as 'Richard of York Gave Battle in Vain' that help recall order – in this case, the colours of the rainbow (Morris & Cook, 1978).

mnemonics techniques for improving memory

But the oldest mnemonic method is the *method of loci*, traditionally attributed to Simonides around 500 BC and taught from Classical times until the present day. The technique involves knowing a series of places or loci that are familiar yet distinct – students might use places around their campus. The first item to be remembered is imaged in the first of these places, the second item in the second place, and so on. Recall then involves mentally revisiting the places and re-experiencing the images. Research has shown the technique to be highly effective (Morris, 1979), but its use is obviously limited by the availability of suitable loci and material to image.

method of loci a mnemonic technique used to improve memory by creating images that link the items to be remembered with a series of familiar locations

The method of loci has since been elaborated into the more flexible pegword system, using the phonetic mnemonic in the construction of the pegwords (Higbee, 2001). Easily imagined pegwords that can be relatively easily learned replace the places of the method of loci. For example, we might learn words to represent each of the numbers from 1 to 100. The words are easily learned because they are constructed according to a few simple rules that underlie the phonetic mnemonic. Each digit is replaced by a specific consonant sound and then vowel sounds are inserted in between to create concrete, imageable words instead of number combinations (for which it is more difficult to create images). In the phonetic mnemonic the consonant sounds for the digits 1 and 2 are 't' and 'n', respectively. So, the number 21 can be represented by 'net' or 'nut'. The full phonetic mnemonic and pegwords for the numbers 1 to 100 can be found in Higbee (2001).

Pegword mnemonics allow a much more flexible use of the imagery mnemonic than the method of loci and can be dramatically effective (Bellezza, 1996; Morris & Reid, 1970); they form the basis of

pegword mnemonics method for remembering items by imagining them interacting with a learned set of peg items

most professional memory improvement techniques. The pegs provide easily accessed memory cues, while the use of imagery links the cue and the item to be remembered through visuo-spatial interaction (Morris & Stevens, 1974).

Imagery mnemonics have been developed to tackle a range of practical memory problems. For example, Morris, Jones and Hampson (1978) evaluated an imagery mnemonic that was recommended by several stage memory performers. To remember a name, it had to be converted into some easy-to-image pegword form. For example, the name Gordon could be converted into a 'garden'. Then a garden would be imagined growing on some prominent feature of the person's face to link the pegword cue and the item to be remembered. By deciphering the pegword cue 'garden' into 'Gordon', this mnemonic produced an 80 per cent improvement in the learning of names.

Similar techniques have been extended to language learning, such as the *Linkword system* – extensively investigated and developed by Gruneberg (1987, 1992). The foreign words are converted to some similar-sounding English word that can be easily imaged. A mental image is then formed to link the image with the actual meaning of the foreign word. So, for example, the French for tablecloth is *nappe*, so Gruneberg recommends imagining having a nap on a tablecloth.

Wilding and Valentine (1997) describe studies of memory champions and other memory experts, many of whom have discovered for themselves the value of mental imagery as a memory improvement technique. The use of imagery is not essential for memory improvement, of course. It is just one way in which material that is superficially meaningless and disconnected can be made more meaningful and connected and therefore easier to remember. A simple way of connecting words from a list is to compose a story. Bower and Clark (1969) showed that getting people to make up a story that linked together a list of 12 words made later recall of the words very much better.

Reflecting on our own learning

metamemory someone's understanding about how their memory works

Metamemory refers to the understanding that people have of their own memory.

When attempting to learn something, it seems reasonable to assume that we will monitor our own learning and schedule subsequent study activities to attempt to improve it. But how accurate are we at judging how well we have learned something? If the judgement is made soon after studying the material, we are comparatively poor at predicting our later performance. On the other hand, when the judgement is made after a delay, we are relatively better at making this judgement (Dunlosky & Nelson, 1992). If we can adequately judge how well (or poorly) we have learned material, we can apply this knowledge to inform our subsequent study plans, spending additional time on material that is less well learned.

Laboratory studies suggest that people schedule their time appropriately, in just this way. But preliminary work by Metcalfe and Son (1999) suggests that, in some more natural learning situations, people are more likely to schedule their study time with emphasis on areas that they know well or find particularly interesting, neglecting areas that need work.

FINAL THOUGHTS

Memory plays a critical role in many aspects of our daily existence. Indeed, without memory many of the other capacities that we consider in this book (such as language, the identification of familiar objects or the maintenance of social relationships) would not be possible.

It should be apparent after reading this chapter that memory represents a collection of abilities rather than a unitary capacity (as might be implied by an unfortunate tendency to refer to our memory in the singular in everyday speech). Moreover, memory is not a passive receptacle, nor is it necessarily a truthful recording of events in our lives. It is an active and selective process, reflecting both strengths and weaknesses, which often represent the opposite sides of the same coin.

In a recent book, Dan Schacter (2001) refers to the 'seven sins of memory', highlighting the kinds of errors to which human memory is prone. At the same time, our memory tends to record events in our lives associated with situations of (potential or actual) threat or reward quite effectively – something that was probably very important for survival in our evolutionary past.

Summary

- Memory is important to people; it plays a role in comprehension, learning, social relationships, and in many other aspects of life.
- Memory for a past event or information is indicated whenever a past event or information influences someone's thoughts, feelings, or behaviour at some later time.
- The person need not be aware of any memory for the past event, and might not even have been aware of the event when it occurred; the intention to remember is also unnecessary.
- Memory is observed through free recall, cued recall, recognition, familiarity, and other behavioural changes such as priming.
- Memory seems to involve more than just one system or type of process, as there is evidence that different sorts of memories can be influenced differently by specific manipulations or variables.
- Memory, like many topics in psychology, is difficult to study, in that it must be inferred from observable behaviour.
- Memory is not a veridical copy of a past event – events are constructed by people as they occur; remembering involves the re-construction of the event or information.
- Memory is the result of an interaction between the world and the person.
- In the past, when the event occurred, the personal experience of that event was constructed; at a later time, the event that is remembered is a new construction based partly upon that earlier construction.
- Psychologists have improved our understanding of many variables that influence memory, but there is still much to learn. Nevertheless, we can each be wiser users of our own memories by using effective mnemonic strategies and directing our efforts appropriately to help us learn and remember information.

REVISION QUESTIONS

1. Is memory dependent upon the intention to learn or recall? (Think of examples from your own life where you remembered something that you never intended to learn. Think of examples where you remember something without any intention to remember it.)
2. What is the difficulty in inferring memory from behaviour? How do psychologists deal with the problem?
3. Why is it not appropriate to think about different types of memory as existing along a continuum?
4. What evidence is there that memory is not like a tape recording?
5. We are aware of some memories, and unaware of others – awareness could be a useful way of distinguishing between different types of memory. What evidence supports this distinction?
6. Are there advantages of considering memory processes within an information processing framework? How might this approach lead to conceptual mistakes and misunderstandings?
7. Which approach is likely to produce better memory: copying information or explaining information?
8. How is memory performance dependent upon the interrelationship between the previous event and the later event?
9. What part does meaning play in influencing what we can remember?
10. Why do we sometimes remember things that did not happen?
11. Are there special techniques that can improve memory? If so, how do they work?

Further Reading

Baddeley, A.D. (1997). *Human Memory: Theory and Practice*. Revised edn. Hove: Psychology Press.
Review of research on memory, with particular emphasis upon Baddeley's personal interests including working memory, written at a slightly higher level than *Essentials of Human Memory* (see next entry).

Baddeley, A.D. (1999). *Essentials of Human Memory*. Hove: Psychology Press.
An interesting and readable introduction to memory written by one of the leading experts on memory.

Cohen, G. (1996). *Memory in the Real World*. 2nd edn. Hove: Psychology Press.
Another comprehensive and readable review of memory research with particular emphasis on memory outside the laboratory.

Gruneberg, M., & Morris, P.E. (eds) (1992). *Aspects of Memory. Vol. 1*. 2nd edn. London: Routledge.
A more applied perspective with particularly clear explanations.

Haberlandt, K. (1999). *Human Memory: Exploration and Application*. Boston: Allyn and Bacon.
An excellent review of memory research with particular emphasis on currently popular topics.

Higbee, K.L. (2001). *Your Memory: How it Works and How to Improve it*. New York: Marlowe.
An easy-to-read review of methods of improving memory that is written for a general audience but which is based upon psychological research that is fully documented through footnotes.

Morris, P.E., & Gruneberg, M. (eds) (1992). *Theoretical Aspects of Memory*. 2nd edn. London: Routledge.
Very accessible coverage of many major areas in memory research, written for beginning students in psychology.

Parkin, A. (1997). *Memory and Amnesia: An Introduction*. 2nd edn. Oxford: Blackwell.
An introduction to memory research, with particular emphasis on memory disorders and the physiological damage that typically underlies them.

Animal list for p. 228

Cat, dog, horse, mouse, sheep, cow, goat, rat, lion, tiger, bear, donkey, elephant, monkey, whale.

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Language and Thought

12

CHAPTER OUTLINE

LEARNING OBJECTIVES

INTRODUCTION

LANGUAGE

- Syntax, semantics and pragmatics
- Understanding language
- Discourse, and a return to understanding
- Tracking the reading process
- Language disorders
- The power of metaphor

THOUGHT

- Problem solving
- Logical and conditional reasoning
- Heuristic reasoning – or taking a short cut
- Intuition
- Are humans poor at reasoning?

FINAL THOUGHTS

SUMMARY

REVISION QUESTIONS

FURTHER READING

Learning Objectives

By the end of this chapter you should appreciate that:

- language can be understood in terms of its grammar (syntax), its meaning (semantics) and its significance (pragmatic interpretation);
- a major issue is which language systems are modular and which interact with each other, and when;
- language consists not of separate sentences, but of connected discourse;
- normal reading depends upon eye movements, which can therefore be used to measure difficulties in reading texts;
- aphasia refers to language disorders that may affect the comprehension and production of language, and whether the language that is produced is grammatical or not;
- dyslexia is a disorder of reading and may be apparent during individual development or acquired later through brain injury;
- problem solving is characterized by the development of a mental representation of the problem, while logical reasoning is concerned with how people draw necessary conclusions from particular states of affairs;
- people often rely on simple heuristics to solve probability problems, sometimes leading to the wrong conclusions;
- on the other hand, if the information is in the right format, reasoning can be very effective.

INTRODUCTION

This chapter is about two central activities of human life, and as such we are confronted by a vast array of studies, almost all fascinating, and often important.

information-processing approach understanding how something works by finding out the kinds of information involved and the steps through which it goes in order to accomplish a task

This chapter takes an *information-processing approach*, which essentially asks by what processes we can accomplish the tasks of thinking and using language. The information-processing approach has been the most successful of approaches to understanding cognition. Other aspects of language and thinking research, such as cross-cultural and cross-linguistic comparisons, provide rich data about the nature of what language is, but it is the information processing approach that has to be applied in order to understand how language actually works. Another important aspect of language is how processing develops in children: this is dealt with in chapter 9.

Nowhere is the astonishing capacity to perform acts of inference revealed more clearly than in the study of language, and nowhere are the limitations of inference-making rendered more obvious than in the study of thinking.

LANGUAGE

Language gives us the capacity to let others know things and do things that would otherwise be impossible. It enables us to share knowledge and ideas, and to extend our spheres of influence beyond the immediate.

Spoken language is the most basic form, especially dialogue, but most cultures have also developed written language systems. Written language not only allows the ready dissemination of information within our own culture, but also enables us to keep in touch with cultures that are remote in both time and place.

The psychology of language is concerned with the organization and processing of both written and spoken language. It is a complex field, at the interface of pure psychology, linguistics and communication studies. And as we examine how language is processed, it will soon become clear just how complex and mysterious the process is. For instance, a colleague of mine recently mentioned that he was feeling 'low' because he had just received some severe criticisms of a paper he had written. Why did I know immediately what he meant? Why did I not think he was simply nearer to the ground?

Syntax, Semantics and Pragmatics

It is conventional to divide up issues of language under the headings syntax, semantics and pragmatics.

syntax rules that govern the admissible orderings of letters within words, and words within the sentences of a language

Syntax is the set of rules or principles that govern word order, and which words can be combined with which. The rules and principles have been determined by scholars but, in a sense, they reflect the way the brain analyses language. An example of a syntax rule, in English, is that a sentence consists of a noun phrase plus a verb phrase. This can be written as:

$$S \rightarrow NP + VP$$

So with the sentence 'John loves Mary', 'John' is the noun phrase (NP) and 'loves Mary' is the verb phrase (VP).

Other descriptive rules specify what is an NP and a VP. The details are quite complex, but a descriptive grammar is one that allows only those strings of words that people accept as sentences.

Psycholinguistics has been especially concerned with how people *parse* sentences – that is, how they break them down into their correct grammatical structures. This has to be done because, otherwise, it would be impossible to interpret a sentence at all. Consider the following:

> The horse raced past the barn fell.

Is this an acceptable English sentence? What does it mean? In fact, it is a classic illustration of the problem of parsing. People normally find this a hard sentence to understand, because the parsing mechanism treats 'The horse' as an NP and 'raced' as the main verb, so it then expects more information consistent with the noun phrase. But the sentence actually contains what is called a reduced relative clause. Here it is in its unreduced version:

> The horse that was raced past the barn fell.

By missing out the words 'that was', the relative clause is reduced. So, in fact, the structure of the sentence is:

> NP: The horse (that was) raced past the barn
> VP: fell.

The difficulty in understanding such sentences is ascribed to an initial misinterpretation, and is called a 'garden path' (see Frazier, 1987).

A large amount of time and effort has gone into studying the human parsing mechanism because it is central to language comprehension and production. By misparsing the sentence above, there is a resultant failure in comprehension at all levels. Another well known example is the sentence, 'The old man the boats.' Most people find this sentence ultimately intelligible but find there is a disturbance of understanding, because the string 'The old man' is parsed as an NP, and not as an NP + V ('The old' being a shortened version of 'The old people', and 'man' being a verb). Unless the sentence is properly parsed, it is unintelligible.

semantics the meaning of words and how they combine to give the meanings of sentences

Semantics concerns aspects of meaning. For instance, while 'Green rain sinks frail grannies' has good syntax, it is meaningless. The meaning of a sentence is somehow assembled from the meanings of the individual words that make up the sentence. Meaning at the sentence level is vital for comprehension, just like syntax. Compare the following:

> Harry cooked dinner with his wife last night.
> Harry cooked dinner with a wok last night.

In the first, 'his wife' is a co-agent, accompanying Harry, whereas in the second, 'a wok' is an instrument for cooking. To assign the wrong role (meaning) to 'his wife' would make Harry look like a cannibal!

pragmatics the significance given to a sentence or utterance by relating its semantics to everyday knowledge of situations

And *pragmatics* concerns what we do with language. At the level of sentence meaning, 'Can you pass the salt?' is a simple question, and should be interpreted as a question about competence. But when a child is asked this at the table and replies 'Yes', everyone knows this is a game. This is because there is a distinction between semantics, or sentence meaning, and pragmatics, which is sometimes called speaker meaning, and concerns the meaning of an utterance, not just a sentence.

The fact that sentence meaning is not sufficient to guide an interpretation led to a theory of speech acts (Searle, 1969), which

treated utterances as actions on the part of a speaker, with the actions requiring their own interpretation.

The introduction of pragmatics is essential to any account of language processing, and is especially obvious in cases where semantics (or literal meaning) appear to fall short.

There are two principal classes of phenomena that obviously require more than literal meaning. One is indirect speech acts, like the salt example above. The other is metaphor and related phenomena. For instance, if I say 'Adolf Hitler was a butcher', I do not mean it literally. Similarly, if I say 'John is really blue (or low) today', I do not mean that he is covered in blue dye, or has shrunk in height. I mean that he is depressed.

We appear to process many metaphors so readily that it is difficult to see what the problem is, but the processing problem is huge: not only does the processor have to parse sentences, but she has to determine their significance too. The psychology of language understanding is about just these issues.

Finally, interpretation proceeds by linking language to our knowledge about people and situations. Consider the following:

A. John was hungry. He went to a restaurant and ordered some nine-inch nails.
B. John was really hungry. At the restaurant, he ate some Crepe Suzette, and then ordered steak, followed by Moules.
C. Harry put the wallpaper on the wall. Then he sat his full coffee cup on that.
D. Harry put the wallpaper on the table. Then he put his coffee cup on that.

- In case A, a problem is detected because nine-inch nails are not edible. This information has to be retrieved in order to make use of it. It implies access to an almost encyclopedic knowledge of what one can eat.
- In case B, the procedure for determining the order in which things are eaten is accessed. In this case, one would not normally consume a sweet dish (Crepe Suzette) before a savoury dish (Moules). Schank and Abelson (1977) suggested that we have mental scripts for stereotyped sequences, which are accessed under the right conditions, and as a result we can spot anomalies when they occur. Without such stereotyped knowledge, we would not have any knowledge of social norms.
- In case C, wallpaper being on a wall puts it in a vertical position, so you cannot put your cup of coffee on it. Detecting the problem suggests that we set up a mental representation of what putting wallpaper on a wall entails.
- Case D is not a problem at all. But it is almost identical in linguistic terms to C; it is just that 'on the table' is taken to mean flat on the table, so sentence D is judged not to be problematic.

Understanding language

Comprehension of language requires the processor to use knowledge of the language (syntax), meaning (semantics), and our knowledge of the world (scripts) and inferences about the intentions of speakers (pragmatics).

The central questions for the study of the processing system are:

How and when are these sources of information called upon?
How is the architecture of the system organized?
Is syntactic analysis carried out first, and then meaning and interpretations ascribed later? Or are they all used at any point they might be needed?

There are too many studies in this area to present a full overview here. Instead we present just two sample problems (word-sense retrieval and nonliteral meaning) to indicate how the issues may be addressed experimentally.

Word sense retrieval

When reading or listening, it is important to retrieve word meaning, and that means retrieving the right sense of a word. This is an area where the role of background knowledge is important. For instance, in understanding 'John put his salary in the bank', it is necessary to select the appropriate sense of 'bank' – i.e. a place where financial transactions take place, not the side of a river. Context usually provides the solution to this problem, but the question is when during the sequence of processing? Is just one meaning of 'bank' selected at the outset, or are both meanings initially recruited, and then the right one selected later?

There are two main possibilities:

modular view two processes are said to be modular when they occur independently of one another and do not interfere with one another

1. The *modular view* is that word meanings are stored in a way that is not context sensitive. When we encounter a string of letters that represents a word, we automatically look up and retrieve the meaning. If the string (such as 'bank') represents more than one word, then both meanings should be retrieved. The modular view is attractive because it keeps the mechanisms of looking up word meaning separate from context, and so is computationally simpler (see Fodor, 1983, for a discussion of this position).

interactive view two processes are interactive when the processing occurring in one of them depends on the processing occurring in the other

2. The *interactive view* suggests that word meaning information is connected to other processes of comprehension, so that which aspects of word meaning are active depends on context. This view is attractive because it implies a very adaptive organization of knowledge and word meaning, but at the cost of more computational complexity (e.g. see McClelland and Rumelhart, 1981; Morton, 1969).

An important technique for finding the answer is priming (see Meyer & Schvaneveldt, 1971). When a word is read, it becomes easier to recognize words that are associated with it. So if you read the word 'nurse', you will then read the word 'doctor' more quickly than if you had just read an unrelated word, such as 'bread'. What will be primed after reading the word 'bank'? If

Research close-up 1

The Moses illusion and beyond

The research issue

One view of language processing is that the individual words of a sentence are read and their meaning discovered, and then these meanings are combined to produce the whole meaning of the sentence. So each word's meaning would be retrieved from memory as it is read.

But this is not necessarily the case. Answer the following question before reading on:

How many of each sort of animal did Moses put on the Ark?

Erickson and Mattson (1981) reported that many people simply respond 'Two' to this question, even though they 'know' that it was not Moses who put the animals on the Ark (it was, of course, Noah). This effect has been dubbed the 'Moses illusion'.

Barton and Sanford (1993) explored this effect further. They hypothesized that provided a word fits a context very well, then its meaning need not be 'fully' analysed, because it is easy to work out what it must mean from the utterance as a whole.

Design and procedure

Barton and Sanford had participants individually read and answer questions like this:

When an air crash occurs, where should the survivors be buried?

The question was asked as one of ten in a questionnaire about social customs that included questions like: 'After a death, who should officially be informed?' and 'At what age should people be permitted to hold a driver's licence?'

The data were the numbers of participants who spotted the fact that you simply do not bury survivors.

One group of participants got the air crash question and another group got a bicycle accident version of the same question:

When a bicycle accident occurs, where should the survivors be buried?

Barton and Sanford (1993) reasoned that people would have mental representations that included the concept of survivors for an air crash, but not for a bicycle accident, where deaths are less common. Consequently, the term 'survivors' would fit easily in the air crash context, and result in shallow analysis. In contrast, because the word does not fit so well in the bicycle accident context, it would be scutinized more closely, resulting in higher detections.

Results and implications

For the air crash scenario, detection rate was 33 per cent, while for the bicycle accident it was 80 per cent, confirming the hypothesis.

These results demonstrate that the extent to which the meaning of a word is processed is not all-or-none but is variable. It also depends on the fit of the word to the situation. If it fits well, subsequent analysis may be minimal; if it fits poorly, then the system analyses its meaning to a greater extent in order to achieve a fit. This enables anomalies to be detected with a higher probability if the word fits the situation relatively poorly.

More generally, psycholinguists are becoming increasingly interested in the extent to which the various processes underlying sentence comprehension always occur as fully as previously thought, and how little work the system can get away with while sustaining comprehension.

Barton, S.B., & Sanford, A.J., 1993, 'A case-study of anomaly detection: Shallow semantic processing and cohesion establishment', *Memory and Cognition*, 21, 477–87.

there is no biasing context, then target words relating to both senses should be primed, such as 'river' and 'money'.

Swinney (1979) presented participants with spoken passages like these:

(a) Mary needed to buy some presents, so she went to the bank.
(b) Mary found the river cold, so she swam to the bank.

Immediately after the presentation of the ambiguous word, he presented a single letter string on a screen. Participants had to decide whether the letter string was a word or not (a lexical decision). When the string was a word, it could either be related to the intended sense of the ambiguous word (e.g. 'money'), related to the other sense (e.g. 'mud'), or unrelated to either. The question was whether there would be a response time advantage

for the intended-sense associate alone, or whether there would also be an advantage for the other-sense associate of the word too.

It turned out that there was equal advantage (priming) for both senses. So context did not appear to affect initial sense selection. But if there was a delay of only 300 ms between hearing the ambiguous word and reading the letter string, the priming effect remained only with the intended (contextually cued) sense.

This work suggests that word meaning information is initially stored in a modular fashion, and its retrieval is uninfluenced by context. On the other hand, very shortly after a word has been processed, contextual cues inhibit the activation of word sense information that is inappropriate.

This one example represents a sample of work on the problem of modularity; research in this area remains very active (see Sanford, 1999, for a fuller review).

Nonliteral meaning

How do we understand sentences? One explanation is that we assign a literal meaning to them and then integrate this into the meaning of the discourse. But the literal meaning may not make any sense, especially if the sentence conveys an indirect speech act or a metaphor. For instance, if I say 'My job is a jail', I mean it restricts my freedom in a way that parallels being in jail. One prevalent view is that metaphors are first interpreted literally, then, if this fails, they are interpreted as nonliteral, or figurative (Searle, 1975, 1979).

As a series of processing operations, this may be formulated as follows (from Glucksberg & Keysar, 1990):

1. Derive a literal interpretation of the utterance.
2. Assess the interpretability of that interpretation against the context of that utterance.
3. If that literal meaning cannot be interpreted, then and only then derive an alternative nonliteral interpretation.

The sequence above suggests that in order to make an appropriate interpretation of a statement, we need to know whether it is meant to be literally true or not. But it also makes strong assumptions about the processes underlying comprehension that subsequent work has suggested may be incorrect.

The account has been examined for both indirect speech acts and metaphor comprehension. Gibbs (1979) showed that people take no longer to process indirect requests such as 'Must you open the window?' – meaning 'Don't open the window' – than to understand literal uses of the same expressions (in the present case, meaning 'Need you open the window?'). These data suggest that people do not need to obtain a literal meaning of an expression first in order to comprehend an indirect speech act. This runs against the traditional model (Glucksberg & Keysar, 1990).

Gibbs (1983) claimed, more strongly, that participants do not always derive a literal meaning at any point. To establish this would be another blow to the traditional model, since this model specifies that literal meanings are necessarily established. Gibbs had participants read stories that ended with critical sentences such as 'Can't you be friendly?' In different stories, the sentence was given a literal meaning ('Are you unable to be friendly?') or an indirect interpretation ('Please be friendly'). After reading a passage, participants had to decide whether a string of words was a grammatically correct sentence. Some of the strings were either the literal or the nonliteral interpretation of the critical sentence.

Gibbs predicted that the literal context would prime the literal interpretation, and the nonliteral context would prime the nonliteral interpretation. These results should be reflected in a priming effect on the subsequent sentence judgement task. In two experiments, the results confirmed these expectations. In particular, when the context biased the interpretation of the critical sentence towards a nonliteral interpretation, there was no priming of the literal interpretation.

These findings show that the applicability of the standard comprehension model (Glucksberg & Keysar, 1990) is at best limited, although it is worth noting that the comprehension of sentences in stories (such as have been used in most of the studies reported here) and actual interactions in dialogue are very different situations, so we must guard against simplistic conclusions. Nevertheless, work on indirect speech act comprehension reinforces the view that literal interpretation is not always necessary.

Similar findings have been obtained for metaphor comprehension. For example, Glucksberg, Gildea and Bookin (1982) asked participants to decide whether simple statements were literally true or false. For example, consider the statement 'Some desks are junkyards.' This is literally false, and so (according to the conventional model) the obvious metaphorical interpretation should not interfere with processing and the production of a 'no' response. Yet it does. A statement with an obvious figurative interpretation takes longer to reject as literally false than does a sentence with no obvious figurative meaning, such as 'Some desks are roads.' So, in the case of 'some desks are junkyards' it seems that the metaphorical meaning is computed automatically even though it is not needed, which indicates that testing for literal meaning cannot represent the previous, modular processing stage that the classic position would claim (see also Glucksberg and Keysar, 1990).

Our sample of work on the comprehension of metaphors shows how simple response time studies can be used to evaluate the sequence of language processing events. The conclusions suggest that the straightforward classical view that literal interpretation takes place first, and then nonliteral interpretation takes place later if needed, is wrong.

Discourse, and a return to understanding

Language consists of more than disconnected utterances. When sentences are put together to make a sensible message, the result is *discourse*. A substantial part of the psychology of language deals with discourse processing, especially when it concerns text. Many theories of discourse processing have been developed, for example by Gernsbacher (1990), Kintsch (1988), and Sanford and Garrod (1981).

discourse a set of sentences that bear a sensible relationship to one another and so form a message

The primary feature of discourse is that it is coherent – in other words, the individual sentences fit together in a meaningful way and do not contain any contradictions. Sometimes sentences are connected by explicit devices, called cohesion markers. Consider the following:

John fell off the cliff because he was walking too near the edge.

There are two cohesion markers here:

1. the connective 'because' indicates that the sentence 'John fell off the cliff' portrays the result of a cause – i.e. 'he was walking too near the edge'; and
2. the pronoun 'he' signals that some individual who is singular and male has been mentioned. The only thing that fits the bill is 'John', so we take it that it was 'John' who 'was walking near the edge'.

But the establishment of coherence does not always rely on cues such as these. For instance:

John was hit by a train. He had been walking down the track.

This is coherent because 'walking down the track' was the condition that enabled 'John' to be 'hit by a train'. But there is no explicit connector ('because'): the connection is inferred. Coherence establishment may sometimes make use of cues in the text, but always relies on some degree of inference.

As a final example, consider the following single sentence:

John lent Harry some money because he was hard up.

What is the referent of 'he'? Obviously it is 'Harry', not 'John'. Why? Because money is lent to people who are 'hard up', and this inference is automatically drawn and used to solve the reference problem.

These few examples show the complexity of the computational operations that underlie even the most mundane language processing at the discourse level, and they represent just a small sample of the issues.

Inferences vs. scenarios

Experimental work shows that it takes time to make inferences. Haviland and Clark (1974) asked people to read short texts made up of two sentences, and then measured the reading times for the second sentences. Compare the following pairs:

Inference version:	Herb took the picnic supplies from the car. The beer was warm.
Explicit control:	Herb took the beer from the car. The beer was warm.

The reading time for the second sentence was longer in the inference version, because participants had to infer that 'The beer' is part of the 'picnic supplies'. The text demands that an inference be made, which demands cognitive resources.

But sometimes knowledge may be automatically recovered and included in the mental representation of the sentence. For instance, given 'Harry drove to London', there may be a default representation of the fact that a car was used. Subsequent mention of a car would not be a problem, because its default is already in the representation resulting from the sentence. This is what Garrod and Sanford (1982; 1983) found to be the case. In a fuller theory, Sanford and Garrod (1981; 1998) argued that we automatically relate what is being said to background knowledge, and that background knowledge is organized in long-term memory about specific situations. They called these structures 'scenarios', and argued that the basic, most fundamental operation of understanding is to recognize the situation in which the message is set. So, because we are retrieving further situation information from memory, sentences can lead to representations that go beyond their content.

As one final example of a study that seems to support this view, Garnham (1979) required participants to try to remember sentences they had seen previously: e.g. 'The housewife cooked the chips.' He found that participants remembered this sentence better if they saw the cue 'fried' than if they saw the cue 'cooked', even though 'cooked' is actually part of the original sentence. According to the scenario theory, this is because cooking chips has been implicitly represented as a situation in which frying is taking place. Of course, another possibility is that the word 'fried' simply provided more information, in terms of a cue for remembering.

The ultimate questions

For discourse studies, the ultimate questions are just *which* inferences are made (i.e. what knowledge is recruited) and *when* during language processing. Some theorists believe that sometimes there might not be much inferential activity taking place during natural discourse (McKoon & Ratcliff, 1992), and that inferences and elaborations will only take place when the relevant background knowledge is highly available in memory. Sanford and Garrod (1998) take the view that it is the task of the writer or speaker to say things in such a way that a scenario can easily be found, because this is essential for good message-level interpretation.

Whatever they think about component processes, there would be few scientists who would disagree that understanding is based on bringing language input into contact with world knowledge – the basic question being how this is done. Noam Chomsky has been at the forefront of international thought over the past several decades regarding the individual development and intergenerational heritability of language. The classic Chomskian sentence 'Curious green ideas sleep furiously' is not intelligible at the message level, simply because it is hard to relate to anything we know about. But 'The housewife cooked the chips' is intelligible because we can easily relate it to many things we know about.

TRACKING THE READING PROCESS

Reading is a complex process, which can be broken down into a variety of activities:

Pioneer

Noam Chomsky (1928–) has been at the forefront of international thought over the past several decades regarding the individual development and inter-generational heritability of language. Chomsky was a key figure in formulating a major systematic approach to the nature of grammar. He demonstrated the formal requirements for the kinds of rules needed to explain the syntax of natural languages. Chomsky has claimed (i) that knowledge of grammar is based on innate properties of mind, and (ii) that language is modular. He has also captured public attention through his socially focused writings and political activism.

- fixating words with our eyes;
- processing words in accordance with syntax and semantics;
- representing meaning; and
- understanding the significance of what is read.

Until now, we have focused on the last three activities – how we come to understand language. Now we will take a look at the first point in the process.

Some of the oldest studies of the reading process were concerned with the pattern of eye movements that occurs when we read text. Even today, many of our insights come from studies of eye-tracking.

Using modern eye-tracking equipment (see figure 12.1), it is possible to establish where the most sensitive part of the eye (the fovea) is fixating within a piece of text. Although we have the impression of a smooth process when we read, in fact the eye moves in jumps, called saccades, and then fixates, or remains stationary, upon successive pieces of text (see chapter 7). Figure 12.2 shows an eye-tracking record for a person reading a piece of text.

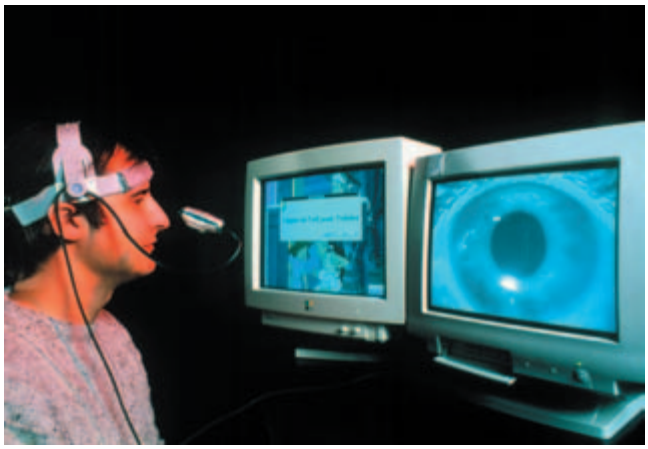

Figure 12.1

Eye-tracking apparatus enables researchers to establish how the eye moves and where it fixates within a piece of text.

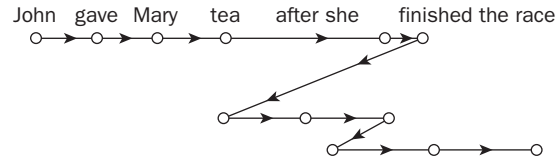

Figure 12.2

A sample showing eye-tracking of a single sentence. Source: Martin (1998).

The dots are fixation points, and the lines are saccades. When the line moves back towards an earlier part of the sentence, this is a regression. Word information is only encoded when the eye is stationary, and then only about 15 letters can be encoded within a single fixation.

From the perspective of understanding, it is interesting to note that small words are not always fixated. So a word such as 'he' may only be fixated 30 per cent of the time. Content words, on the other hand, are nearly always fixated.

At one time it was thought that where the eyes fixated was simply a mechanical process, but now it is clear that eye movements are under the control of some of the complex processes underlying language understanding (Rayner & Polletsek, 1989). For instance, when someone has difficulty comprehending a piece of text, regressive eye movements take place – in other words, their eyes move back to earlier parts of the text. These movements are quite common, even in reading straightforward text, as a means of checking earlier information to aid interpretation.

Language Disorders

Aphasia

Loss of language function is called aphasia (see chapter 1) – strictly dysphasia when there is partial language loss, but the term 'aphasia' is commonly used for all types of language loss.

Aphasia is diagnosed when there are language difficulties that occur in the absence of sensory impairments or thought disturbances – in other words, the symptoms are specific to language.

The traumatic event of a stroke often results in an inability to use language to some degree, and is a sadly common occurrence. Strokes (cerebrovascular accidents) affecting those parts of the brain that support language processing account for 85 per cent of aphasia cases.

The main areas of the brain implicated in aphasia are shown in figure 12.3.

The left hemisphere has long been known to be associated with language function. Damage the left hemisphere, and language dysfunction is likely to result. In particular, two areas of the brain have long been associated with specific aphasic symptoms: Broca's area, and Wernicke's area (see chapter 3).

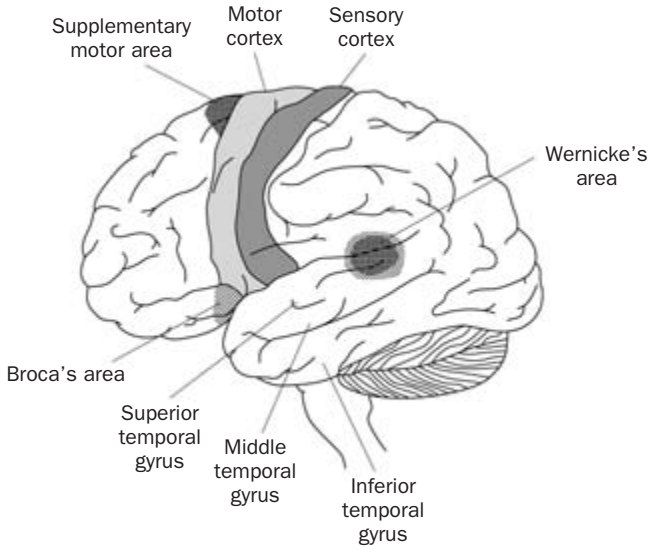

Figure 12.3

The main areas of the brain implicated in aphasias.

Broca's aphasia (or production aphasia) Broca's area (see figure 12.3) is found to be damaged in patients with Broca's aphasia. These patients have difficulty in the production of language, some being unable speak at all, others only with difficulty. When language is produced, it lacks fluency and is slow. Speech may consist of just one or two words, with no grammar and often an absence of verbs necessary for the production of well-formed sentences. Broca's aphasics can understand language, though. This is demonstrated by their capacity to follow instructions or to verify whether scenes match sentences.

Wernicke's aphasia (or sensory aphasia) Patients with Wernicke's aphasia have a problem in comprehending the speech of others, and although they can produce a fluent flow of speech, it is usually garbled, containing many pseudo-words (so-called jargon). Because they cannot understand the speech of others, they also may not be aware that they are not making sense. They suffer from word retrieval deficits and cannot properly parse sentences. These effects result from lesions to Wernicke's area (see figure 12.3).

Other types of aphasia include the debilitating global aphasia, in which heard speech cannot be comprehended or even repeated, there is no capacity to produce speech, and even objects cannot be named. Another category is conduction aphasia, in which patients have an apparently normal capacity to understand and produce speech. But they have difficulty repeating word-strings and 'nonsense' words. This condition has been attributed to damage to fibres connecting Broca's and Wernicke's areas.

Psychologists who study the changes that occur in aphasia will explore specifics, such as whether the patient has difficulty finding the right words in normal speech, repeating words and sentences, using grammar so that they can understand sentences, or producing grammatical outputs themselves. For further information on treatments of aphasia, see Zurif and Swinney (1994).

Dyslexia

Dyslexia means impaired reading. There are two broad categories: acquired dyslexia and developmental dyslexia.

dyslexia impaired reading due to trauma or developmental factors

1 Acquired dyslexia Brain damage in people who could previously read well can lead to acquired dyslexia. There are four main classes of this disorder:

1. People with visual form dyslexia might not be able to recognize all the individual letters. So they might read 'mat' as 'cat'.
2. Those with phonological dyslexia have difficulty reading pronounceable pseudo words, like 'pleke', but they are good at reading real words. This shows that their problem is caused by damage to the mechanism that connects how a word looks (its orthography) to how it sounds (its phonology). By contrast, when they read well known real words, these patients can use direct routes between the whole word pattern and its sound – these direct routes are established when we learn to read.
3. Surface dyslexia is the opposite way round to phonological dyslexia. People with this disorder are unable to use this direct route to recognize words on the basis of their overall appearance, but they can read words by using orthographic knowledge. This means that they make errors pronouncing words that are irregular in the mapping between the letters and the sound, like 'pint' or 'yacht'.
4. Deep dyslexia forms a very interesting category. On being asked to repeat concrete nouns, such as 'uncle', the patient may say 'aunt' instead: i.e. they substitute a semantically related item. These patients cannot read abstract words and pronounceable pseudo words. Deep dyslexia is associated with widespread left hemisphere damage, and tends to co-occur with aphasia.

2 Developmental dyslexia This refers to a developmental difficulty with reading, despite adequate intelligence. Attempts to match the reading difficulties to the categories of acquired dyslexia have led the division of syndromes into two main types: those associated with difficulties in 'sounding out' (as in acquired phonological dyslexia) and those related to difficulties in recognizing word forms (as in surface dyslexia). But one prevalent problem for most developmental dyslexics is poor phonological awareness: so they perform badly on tests of rhyme awareness, segmenting words into individual sounds (spelling out) and producing rhymes.

The detailed study of dyslexia entails the application of well developed psycholinguistic techniques. For a review of one hundred years of work in this area, see Miles and Miles (1999).

Everyday Psychology

The tip-of-the-tongue (TOT) phenomenon

'I left it on the, you know, what's its name?' . . . We have all had the experience of being unable to find a word that we want, when we want it. It is there, somewhere, we can feel it, but we cannot find it or speak it. We say it is 'on the tip of my tongue'.

The tip-of-the-tongue (TOT) phenomenon is defined as the temporary inability to retrieve a word that is well known to the speaker. How have psychologists investigated TOTs? When are they more likely to occur? Why do they occur? What does it tell us about everyday speech production and memory?

Researchers have used two main approaches to study TOTs, both rely on introspection. Researchers have either elicited TOTs experimentally in the laboratory, or asked speakers to record spontaneously occurring TOTs in a diary. In laboratory studies (e.g. Brown & McNeill, 1966) speakers are presented with a definition of a rare word (e.g. 'a place where bees are raised for honey' [word = *apiary*]), then asked to provide the name. Those speakers who are unable to say the word, but who report that they know the word and feel that it is on the verge of occurring to them are in a TOT state. They are then asked to provide information about the unavailable word (e.g. other words that come to mind, the initial letter etc). In diary studies (e.g. Burke et al., 1991), similar questions are asked, as well as which strategies the speaker uses to resolve TOT states.

The incidence of TOTs is related to two main classes of factors (see Brown, 1991), speaker-related factors and word-related factors. Speaker-related factors include age and brain damage. TOTs are more common for older than younger speakers (Burke et al., 1991), and much higher in patients with *anomia* (language-specific disturbance arising after brain damage; Vigliocco et al., 1999). Word-related factors include word type (TOTs were highest for proper names; Burke et al., 1991; see also chapter 11), how frequently a word is used and how recently it has been used.

TOT can be interpreted as a failure of memory retrieval, rather than a problem of either memory encoding or storage. Speakers in a TOT state are able to report some information about the word at better than chance levels: its meaning, its grammatical features, its number of syllables, and its beginning sound or letter. This evidence has been interpreted in models of speech production as supporting a dual-stage word retrieval process: TOT states do not occur during the first step, retrieving memory and syntax, but during the second, retrieval of form (i.e. the sound pattern of the word).

Thus this mundane speech error has provided psychologists with fascinating material about everyday language and cognition. TOTs have also been used as a tool for studying 'meta-cognition' (i.e. what people 'know that they know'; see Koriat, 1993), and for improving our understanding of psychological deficits associated with brain damage in patients with anomia or Parkinson's disease (Matison et al., 1982; Vigliocco et al., 1999).

Brown, A., 1991, 'A review of the tip-of-the-tongue experience', *Psychological Bulletin*, 109, 204–33.

The Power of Metaphor

There is an interesting theory that the natural metaphors we use to talk about things influence our descriptions and the way we think. Over the past 20 years or so, Lakoff and his colleagues (Lakoff, 1987; Lakoff & Johnson, 1980) have presented a remarkable set of observations about the role that metaphorical systems play in both our thinking and our language. In general, the Lakovian claim is that the conceptual system relies on metaphor because this is equivalent to setting up mental models, and that these then constrain the way we think and communicate.

Metaphors are much more prevalent than you might think (e.g. Cacciari & Glucksberg, 1994). Far from being restricted to specialist literary uses, they permeate our language in such a way that they surely must reflect something about the way our conceptual structures support understanding in general. Lakoff suggests that there are certain fundamental ways in which we think about things. This kind of analogical thinking finds its way into our language in striking ways.

For example, Lakoff (1987) considers the conceptions we have about anger. There are many expressions relating to anger, which, if taken literally, make no sense at all:

> John was so angry, he hit the ceiling [roof]
> Mary blew her stack when she heard the news.
> When John broke the news, Mary exploded.
> There was steam coming out of his ears.

Lakoff claims that mental models of anger result from simple observations, like an increase in internal pressure (blood pressure, heart pounding), becoming hot and sweaty, etc. These observations can be understood in terms of familiar everyday experiences with the material world, such as heating things up in containers. So Lakoff suggests that one way in which we conceptualize anger is in terms of heat being applied to a container that may contain a liquid (e.g. 'she was boiling/seething').

Once the model of heat being applied to a container is being used, it is generative – that is, it leads to outcomes, like steam. To keep the steam in, a lid is normally used. So we get expressions

like 'Contain your anger' and 'Put a lid on it'. A lid on a container generates other possibilities, too. For instance, increased pressure leads to the lid coming off – 'He flipped his lid' – and ultimate explosion – 'John exploded with rage', 'Mary blew her top'.

In his case study of anger, Lakoff suggests many more metaphors may be produced on this well known, simple basis. And we can understand statements like 'I thought he was going to erupt' because of these well worn conceptual connections. If you overheard this statement in a conversation, you would likely infer that it was about anger.

Lakoff's basic argument is that we have very simple but significant and repeated experiences of certain types. For instance, we all go on journeys, we all use pots and containers, and we all engage in some sort of competition. We are also familiar with conflict and war, albeit to different degrees. These common experiences are used as models for the interpretation of a wide range of phenomena. So, in the anger case, containers play a central role. In the same way, the idea of a journey can form the basis of understanding relationships – 'This relationship is at a dead end/isn't going anywhere' – or arguments – 'At least we are getting near the conclusion.'

These attractive ideas merit very careful consideration, not just because they have the potential to explain the wide variety of metaphorical features of language, but because of the influence they have on thought and communication.

It was a very deliberate act of dehumanization when the Nazi propagandists portrayed Jews as rats in films, justifying the treatment of people in an inhuman way. More recently, in Rwanda, propaganda by one group, Hutu, described the other group, Tutsi, as 'cockroaches'. In a similar vein, many things that require action are thought of in terms of war. For instance, Lakoff and Johnson (1980) cite Jimmy Carter, one-time president of the USA, as reacting to the energy crisis by declaring 'the moral equivalent of war'. They point out that this opens up a set of analogues of war concepts. So there will be an 'enemy', a 'target' will be set, 'sacrifices' will be called for, and so on.

THOUGHT

The study of thinking concerns how we come to understand the world, what our intuitions are, and how we reason, solve problems and make judgements and decisions about things.

The cognitive approach to thinking attempts to discover the processing activities that characterize these mental acts. As with language, a great deal of progress has been made as a result of adopting a procedural approach. But the most striking thing to emerge from the study of thinking is that, as a species, although we can solve some amazingly difficult problems, we can also fail on others that seem quite simple.

Two main strands have coexisted in the study of thinking for many years: problem solving and reasoning. Problem solving has revolved around the study of puzzles and how people solve them, while reasoning has been more concerned with what conclusions people draw, logical or otherwise, on the basis of knowledge and evidence.

More recently, studies in both areas have stressed the nature of the representation that results from trying to understand what a problem is about. This has led to the suggestion that people form mental models of problems, which represent, as far as possible, the crucial aspects of the problems. In this way, mental model theory links thinking to language comprehension (Johnson-Laird, 1983), placing great emphasis on how problems are both understood and represented.

PROBLEM SOLVING

If I ask you, 'What is 6 + 6?', unless you are a young schoolchild, you will be able to retrieve the answer 12 straight from memory. On the other hand, if I ask you, 'What is 37 + 568?', you have to do some problem solving.

Being numerate means that you know how to solve this problem: it calls for a standard application of arithmetic procedures, and these procedures can be drawn from memory. This kind of problem-solving is called simply routine problem solving. In contrast, creative problem solving cannot be done according to a formula because there are no standard procedures in memory.

As we experience the same problem type over and over again, what was at first creative may become routine, of course.

Search space

Consider this anagram problem:

> What two-word phrase can be made out of these letters: SPROGOLIBVELM?

What strategies would you employ to solve it? The simplest is blind search, in which you just move the letters around blindly until a phrase appears. The possibilities here are enormous, so blind search is clearly not a very smart way to proceed. But how do we constrain the search?

There are some sequences of letters in English that are legal and commonplace (like 'pro'), some that are rare (like 'goli'), and some that are downright impossible (like 'blvm'). So a smarter strategy is to try constructing fragments from common grammatically legal combinations, then trying sequences that are more and more rare. Fragments will serve to cue word possibilities that you know, which will help speed up the search. With practice, people who like anagrams in crosswords develop a number of ways to constrain the *search space*.

search space a space of possible reasoning, within which we search for a path linking the problem with the solution

All problems can be construed in terms of search spaces, though this is more obvious with some problems than with others. In their classic book *Human Problem Solving*, Newell and Simon (1972) illustrated the problems of search space more thoroughly than anyone had before. One problem they studied in some detail is the following (cover the solution and try the problem first):

For each letter, substitute one digit, such that the whole thing fits the laws of (base 10) arithmetic; in the example below D = 5:

```
  DONALD
+ GERALD
  ROBERT
```

Solution:

```
  526485
+ 197485
  723970
```

You will notice that your perception of what is involved in the problem increases as you work on it. For instance, to begin with, you may not have noticed the problem of carrying. That is, you will need to add 1 to a column left of the one you are working on if the sum exceeds 9.

speak-aloud protocols a description of our own processes of thinking during a problem solving task

Newell and Simon (1972) collected *speak-aloud protocols* – they required people to say aloud what they were doing while they were attempting problems like this. This helped them to analyse in detail the steps people go through in problem solving. There were two main findings:

1. People set up initial representations of problems, which influence the search space.
2. They employ general purpose techniques, called heuristics, which help constrain the search space.

So, with the problem above, Newell and Simon found several possible representations. For instance, some people saw it as being one based on word meaning. Suppose the puzzle was:

```
  BILL
+ WAS
= KING
```

A person might reason that BILL = William the conqueror → 1066, therefore B = 1, I = 0, L = 6. This kind of reasoning turns out to be inappropriate for our particular problem given above. Other examples might be described as typographic – E looks a bit like 3, etc. – and cryptographic – using some sort of systematic code, like A = 1, B = 2, etc. Neither applies to our particular example, but the important point here is that our initial conception of the problem can alter the way in which we attempt to solve it.

Understanding how people develop a problem space – the representation of a problem in the head of an individual – is a major aspect of work on problem solving. (The more general idea of a Mental Model is discussed later in this chapter.) For instance, when we learn how to problem solve, we must first recognize when seemingly different problems have a common logical structure.

Looking for a common structure

A classic study of how underlying common structure might be spotted was carried out by Gick and Holyoak (1980; 1983). They examined how experience with a puzzle called the 'military problem' (Holyoak, 1984) affected performance on a second problem, called the 'radiation problem' (Duncker, 1945):

The military problem

A general wishes to capture a fortress located at the center of a country. There are many roads radiating out from the fortress. All have been mined, so that although small groups of men can pass over the roads safely, any large force will detonate the mines. A full-scale direct attack is therefore impossible. What should the general do? (Holyoak, 1984, p. 205)

The radiation problem

Imagine that you are a doctor treating a patient with a malignant stomach tumor. You cannot operate because of the severity of the cancer, but you must destroy the cancer. You could use high-intensity X-rays. However, the intensity needed is such that the beam would destroy the healthy tissue that the rays must pass through. A lower intensity beam would not harm the healthy tissue, but would also not destroy the cancer. How can you use X-rays to destroy the tumor without destroying the healthy tissue? (adapted from Duncker, 1945)

The solution to the two problems is very similar. In the case of the radiation problem, the solution is to direct weak X-rays from a number of different points outside of the body, and to set the sources up so that the beams converge at the site of the tumor. That way, no single beam is strong enough to cause damage to healthy tissue, but the combined effect on the tumour is enough to destroy it. The military problem has a solution based on the same principle: small groups of soldiers are sent along different roads at the same time, converging as one big army at the fortress.

Gick and Holyoak had participants do the military problem first. One group of participants simply read the problem in the belief that they were just to recall the wording. Under those circumstances, only 30 per cent derived the correct solution to the radiation problem. However, if the participants were given two similar problems before the radiation problem, then there was more transfer. In general, though, the more superficially similar problems are, the better the transfer (Holyoak, 1990). So spotting the similarity of problems is far from automatic.

Logical and conditional reasoning

Logical reasoning

logical reasoning reasoning about issues whose conclusions necessarily follow from what is given

A special form of problem solving is *logical reasoning*. In these kinds of task, people are required to draw conclusions that necessarily follow from a given, but not to draw conclusions about what might possibly follow. For example, in this syllogistic reasoning task, two premises enable conclusions to be drawn:

If all men have blood, and John is a man, then, necessarily, John has blood.

But syllogisms are not always this easy, and some can lead to false conclusions. For example:

> If some As are Bs, and some Bs are Cs, what can be said about the relation of As to Cs?

A common error is to say: Some As are Cs. But while this may be case, it is not necessarily true. Those Bs that are Cs might be the ones that are not As. Johnson-Laird (1983) suggested that when people get this wrong, it is not because they are not 'logical'; it is because they have an inadequate representation of the problem – what he calls a mental model (see figure 12.4). Johnson-Laird was able to show that forming such models is harder with some premises than others, and that the harder it is (i.e. the more complex the mental models), the more likely it is that we will make an error.

Conditional reasoning

Another much studied type of logical reasoning is *conditional reasoning*, which deals with 'if–then' statements. For instance:

> If a green light comes on, then the ball has rolled left.

Suppose the ball has rolled left. What can we conclude? A common error is to conclude that the green light must have come on (Rips & Marcus, 1977), but this is not a necessary conclusion. The ball could have rolled left for any number of other reasons.

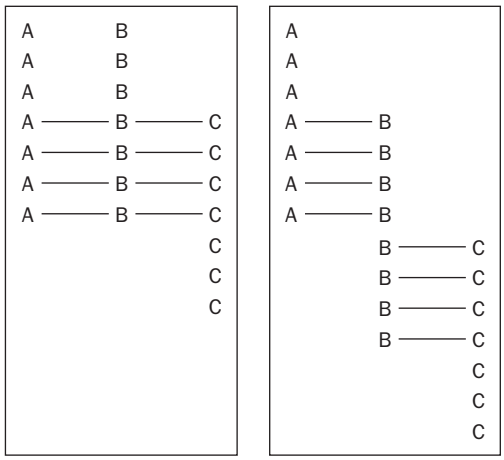

Figure 12.4

A representation of two mental models for the syllogism.
Some As are Bs
Some Bs are Cs
What follows?
Both (a) and (b) are possible representations. The difference is that in (a), the Bs that are connected to Cs are also connected to As. In (b), the Bs that are connected to Cs are not connected to As. This means that although a possible conclusion is that 'Some As are Cs', this is not necessarily true (as in case (b)). Johnson-Laird's idea is that we set up such mental models when reasoning about syllogisms, and that unless we set up all possibilities, we may erroneously consider a possible conclusion to be logically necessary.

Pioneer

Phillip Johnson-Laird (1936–) has been a major contributor to the nature of reasoning and also to the psychology of language, becoming particularly well known through his book *Mental Models* (1983). Much of this work was conducted in conjunction with Peter Wason, especially regarding his work on deduction (as evaluated, for example, using the Wason selection task). Johnson-Laird proposed and developed the theory of mental models, which seeks to explain how understanding works through mental representations of the situations depicted by a text or problem description. According to Johnson-Laird, humans are not always rational, but they are not intrinsically irrational either.

This error is called 'confirming the antecedent'. Does the fact that the error occurs mean that people are not logical? This is the wrong way of thinking about the issue. Like the logical error, what it means is that some people have the wrong representation of the problem, and this leads to false conclusions. For instance, the abstract form of the problem, 'If A then B. B, so . . . ?', suggests that there is only A and B to consider, in which case it is reasonable to suppose that if B, then A. But, in general, there can always be some other cause for B – it simply is not stated. So it is easy to confirm the antecedent. For instance, if you commit murder, you go to jail. But if you go to jail . . . this does not mean you committed murder!

Detecting cheats

A very important way of testing if–then statements is known as the Wason Selection – or four-card problem (Wason, 1966). In this task, the participant is given a rule, and four cards are laid out that have information written on both sides. For example:

> Rule: If a card has a vowel on one side, then it has an even number on the other side.
> Card 1: A
> Card 2: D
> Card 3: 4
> Card 4: 7

The task is to verify (i.e. test) whether the rule holds by turning over the two cards that will enable this to be determined. Which cards would you turn over to verify the rule? Try it before you continue reading.

The most frequent response is to check A and 4. Turning A will provide information that is consistent with the rule if there is an even number on the other side of the card, and will falsify the rule if there is an uneven number, so that is fine. But turning 4 will achieve nothing, because the rule does not say, 'If a card has an even number on one side, it will have a vowel on the other.' Turning this card is very much like confirming the antecedent. In fact, the crucial second card to turn is the card with the 7, because if this has a vowel on it, then the rule is false.

This problem is hard to think about. But real-life versions can be much easier. For instance:

> If a student is drinking beer, then they are over 18.
> Card 1: Over 18
> Card 2: Drinking beer
> Card 3: Drinking Coke
> Card 4: Under 18

How would you test the rule? Most people would now think the crucial card to turn was card 4, 'Under 18', because if that had 'Drinking beer' on the other side, there is a clear violation of the rule. This is because testing for under-age drinking is an example of detecting cheating, which is something we appear to be good at (Cosmides, 1989; Gigerenzer & Hug, 1992). The argument is that we have social rules to live by, and that we are naturally attuned to be able to test whether these rules are being broken.

Clearly the representation of the problem is crucial to how reasoning takes place. When a concrete form of the problem is used, we can bring in specific procedures that we have access to for detecting cheats, which is something that is socially important. With an abstract version of the task, this is not possible.

Heuristic reasoning – or taking a short cut

Thinking, understanding and decision-making take place in the real world, where there are usually time pressures and rarely a full range of information available to support a complete appraisal of the problem at hand.

For instance, suppose you are buying a new washing machine. A good basis for the decision might include comparative data on reliability, ease of servicing, servicing and repair costs, ease of use, even noise levels during operation. The list could go on and on. Although sometimes data of this sort might be available, and sometimes it might be published in magazines, it is more likely that you will have to cut corners. In other words, you might not be able to obtain a machine that fulfils all of your desirable features, but you will instead settle for the closest that is available.

heuristic reasoning solving a problem by using a method that is likely to give the right answer, although there is no guarantee

Kahneman, Slovic and Tversky (1982) popularized the term *heuristic reasoning* for thinking and decision making that involves these types of short cuts. They also suggested that these short cuts are so common that they should be considered part of the machinery of thought itself.

Availability

availability relies on the possibility that a solution (from heuristic reasoning) that readily or quickly comes to mind may be the correct one

Perhaps the simplest kind of heuristic reasoning is *availability*. The availability heuristic is a method of estimating the likelihood of something based on how easily it comes to mind. For instance, we might assess the divorce rate by thinking of its prevalence amongst people we know personally. Or when buying a car, we might estimate reliability from comments made by acquaintances and colleagues. Because there will generally be a correspondence between what comes to mind easily and the likelihood of the underlying event, this heuristic can be useful.

Kahneman et al. (1982) point to two mechanisms that come under the availability rubric: ease of recalling relevant instances and ease of constructing representations. For instance, someone's estimate of how many flower names they know will directly depend on how many they can think of in a short time – say, two minutes (Tversky & Kahneman, 1973). In this case, there is generally a good correspondence between initial rate of retrieval and the total number known. But this is not always the case. For instance, it is easier to recall the names of famous people than ordinary people. So if participants hear lists of names containing equal numbers of famous and non-famous names, they will typically believe that there are more famous people on the list than ordinary ones (Tversky & Kahneman, 1973). Here, the heuristic leads to a biased outcome.

Another example of bias occurs through the construction of representations. Consider the following problem:

> A group of ten people want to form a committee with only two people in it. How many possible committees are there?

Now try this:

> A group of ten people want to form a committee with eight people in it. How many possible committees are there?

Most people produce a higher figure for the first question than for the second, even though they are actually equivalent questions

Pioneer

Daniel Kahneman (1934–) has conducted highly influential work over the last several decades into human reasoning, specifically regarding the role of heuristics (i.e. reasoning short cuts, using strategies that generally work but are not guaranteed to work). To a large extent, heuristic reasoning overlaps considerably with the everyday idea of intuition. Kahneman and colleagues have suggested that these heuristic short cuts are so common that they should be considered part of the machinery of thought itself. For example, the availability heuristic is a method of estimating the likelihood of something based on how easily it comes to mind. The representativeness heuristic is based on the principle that we can estimate the likelihood of something by seeing how well it fits a prototype of which it may be an exemplar. For his body of work investigating human judgement and decision-making under conditions of uncertainty, Kahneman was awarded the Nobel Prize in 2002.

(because 8 + 2 = 10, so for every committee of 2 that is formed there is an equivalent committee of 8 formed from among the same group of 10 people). Tversky and Kahneman argue that this is because it is easier to imagine several committees of two than several committees of eight. (This seems reasonable if we suppose that it is easier to form and manipulate a mental model with two rather than eight tokens in it.)

The availability heuristic has been used to explain many, many phenomena. In risk perception, for example, people tend to overestimate car accidents, tornadoes and homicide as causes of death, and underestimate death from complications due to diabetes, stroke and smallpox vaccination. Furthermore, studies show a good correlation between the prevalence of these events in news reports (availability) and estimated likelihood as a cause of personal death (Slovic, Fischhoff & Lichtenstein, 1979).

Social psychology research has established that individuals tend to think that they initiated arguments with significant others more than 50 per cent of the time, and that they did more than 50 per cent of the work in domestic situations. This applies to both partners! It is argued that this is because we each have ready access to information about our own contributions in these situations, so we are more likely to register and remember these than our partner's contributions (because of the higher availability of the former) (Ross, 1981; Ross & Sicoly, 1979).

Representativeness

This heuristic is based on the principle that we can estimate the likelihood of something by seeing how well it fits a prototype of which it may be an exemplar. For instance, if you are trying to decide whether a person is a Christian, the more properties they have that fit your model of how Christians behave, and the fewer they have that do not fit, the more confident you would be that the person is a Christian.

representativeness used in heuristic reasoning to decide whether something is likely because it corresponds to an idea of what is typical in that situation

Like availability, *representativeness* is a double-edged weapon – it can lead to fallacious reasoning. Many of the examples Kahneman and Tversky (1972) give are about reasoning with distributions, such as the 'Exact Birth Order Problem':

> All families of six children in a city were surveyed. In 72 families, the exact order of boys and girls was GBGBBG. What is your estimate of the number of families found in which the exact order was BGBBBB?

The majority of participants thought that the first sequence was much more likely. In fact, the two orders are almost equally likely because, on any occasion, either a boy or a girl could be born with approximately equal probability. Both of these orders fulfil this requirement. From an intuitive viewpoint, the first seems much more likely because there is an equal number of girls and boys. But the equal number gives the impression of being more likely seemingly because it is judged to be more representative.

The impact of representativeness on exact order judgements can be seen even more clearly with the following:

> Which is more likely to occur: GGGBBB or GBBGBG?

Most people think it is the latter, because it is more 'random-looking' than the former. Yet on a random draw basis, both examples are equally likely.

To make this clearer, draw out all the possible sequences that could occur using three boys and three girls. Although the sequences are all equally likely, there are more 'mixed up' ones like the second one above, and only one other (BBBGGG) that looks more extreme (and therefore less representative). Yet these possibilities are all equally likely.

Another example shows how representativeness can apparently obscure the use of what is termed base-rate information. Consider the following scenario:

> 100 people, comprising 70 lawyers and 30 engineers, apply for a job. One of the applicants, Dick, is a 30-year-old man, married with no children. A man of high ability and motivation, he is likely to be quite successful in his field. He is well liked by his colleagues.

Is Dick more likely to be an engineer, a lawyer or equally likely to be either? Kahneman and Tversky (1972) found that the predominant answer given was 'equally likely' because the information does not discriminate between the two. Yet the prior odds are 70:30 in favour of Dick being a lawyer, so this should be the answer in the case where there is insufficient extra evidence in the description. In such cases, it is as if the representativeness of the description dominates the thinking of participants – a typical illustration of what is widely known as the 'fallacy of ignoring the base-rate'.

Intuition

Heuristics provide a means of reasoning, but they are short cuts, using strategies that generally work but are not guaranteed to work. At the same time, they can induce quite high levels of confidence in us regarding our decisions, even when we are wrong.

To a large extent, heuristic reasoning overlaps considerably with the everyday idea of intuition. Intuitive thought is automatic, often fast and not derived from detailed analysis. It involves a strong feeling of conviction but – like heuristic reasoning – tends to be hard to justify.

Problem-to-model mapping

The mappings from the description of a problem to an automatic conception of that problem can be very strong, and constitute the basis of some very strong feelings of the intuitive 'correctness' of our understanding. Try the following problem (schematically illustrated in figure 12.5):

> Suppose there are three cups in front of you and the experimenter puts a coin under one of the cups. You don't know which one it is

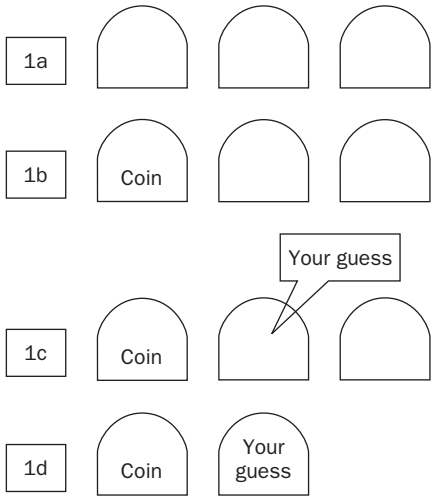

Figure 12.5

The 'Three Cups Problem', showing the sequence of events. A description of the task is given in the text.

under. Next you try to choose the cup you think the coin might be under. Rather than tell you whether you are right or wrong, the experimenter removes one of the cups, but not the one you pointed at, and not the one the coin was under (which may be different). The question is, would you have a greater chance of getting the coin if you stuck to your original choice, or shifted?

Participants usually believe that they have a 1:3 chance of being correct when they start, and then that they have a 1:2 chance of being right once there are just the two cups left. They usually declare that there is no point in changing because after the cup has been removed thay have a 50/50 chance of being correct (and if they changed their choice at this stage they would still only have a 50/50 chance of being correct). This behaviour fits a simple mental model: with N choices, the chance of being correct is 1:N. The situation is mapped onto this simple model, and the result is coherent and compelling.

Despite this, the answer is that you should shift. In the first place, the chance of being correct was 1:3, and the chance of being incorrect was 2:3. But the important point is that the experimenter does not remove the cup at random, and – the key point – she never moves the cup that contains the coin. So the chance of being wrong by sticking to the original decision is still 2:3 (as per the original decision), even though there are only two cups now left. But since there is only one other cup now remaining, the chance of that being the wrong choice is in fact 1:3 (because there is only one other of the original three cups under which the coin could now be located), so it makes sense to change. In fact, the odds in favour of changing are 2:1.

This is a very difficult puzzle to think about (e.g. see Granberg & Brown, 1995). The usual mental model people set up does not have the capacity to deal with the correct solution, and yet it is very compelling.

There is an intuitive way of making the point about shifting, though. Suppose there are 100 cups (each numbered), and one has a coin under it. The chance of your being incorrect in your choice is 99:100. You choose a cup – say, number 15. Now the experimenter takes away all of the cups except the one you chose and one other (say number 78), but you know she never takes the one with the coin under it. Do you now think that there are even odds on your having selected the correct one, or would you prefer to shift? Most people think it appropriate to shift under those circumstances.

The 'Three Cups Problem' is a good illustration of a strong mapping between a state of affairs (two cups are left) and a pre-existing mental model (if there are two cups, one with a coin under it, then the odds on choosing the correct one are 50:50). The intuitive belief that goes with these problem-to-model mappings is very strong. Try it on your friends.

The hindsight bias

Just as discourse makes sense if it portrays a series of connected events that match some plausible possible world, so facts about things make sense if they fit a coherent scenario. Also, once we know the facts, it is often easy to find a way of linking them.

Nowhere is this clearer than with the *hindsight bias* (see chapter 1), in which people believe that they had a prior insight ('I knew it all along') and that an event was therefore not surprising. Hindsight judgements are made 'after the fact'.

hindsight bias falsely overestimating the probability with which we would have predicted an outcome after we know it has already occurred

In a typical hindsight experiment (Fischhoff, 1977; Slovic & Fischhoff, 1977), participants first answer binary-choice general knowledge questions, such as:

Was Aladdin (a) Chinese?
(b) Persian?

Subsequently, they are presented with the questions again, this time with the correct alternative marked, and are asked to say whether they got each one right on the previous occasion.

In general, participants tend to falsely remember getting more right than they actually did, as though the correct answer interferes with their memories. Even if participants are paid for remembering correctly, the effect still occurs, so strong are the intuitions the paradigm generates.

A major consequence of the hindsight bias is that things appear to be more obvious than they should. Before new experiments are carried out, it is never clear what the outcome will be – otherwise they would not be original experiments. Yet in one interesting study, the same information was presented to two groups of participants concerning an experiment with rats. One group was told that one result occurred, while the other group was told that another occurred. Although the two sets of results were quite different, both groups of participants rated the outcome as obvious (Slovic & Fischhoff, 1977).

Are humans poor at reasoning?

This brief overview of the literature on thinking might lead us to wonder whether we are capable of being rational and logical, or whether we fall short of that 'ideal'.

Caution is needed with this question. Survival depends on being good at doing things that confront us in the real world. Rather than think of rationality as an absolute, Herbert Simon (1991) introduced the idea of *satisficing* – that is, performing optimally with the limited data and time available to us. This is known as *bounded rationality* – it is about as close to the idea of being rational as we are likely to get, and is the best we could expect from any system with finite resources.

satisficing making a judgement based on bounded rationality

bounded rationality being rational by making a rational judgements, but based on only part of the evidence

ecological validity the extent to which a task is typical of tasks that people have to solve in everyday life

It has also been argued that many of the tasks used in laboratories are artificial, and that they lack *ecological validity*. In other words, they are not typical of the kinds of problem humans have to solve. (For a discussion of this important idea, see Cosmides & Tooby, 1997; Gigerenzer & Hoffrage, 1995.) Gigerenzer and Hoffrage show, for example, that when information is presented in terms of frequencies (like 95 out of 100) rather than probabilities (like 0.95), people do better at a range of reasoning tasks, and ignore base-rates to a lesser degree. They argue that this is because we are naturally adapted to frequency information because we tend to collect instances one at a time. These authors are working on a program of investigation into *evolutionary cognition*, which attempts to establish whether we are good at certain ways of thinking because we have evolved that way to adapt to our evolutionary environment (see also Piatelli-Palmarini, 1992).

evolutionary cognition cognitive processes that are established by evolution

Pioneer

Herbert Simon (1916–2001) was a true cognitive scientist, crossing disciplinary boundaries in his efforts to understand human problem solving and decision making. He was awarded the Nobel Prize in economics for his work on administrative behaviour, but is best known in psychology for his work on the representation of problems, and problem-solving heuristics (with the eminent cognitive scientist Alan Newell). In the early 1950s, Simon and Newell conceived the idea that the best way to study problem-solving was to simulate it with computer programs. Computer simulation of human cognition subsequently became Simon's central research interest, which he pursued until his death in 2001.

Research close-up 2

Is there a 'natural' way of thinking about probabilities?

The research issue

Extracting regularities from the environment – learning what goes with what, and how frequently or probably things will co-occur – is an important aspect of our survival skills. Yet there is a mass of evidence that people are rather poor at solving the kinds of problem that use this information.

Are humans incapable of using probability information? Gigerenzer (2000; Gigerenzer & Hoffrage, 1995) suggest that it all depends on how the information is presented.

Design and procedure

Gigerenzer presented two versions of a puzzle to two groups of 24 physicians. One version used a frequency format:

> *A doctor screens women for breast cancer using a mammogram. He knows that:*
> *Ten out of every 1000 women have breast cancer.*
> *Of these ten women with breast cancer, eight will have a positive mammogram.*
> *Of the remaining 990 women without breast cancer, 99 will still have a positive mammogram.*
>
> *Imagine a sample of women (aged 40–50, no symptoms) who have positive mammograms in your breast cancer screening.*
> *How many of these women do actually have breast cancer?*
>
> _____ out of_____

Try this before reading on.

The other version of the same problem, presented to a second group of 24 physicians, used a probability format (most commonly used in these types of studies):

The probability that a woman has breast cancer is 1 per cent if she is in the 40–50 age range.
If a woman has breast cancer, the probability is 80 per cent that she will have a positive mammogram.
If a woman does not have breast cancer, the probability is 10 per cent that she will still have a positive mammogram.
Imagine a woman (aged 40–50, no symptoms) who has a positive mammogram in your screening. What is the probability that she actually has breast cancer?

_____%

Try this before reading on.

Results and implications

The two formats contain the same information, presented in different ways. Gigerenzer found that using the first format, 46 per cent of physicians gave the correct answer (around 7.7 per cent). But using the second format, only two of the physicians (8 per cent) gave the correct answer, the median estimate being 70 per cent!

The results suggest that using a frequency format enables people to set up representations for the problem that enable an easier solution than the (mathematically equivalent) probability format.

Discovering which ways are natural and easy for people to represent problems, and which ones are difficult, is important if psychologists are to understand the evolution of human understanding and thinking skills. Using the right formats for providing information about uncertainty and probability is also of great practical significance for many walks of life. Gigerenzer's insights are a valuable step along this road.

Gigerenzer, G., & Hoffrage, U., 1995, 'How to improve Bayesian reasoning without instruction: Frequency formats', *Psychological Review*, 102, 684–704.

FINAL THOUGHTS

It is possible to look at language and thinking as processes, and the attempt to determine the steps involved in the execution of mental activity is crucial to a proper understanding of that activity. In the case of language, the challenge is to specify how squiggles on a page, or complex sound stimuli, become interpreted as messages about the world. We have attempted to show how some of those stages may be isolated, and we have illustrated some of the techniques used to measure them. How language understanding works is one of the great scientific mysteries of the present age.

Thinking can seem even more intractable than language, being more difficult to break down into component processes. Yet this was exactly what Newell and Simon set out to do in their work on problem solving. Studies of intuition, something normally considered to be quite different from logical problem solving, have also benefited from carefully considering just what processes a thinker must go through in order to have an intuition.

The psychology of language and thinking is of great intrinsic interest, but there are practical reasons for adopting an information-processing approach. Designing intelligent programs that can understand language, or solve problems, has benefited from psychological modelling, and psychology has benefited from the computer scientists' need to be clear about what is happening at every stage of processing. These topics are at the core of interdisciplinary efforts to understand the nature of mental activity.

Summary

- Language can be understood in terms of its grammar (syntax), its meaning (semantics) and its significance (pragmatic interpretation).
- A major research issue is which language systems are modular and which interact with each other, and when.
- Language consists not of separate sentences, but of connected discourse. In this chapter, we have considered how meaning and significance are established with multi-sentence written texts.
- Normal reading depends upon eye movements; eye movements can be used to measure difficulties in reading texts.
- Aphasia refers to language disorders that may affect the comprehension and production of language, and whether the language that is produced is grammatical or not. Aphasia results from brain injury. Dyslexia is a disorder of reading, and may be detected during individual development, or may be acquired later through brain injury.
- Problem solving is characterized by the development of a mental representation of the problem: the problem-space.
- Logical reasoning is concerned with how people draw necessary conclusions from particular states of affairs. Central to reasoning is the concept of a mental model of the problem. Socially important activities like detecting rule-breaking are also important.
- Lakoff has argued that all thinking is to some extent metaphorical. We considered some examples.
- Several studies show that humans can be poor at solving probability problems. They can often rely on simple heuristics, which sometimes lead to the wrong conclusions.
- Availability and representativeness are two important heuristics that people often use when reasoning.
- Intuition can be seen as part of the mechanism of mapping problems onto existing cognitive representations. If the fit is good, the intuition seems strong.
- Humans are not necessarily poor at reasoning. If they have the information in the right format, reasoning can be very effective.

REVISION QUESTIONS

1. What are the distinctions between syntax, semantics and pragmatics? Can you think of examples from your daily life where one of these components of language may have failed you in the past?
2. Why is modularity an important concept for language?
3. How would you define discourse? Is ‘communication’ different from ‘language’?
4. ‘Speed reading’ courses often emphasize eye movements during reading. What do you think is the basis for these techniques? Do you think they are effective?
5. What is aphasia? Do you think that we all suffer from some form of aphasia from time to time?
6. Does acquired dyslexia have the same functional characteristics as developmental dyslexia?
7. What types of problem solving do you think humans are good at, and why? What about computers?
8. Sometimes people believe that the results of psychology experiments are ‘obvious’, and that the research was not worthwhile. What pattern of reasoning would lead to such a judgement, even in cases when, strictly speaking, the results of the experiment could not have been predicted?
9. Can you think of an example from the everyday life of you or your friends where you have used a) the availability heuristic or b) the representativeness heuristic during problem solving?

Further Reading

Altmann, G.T.M. (1997). *The Ascent of Babel*. Oxford: Oxford University Press.
A wide-ranging discussion of the psychology of language.

Davidson, J.E., & Sternberg, R.J. (eds) (2003). *The Psychology of Problem Solving*. London: Cambridge University Press.
Current issues in problem solving, alongside historical background.

Garrod, S.C., & Pickering, M.J. (eds) (1999). *Language Processing*. Hove: Psychology Press.
A collection of readings describing state-of-the-art research in a number of key areas.

Gigerenzer, G. (2002). *Reckoning with Risk*. London: Penguin.
An exciting new view of thought processes associated with handling risk.

Johnson-Laird, P.N. (1983). *Mental Models*. Cambridge: Cambridge University Press.
A classic book expounding a key theory of understanding and reasoning.

Rayner, K., & Polletsek, A. (1989). *The Psychology of Reading*. Englewood Cliffs, NJ: Prentice Hall.
Another classic text, describing eye movement and more general research in reading.

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Intelligence 13

CHAPTER OUTLINE

Learning Objectives

By the end of this chapter you should appreciate that:

- there is intense controversy surrounding both the construct of intelligence and its measurement (IQ), which goes back over a century and continues today;
- the central discovery of recent research in intelligence is the attribute we call general intelligence (*g*);
- general intelligence may be related to a property of the brain that we can best summarize as speed of information processing;
- various theories attempt to accommodate the relationship between general intelligence and more specific abilities, each testing their theory by trying to explain 'exceptions' to normal intellectual development, such as mental retardation and the *savant* syndrome;
- IQ appears to have a reliable genetic component, but there is ongoing controversy regarding the relationship between race, genes and intelligence;
- there are other important defining characteristics of a person in addition to their 'intelligence'.

INTRODUCTION

If someone could offer you a pill to make you more intelligent – would you take it? How would your life change if you woke up one morning with a 20 point increase in your IQ? Are you using the full extent of the intelligence you have? Answering these questions requires us to reflect on what we think intelligence is, what it 'does' and how important it is in our lives.

Psychologists have been puzzling over what intelligence is for a long time. So, too, have parents, teachers, employers and philosophers.

Why do we care so much about intelligence? Perhaps because it reaches to the heart of our conceptions of ourselves as rational beings set apart from all other animals. 'I think therefore I am', declared French philosopher René Descartes (1596–1650), capturing the broad sense in which intelligence has perhaps always been fundamental to our notion of human nature. More pragmatically, intelligence and intelligence tests have implications for our lives in terms of selection, advancement and exclusion in a range of domains.

In this chapter we will visit key historical milestones in the study of intelligence before presenting current challenges in this arena. The territory we traverse ranges from the genius of Mozart to the *savant* (i.e. 'intellectually handicapped genius') and from affirmative action policies in the workplace to eugenics (the science of selective breeding of human beings for 'desirable' traits).

SETTING THE SCENE

Questions of intelligence

Parents and teachers will both tell you that they notice differences in the rate at which siblings or classmates complete their work and progress from one level of learning to another. At one extreme, some children apparently have pervasive difficulty in completing daily tasks, while at the other extreme are children who seem 'gifted', excelling at almost everything. Think back to your own schooldays, and you will probably recollect a growing awareness of where you 'fitted in' relative to your classmates – in other words, which classmates tended to do better than you on maths and English tests and which would come to you for help with their homework.

Parents want to know if their child is capable of learning more than they appear to be. They want to know whether problems experienced by their child at school are due to a general inability to keep up with their classmates, or due to a specific area of skill deficit (such as a difficulty mastering reading), or perhaps a personality style or 'motivational' factor and nothing to do with intelligence at all. Teachers want to know the answers to a number of important questions; for example, (a) how to give each child the best learning environment, (b) whether lessons should be targeted to a child's preferred learning style and (c) whether all children can learn the same things if given enough time.

Businesses, too, spend large sums of money each year on training new staff, so they want to know which candidates are most likely to learn quickly and accurately the skills and knowledge required to complete their jobs. Some companies also want to know how flexible potential employees are likely to be in dealing with new problems. They want to know whether the person who will 'act most intelligently' in one position will also act most intelligently in another. Is the best person for the job the one with the college degree or the one with only a basic formal education but ten years' experience working her way up from the factory floor?

Our concern with intelligence leads to endless questions. For example: Can intelligence be effectively measured? What do traditional intelligence tests measure? Is intelligence one thing or made up of many different abilities? Was Einstein's intelligence of the same kind as Mark Twain's, Leonardo Da Vinci's or Helen Keller's? Are we born with a fixed amount of intelligence? Are the same people who were smartest at school still smartest as adults? Are they the most successful? Is intelligence changed dramatically by education and culture? (Who do you think is more intelligent – Aristotle or a current undergraduate physics student whose understanding of the physical world is clearly superior?)

Is it possible to compare the intelligence of different racial groups? If you placed Anglo-Saxon Australian children from the city into a remote Aboriginal community in central Australia, would they perform as well on local tests of judgement and reasoning as children of the same age from that indigenous community? Would they know how to find water in a desert terrain or how to find a goanna? Probably not – but does that mean they have become less intelligent all of a sudden? Which group would we expect to perform better on conventional tests of spatial ability or verbal reasoning? If we do compare groups, do any differences have a genetic or cultural root? Does intelligence 'run in families'? This chapter will address the core issues in understanding intelligence that bear upon these questions beginning with the notion of individual differences in intelligence.

Galton and individual differences

Francis Galton can be credited with the first systematic, scientific attempt to both understand and measure human intelligence (see chapter 1). Galton's essential idea was that there are stable, biological differences in intelligence between people.'I have no patience with the hypothesis . . . that babies are born pretty much alike, and that the sole agencies in creating differences between boy and boy, and man and man, are steady application and moral effort,' he wrote. 'The experiences of the nursery, the school, and of professional careers, are a chain of proofs to the contrary' (1892, p. 12). Galton considered intelligence to be a low-level property of our nervous system that we inherit from our parents. He believed that individual differences in intelligence reflect differences in the efficiency of operation of simple neural processes.

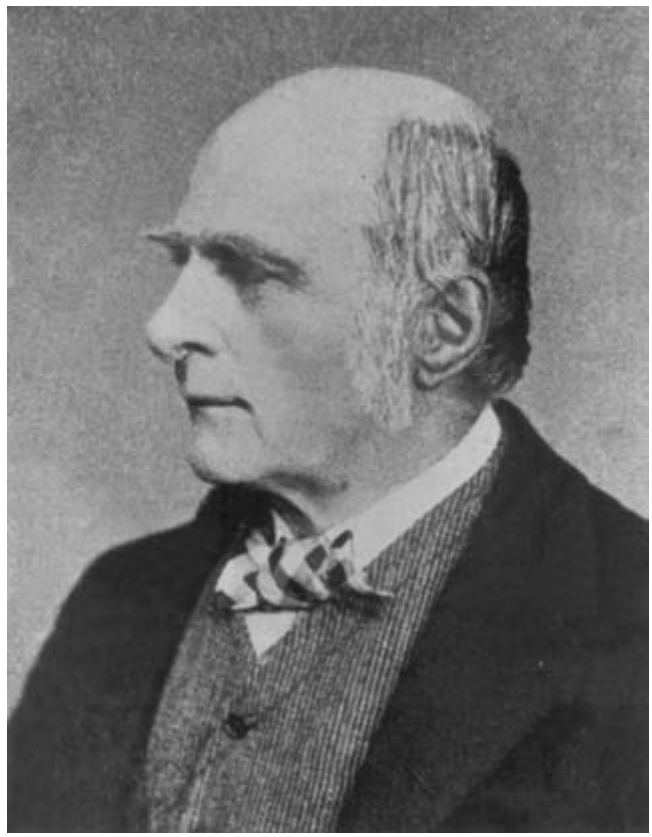

Figure 13.1

Francis Galton believed that biology has a large part to play in level of intelligence.

Galton pursued his theory in several ways – first, by constructing extensive family trees of 'persons of reputation' in one domain or another to investigate patterns in eminence and achievement within families. His book *Hereditary Genius*, first published in 1869, presents family trees of 'Commanders, men of Literature and of Science, Poets, Painters and Musicians of whom history speaks' to support his hypothesis.

Normal distribution

Another of Galton's contributions was to bring statistical understandings from the physical sciences to the study of psychology – particularly, the notion of normal distribution (see chapter 2). Galton noted that for any of our 'natural gifts' (physical, temperamental or intellectual) there will be an 'average' amount of that feature, to which most people approximate. Then, as we consider scores increasingly higher or increasingly lower than that 'average score', there will be fewer and fewer people registering those scores. Galton explains it as follows:

> Suppose a million of the men . . . stand in turns, with their backs against a vertical board of sufficient height, and their heights to be dotted off upon it . . . The line of average height is that which divides the dots into two equal parts . . . The dots will be found to be ranged so symmetrically on either side of the line of average, that the lower half of the diagram will be almost a precise reflection of the upper. (1892, 27–8)

The idea here was that, in this group, there would be many men of about average height (say 160cm) and increasingly fewer men as we approach 190cm, and similarly fewer as we approach 130cm.

Studying the normal distribution of psychological characteristics such as intelligence enables us to estimate attributes within a group and to have a point of comparison for an individual's abilities. So, we expect that most people will approximate average intelligence, and there will be a small but predictable number of people of exceptionally high intelligence and an equally small and predictable number will be severely mentally disabled.

Correlation

correlation the extent to which two variables, such as weight and height, are related; a correlation of +1 indicates a perfect positive association, and −1 a perfect negative association

Galton also introduced the idea of 'co-relation' (Galton, 1888), or *correlation*, which is a measure of the extent to which two variables, such as weight and height, are related.

A correlation of +1 would reflect a perfect positive relationship between the two variables – as height increases, so weight increases in direct proportion. But we know from our own experience that there is not necessarily a perfect relationship (there are some short, heavy-set people and some tall, skinny people) so the correlation between weight and height is likely to be less than one but still positive. A correlation of –1 would reveal a perfect negative relationship, where an increase in scores on one variable is directly related to decreasing scores on the other – for example, the number of cigarettes smoked is negatively correlated with life expectancy.

Together, the notions of normal distribution and correlation allow us to consider how our abilities vary in relation to each other and in relation to the abilities of others in the population, and how well we can use scores on one variable to predict scores on another.

Early attempts to measure intelligence

In his Anthropometric Laboratory in London in the late nineteenth century, Galton attempted to measure a range of attributes that show individual variation. These included physical attributes such as head circumference, height and hand size, as well as intellectual characteristics (which, remember, he believed were a function of neural processes). These intellectual measures included basic sensory-motor tasks, such as speed of reaction to sounds and visual stimuli. Galton then compared these innovative measures of 'intelligence' to subjective estimates of the intellectual prowess of his participants based on their 'reputation' and eminence in the family tree (There were no such things as intelligence tests at the time!). Unfortunately, his empirical efforts were not successful.

Subsequently, Charles Spearman (1904) set out to estimate the intelligence of 24 children in his village school. He discovered a relationship between each child's performance in a number of domains (including teachers' ratings of 'cleverness' and ratings by other students of their 'common sense out of school') and measures of their ability to discriminate light, weight and pitch. In other studies, he found strong associations between scores on examinations in different subject areas such as classics and maths. Linking together these strands of evidence, Spearman concluded that there was a 'general' intelligence underlying performance on these very different tasks. He regarded general intelligence, or *g*, as a unitary, biological and inherited determinant of measurable intellectual differences.

In apparent contradiction, Spearman also noted that there were some 'specific abilities', such as musical aptitude, that contributed to differentially exceptional performance in specific areas and seemed less related to performance in other disciplines. But his finding of a general feature that underlies performance in many areas was so radical that it became the hallmark of his work. Spearman likened *g* to mental energy – a limited resource available to all intellectual tasks. So the idea was that individuals differ in general intelligence because they have different amounts of this mental energy.

Binet and developmental changes

In contrast to Galton and Spearman, Alfred Binet focused on the universalities of human intellect. He proposed that we all pass through certain developmental stages, and that to understand these stages we should consider the 'higher faculties' of the mind rather than 'low-level' neural processing: 'It seems to us that in

Pioneer

Figure 13.2

Alfred Binet's focus was on the development of intelligence with an emphasis on the roles of reason and judgement.

Alfred Binet (1857–1911), a French lawyer and self-trained psychologist, came to the field of intelligence via a study of psychopathology, free will and hypnosis. His interest in intelligence was prompted by observation of his two daughters, Madeleine and Alicia. While he was interested in how their different personalities affected their understandings of the world, he also noted that with age came the ability to reason about events in increasingly abstract ways. Binet observed their performance on various puzzles and asked them to explain how they had solved them. He was fascinated with their different approaches. This informal case study methodology led to the development of intelligence tests as we know them today.

intelligence there is a fundamental faculty. . . . This faculty is judgement, otherwise called good sense, practical sense, initiative, the faculty of adapting oneself to one's circumstance' (Binet & Simon, 1916, pp. 42–3). An emphasis on reason and judgement is perhaps not surprising given Binet's formal training as a lawyer.

The first intelligence tests

In 1904, Binet was charged by the Parisian authorities to develop tests that would identify children in need of special education, without relying on the subjective reports of parents or teachers. So he set about finding a way to construct tests with objectively verifiable scales of difficulty that could measure rates of development in 'higher mental processes'.

Binet's technique for constructing the first test was based on an important insight: whatever intelligence is, we can be sure that it changes (develops) with age. So the first intelligence test was based on the central idea that the age at which the 'average child' can succeed at a particular problem is an indication of the difficulty of that problem. Using this yardstick, children can be characterized as 'average', advanced or delayed in their rate of development compared to their peers.

Binet and his associate Théodore Simon used a range of tasks in their first intelligence tests. These included around 30 items of increasing difficulty, beginning with simple items that even children with intellectual disabilities were able to complete (such as following a lighted match with your eyes and shaking hands with the examiner). More complex tasks included pointing to body parts and defining words such as 'house' or 'wheel', and tasks that were harder still, such as repeating back strings of digits and constructing sentences involving several specified words.

Interestingly, vocabulary and digit recall tasks are still used in our most advanced intelligence tests today. Binet was also the first psychologist to specify that such tests must be:

1. administered and scored in a careful and *standardized* manner if comparisons between children's performance are to be valid and reliable;
2. presented in the same order to all children and in order of increasing difficulty so that each child can pass as many tests as possible; and
3. administered in a one-to-one setting and only where the examiner has first established a friendly rapport with the child.

Psychologists still adhere to these very important principles of testing today.

IQ and the birth of psychometrics

Later, Binet used the idea of the average age at which a task was mastered to derive a child's *mental age* – a radically new concept. Mental age (MA) is equivalent to the chronological age (CA) for which any test score would represent average performance. So a child scoring better than the average child of his age would have a higher MA than CA, and a child scoring lower than average would have a lower MA than CA.

It took one short step, by Stern (1914), to derive an index of differences in intelligence within ages. The resulting intelligence quotient, or IQ, was calculated using the classical formula, $IQ = MA/CA \times 100$. The calculation of IQ gave birth to two ideas:

1. individual differences in intelligence can be expressed by a single score (note that this notion of a single score actually presumes the existence of *g*); and
2. a range of measures of performance on different kinds of knowledge, judgement and reasoning tasks (as evaluated by tests such as Binet's) can be taken together to contribute to our understanding of intelligence.

Psychometrics or the measurement of human abilities (later extended to other attributes) was therefore born. Stern's formulation helped to drive a wedge between the two different approaches to studying intelligence – the individual differences method (concerned with IQ differences among peers) and the developmental method (concerned with changes in MA with CA). And this wedge finally culminated in these different research approaches being split apart through the work of Jean Piaget.

Piaget and the importance of error

Piaget's early career involved further developing Binet's tests and included some collaboration with Binet's associate Théodore Simon. His genius was to realize that errors on intelligence tests might be even more informative than the total test score used in Binet's calculations of MA. By contrast, at the same time psychometricians became further interested in developing better measures of individual differences in *g* (expressed in terms of test scores). They focused largely on the structure of adult intelligence, which was generally considered to be fully developed.

On the other hand, Piaget's approach – inspired (like Binet's) by observation of his own children – was to focus more on the kinds of errors made by children of different ages. Piaget took these to be indicators of the universalities or commonalities in underlying cognitive structures at different stages of cognitive development. The rate of cognitive development was thought to vary between children, but with all children eventually passing through these same stages. In due course, Piaget developed his own tests based on his stage theory of cognitive development (see chapter 9).

Back to the future: the intelligence landscape

Both Binet and Galton died in 1911. In the century since, in terms of *psychological practice*, Binet's conception of intelligence has dominated over Galton's and Spearman's, and has shaped the content of the current intelligence tests that are used in the Western world today. The Binet–Simon scale was even selected by the prestigious journal *Science* as one of the 20 most significant discoveries and developments of the twentieth century. Lewis Terman developed this scale further at Stanford University to produce the Stanford–Binet – a test still widely used today.

Both Binet and Galton have had a significant influence on social policy. Binet's test was used for placement of children into classes supporting remedial education with a view to improving their life options. Unfortunately, others (including Terman) have supported the use of IQ tests to segregate children (and adults) without any intention of working to improve their circumstances or opportunities. Galton's work in the eugenics movement supported highly controversial social policies, such as recommending immigration to Britain for select talented people, enforced sterilization of women with low IQ scores, and social segregation on the basis of racial differences in IQ.

On the other hand, the theoretical and empirical contribution of both men has been to sketch out the landscape for the ongoing debate about the nature of intelligence. The key questions raised by Galton and Binet remain questions of interest today. Indeed, a quick check in a recent edition of the pre-eminent journal *Intelligence* revealed:

a) arguments about the relative importance of general intelligence and specific cognitive abilities (Brody, 2003a; 2003b; Gottfredson, 2003; Sternberg, 2003);
b) studies of twins and adopted siblings exploring the relative contribution of genes and environment to the development of general intelligence (Spinath, Ronald, Harlaar, Price with Plomin, 2003);
c) consideration of the efficacy of information-processing measures of general intelligence (Bates & Shieles, 2003; Burns & Nettelbeck, 2003); and
d) comparisons of age group differences in intelligence with racial group differences (Jensen, 2003).

These recent papers reflect many of the central issues raised by Galton and Binet – we will here examine contemporary developments in each of these areas.

GENERAL INTELLIGENCE – MULTIPLE ABILITIES

How is the intellect structured?

Following the development of the first standardized intelligence tests, it was thought that data from test performance might reveal the secret of how the intellect is structured.

Intelligence as a general mental facility

Initial studies looked definitive. If a random sample of participants take different types of cognitive tests, such as those in the Binet–Simon scale or the more recent Wechsler intelligence scales, those who are better than average on tests of vocabulary will generally be better than average at mechanical reasoning. They will also be better at solving analogies, making inferences and carrying out arithmetical calculations, know more general information, be faster at substituting digits for other symbols, and so on.

The fact that the correlations between ability tests are all positive has been termed *positive manifold*. In other words, different tests may well tap similar underlying factors or traits, as Binet had suggested. So it seemed that perhaps geniuses as diverse as Einstein and Mark Twain might have something in common after all. This model suggests that, rather than there being different types of intelligence, differences between these men may have more to do with the application of a general mental facility to different areas of interest.

positive manifold the fact that the correlations between ability tests are all positive

Research close-up 1

Can we raise intelligence?

The research issue

Our models of intelligence affect the way we interpret intelligence test performance and help to answer philosophical questions about human nature. But they also matter in psychological practice where we have a responsibility to validate our theories before they are put into practice to ensure that we 'do no harm' – the first ethical principle of being a psychologist.

There have been instances in the past of theories about causes underlying intellectual deficits leading policy makers and educators down unhelpful paths. For example, at one time, people with low IQ were locked in asylums with no effort at remediation or maximization of potential. Today, there are ongoing debates about integration of children with Down's syndrome into regular classrooms. While some people believe this 'elevates' the child's intelligence, others argue that it places the child under unreasonable pressure.

In answering questions like this, perhaps we need to consider the central issue of whether it is possible to improve our intelligence. There have been many attempts to do so. The Carolina Abecedarian Project (www.fpg.unc.edu) is one example of a scientifically controlled study exploring the potential benefits of early childhood educational intervention programmes for children from poor families who were considered to be at risk of environmental or 'cultural–familial' mental retardation.

Design and procedure

Beginning in 1972, each of 111 children received nutritional supplements and referral to social services as needed. Additional educational intervention was provided to 57 of these children in a full-time childcare setting from infancy to age five. Each child had an individualized programme of educational activities presented as 'games' throughout the day, focusing on social, emotional and cognitive development. Children's progress was monitored over time and into adulthood (Campbell & Ramey, 1994, Campbell et al., 2002).

Results and implications

Results suggest that children in this study completed more years of education and were more likely to attend college, they were older (on average) when their first child was born, and their own mothers achieved higher educational and employment status than those whose children were not in the programme. These results seem especially pronounced for the children of teen mothers. A cost–benefit analysis estimated a 4:1 financial return on the cost of the programme in terms of savings from poor predicted outcomes for this population (Masse & Barnett, 2002). And yet, importantly, when the results were carefully evaluated, no increase in measured IQ was found (Spitz, 1999).

This research suggests that even when significant environmental factors contribute to intellectual impairment (perhaps through lack of opportunity for learning), structured educational intervention does not lead to general improvements in IQ. Similarly, in early intervention studies focusing on children with specific organic intellectual disabilities, such as Down's syndrome, changes in IQ do not typically occur following early intervention, despite many optimistic reports. See Spitz (1999) for a critical review of methodology in studies targeting changes at both ends of the IQ spectrum.

Does it follow that special educational opportunities are pointless for children with low IQ, as some researchers have suggested (e.g. Howe, 1998)? No, it does not. What does change as a result of such programmes is behavioural repertoire, levels of functional daily skills and the range of applications of knowledge through repetition and reinforcement across contexts. Such changes can have an enormous impact on quality of life for participants and their families. These interventions provide an opportunity to maximize the use of the cognitive resources available to the child. As outlined in the Abecedarian Project, there may also be important social welfare outcomes.

Campbell, F.A., & Ramey, C.T., 1994, 'Effects of early childhood intervention on intellectual and academic achievement: A follow-up study of children from low-income families', *Child Development*, 65, 684–98.

Campbell, F.A., Ramey, C.T., Pungello, E., Sparling, J., & Miller-Johnson, S., 2002, 'Early childhood education: Young adult outcomes from the Abecedarian Project', *Applied Developmental Science*, 6 (1), 42–57.

Howe, M., 1998, 'Can IQ change?', *The Psychologist*, February, 69–71.

Masse, L., & Barnett, W.S., 2002, *A Benefit–Cost Analysis of the Abecedarian Early Childhood Intervention*, National Institute for Early Education Research (accessed at http://nieer.org/resources/research/AbecedarianStudy.pdf, May 2004).

Spitz, H.H., 1999, 'Attempts to raise intelligence' in M. Anderson (ed.), *The Development of Intelligence*, Hove: Psychology Press.

Underlying mental traits

The question then becomes: how many (or how few) underlying traits are there, which explain most of the difference in scores we find on a whole battery of tests? This is what psychologists hoped to find out using *factor analysis* – a statistical technique developed by Charles Spearman specifically for this purpose. Factor analysis is a complex mathematical technique for identifying how many 'factors' underlie a large number of individual pieces of data, and its exploration is best left to a more advanced, dedicated statistics text. However, it is relevant to mention here that two different, but equally sound, approaches to factor analysis have led to fierce debate about the number of basic elements of intelligence.

factor analysis a data reduction technique where relationships between a large number of variables can be reduced to a relationship among fewer hypothetical (i.e. latent) factors

The original factor solutions obtained by Spearman found a general factor of intelligence (g) and some specific factors. But Louis Leon Thurstone (1938) argued that, rather than a single general intelligence, there are seven 'separate and unique' primary mental abilities: word fluency, number facility, verbal comprehension, perceptual speed, associative memory, spatial visualization and inductive reasoning.

Horn and Cattell (1966) identified two factors, which they labelled *fluid intelligence* (*Gf*) and *crystallized intelligence* (*Gc*). Unlike Thurstone, Horn and Cattell believed that these different aspects of intelligence were differentially important. *Gf* seemed to represent something akin to Spearman's *g*, namely an overarching processing capacity that in turn contributed to *Gc*, which represented diverse skills and knowledge acquired across the lifespan. There is some evidence to support this conceptualization of intelligence, as tests that tap these two different aspects of intelligence (*Gf* and *Gc*) seem to be differentially related to ageing.

fluid intelligence (*Gf*) Horn and Cattell's *Gf* is something akin to Spearman's *g*, namely an overarching processing capacity that in turn contributes to *Gc* (see **crystallized intelligence**)

crystallized intelligence (*Gc*) diverse skills and knowledge acquired across the lifespan

The current consensus

After decades of debate, Carroll (1993) and the American Psychological Association Task Force on Intelligence (1996) concluded that there is now a strong consensus among psychometricians that the inclusion of a *g* factor leads to a better factor structure when attempting to interpret findings obtained from ability testing. This outcome is partly based on the fact that Thurstone's 'primary mental abilities' themselves correlate with each other. The same is true for Horn and Cattell's crystallized and fluid intelligence. This allows these constructs to be factor-analysed, in turn producing a general factor (i.e. a factor that all the original tests are correlated with) – something that Thurstone himself acknowledged.

Speed of Information Processing as a Measure of Intelligence

Studies of reaction time and inspection time

In the 1970s Arthur Jensen began a research programme investigating the possibility that intelligence, or psychometric *g*, is based on the speed with which we process information. Jensen thought that the latter might be measured without asking any of the conventional questions found in intelligence tests, thereby avoiding concerns about cultural bias (more about that later).

To measure speed of processing, Jensen used a very simple *reaction time* (RT) procedure, in which participants have to respond quickly to the onset of a light (see figure 13.3). He found that individuals with higher IQs respond faster and are more consistent in the speed of their responses. Jensen (1982) claimed that the basis of individual differences in intelligence is to be found in the speed with which we process a single bit of information (as evaluated, for example, by his *speed of information processing* task). Jensen proposed that this capacity may be underpinned by the rate of oscillation of excitatory and inhibitory phases of neuronal firing (see chapter 3).

reaction time (**RT**) the time taken to process a single bit of information: the stimulus is seen until a decision is made and response is completed

speed of information processing the speed with which an individual can take in information from their environment; the speed of perceptual encoding.

While these findings were exciting, reaction time experiments were subsequently criticized on the basis that the response time could be confounded by the speed or organization of motor responses and task strategies, rather than being a pure measure of speed of intellectual processing.

In the 1970s an Australian researcher, Doug Vickers, addressed this concern by developing the *inspection time* (IT) task (see Research close-up 2), in which it does not matter how long participants take to respond to a presented stimulus, so motor organization is no longer an issue. Instead, the length of time they are exposed to the stimulus is controlled by varying the time of stimulus presentation before the onset of a following masking stimulus (this is a figure that effectively destroys the information from the target stimulus). Interestingly, the decision task itself does not get any more complex – it is only the decreasing exposure duration that makes the task increasingly difficult.

inspection time (**IT**) the time taken to process a single bit of information: the stimulus is seen (inspected) for a very short time before disappearing

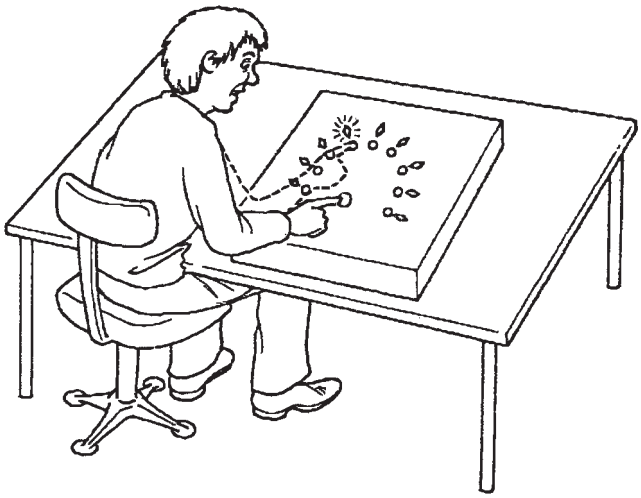

Figure 13.3

One measure of speed of processing. This shows the apparatus used by Jensen and colleagues. When one of the peripheral lights comes on the child must lift his or her hand from a central home button and press the button beneath the light as quickly as he or she can. Source: Anderson (1992).

Pioneer

Arthur Jensen (1923–) articulated an influential body of thought regarding IQ and processing speed. In the 1970s, Jensen began a research programme investigating the possibility that intelligence, or psychometric *g*, is based on the speed with which we process information. To measure speed of processing, Jensen and his colleagues used a very simple reaction time task. They found that individuals with higher IQs responded faster and were more consistent in the speed of their responses. The application of the reaction time technique to the study of IQ has since been criticized, but it has stimulated a considerable volume of work in related areas, such as in the use of inspection time as a complementary methodology. Jensen has also written controversially on the topic of IQ and race.

The IT task was made simple enough for children with intellectual disabilities to discriminate between two line lengths after seeing the stimulus for only 200–300 ms. Participants with higher IQs can make the discrimination at shorter exposure durations – that is, they have shorter inspection times of around 100 ms. Child-friendly versions of the inspection time task use 'space-invader' type computer games, where the discrimination relates to the relative height of an alien's antennae (Anderson, 1988; Scheuffgen et al., 2000).

In careful reviews of many studies, Nettelbeck (1987) and Kranzler and Jensen (1989) came to the conclusion that inspection time and IQ correlate negatively at about −0.5. In other words, the speed of processing a 'simple' unit of information predicts about 25 per cent of the individual differences we find in intellectual performance, as measured by a typical intelligence test. (Note, the square of a correlation, r^2, indicates the shared variance between two variables.) Inspection time continues to be of great interest in helping us understand the nature of intelligence (Burns & Nettelbeck, 2003).

How fast is your nervous system?

In parallel with these studies, there has been challenging research on physiological correlates of intelligence. Much of this research was championed in its earliest stages by Hans Eysenck (1988), who was also exploring physiological correlates of personality at the time, and with whom Jensen had worked (see chapter 14).

Research has found correlations between IQ and brain evoked potentials (Deary & Caryl, 1993), cerebral glucose metabolism (Haier, 1993) and nerve conduction velocities (Reed & Jensen, 1991, 1992). Deary and Caryl (1997) provide a comprehensive and positive review of the evidence for a physiological basis to differences in intelligence, although some researchers remain unconvinced (Howe, 1997). There is also a growing swathe of brain-scan studies which use magnetic resonance imaging to examine neural activation changes during thoughtful activity in healthy control participants and in patients with diseases such as Alzheimer's, which affects intellectual functioning.

Considered together with the robust evidence from inspection time and reaction time studies, the hypothesis that a biological variable might form the basis of general intelligence has received increasing support. This variable is best thought of as reflecting differences between individuals in the speed or efficiency with which information in transmitted in the nervous system.

NON-UNITARY THEORIES OF INTELLIGENCE

Gardner's theory of multiple intelligences

Ever since Thurstone (1938), there has been a long series of challengers to Spearman's unitary conception of intelligence. Probably the most influential is Gardner (1983), an educationalist who believes that the classical view of intelligence reflects a Western bias towards logical reasoning, which in turn is reflected in our educational system.

Whether we are considering intelligence in terms of processing capacity, or considering Thurstone's primary mental abilities, or reviewing the tasks that are routinely included in intelligence tests, Gardner believes that we typically only focus on a narrow range of logico-mathematical abilities. His theory of *multiple intelligences* accounts for the diverse

multiple intelligences Gardner's theory that there are many autonomous intelligences including linguistic, musical, logical–mathematical, spatial, bodily–kinaesthetic, personal, naturalist and spiritualist

Research close-up 2

A classic study using inspection time

The research issue

Nettelbeck and Lally (1976) were the first to use inspection time in research on intelligence. The hypothesis was that differences in speed of information processing might underlie IQ differences. This experiment aimed to take a novel index of the speed of perceptual encoding and examine whether 'more intelligent' people encode information faster than do 'less intelligent' people.

Design and procedure

Ten male participants aged 16–22 years with a mean IQ of 83 (range = 47–119) took part in the study. Three of the participants with the highest IQs were referred for the study because of problems associated with minor injuries or for assistance with behavioural problems. The seven with the lowest IQs were referred because of their inability to cope with open employment.

The stimuli were drawn on cards and presented to the participant using a *tachistoscope* – a device that allows very fast presentation of visual material. (Nowadays, stimuli are presented on computer monitors.) The stimuli were two vertical lines of markedly different lengths joined at the top by a short horizontal bar. For one type of stimulus, the shorter of the lines was on the left, and for the other type it was on the right (see figure 13.4).

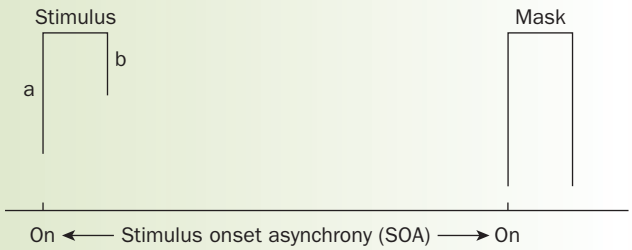

Figure 13.4

A second measure of speed of processing. This shows the typical stimulus used in an inspection time task. Here participants must decide which line in the figure is the shortest (line *b* on the right). The task is made difficult by having a short stimulus presentation, which is terminated by a masking stimulus. Source: Anderson (1992).

The participants simply had to decide whether the long line was on the left or the right of the stimulus. The task was made more difficult by covering up the stimulus with another card that showed two lines of equal length that were thicker and longer than the longest line in the test stimuli. In this way, the second card acted as a 'backward masking' stimulus that destroyed the information contained in the first test stimulus.

The exposure duration of the test stimulus for each trial was manipulated by varying the time between the onset of the test stimulus and the onset of the masking stimulus (stimulus onset asynchrony, or SOA). On each trial, the participant had to press a key to indicate whether the short line on the test stimulus was on the left or on the right.

Participants were given 105 trials of different exposure duration in each testing session. The first five trials were for practice only, and were excluded from subsequent analyses. The importance of accuracy rather than speed was emphasized. For each participant an inspection time was extrapolated from the data relating accuracy to SOA in order to estimate the shortest exposure required for 97.5 per cent accuracy in decision making.

Results and implications

Estimates of inspection time correlated −0.92 with performance IQ (PIQ) derived from administration of the Wechsler Adult Intelligence Scale (WAIS), but, interestingly, the relationship with verbal IQ (VIQ) derived from the WAIS was not statistically significant. So the study showed that a very simple measure of perceptual speed is related to IQ differences, although this association was specific to one form of IQ (i.e. performance rather than verbal IQ). Subsequent research has suggested that PIQ has a higher visual-spatial component than does VIQ, which might explain this finding.

By today's standards, this study is methodologically weak – there are too few participants, too many of them have low IQ for a study that hopes to extrapolate to normal variation in intelligence, and the psychophysical procedures are less than perfect.

But the basic relationship with IQ observed here has held up, with meta-analyses suggesting that the correlation is about −0.5. So inspection time as a task has become a cornerstone of theories proposing that differences in general intelligence might be due to global differences in speed of information processing.

Nettelbeck, T., & Lally, M., 1976, 'Inspection time and measured intelligence', *British Journal of Psychology*, 67 (1), 17–22.

range of important adult capacities by considering a diverse range of abilities, each of which he values as highly as traditional conceptions of 'intelligence'. Gardner lists these autonomous intelligences as linguistic, musical, logical–mathematical, spatial, bodily–kinaesthetic, personal, naturalist and spiritualist (Gardner, Kornhaber & Wake, 1996). Each is manifested, suggests Gardner, in culturally relevant 'intelligent' behaviours, with normal adults having differing profiles of relative strengths and weaknesses across these intelligences.

Gardner's abilities were identified from a diverse body of evidence, including:

- the selective damage of individual abilities through brain damage;
- the existence of otherwise very low-IQ individuals who display extremely well-developed ability in one intelligence (*savants*);
- examples of excellence in one domain but ordinariness in another (e.g. Mozart was a musical genius but struggled in many other aspects of life); and
- the constraint that the ability should be culturally valued and have a plausible evolutionary and developmental history.

Gardner's multiple intelligence model made a significant impact in the field of education, with schools developing broader and more responsive approaches to assessment, and a more diverse curriculum to help develop individual intelligences in each student. But not only is Gardner alone in claiming that there is no general factor of intelligence, he also provided no theoretical specification of what any of his proposed intelligences constitute, or how they work at any specific level of description – social, cognitive or biological (see Anderson, 1992). This makes gathering evidence for the theory of multiple intelligences problematic. Although it is a challenging and somewhat appealing idea, there is no evidence for true autonomy of intelligences either – rather the reverse. As we have seen, as per the earlier theorizing of Charles Spearman, diverse abilities are generally correlated.

That said, the idea that there is more to intelligence than *g* alone is now generally accepted. The challenge for the future is to develop a theory that makes *g* compatible with the observed degree of specificity in intellectual functioning that has been outlined as evidence by Gardner. Finally, Gardner's desire to emphasize the value of a diverse range of human talents is laudable, but attempting to achieve this by re-naming them 'intelligences' can lead to confusion and errors in application. For example, we may encourage unrealistic expectations of people if we adopt the position that there is a genius in us all and we just need to find our hidden gift – paradoxically we may put children under pressure to 'find their intelligence'. While it is a truism to say that we all have our strengths and weaknesses, few of us will truly excel, even with concentrated application in one domain.

A hierarchical structure for intelligence

Sternberg (1984, 1985) also proposed a non-unitary theory – the triarchic theory of intelligence. Like Gardner, he proposes several types of intelligence: analytical intelligence (which approximates the traditional notion of *g*); creative intelligence (which involves insight, synthesis and the ability to respond to novel situations); and practical intelligence (which involves the ability to solve real-life problems). But in his theory Sternberg attempts to go beyond this to explain how these intelligences work. He suggests that each kind of intelligence involves a control hierarchy of *cognitive components* that contribute to our 'mental self-management' – these include a) performance components, b) knowledge acquisition components and c) metacomponents.

cognitive components basic information-processing routines (e.g. encoding, response selection) which underpin task performance

At the bottom of the hierarchy are the elemental performance components. These are the information-processing mechanisms involved in the execution of any task and invoked by a particular sequence of operations, such as encoding, inference and response selection. Sternberg came to the conclusion that although performance components contribute to individual differences in intelligence, overall the contribution is weak, with correlations rarely exceeding 0.3. Knowledge acquisition components are those processes involved in the gaining and storing of information – processes such as memory – and in turn, these components will evolve performance components in the service of their own functions.

At the top of Sternberg's processing hierarchy are metacomponents. These are executive processes responsible for planning task solutions and monitoring feedback from performance and knowledge acquisition components. Sternberg claimed that the major individual differences related to intelligence are found in these metacomponent processes. In other words, intelligence is the province of the processes principally involved in problem-solving strategies (high-level components) rather than the information processing (low-level components) that implements the problem-solving routines. So, for example, one of Sternberg's metacomponents is responsible for recognizing the nature of the problem set by a cognitive task.

Although Sternberg has written extensively on his theory, it reads more like a re-statement of how intelligence is manifested rather than an explanation of it. Furthermore, recent reviews of the theoretical and empirical support for the theory do not support the notion that creative or practical intelligences are as important as analytical intelligence (i.e. an approximation of *g*) in predicting life success (Brody, 2003a; Gottfredson, 2003).

INTEGRATING CURRENT ISSUES

A century after Galton and Binet, we are now making progress in developing new models that draw together some of the apparent contradictions of earlier research. And we have moved some way towards understanding both individual differences and developmental change in 'normal' intelligence, as well as in exceptional intellectual populations. Work in the field of intelligence has never been more vibrant at both the level of theory development and at the level of applied research and practice.

Our overview of new research on intelligence begins with a couple of contemporary theories. These will allow us to look at two areas of research that today are regarded as test-beds of any comprehensive theory of intelligence – *savant* syndrome and the nature of mental retardation.

But first please note that the terms 'retarded' and 'mental retardation' are being used here in a professional-technical sense with a very specific definition of measured IQ being less than 70. It is offensive to use the word 'retard' to refer to an individual who could be given the diagnostic label 'retarded', and the term 'retard' should always be avoided, as the intellectual abilities of such people are clearly not defining features of them as individuals.

These two cases are important in evaluating theories of intelligence because they are anomalies, that is they are exceptions in terms of intellectual ability. Any theory that comprehensively characterizes the concept of 'intelligence' must be able to explain what is 'normal' as well as that which is exceptional.

Detterman – the best of both worlds

Detterman (1986, 1987, 1996) claims to have solved the two major (and related) oppositions in the history of intelligence theory:

1. Intelligence as a low-level, global property of all intellectual operations vs. intelligence as a high-level, complex intellectual function – as we have seen already, the first view is advocated by Galton, Spearman and Jensen whereas the second is advocated by Binet, Thurstone and Sternberg.
2. Intelligence as a general ability (again as advocated by Galton, Spearman and Jensen) vs. intelligence as specific abilities (as advocated by Thurstone and Gardner).

Detterman's solution to these oppositions is to take the 'best of both worlds' – general intelligence is real, but rather than being a single 'ability', it is better viewed as a high-level property of a complex system composed of multiple intelligences. Detterman argues that the performance of any complex task, including intelligence tests, requires a number of basic abilities. In this scheme, general intelligence represents an average of the processing of several independent components that contribute to the performance of any complex task.

This contrasts with Spearman's proposal that there is a single ability common to all tasks and that differences in this single ability between individuals (hypothesized, for example, by Jensen to be represented by differences in speed of processing) give rise to differences in 'general' intelligence. Although these conceptions may sound similar, if Spearman is right, we have two important empirical predictions:

1. there should be a single task that correlates as highly with a standard measure of intelligence as measures of intelligence correlate with each other; and
2. if two tasks are correlated with a measure of general intelligence, they should also be correlated with each other.

Detterman considers that both of these predictions are falsified by actual data. Measures of basic cognitive functions in fact have low correlations with each other, and no single basic task correlates with *g* as highly as Spearman would predict. Detterman cites Guilford (1964), who measured correlations between tests that he believed reflected 150 facets of intelligence. Each test individually correlated with the general measure of IQ derived from the test battery. But a full 17 per cent of 7000 or so correlations between tests were effectively zero.

On the other hand, Deary and Stough (1997) have argued that the correlation between inspection time and IQ is high enough to support the prediction that Spearman's *g* might be measurable by a single simple task. It is also unclear to what extent in Guilford's studies the zero correlations between tasks were due to the different reliabilities of the elementary tests used or to the use of participants with a restricted range of abilities. Nevertheless, Detterman has pointed to a new approach to resolving what are now very old disputes in the intelligence literature.

Anderson – two routes to knowledge

Anderson (1992) attempts the same synthesis as Detterman (that is, between low-level and high-level views of intelligence, and between general and specific abilities) but incorporates a developmental dimension. Anderson's theory is also framed within a general theory of cognitive architecture proposed by Fodor (1983).

minimal cognitive architecture Anderson's model of intelligence outlining two main contributors to the gaining of knowledge: speed of information processing and modular development

Anderson's theory of the *minimal cognitive architecture* underlying intelligence and development argues that intelligence tests measure intelligence by assessing knowledge, but that knowledge itself is acquired through two different routes, as proposed by Fodor. The major proposition is that these two processing routes are related to the two different dimensions of intelligence – one related to individual differences (viz Galton, Spearman and Jensen) and the other to cognitive development (viz Binet and Piaget).

Central processes of thought

central processes Fodor's term for the kinds of proposed information processing carried out in thought as distinct from those carried out by mental 'modules'

Anderson suggests that the first route to knowledge is through thought (*central processes*) and is related to differences in IQ.

Thoughtful problem solving can be done either by verbalizing a problem (using language-like propositions to think) or by visualizing it (using visuo-spatial representations to think). For this to happen, we need two different kinds of knowledge acquisition routines, each generated by one of two specific processors. It is proposed that these processors are the source of individual differences in specific abilities, which, in turn, are constrained by the speed of a basic processing mechanism. So, at a slow processing speed, only the simplest kinds of thoughts of

either kind can occur (It is argued that the speed of the basic processing mechanism can be measured using tasks such as inspection time and reaction time.). It is suggested by Anderson that this constraint is the basis of individual differences in general intelligence and the reason for manifest specific abilities being correlated (giving rise to the *g* factor).

Information-processing modules

modules dedicated information-processing systems that provide information about the environment (e.g. complex information conveyed by people's faces) which cannot be provided by central processes of thought in an ecologically useful time frame

The second route to knowledge is through dedicated information-processing *modules*, and it is argued by Anderson that this route is related to cognitive development.

It is suggested that modules have evolved to provide information about the environment that cannot be provided by central processes of thought in an ecologically useful time frame. For example, if we had to 'think through' all the perceptual information presented to us in order to construct a three-dimensional view of the world, we would be literally lost in thought. Because this activity is so important to us and requires great computational power and speed, it is suggested by Anderson (building on Fodor) that evolution has created special modular devices to allow us to do this automatically. Anderson theorizes that this is catered for by the 'perception of 3D space' module illustrated in figure 13.5.

Other examples of likely modules are language acquisition devices, face recognition systems, and the core computational procedures involved in acquiring a theory of mind (Leslie, 1987; see chapter 9).

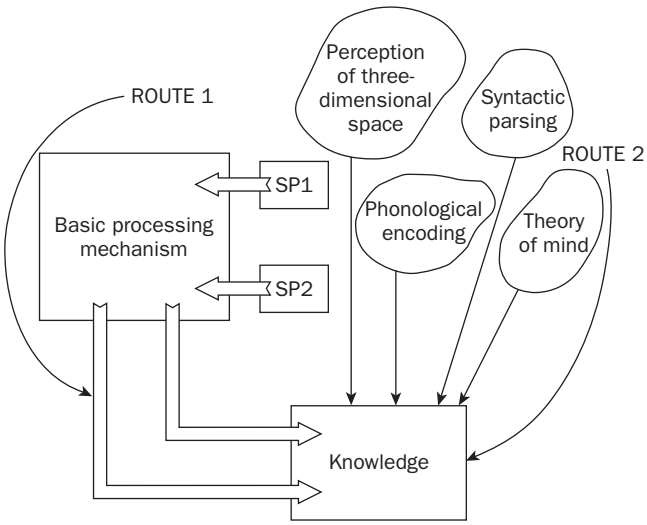

Figure 13.5

The theory of the minimal cognitive architecture underlying intelligence and development. (SP1 and SP2 denote specific processors.) Source: Anderson (1992).

According to Anderson's viewpoint, the maturation and acquisition of modules is the prime cause of developmental change. Because modules function independently of variations in the speed of the basic processing mechanism, their operation is independent of differences in IQ. This means that, according to Anderson, individual differences and cognitive development represent two independent dimensions of intelligence. It also means that these complex modular attributes are available to non-brain-damaged individuals with intellectual disabilities.

While evidence for, and application of, Anderson's model is increasing (Anderson, 2001), a theory such as this is necessarily constrained by imperfections in the tasks (such as inspection time) used to measure the hypothetical, biological basis of speed of processing. Indeed others have suggested that inspection time, for example, is more related to specific visual processes than to general intelligence (Burns, Nettelbeck & White, 1998; Deary, 2000).

What do we mean by 'mental retardation'?

As mentioned previously, mental retardation is a diagnostic category applied to individuals with an IQ below 70 in the presence of other limitations in functional skills, such as communication, self-care and social skills. People with mental retardation make up approximately 3 per cent of the general population.

Interestingly, there are more severely mentally retarded individuals (i.e. with IQs under 50) than the normal distribution of IQ strictly ought to allow. There is relatively high heritability of IQ (Bouchard et al., 1990), and it is likely that low-*g* is the major form of inherited mental retardation (Spitz, 1992). In addition, there are specific clinical etiologies, including Down's syndrome, Fragile-X, autism and Praeder-Willi syndrome, that have little in common other than mental retardation (Simonoff, Bolton & Rutter, 1996).

These characteristics support the idea that there are two distinct groups of people with mental retardation – those with known organic etiology and those who represent the low end of the normal distribution of general intelligence (Zigler, 1967, 1969). While there is a clear theoretical value in distinguishing these groups, its importance for predicting everyday behavioural competence is disputed (Burack, Hodapp & Zigler, 1990; Goodman, 1990). To put it another way, IQ is a good predictor of functional abilities no matter how it comes about, but each low-IQ group may require different approaches to education and home care.

Theories of retardation

The development debate

What of the development of intelligence in those with mental retardation? The classic debate has been framed around two views. The developmental view states that while the retarded as

a group are disabled with respect to their same-age peers, they go through the same (Piagetian) stages of cognitive development (Zigler, 1969). They simply develop more slowly. The difference view, by contrast, says that there is a fundamental deficit associated with mental retardation, which means there can be no real cognitive equivalence between someone with mental retardation and a non-retarded person (Spitz, 1982). There is no point at which a person with low IQ will 'catch up' or reach adult levels of cognitive functioning.

The majority of studies have found that participants with mental retardation perform more poorly on most cognitive tasks even when matched for mental age with the control group. This phenomenon, termed 'mental-age lag' by Spitz (1982), supports the difference, or deficit, position. But a series of meta-analyses by Weiss and colleagues (1986) split the developmental view into two components: (a) cognitive stages defined within a Piagetian framework and (b) cognitive structures as defined by basic information-processing operations. This appoach implies that both the developmental and difference theorists are right. Children with mental retardation go through the same kinds of knowledge restructuring as described by Piaget, but do so more slowly than non-retarded children. But children and adults with mental retardation will always suffer a fundamental deficit in efficient (intelligent) information processing, even when compared with mental-age peers. So low IQ has a pervasive and enduring effect that is not ameliorated by progression through the stages of normal cognitive development.

Testing Detterman's theory

As Detterman (1987) has pointed out, it is a curiosity that while the study of mental retardation has a long history and has contributed to an understanding of intelligence in general, there have been few explanations of mental retardation in terms of contemporary theories. Those with retardation are regarded as simply deficient in whatever processes are hypothesized to contribute to intelligence.

Such theories as there are – for example, that people with mental retardation are specifically deficient in attentional processes (Zeaman & House, 1963) or laying down memory traces (Ellis, 1970) or in executive processes (Belmont & Butterfield, 1971) – have, in turn, lacked any real applicability to theories of intelligence in general.

So how does Detterman's theory fare in helping us to understand mental retardation?

To explain the phenomenon that individuals with mental retardation are poor on all cognitive tasks, Detterman (1987) has two theoretical options.

1. Because general intelligence is, by his definition, the average of all the independent component abilities, then chance alone would lead us to expect *savants* to be more common than they are.
2. But Detterman himself favours the second option, which is to suppose that some of the abilities are more commonly used than others. So while the basic abilities in Detterman's theory are independent of each other, he supposes that one or two of these abilities are more 'central' for all of us – i.e. involved in most higher-level abilities – and it is these 'central' abilities that are deficient in people with mental retardation.

Detterman accommodates both the developmental and difference positions by claiming that Zigler's developmental view applies to molar (or higher-level) measures. He argues that these are aggregate measures of the operation of the system as a whole. According to Detterman, Spitz's (1982) difference view, by contrast, applies to molecular (or low-level) measures. In this context, molecular measures would be measures of the basic cognitive abilities, each of which contributes to the functioning of the system.

While this neatly synthesizes the developmental and difference positions, it does prompt the question of why, on nearly all tests of basic abilities, not just a few central ones, groups with retardation perform more poorly than their mental-age-matched non-retarded peers. Indeed, it further prompts the question of how we can distinguish, in principle, between central abilities (i.e. those most deficient in people with mental retardation) and other basic abilities in a way that is not merely ad hoc.

Testing Anderson's theory

In Anderson's theory of the minimal cognitive architecture, the two causes of intelligence echo (to some extent) the pervasive view that there are two kinds of mental retardation.

The primary cause of mental retardation is deemed to be a slow basic processing mechanism (Anderson, 1986). This view implies that the majority of retarded individuals represent the tail of a statistical distribution of processing speed across the general population but these individuals will not necessarily have compromised modular functioning. For example, Moore, Hobson and Anderson (1995) and Anderson and Miller (1998) have shown that those with mental retardation may be as capable as anyone of executing the module-based, complex, perceptual processes underlying person perception and some aspects of object perception. In contrast, performance on simple perceptual discrimination that is required by a standard inspection time task is impaired in the group of individuals with mental retardation.

According to Anderson, a secondary hypothesized cause of mental retardation is where the absence of, or damage to, a module leads to a general cognitive deficit because of the module's central role in cognitive functioning. If representations (e.g. linguistic representations) are missing because of damage to a module, there will be striking patterns of cognitive breakdown in specific areas. But these deficits are not confined only to those areas where modules 'feed in' to a range of other cognitive skills. The clearest example of this is the association between mental retardation and autism (Anderson, 1998; Frith, 2003; Frith & Happé, 1998). It has been suggested that modular damage, specifically to the 'theory of mind' module (see chapter 9), may underlie specific cognitive deficits in autism (Baron-Cohen, Leslie & Frith, 1985; Frith, 1989; 2003; Leslie & Thais, 1992). A 'theory

of mind' module would normally include representations like 'she wants' or 'he wishes', which are used to make inferences (i.e. to think) about social interactions. The absence of these kinds of representations not only makes any reasoning about human behaviour strikingly difficult, but, interestingly, it also seems to spill over to make most everyday problem solving extremely difficult and computationally expensive. It certainly results in low IQ scores.

Equally, Anderson's theory of the minimal cognitive architecture predicts that the normal apparatus underlying thoughtful processing might be spared in those with 'modular' deficits, in which case these individuals should show normal levels of speed of processing. This has recently been confirmed for performance on an inspection time task, where autistic participants were shown to have, if anything, superior levels of speed of processing (Scheuffgen et al., 2000).

As for the developmental versus difference views, Anderson argues that cognitive development is determined primarily by the acquisition of modules and that this accumulation will change the (Piagetian) cognitive stage of the child. Anderson suggests that modular functions are independent of IQ, so modules should be acquired according to the same developmental sequence in children with retardation as in other children. This could explain the finding from Weisz and colleagues that, in terms of Piagetian development, there is no deficit associated with mental retardation. But Anderson's theory of the mimimal cognitive architecture also accommodates the difference position. If the majority of children with mental retardation have slow speed of processing, this explains why they are still deficient in on-line processing (as measured, for example, by inspection time) compared with their non-retarded peers, even when matched for mental age.

Savant syndrome

Savants (formerly known as *idiots savants*) are individuals with measured IQ in the mentally retarded range who, nevertheless, display a single and exceptional cognitive ability.

For example, they might be able to calculate what day of the week any named calender date falls on (O'Connor & Hermelin, 1984). They might display high musical ability (Sloboda, Hermelin & O'Connor 1985) or artistic talent (Hermelin & O'Connor, 1990). Or they might be unusually skilled at learning foreign languages (Smith & Tsimpli, 1995) or factoring numbers (Hermelin & O'Connor, 1990). How are such feats possible if the general intelligence of these individuals is in the retarded range?

The memory explanation

An early view of *savant* skills was that they are based on an exceptionally good but essentially unorganized rote memory system and/or extensive practice (Hill, 1978; Horwitz et al., 1965). More recently, it has been suggested that many *savant* skills can be explained in terms of an extensive but generative (rather than passive) memory for domain relevant material (Nettelbeck, 1999; Nettelbeck & Young, 1996; Young & Nettelbeck, 1994).

Figure 13.6

Dustin Hoffman cleverly portrayed a character with *savant* syndrome in the movie *Rainman*.

There are some problems with the memory explanation of all *savant* abilities, though. O'Connor and Hermelin (1984, 1992), for example, found that calendrical calculators (those who can calculate what day a particular date falls on) can name days for dates for which no calender yet exists. They also use abstract rules and structures governing the calendar in order to perform their calculations (Hermelin & O'Connor, 1986). The memory explanation also seems an unlikely basis for artistic talent and for some other calculating abilities, such as the prime number calculating individual investigated by O'Connor and colleagues (Anderson, O'Connor & Hermelin, 1999; Hermelin & O'Connor, 1990). On the other hand, if *savants'* feats are accomplished using some kind of automatic or non-thoughtful processing (automatic long-term memory retrieval is the classic example of this), there is no inherent contradiction with the notion of *g*. However, it should be noted that there have even been suggestions of specific forms of memory deficits in autism (see Shalom, 2003, for a recent review).

Detterman (1996) does argue that *savants* falsify the idea that there is a single and common ability underlying all intellectual

task performance. In so doing, Detterman takes a similar line to that advocated by Gardner (1983), namely that *savants* prove the fundamental independence of the component abilities that 'normally' make up *g*. Yet this feels just a little too easy. For one thing, the abilities that *savants* display are somewhat implausible candidates as the 'component abilities' of Detterman's theory. After all, *savant* skills represent rich, high-level abilities in themselves, not the basic procedures of information processing described by Detterman. Moreover, recent research with calendrical calculators has found that they are not talented mathematicians (although some have adequate mathematical ability), which challenges one of the main tenets for Gardner-like models of multiple intelligences (Cowan, O'Connor & Samella, 2003).

The modular explanation

Anderson's theory of the minimal cognitive architecture assumes that the brain damage that leads to *savant* syndrome has selectively spared some modules from the generalized brain damage that has led to mental retardation in these individuals. It is proposed that these modules come in three kinds:

- *Mark I modules* are the full blown innate variety that most plausibly underlie *savant* talents in art, music and language. They are represented by all but one of the modules shown in figure 13.5.
- *Mark II modules* are the fetch-and-carry mechanisms of cognitive processing, such as long-term memory retrieval, or the ability to recognize mental representations that forms the basis of the 'theory of mind' mechanism (Leslie, 1987).
- *Mark III modules* are associative processes established after extensive practice, and they are not explicitly represented in figure 13.5.

According to Anderson, because *savant* abilities are modular there is no paradox in their existence in individuals with low IQ, which is a property of thoughtful processing. Frith (2003), Smith and Tsimpli (1995) and others have presented this model as the best fit for explaining observations of *savant* syndrome.

ENDURING ISSUES

Two enduring issues that have bedevilled research in intelligence are the genetics of IQ, and the relationship between race, genes and intelligence.

THE GENETICS OF IQ

Before considering whether intelligence 'runs in families' and, more specifically, how we can tell whether there is a genetic contribution to differences in IQ, it might be helpful to look at a few basic terms and methods from quantitative behavioural genetics – the discipline that aims to answer these questions.

Figure 13.7

Identical twins have identical genotypes, which makes them interesting participants for intelligence studies.

genotype our genetic complement, coded in DNA, that we inherit from our parents

phenotype the expression of our genes in behavioural traits that we can measure

Our *genotype* is the genetic complement, coded in DNA, that we inherit from our parents. No two people have identical genotypes except identical twins. The expression of those genes in behavioural traits that we can measure is called our *phenotype*. Phenotypes can vary because of genotypic differences and/or because the environment affects how our genes are expressed. IQ test scores are phenotypic measures, and intelligence is one of the most frequently researched traits in behavioural genetics simply because IQ represents one of the most reliable and important psychological measures.

Genetic contributions to IQ differences can be estimated by comparing the similarity of IQ in individuals of different degrees of genetic relatedness while also assessing environmental similarities and differences. Heritability is a statistic that represents the proportion of phenotypic variance that is due to genetic differences – that is, the extent to which differences in measured intelligence are due to genetic differences. The maximum possible heritability is 1.0 (100 per cent of the difference is inherited) and the minimum is 0 (none of the difference is due to genetic differences).

The influence of environment

The influence of the environment on phenotypes comes in two main forms. There are differences between families (levels of income, parental rearing style, number of books in the home, etc.) which make children raised in a particular home more similar to each other than to children reared in a different home. This source of differences is often called the effect of the *shared*

environment. The second kind of environmental influence is differences within the same family (in birth-order, children's friends, school teachers, etc.). These effects make children in the same family different from each other and are referred to as *non-shared environment* effects.

We can measure the influence of the common, or shared, environment by comparing individuals who are reared together or apart. The extent to which pairs of individuals are more similar when they are brought up in the same home is a measure of the importance of the common or shared environment. For example, if the home environment makes a difference it should increase the similarity of, for example, identical twins when they are reared together compared with when they are reared apart (i.e. when they are adopted into different homes). Similarly, the extent to which siblings who are reared together in the same home but who are genetically unrelated (because one or both is adopted) are similar to each other gives an estimate of the influence of shared environment.

The effect of non-shared environmental variance can be detected in a number of ways. The most obvious is to measure the extent to which identical twins reared together (i.e. with both genetic and shared environmental variance in common) are different from each other due to the non-shared environmental influences they may experience when growing up (e.g. at school, or from peers).

Do we inherit our IQ?

Studies on the influence of genetic differences on intelligence are in broad agreement. Intelligence, as measured by IQ tests, has a substantial heritability.

Estimates of heritability vary between 80 per cent (Bouchard et al., 1990) and 50 per cent (Plomin 1990). So even the more conservative estimates argue that genetic differences are far from trivial – they are at least as important as environmental differences, and maybe more so. The Bouchard et al. (1990) study is particularly important because these researchers measured a number of variables that can potentially confound (see chapter 2) twin studies (such as the length of time the twins had been in contact with each other) and attempted to determine their influence on the estimate of heritability. It turns out that these effects are minor, contributing at most 3 per cent to the estimate of 70–80 per cent heritability in their study.

The many studies from the Colorado Adoption Project (see Plomin, 1990) estimate the heritability of intelligence at about 50 per cent. They suggest that the shared environment is more influential early in development than in later life (see figure 13.9). For example, the correlation between adopted children and their biologically unrelated siblings (who are usually reared from birth in the same family) averages around 0.2–0.3 before their teenage years.

The importance of life events

Over the whole lifespan it seems that the most important environmental differences are those that are non-shared and unique to the individual concerned (that is, they are not shared by members of the same family). So rather than the major socio-economic variables (which represent a large part of the shared, or common, environmental variance) being the principal environmental contributor to difference in intelligence, it is unique life events that make up the major environmental contribution.

Pioneer

Figure 13.8

Through his study of twins, Sir Cyril Burt concluded that intelligence is largely hereditary.

Sir Cyril Burt (1883–1971) encouraged new methodological rigour in data analysis through his use of factor analysis of complex data sets. He also contributed significantly to the development of intelligence testing methods, schools for children with intellectual disabilities, child guidance clinics, and the 11+ testing system in the UK in which all 11-year-olds were assessed for intellectual potential to provide optimal educational opportunities. However, it is probably for his analysis of twin IQs that he is best known. Burt compared twins raised together with those adopted out and concluded that intelligence is largely hereditary. In the latter part of his career, Burt was charged with falsifying data in his groundbreaking twin studies, but his findings have been supported by more recent research.

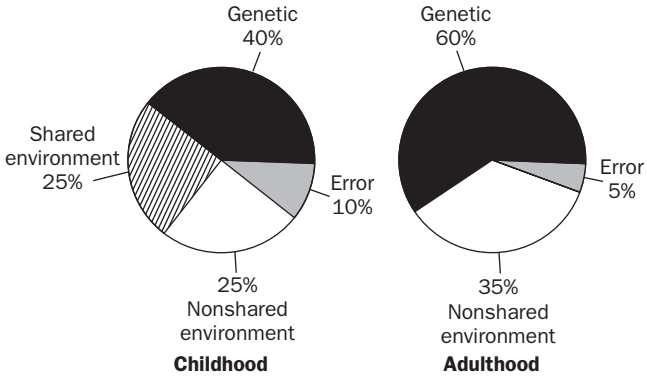

Figure 13.9

The proportion of variance in general intelligence accounted for by genes increases with development, while that accounted for by shared environment decreases. Source: Plomin et al. (1997).

In a review of adoption and twin studies, Scarr (1992) estimated that the contribution of the shared environment to differences in IQ is approximately zero by adulthood. This is consistent with the finding that the heritability of *g* increases throughout our lives (McGue et al., 1993), beginning at about 20–30 per cent in early childhood and increasing to about 50 per cent after adolescence (Bishop et al., 2003; Spinath et al., 2003). This may be explained by the increasing influence of the biological underpinning of intelligence across the lifespan, as the effect of the shared environment decreases.

All this means that, irrespective of our shared environment, most of us find ways ultimately to realize our genetic potential, depending on the effects of our idiosyncratic life events (i.e. non-shared environment).

Finding the IQ gene(s)

Most recently great excitement has surrounded the methodology of quantitative trait loci (QTL), which attempts to associate particular genes with specific behaviours. Researchers compare the DNA of a tightly defined group of individuals considered 'high' on some trait with the DNA of control individuals who, ideally, only differ by being 'low' on the same trait. In so doing, they hope to find genes that contribute to difference between the two groups.

This method has been successful at finding genes that appear to be associated with discrete pathological conditions, such as reading disorder (Cardon et al., 1994) and autism (Bailey et al., 1995). But the general consensus is that intelligence must be *polygenic*, which means that many genes contribute in an additive or dose-related fashion to IQ differences. If this is right, current QTL methods have very little chance of discovering the individual genes that each contribute only a relatively small proportion to the overall genetic effect. Even so, some researchers claim to have discovered a gene that is over-represented in individuals with a very high *g* (Chorney et al., 1998). While exciting, this methodology is new, and its results should be treated with caution.

Almost everyone now accepts that there are genetic influences on IQ differences, but the most important recent discoveries concern environmental rather than genetic influences, particularly the finding that it is the non-shared environment that has a lasting effect on individual intellectual differences. The challenge is to move on from the heritability issue to theories of how genetic predispositions may interact and correlate with environmental circumstances to produce the patterns of IQ differences that we find in our society (see Scarr, 1992).

Race, genes and intelligence

The issue of the genetic influence on intellectual functioning has historically gone hand in hand with the inflammatory issue of racial differences in intelligence. There is some conflict surrounding the term 'race' and whether, in fact, it is a scientifically valid entity. The term 'ethnicity' has been suggested as a more accurate alternative, but we use the term 'race' here to reflect more accurately the categorization used in the published research.

The race–IQ debate

In 1969, a famous article by Arthur Jensen provided a spark that re-lit the race–IQ debate. He commented that a much-lauded programme of early academic intervention for socially disadvantaged children, known as the Headstart Program, had not resulted in any increase in IQ, and that this was likely to be due to the genetic contribution to intelligence.

The idea that an important human trait like intelligence might be, in part, genetically determined and – worse – associated with racial characteristics spawned a stream of outrage, with claims of inherent white Caucasian racial superiority (see Gould, 1996, for a critical review). Such claims had been used in association with the availability of intelligence testing to support a discriminatory immigration policy in the United States in the early part of the twentieth century, favouring Anglo-Saxon immigrants over those of other nationalities on the (plainly ludicrous) grounds that the average IQs of the latter were in the feeble-minded range.

As recently as the 1970s, William Shockley, a Nobel laureate for physics (and therefore no expert in psychology), advocated a financial incentive scheme where individuals would be paid not to breed, the amount increasing as IQ decreased. Even more recently, Rushton (1997) has claimed evidence for genetically determined differences between races in many behavioural traits – intelligence being the most important.

And finally, publication of *The Bell Curve* (Herrnstein & Murray, 1994) reignited the fuse primed by Jensen's famous review. Not only did it claim overwhelming support for the idea that race differences in IQ are in part genetically determined, but it implied that nearly all social disadvantage of racial groups can be traced not to societal discrimination, but to inherited differences in IQ.

This issue is large and complex enough to warrant the many books and articles devoted to its discussion (for example, see Gould, 1996; Jensen, 1987; Rose, Lewontin & Kamin, 1984) and also to have evoked a strong and unprecedented public statement signed by 52 intelligence researchers in the *Wall Street Journal* in

December 1994, outlining what is known and what cannot reasonably be extrapolated from research on race and IQ.

The core of the race arguments rests on two major propositions, both of which we know are not true:

1. The reliably observed difference in mean IQ – amounting to one standard deviation – between black and white Americans is due to an inherent bias of IQ-type tests against minority groups (see figure 13.10). While some tests undoubtedly show some cultural bias, this is neither systematic nor large enough to account for these reliable IQ differences (see Herrnstein & Murray, 1994; Neisser et al., 1996). Most authorities now accept that the differences measured by IQ tests represent real differences in intellectual attainment. What is denied by most authorities in the field, however, is that these differences are genetic in origin. This brings us to the second untrue proposition.
2. Because we now know that individual differences in measured IQ have a large genetic component, it is probable that differences in IQ that may be observed between races are genetic in origin too (Herrnstein & Murray, 1994).

What we do know is that the heritability of within-population differences is logically independent of between-group differences in means (Block, 1995). So, for example, when wheat is planted in a field, some genetic strains will produce more than others under the same soil conditions. In other words, there will be individual differences in yield that are attributable to genetic differences between strains of wheat. On the other hand, the average level of production is likely to be very different in different fields – and this is attributable to the large influence of the different soils (environment) in the fields. So the difference between group means (average wheat yields in each field) and the cause of the within-group individual differences (differences between the genetic strains in each field) are logically distinct.

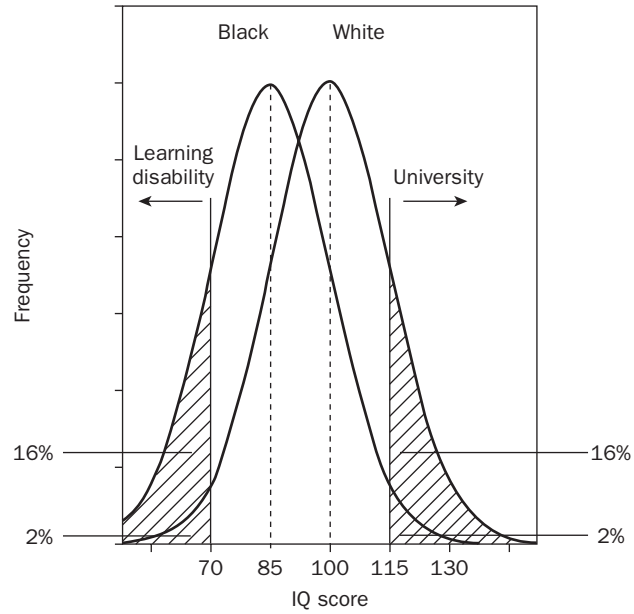

Figure 13.10

The consequence of one standard deviation difference in the mean of black and white populations for a set criterion based on IQ.

To bring this back to people, what this means is that we cannot necessarily infer that reliable differences between human groups ('yield of wheat in different fields') are due to similar mechanisms that determine differences within groups ('yield of

Everyday Psychology

Intelligence tests

Intelligence tests are widely used for a range of purposes, but what can they tell us? In 1994, the American Psychological Association Task Force on Intelligence summarized their findings on this subject in a review of research. They found that intelligence test performance correlates with school grades at about 0.50, total years of education about 0.55 and supervisor ratings of job performance between 0.30 and 0.50. This means that intelligence test performance is one of the best predictors we have of academic and work-related performance (Schmidt & Hunter, 1998).

On the other hand, the modest magnitude of these correlations suggests that other factors – such as personality and socio-economic status – also significantly contribute to these outcomes. Indeed a correlation was found between IQ and socio-economic status of about 0.33.

In addition to educational and vocational uses, intelligence tests form an important part of neuropsychological assessment for people with suspected brain injury, tumours or disease (such as dementia) (Lezak, 1995).

The Wechsler tests are now probably the most widely used individual tests of intelligence and have impressive reliability and validity. They include the WAIS (Wechsler Adult Intelligence Scale), the WISC (Wechsler Intelligence Scale for Children) and the WPPSI (the Wechsler Preschool and Primary Scale of Intelligence) – each devised very much in the spirit of the Binet scales. The tests are divided into performance and verbal subscales, and the resulting scores can be used to compute three intelligence quotients, or IQs – verbal, performance, and full scale (which is derived from combining the verbal and performance scores).

The verbal subscales, as their name suggests, usually require a verbal response and test verbal knowledge. Examples include:

- tests of vocabulary;
- general information, or common world knowledge (e.g. 'In which direction does the sun rise?');
- comprehension about problem solving in daily life situations (e.g. 'What would you do if . . . ?');
- ability to draw out similarities between objects or ideas (e.g. 'In what way are a dog and a cat alike?'); and
- ability to recall strings of numbers and/or letters.

The performance subscales do not require a verbal response. Instead they usually require the testee to manipulate pictures, objects and non-verbal symbols. Non-verbal tests are considered to be more 'culture-free' than other intelligence tests as they do not depend on language or culturally embedded knowledge (though it should be noted that no test can be completely 'culture-free').

The performance tests include:

- block design, in which red and white cube-shaped blocks must be arranged to match a pattern shown to the testee (see figure 13.11);
- matrix reasoning, in which a series of figures is presented and a missing figure must be identified from a set of alternatives (see figure 13.12);
- digit symbol, in which a list of arbitrary symbols must be replaced by their corresponding numbers under speeded conditions;
- picture completion, in which a missing part of a picture must be indicated;
- picture arrangement, in which a series of pictures must be arranged in an order that generates a coherent narrative; and
- object assembly – essentially a jigsaw puzzle involving familiar objects.

A major difference between the Wechsler tests and Binet's intelligence tests is the way in which IQ is calculated. The Binet tests typically calculated an IQ after first calculating a mental age (see page 272). The Wechsler scales, by contrast, calculate a deviation IQ directly from age norms – that is, IQ reflects the position in the distribution of scores obtained from a standardization sample of people of the same age.

Schmidt, F.L., & Hunter, J.E., 1998, 'The validity and utility of selection methods in personnel psychology: Practical and theoretical implications of 85 years of research findings', *Psychological Bulletin*, 124, 262–74.

Figure 13.11

The Block Design subtest from the WISC does not require a verbal response. Red and white blocks must be arranged in a particular pattern.

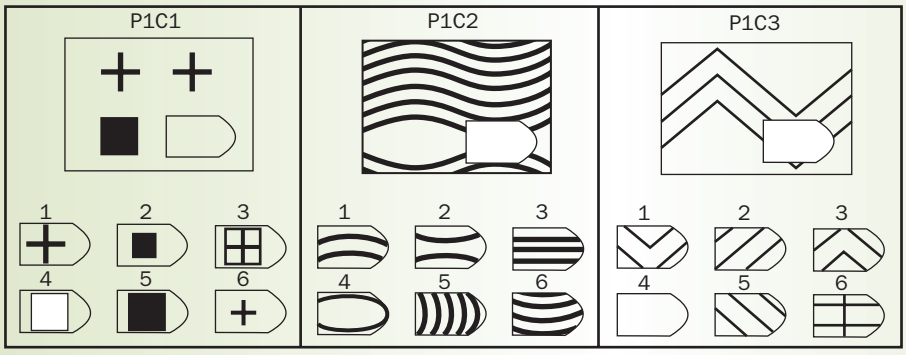

Figure 13.12

Example of a Matrices type item. The item that completes the pattern must be chosen from one of the six options.

wheat in the same field'). It is perfectly plausible, for instance, that differences in IQ between races are due to differences in the typical environment ('fields') across these races.

Explanations for the false correlation

Why is a genetic explanation usually cited by the proponents of racial differences in intelligence, rather than the more obvious environmental explanation (such as the different socio-economic circumstances of the two groups)? The likely reason is the association of group membership with a strong genetic marker – in this case skin colour.

To illustrate this point in another way, imagine a fictitious land governed by a dictator who wants a class of workers to perform the more menial roles in society. This dictator introduces the 'regime of the hammer', whereby every child with red hair (which, for the sake of this argument, we will presume is a highly heritable trait, just like black versus white skin colour) is tapped on the head with a hammer in a way that lowers their IQ by one standard deviation. This leads to an over-representation of red-haired people with lower IQ. The effect of such a heinous act on the population heritability of IQ (as calculated in a computer simulation) is shown in table 13.1.

The data show that, as desired by our dictator, red-haired people now have a lower mean IQ than people who do not have red hair. Yet the heritability of IQ in the whole population has only been reduced from an extremely high 80 per cent to a still very high 74 per cent by the hammer regime. This highlights two points:

1. The lower IQ of red-haired people is environmentally caused (by a hammer blow), even though it is correlated with a genetic difference. (Genetic differences lead to differences in hair colour, and it is the genes for red hair that lead to the environmental insult.) Because the genetic differences associated with hair colour are so compelling, it is likely that a genetic cause for the differences in intelligence will be seized upon and used to explain the lower IQ of people with red hair.
2. The environmental cause of the lower IQ of red-haired people is consistent with a high heritability for differences in the population as a whole. The analogy with black/white differences in American data should be obvious. If being black means a lifetime of disadvantage and different treatment, this environmental effect could cause a difference in group means in IQ (just like being hit on the head with a hammer) that is perfectly consistent with the idea that differences in general have a high heritability.

In case you are still finding it difficult to imagine environmental or cultural differences causing a difference as large as one standard deviation (the reliable race-related IQ difference) in the face of a high heritability for IQ, consider the 'Flynn effect'. Flynn (1987) has shown that there has been a standard deviation increase, per generation, in the mean level of intelligence test performance for most of this century in Western society, which equates to about three IQ points per decade. Such a difference has to be the result of an environmental change, because gene frequencies in populations could not change so quickly. If there can be shifts of one standard deviation in IQ between generations that are environmental in origin, despite the high heritability of IQ differences, why could there not be similar environmentally mediated differences between populations within the current generation?

Table 13.1 IQs of population and red-haired children before and after the hammer regime.

	Before hammer	*After hammer*
IQ mean	100.05	98.55
SD	15.01	15.65
Heritability	79.9%	74%
Red hair		
IQ mean		85.24
SD		15.17

FINAL THOUGHTS

Given recent progress in our understanding of the concept of intelligence, it is little wonder that we are on the brink of a new understanding of the interplay between genes and environment in shaping intelligence. Undoubtedly, great progress will be made in this area over the next few years. Perhaps some of you will be driving that process.

The question of the mechanisms underlying individual differences in intelligence is one of the oldest topics in psychology. This question has spawned not only a great deal of research but enormous controversy, which has been detrimental to the development of the science of intelligence. While this controversy is unlikely to go away, it now seems that, after some years of stagnation, the field is at last moving forward. New ideas for reformulating old problems and a greater understanding of the theoretical issues should lead to advances in our scientific understanding, and in the consequences of our knowledge for social issues. This is an exciting time to be involved in research on intelligence.

It is perhaps worth remembering another important finding from the research, that is that intelligence is not related to happiness (Kammann et al., 1979; Sigelman, 1981; Wilson, 1967). There is even evidence to suggest that genius is often associated with emotional turmoil and psychopathology (Albert, 1983). Nor should intelligence be placed above, focused upon more intensively, or valued more

greatly than other aspects of human ability in deciding on social policy. Psychologists traditionally involved in the study of individual differences have attempted to understand the complexities of human lives, needs and behaviours by considering the interplay between individual differences in a range of areas. These have included intellect, personality, physical attributes and opportunity. Each of these factors has been found to influence life achievement and performance significantly. Unfortunately, over recent years the field has become somewhat splintered, and the study of such multidimensional interrelationships is the exception rather than the rule. But perhaps (and hopefully) this is the direction of the future.

Summary

- The central discovery of research on intelligence is the existence of an attribute that we can call general intelligence.
- Spearman has been vindicated by modern research, particularly the finding that general intelligence may be related to a property of the brain that we can best summarize as speed of information processing.
- However, there is more to intelligence than Spearman's *g*, and in this sense the spirit of Thurstone, too, has been vindicated. Various theories accommodate the relationship between general intelligence and more specific abilities differently, but they have in common the ability to generate new insights in a number of areas, including the nature of mental retardation and the savant syndrome.
- Despite the fact that the upper limits of our intellectual potential are constrained by our biology, the development of our intelligence can be importantly facilitated by the richness of the environment provided by our families in our early years and by aspects of our experience outside of our families as we get older. Intelligence can be significantly compromised under conditions of extreme deprivation.
- The differences in measured IQ between races is most likely attributed to pervasive differences in environmental (life) circumstances of the groups.
- In any population, there will be a large number of people of average intelligence, very few of extremely low IQ and an equal paucity of people with very high IQ. This is called a normal distribution.
- We all go through stages of cognitive development as we get older. This affects certain aspects of our measured IQ (such as the degree to which we are able to think abstractly) but not others (such as the speed at which we process information.)
- Life performance and achievement is partly a function of intellectual capacity but is also significantly influenced by personality and other individual characteristics.

REVISION QUESTIONS

1. How have intelligence tests helped or hindered our quest to understand intelligence?
2. Are people with savant syndrome 'intelligent'?
3. Is genius just a matter of high IQ?
4. How important is intelligence as a defining characteristic of a person?
5. How likely do you think it is that we will find genes for intelligence?
6. Do all people with an IQ of 100 function equally well in their life?
7. Can someone 'catch up' intellectually if they have experienced deprivation in their first few years of life?
8. If you move to live in another culture that is unfamiliar to you, does your intelligence 'drop'?

Further Reading

Anderson, M. (ed.) (1999). *The Development of Intelligence*. Hove: Psychology Press.
A contemporary account of current theories on the development of intelligence by experts in the field.

Deary, I.J. (2001). *Intelligence: A Very Short Introduction*. Oxford: Oxford University Press.
A very readable and clear introduction to the main issues.

Gardner, H., Kornhaber, M.L., & Wake, W.K. (1996). *Intelligence: Multiple Perspectives*. Fort Worth, TX: Harcourt Brace.
A series of alternative accounts of intelligence, particularly multiple intelligences theory.

Jensen, A.R. (1998). *The g Factor: The Science of Mental Ability*. Westport, CT: Praeger Press.
A highly technical read, but the definitive scientific account of general intelligence.

Mackintosh, N.J. (1998). *IQ and Human Intelligence*. Oxford: Oxford University Press.
A very considered and scholarly review of the field.

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Mike Anderson & Corinne Reid

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Personality 14

CHAPTER OUTLINE

Learning Objectives

By the end of this chapter you should appreciate that:

- personality theorists are concerned with identifying generalizations that can be made about consistent individual differences between people's behaviour and the causes and consequences of these differences;
- Sigmund Freud developed a psychoanalytic approach that emphasized the role of the unconscious in regulating behaviour;
- Raymond Cattell and Hans Eysenck proposed traits as descriptors that we use to describe personality and that have their origins in everyday language;
- biological theories of personality attempt to explain differences in behaviour in terms of differences in physiology, particularly brain function;
- research in behavioural genetics has permitted the examination of both genetic and environmental factors in personality;
- social–cognitive theories of personality examine consistent differences in the ways people process social information, allowing us to make predictions about an individual's behaviour in particular contexts.

INTRODUCTION

You do not need to be a psychologist to speculate about personality. In our everyday conversations we refer to the personality traits of people we know. Novels, playwrights and filmmakers make constant use of the personality of key figures in their stories, and this is one of the great attractions of popular fiction. The term 'personality' is now part of everyday language, and theories of personality are generated by all of us every time we answer the question, 'What is she or he like?'

As a branch of psychology, personality theory dates back to the beginning of the twentieth century and the psychoanalytic approach of Sigmund Freud. During the last century a number of different approaches have developed:

- trait approaches (G.W. Allport, 1937; Cattell, 1943; Eysenck, 1947);
- biological and genetic approaches (Eysenck, 1967, 1990; Plomin, 1986; Plomin et al., 1997);
- phenomenological approaches (Kelly, 1955; Rogers 1951);
- behavioural and social learning approaches (Bandura, 1971; Skinner, 1953); and
- social–cognitive approaches (Bandura, 1986; Mischel & Shoda, 1995; Mischel, 1973).

This chapter focuses on trait, biological and genetic, and social–cognitive approaches, providing a representative account of current research activity. We will also look at psychoanalytic and humanistic approaches for an insight into the beginning and history of personality theory.

WHAT IS PERSONALITY?

In 400 BC, Hippocrates, a physician and a very acute observer, claimed that different personality types are caused by the balance of bodily fluids. The terms he developed are still sometimes used today in describing personality. Phlegmatic (or calm) people were thought to have a higher concentration of phlegm; sanguine (or optimistic) people had more blood; melancholic (or depressed) people had high levels of black bile; and irritable people had high levels of yellow bile.

Hippocrates' views about the biological basis of personality are echoed in contemporary theories that link the presence of brain chemicals such as noradrenaline and serotonin to mood and behaviour.

But how do we define 'personality'? Within psychology two classic definitions are often used:

> Personality is a dynamic organisation, inside the person, of psychophysical systems that create the person's characteristic patterns of behaviour, thoughts and feelings.
>
> **G.W. Allport, 1961**

> More or less stable, internal factors . . . make one person's behaviour consistent from one time to another, and different from the behaviour other people would manifest in comparable situations.
>
> **Child, 1968**

Both these definitions emphasize that personality is an internal process that guides behaviour. Gordon Allport (1961) makes the point that personality is psychophysical, which means both physical and psychological. Recent research has shown that biological and genetic phenomena do have an impact on personality. Child (1968) makes the point that personality is stable – or at least relatively stable. We do not change dramatically from week to week, we can predict how our friends will behave, and we expect them to behave in a recognizably similar way from one day to the next.

Child (1968) includes consistency (within an individual) and difference (between individuals) in his definition, and Allport (1961) refers to characteristic patterns of behaviour within an individual. These are also important considerations. So personality is what makes our actions, thoughts and feelings consistent (or relatively consistent), and it is also what makes us different from one another.

Figure 14.1

Jekyll-and-Hyde personality changes are, thankfully, extremely rare.

PSYCHOANALYTIC THEORIES – FREUD AND BEYOND

By the early years of the twentieth century, Sigmund Freud (1856–1939) had begun to write about psychoanalysis, which he described as 'a theory of the mind or personality, a method of investigation of unconscious process, and a method of treatment' (1923/62).

Central to a psychoanalytic approach is the concept of *unconscious mental processes* – the idea that unconscious motivations and needs have a role in determining our behaviour. This approach also emphasizes the irrational aspects of human behaviour and portrays aggressive and sexual needs as having a major impact on personality.

unconscious mental processes processes in the mind that people are not normally aware of

FREUD'S MODELS OF THE MIND

Freud developed a number of hypothetical models to show how the mind (or what he called the *psyche*) works:

- a *topographic model of the psyche* – or how the mind is organized;
- a *structural model of the psyche* – or how personality works; and
- a *psychogenetic model of development* – or how personality develops.

psyche psychoanalytic term meaning 'mind'

topographic model of the psyche Freud's model of the structure of the mind

structural model of the psyche Freud's model of how the mind works

psychogenetic model of development Freud's model of personality development

Topographic model of the psyche

Freud (1905/53b) argued that the mind is divided into the conscious, the preconscious and the unconscious.

According to Freud, the conscious is the part of the mind that holds everything you are currently aware of. The preconscious contains everything you could become aware of but are not currently thinking about. The unconscious is the part of the mind that we cannot usually become aware of. Freud saw the

Pioneer

Figure 14.2

Sigmund Freud's psychoanalytic approach assumed that unconscious motivations and needs have a role in determining our behaviour.

Sigmund Freud (1856–1939) Born the son of a Jewish wool merchant, Freud spent most of his life in Vienna. He studied medicine and specialized in neurology. After becoming disillusioned with physical treatments for mental illness, he became interested in the notion of a 'talking cure'. Freud went on to become the founder of psychoanalysis. He died in England in 1939.

unconscious as holding all the urges, thoughts and feelings that might cause us anxiety, conflict and pain. Although we are unaware of them, these urges, thoughts and feelings are considered by Freud to exert an influence on our actions.

Structural model of the psyche

Alongside the three levels of consciousness, Freud (1923/62, 1933) developed a structural model of personality involving what he called the id, the ego and the superego (figure 14.3).

According to Freud, the id functions in the unconscious and is closely tied to instinctual and biological processes. It is the primitive core from which the ego and the superego develop. As the source of energy and impulse it has two drives:

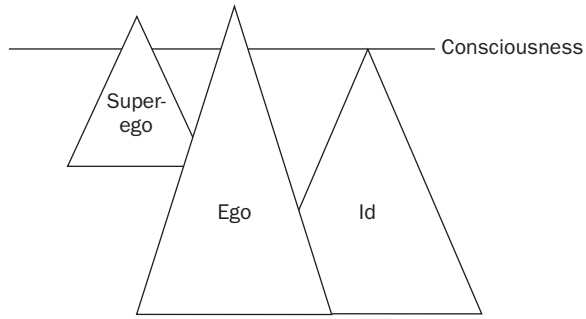

Figure 14.3

Freud said that the psyche was like an iceberg, with most of it being below the level of consciousness. The tip of the iceberg, above the water, corresponds to what we can become aware of. We are aware of some aspects of ego and superego functioning, but the processes of the id are entirely within the unconscious.

Eros – a drive for life, love, growth and self-preservation

Thanatos – a drive for aggression and death

Eros the desire for life, love and sex within psychoanalytic theory

Thanatos the drive for aggression and death in Freudian psychoanalysis

These drives, or instincts, are represented psychologically as wishes that need to be satisfied.

External or internal stimulation creates tension, which the id seeks to reduce immediately. This is called the 'pleasure principle' – the idea that all needs have to be satisfied immediately, avoiding pain and seeking pleasure, regardless of external conditions. The id is directly linked to bodily experience and cannot deal effectively with reality. As such it is limited to two forms of response – reflex responses to simple stimuli (e.g. crying with pain), or primary process thinking (hallucinatory images of desired objects), which provides a basic discharge of tension.

According to Freud, primary process thinking does not actually meet the fundamental need of the organism – just as dreaming of water does not satisfy thirst – so a second structure, the ego, focuses on ensuring the id's impulses are expressed effectively in the context of the real world. The ego, as a source of rationality, conforms to the 'reality principle' – delaying the discharge of energy from the id until an appropriate object or activity can be found. The ego engages in secondary process thinking. It takes executive action on the part of the ego to decide which actions are appropriate, which id impulses will be satisfied, how and when.

But the ego has no moral sense, only practical sense. It is a third structure, the superego, which, according to Freud, provides moral guidance, embodying parental and societal values. The superego has two sub-systems:

- conscience, or images of what is right and what deserves punishment – this is the basis for guilt; and
- ego ideal, or images of what is rewarded or approved of – this is the basis for pride.

Violation of superego standards can generate anxiety over loss of parental love, which is experienced as guilt. By the same token, Freud viewed a 'weak' superego as the cause of self-indulgence and criminality.

According to Freud, the ego mediates between id impulses, superego directives and the real world. Conflicts in this process can lead to three types of anxiety:

- neurotic anxiety – that the id will get out of control;
- moral anxiety – that past or future behaviour is immoral; or
- reality anxiety – about objective dangers in the environment.

When anxiety cannot be dealt with by realistic methods, the ego calls upon various defence mechanisms to release the tension. Defence mechanisms deny, alter or falsify reality. As they operate unconsciously, they are not immediately obvious to us or to other people. Defence mechanisms include:

- displacement – substituting an acceptable behaviour for an anxiety-inducing one;
- projection – projecting the threatening thing on to others;
- reaction formation – creating an attitude opposite to the one that you hold;
- intellectualization – transforming emotional or affective drives into rational intentions; and
- regression – reverting to modes of behaviour from childhood in order to avoid conflict.

Psychogenetic model of development

Freud (1900/1953) proposed that child development proceeds through a series of stages related to physical development, and that adult personality is influenced by how crises are resolved at each stage.

Each stage is named after an erogenous zone, or area of the body that can experience pleasure from the environment. Excessive gratification or frustration at any one stage can result in the fixation of libido and subsequent disruption to normal personality development.

1 Oral stage (birth to 18 months) At the beginning of this stage children are highly dependent on their mothers and derive pleasure from sucking and swallowing. Freud suggested that children who become fixated at this early oral stage derive pleasure in adulthood from activities such as overeating, smoking, drinking and kissing. He referred to such people as oral-incorporative or oral-ingestive.

Later in the oral stage, children begin to cut teeth and experience pleasure from biting and chewing. Fixation at this later part of the stage results in chewing objects and nail-biting in adulthood, as well as being sarcastic and critical. Freud called those fixated at this level oral-aggressive or oral-sadistic.

2 Anal stage (18 months to three years) At this stage pleasure is gained from the expulsion and retention of faeces. This is also a stage at which children start to explore their environment but experience control and discipline from their parents. According to Freud, fixation at this stage may result in people being messy and generous – anal expulsive characters, or being mean and orderly – anal-retentive characters.

3 Phallic stage (three to five years) It is at the phallic stage that children discover pleasure from touching their genitals. They also become aware that they are in competition with siblings and their father for their mother's attention.

Freud believed that boys become increasingly attached to their mother at this stage and resent the presence of their father. These feelings produce anxiety or fear of punishment from the father – or *castration anxiety*. In order to protect themselves against this anxiety, boys identify with their fathers. Freud called boys' desire for their mother the *Oedipus complex*, because of the similarity to the ancient Greek play in which Oedipus unwittingly kills his father and marries his mother.

castration anxiety a male's fear of losing his genitals, which Freud believed was related to the Oedipus complex

Oedipus complex a description used by Freud of boys' tendency in the phallic stage to be attracted to their mothers and to resent their fathers

Freud argued for a rather different process in girls. He believed that girls reject their mother at the phallic stage, owing to resentment that they have been born without a penis. They then feel increasing attraction to their father, who has the penis they lack. Penis envy is not resolved until women have a male child, thereby symbolically obtaining a penis. This process was also named after an ancient Greek play – *Electra*. In Greek mythology, Electra was famous for her devotion to her father, and sought revenge against her mother for her father's death.

Fixation at the phallic phase and failure to resolve the Electra or Oedipus complex was viewed as the cause of sexual and/or relationship difficulties in later life.

4 Latency stage (six to twelve years) According to Freud, personality is formed by the end of the phallic stage, and sexual impulses are rechannelled during the latency period into activities such as sport, learning and social activities.

5 Genital stage (13 years to adult) As young people approach the age of reproductive ability, they begin to focus their libido, or sexual energy, towards the opposite sex. If the earlier psychosexual stages have been successfully negotiated, the individual should now begin to form positive relationships with others.

In the wake of Freud

A number of notable theorists followed Freud. Some had worked with him and then moved on to develop their own versions of psychoanalytic theory. These theorists have been called

neo-analytic, post-Freudian and psychodynamic, in order to differentiate their work from Freud's.

Jung's aims and aspirations

Carl Jung (1875–1961) was one of the first prominent analysts to break away from Freud. Jung worked with Freud in the early stages of his career, and was viewed by him as the disciple who would carry on the Freudian tradition. But Jung saw humans as being guided as much by aims and aspirations as by sex and aggression.

analytical psychology the theory of personality developed by Carl Jung, in which people are viewed as striving towards self-actualization

To distinguish his approach from classic psychoanalysis, Jung named it *analytical psychology* (1951). A basic assumption of his theory is that personality consists of competing forces and structures within the individual that must be balanced. Unlike Freud, he emphasized conflicts between opposing forces within the individual, rather than between the individual and the demands of society, or between the individual and reality.

Horney's optimism

Karen Horney (1885–1952) was another disciple of Freud who developed a theory that deviated from basic Freudian principles. Horney adopted a more optimistic view of human life, emphasizing human growth and self-realization. She concentrated on early childhood development, and her work formed the basis of much later work in this area.

One of Horney's major contributions was her challenge to Freud's treatment of women. She countered that, in the early part of the twentieth century, women were more likely to be affected by social and cultural oppression than the absence of a penis.

The failings of psychoanalytic theory

Freud was an original thinker who created a comprehensive theory of human behaviour, which had a profound impact on twentieth century society, as well as in areas of human endeavour such as art and literature. Few theorists in any scientific discipline have attained such a degree of fame, and few theoretical concepts have been so fully incorporated into Western culture.

Despite this, Karl Popper (1957) declared that psychoanalysis is a pseudoscience because it is inherently untestable. He argued that psychoanalysis is unfalsifiable because the logic of the theory allows for any finding to be explained in different ways. For example, Freud states that aggressive impulses can lead either to aggressive actions or to reaction formations against them. So it is impossible to test definitively any hypotheses about aggressive action.

Freudian psychoanalytic theory presents imprecise concepts and metaphors based on Freud's interpretation of unrecorded therapy sessions, and as such it cannot be thoroughly examined through experimental and scientific methods. Nevertheless, recent developments within cognitive psychology concerning human memory and subliminal perception have reopened the unconscious for serious scientific investigation. For a related consideration from the neuropsychological perspective, see Faulkner and Foster (2002). These authors argue that the effects of brain injury may teach us a considerable amount about the relationship between the conscious and unconscious mind.

HUMANISTIC THEORIES – INDIVIDUALITY

Humanistic, or phenomenological, theories of personality present a positive and optimistic view of human behaviour.

humanistic a branch of personality theory that emphasizes the capacity for personal growth

In complete contrast to theories from the psychodynamic tradition, people are viewed as experiencing beings rather than victims of their unconscious motivations and conflicts. So the emphasis here is on individual experiences, relationships and ways of understanding the world. Fundamental to these theories are the beliefs that everyone's experience is unique, and the individual's perception of the world is critical to their understanding and behaviour.

Humanistic theories have formed the basis of many therapeutic procedures on which modern counselling techniques are based.

THE DRIVE TO FULFIL POTENTIAL

Approval and self-actualization

Carl Rogers (1902–87) saw humans as intrinsically good and as having an innate desire for self-improvement. He believed that self-concept is critical to our experience of the world, and that this develops from the child's perceptions of his parents' approval.

Rogers believed that all people have a basic need for positive regard – approval and love. How we feel about ourselves is determined by how others react to or approve of us, and we tend to be unhappy if we feel that others are not happy with us. According to Rogers, children develop *conditions of worth* – criteria for what we must or must not do in order to gain approval. Although this is essential to the socialization of children, Rogers also argued that conditions of worth may interfere with personal development if our sole objective is to gain approval from others.

conditions of worth conditions under which affection is given

Experiencing unconditional positive regard – love and affection – enables us to grow and to satisfy our core tendency, which is to fulfil our potential by developing our capacities and talents

self-actualization the tendency to grow in ways that maintain or enhance the self

to the full. This is called *self-actualization*. Activities that are self-actualizing are perceived as satisfying, says Rogers, whereas activities that are incompatible with self-actualization are frustrating.

From a scientific perspective, the tendency to self-actualize is vague and untestable. While we may all have the same capacity to self-actualize, the form that actualization takes will be unique to each individual, making it impossible to establish objective criteria for measurement.

Client-centred therapy

Rogers developed a therapeutic approach known as client-centred therapy, which gives a central role to the therapist's unconditional positive regard for the client (see chapter 16). The therapist has to be trusting, accepting and empathic. Rogers argued that this helps the individual in therapy to recognize and untangle her feelings and return to an actualizing state.

One of Rogers' most important contributions to psychology was his attempt to evaluate this method of therapy. Rogers and Dymond (1954) set out to examine changes in the discrepancy between present self-concept and the ideal self (the person the client would like to be). This was done using a Q-sort technique (devised by Stephenson, 1953), whereby the client is given a range of cards on which there is a descriptive statement, such as: 'I don't trust my own emotions' and 'I have a warm emotional relationship with others.'

The client is asked to sort these cards in order, from 'most like me' to 'least like me' under the headings 'Self' and 'Ideal'. From this, Rogers and Dymond produced a numerical discrepancy between real and ideal self. By administering the Q-sort at different times during therapy, the effectiveness of the therapy sessions can be assessed.

Figure 14.4

Client-centred therapy requires the therapist to be trusting, accepting and empathic.

UNDERSTANDING OUR OWN PSYCHOLOGICAL WORLD

Personal construct theory

personal construct a mental representation used to interpret events

To examine how individuals view the world, George Kelly (1905–67) developed *personal construct* theory.

In contrast to the psychoanalytic emphasis on the person as a victim of unconscious desires and impulses, this humanistic theory portrays people as active hypothesis-generators. Personal construct theory treats the individual as her own personal scientist, one who is actively aware of how her own psychological world is constructed and construed. By understanding how the individual perceives the world, we can anticipate how they will behave within it and understand their reactions to events.

According to Kelly, trait theories (see below) try to locate the individual on the personality theorists' dimensions, whereas personal construct theory looks at how people see and align events according to their own personal dimensions. Kelly basically took the view that we are all scientists – so each individual is continually categorizing, interpreting, labelling and judging himself and his world. Each of us generates constructs and hypotheses, which then help us to anticipate and control events in our lives.

The subjective nature of reality

Consistent with this is the notion that we cannot know what another person really means when they say that they are in love or that they are unfriendly. We can only begin to know by relating what they say to their behaviour.

Kelly also proposed the notion of constructive alternativisim – the idea that there is no reality, that reality is only what we perceive it to be. This comes from the observation that while we may not always be able to change events, we can always construe them differently. Different people may choose to perceive an event in different ways, which allows for different courses of action. For Kelly, part of the therapeutic process was to help the client find appropriate or useful constructs of events, rather than simply being concerned with diagnosis and categorization.

Kelly saw the individual as being capable of enacting many different roles and engaging in continuous change. In his terms, a 'role' is an attempt to see another person through that person's own constructs. To enact a role, your behaviour must be guided by your perception of the other person's viewpoint. Kelly used role-playing as a therapeutic technique to help people gain new perspectives, and to find more convenient ways of living.

Explaining negative emotions

Kelly also tried to explain why people experience certain negative emotions. Anxiety, he suggested, occurs when our construct system provides no means for dealing with an experience. This can occur when we start a new job or have to deal with a person we

do not understand. Guilt results from discrepancy between our ideal self and our action. So you feel guilty when you do something that is discrepant with the kind of person you would like to be, or thought you were.

TRAIT THEORIES – ASPECTS OF PERSONALITY

traits labels given to consistent and enduring aspects of personality, viewed as continuous dimensions

Traits – or descriptors used to label personality – have their origins in the ways we describe personality in everyday language.

types a term used by early personality theorists, who divided people into different categories, or types

In the early years of personality theory, many theorists used the term *types* to describe differences between people. Sheldon (1954), for example, categorized people according to three body types (see figure 14.5) and related these physical differences to differences in personality. Endomorphic body types are plump and round with a tendency to be relaxed and outgoing. Mesomorphic physiques are strong and muscular, and usually energetic and assertive in personality. Ectomorphic body types are tall and thin and tend to have a fearful and restrained personality.

Not only is it unlikely that personality can be mapped to body type, but the idea that all people can be allocated to a small number of categories is challenged by modern trait theories.

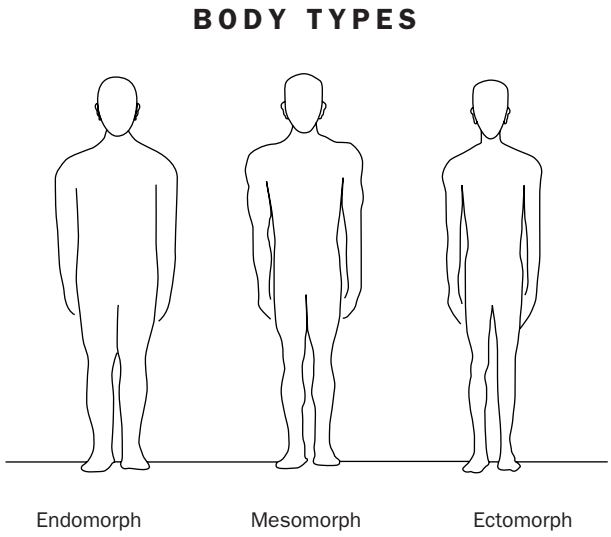

Figure 14.5

Three body types, according to Sheldon (1954). Endomorphic body types are plump and round with a tendency to be relaxed and outgoing. Mesomorphic physiques are strong and muscular, and usually energetic and assertive in personality. Ectomorphic body types are tall and thin and tend to have a fearful and restrained personality.

Modern theorists view traits as continuous rather than discrete entities. So, rather than being divided into categories, people are placed on a trait continuum representing how high or low each individual is on any particular dimension. The assumption is that we all possess each of these traits to a greater or lesser degree, and that comparisons can be made between people.

For example, categorizing people into separate groups of 'sociable' versus 'unsociable' is considered to be meaningless. Instead, it is considered more useful by trait theorists to determine the amount of sociability each person exhibits. Personality theorists regard most traits as forming a normal distribution, so some people will be very high in sociability and others very low, but most people will be somewhere in the middle.

CATTELL'S 16 TRAIT DIMENSIONS

Gordon Allport (1897–1967) made the first comprehensive attempt to develop a framework to describe personality using traits. Allport and Odbert (1936) used Webster's (1925) *New International Dictionary* to identify terms that describe personality.

This work was developed further by Raymond Cattell (1905–97), who used a statistical procedure called factor analysis to determine the structure of personality. Factor analysis is a tool for summarizing the relationships among sets of variables by identifying those that co-vary and are different from other groups of variables (see chapter 13). In personality theory, factor analysis can be used to identify which sets of variables most simply and accurately reflect the structure of human personality.

Like Allport, Cattell believed that a useful source of information about the existence of personality traits could be found in language, the importance of a trait being reflected in how many words describe it. Cattell called this the *lexical criterion of importance*. Building on Allport's work, Cattell (1943) collated a set of 4500 trait names from various sources and then removed obvious synonyms and metaphorical terms, until he reduced these to 171 key trait names. Cattell collected ratings of these words and factor-analysed the ratings.

lexical criterion of importance Cattell's proposal that an aspect of personality described by many words in the vernacular is likely to be more important than one described by just a few

Cattell's subsequent investigations yielded three types of data, which he categorized as follows:

- L-data – life record data, in which personality assessment occurs through interpretation of actual records of behaviour throughout a person's lifetime (e.g. report cards, ratings by friends and military conduct reports);
- Q-data – data obtained by questionnaires (e.g. asking people to rate themselves on different characteristics); and
- T-data – or objective psychometric test data (e.g. the thematic apperception test).

On the basis of this research, Cattell (1947) developed a model of personality describing 16 trait dimensions. He then developed a

questionnaire to measure these traits (Cattell, Eber & Tastuoka, 1977) called the Sixteen Personality Factors Questionnaire (16PF). Here are the 16 trait dimensions used in the 16PF:

Reserved----------Outgoing
Less intelligent----------More intelligent
Stable, ego strength----------Emotionality/neuroticism
Humble----------Assertive
Sober----------Happy-go-lucky
Expedient----------Conscientious
Shy----------Venturesome
Tough-minded----------Tender-minded
Trusting----------Suspicious
Practical----------Imaginative
Forthright----------Shrewd
Placid----------Apprehensive
Conservative----------Experimenting
Group-dependent----------Self-sufficient
Undisciplined----------Controlled
Relaxed----------Tense

Eysenck's supertraits

supertraits Eysenck's three key traits, which he also referred to as types

extraversion the tendency to seek and engage with the company of others

introversion the tendency to avoid the company of others and to withdraw from social situations

neuroticism the tendency to be worried and anxious

Hans Eysenck (1916–97) was a contemporary of Cattell and also used factor analysis to classify personality traits. But Eysenck (1967) began with a theory of personality which he based on two *supertraits* – *extraversion–introversion* and *neuroticism–stability*.

According to this theory, people who are highly extraverted are sociable and outgoing, and crave excitement and the company of others. People who are highly introverted are quiet and introspective; they tend to prefer time alone and to be cautious in the way they plan their lives. People who are highly neurotic tend to be anxious, moody and vulnerable, whereas people who are low on neuroticism tend to be stable, calm and even-tempered.

Eysenck viewed the supertraits of extraversion and neuroticism as independent, and believed that different personalities arise from differing combinations of the two supertraits.

Figure 14.7 shows the traits associated with Eysenck's two major personality dimensions (Eysenck, 1975). People who are high in both neuroticism and extraversion tend to exhibit quite different traits than someone who is low in both, or a combination of low and high. So people who are high on both extraversion and neuroticism tend to be touchy and aggressive, whereas people who are high on extraversion and low on neuroticism tend to be carefree and sociable.

Pioneer

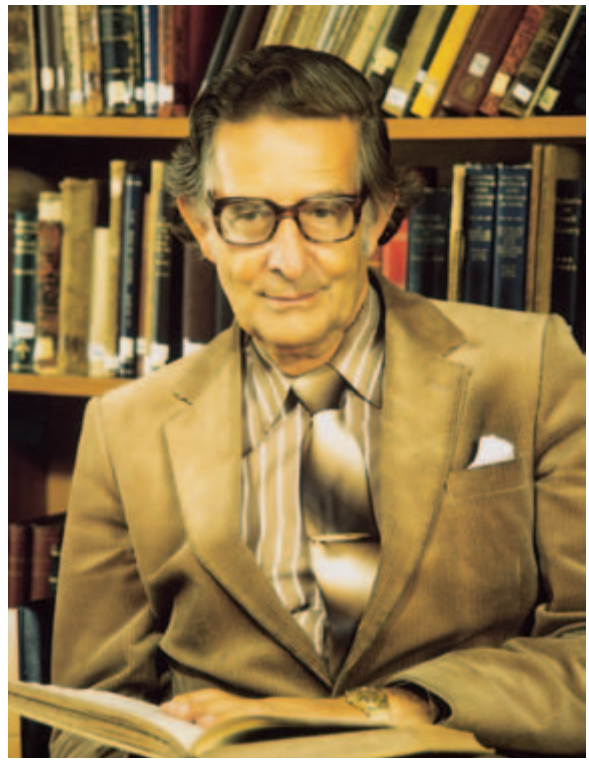

Figure 14.6

Hans Eysenck's theory of personality was based on two supertraits – *extraversion–introversion* and *neuroticism–stability*.

Hans J. Eysenck (1916–97) Born in Berlin, Eysenck moved to England in 1934. Until his death in 1997, Eysenck was the most widely cited psychologist in the world. Best known for his work in personality, Eysenck also contributed to the founding of cognitive-behaviour therapy as an alternative to psychodynamic therapies. His involvement with research on the relationship between race and IQ rendered him a controversial figure. Eysenck founded the Department of Psychology at the Institute of Psychiatry, The Maudsley Hospital, London, in 1946 and continued to work there long beyond his formal retirement in 1983.

psychoticism the tendency to be cold, aggressive and antisocial

A further supertrait identified by Eysenck (1982) is *psychoticism*. People scoring high on psychoticism are described as: 'egocentric, aggressive, impersonal, cold, lacking in empathy, impulsive, lacking in concern for others and generally unconcerned about the rights and welfare of other people'.

Eysenck's (1967) hierarchical model divides personality into various units (figure 14.8). This allows personality to be described

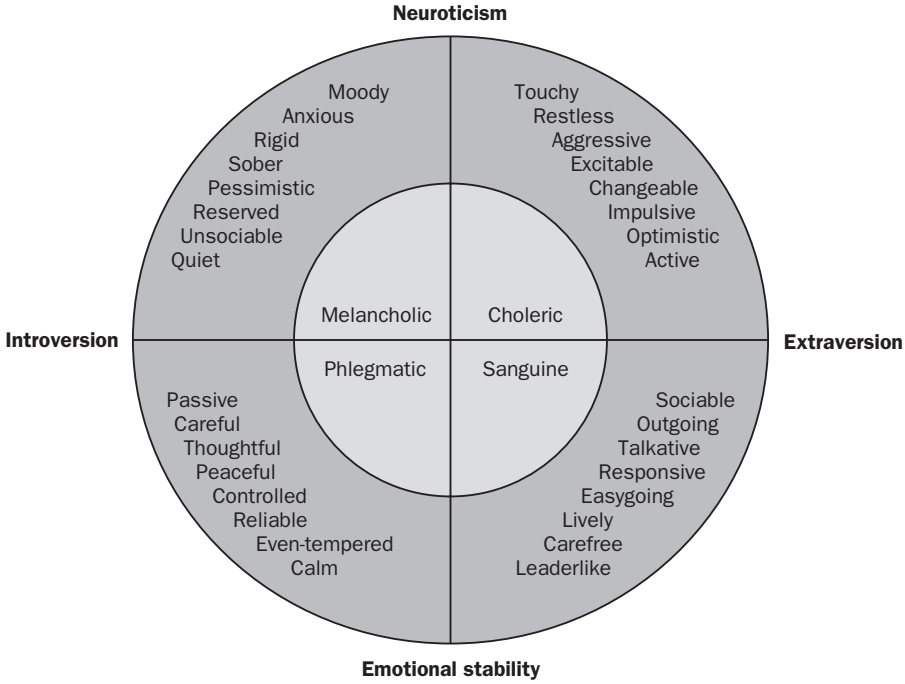

Figure 14.7

Four personality types can be derived from the traits associated with Eysenck's two major personality dimensions of extraversion and neuroticism. Source: Adapted from Eysenck (1975).

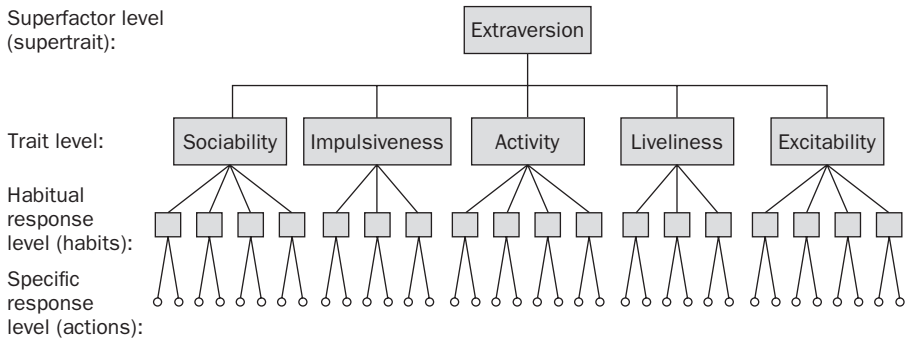

Figure 14.8

Eysenck's hierarchical model of personality. Source: Eysenck (1967).

at a number of different levels – supertraits, traits, habits and actions. Each supertrait is made up of a number of traits, which are in turn derived from habitual responses and specific responses (actions). According to this model, many specific actions make up habitual responses, which are represented as trait dimensions, which in turn are part of one supertrait. All levels are important in determining behaviour.

Like Cattell, Eysenck developed a questionnaire designed to measure his supertraits – the Eysenck Personality Questionnaire, or EPQ (Eysenck & Eysenck, 1975; see table 14.1). He also developed a theory of the biological basis of personality, which is described later.

Table 14.1 Examples of items from the Eysenck Personality Questionnaire.

Question	*Trait*
Are you a talkative person?	Extraversion
Do you like going out a lot?	
Does your mood often go up and down?	Neuroticism
Are your feelings easily hurt?	
Have you ever taken anything (even a pin or a button) that belonged to someone else?	Lie scale
As a child, were you ever cheeky to your parents?	

Source: Eysenck and Eysenck (1975).

Five factors of personality

Although trait theories were well established by the 1960s, there was no consensus concerning the number or nature of the traits that make up personality.

Replications of Cattell's work in factor analysis often failed to find the original factor structure he described. Instead, a number of studies using Cattell's variables came up with a simpler five factor structure (Fiske, 1949; Tupes & Christal, 1958, 1961).

five factor model of personality a model developed using factor analysis to try to determine the key traits in human personality

Since then, further research has confirmed a basic *five actor model of personality* or 'Big Five' (Digman, 1990; Goldberg, 1993):

Extraversion	Sociable vs. retiring
	Fun-loving vs. sober
	Affectionate vs. reserved
Agreeableness	Softhearted vs. ruthless
	Trusting vs. suspicious
	Helpful vs. uncooperative
Conscientiousness	Well organized vs. disorganized
	Careful vs. careless
	Self-disciplined vs. weak willed
Neuroticism	Worried vs. calm
	Insecure vs. secure
	Self-pitying vs. self-satisfied
Openness	Imaginative vs. down-to-earth
	Prefers variety vs. prefers routine
	Independent vs. conforming

(From Costa & McCrae, 1985)

Extraversion and neuroticism are defined in the same way as Eysenck defined them. Openness to experience/intellect refers to receptivity to new ideas and experiences. People low on this trait prefer the familiar, practical and concrete, whereas those high on this trait are open to new experience, curious and imaginative. Agreeableness means the extent to which people are trusting, generous and concerned for others. Those low on agreeableness are viewed as antagonistic, tough-minded and hard-headed. Conscientiousness relates to organization and achievement. Highly conscientious individuals are ambitious, hard-working, competent and organized, and those low in conscientiousness are easy-going, low in self-discipline and not goal-driven.

While this model presents five categories, it should not be seen as a simplistic generalization of trait theory. As in Eysenck's (1967) model, each of the five factors is made up of a number of more specific traits. A questionnaire designed to measure traits within a five factor framework, the NEO-PI (Costa & McCrae, 1985), consists of 300 items. Respondents decide how characteristic each item is of themselves, rating each item on a five-point scale. As well as scoring on the five factors, respondents receive scores on six sub-scales associated with each of the factors.

Most of the early work on the Big Five model was conducted in North America using the English language. If personality theorists are to have solid evidence of a universal five factor personality structure, they need to find evidence that the same model applies when languages other than English are used and when personality is examined in many different cultures. A recent review of studies involving European languages (De Raad et al., 1998) found general support for the Big Five. Evidence from studies conducted in non-Western cultures is less widely available, but does show some support for a five factor structure (Church et al., 1997).

The Big Five forms the basis for trait assessment of personality at the beginning of the twenty-first century, with questionnaires such as the NEO-PI and subsequent revisions (NEO-PI-R, Costa & McCrae, 1992) being used widely in occupational psychology.

Trait debates

Do we all possess all traits?

nomothetic an approach to personality that emphasizes comparisons between individuals and proposes that people are all governed by the same basic behavioural principles

idiographic an approach to personality that proposes each individual is unique and cannot be compared with another

Gordon Allport (1937) was the first trait theorist to raise an issue that began a long debate within personality theory. It concerns whether personality is *nomothetic* or *idiographic*.

A nomothetic approach allows us to make comparisons between people. Its basic premise is that we are all governed by the same behavioural principles – so we all have the same traits and differ only in the extent to which each trait is present. The idiographic approach proposes that each individual is unique and there are some traits that may be possessed by only one person. So, according to the idiographic approach, comparing one person with another becomes meaningless. More recently Baumeister and Tice (1988) have suggested that certain trait dimensions apply to some people more than others, and that some traits may not be important at all in any one person's personality.

The person–situation debate

Since the development of trait theories in the 1950s and 1960s, personality researchers have been concerned about the relationship between traits and behaviour.

Mischel (1968) used the phrase 'personality coefficient' to highlight the rather modest correlations between traits (as measured by self-report questionnaires) and behaviour. A major debate ensued, focusing on whether an individual's actions are better predicted by the situation or by his/her personal characteristics.

The debate was resolved by the concept of interactionism, proposed by Magnusson and Endler (1977) – the idea that personality and the environment interact with each other to produce behaviour.

Another important notion is that some situations may have more influence over behaviour than others. Buss (1989) argued that behaviour is determined more by the situation when it is novel, formal and/or public, and more by personality when the situation is informal, familiar and/or private. So in a strong situation like a lecture, for instance, it might be quite hard to draw conclusions about a fellow student's personality when most people simply sit quietly and take notes. But in a pub or party, people's behaviour is variable enough for personality differences to become apparent.

Everyday Psychology

Personality profiling in the workplace

Many organizations are now administering personality tests to assess suitability for employment, redeployment and promotion or to determine training needs (see chapter 20). The goal is to achieve a better fit between people and jobs. But is personality profiling really a good idea?

In the intensifying competition for jobs and talented employees, hiring the 'right' person becomes increasingly important (especially in situations where a 'wrong' decision can be damaging and painful for employer and employee alike). At the same time, there is increasing evidence of the inefficiency of traditional job recruitment practices such as the job interview (especially when these practices are used in the absence of other forms of selection procedure).

Personality profiling is therefore being adopted more and more as an objective, efficient and fair way of identifying, recruiting and encouraging talent in the workplace.

Personality profiling aims at a certain kind of 'truth', but it does not pretend to capture the individual's character permanently or completely (different people may manifest different aspects of their personality in different situations). The personality tests usually chosen are deliberately designed to evaluate more stable personality traits and avoid value judgements such as 'good' or 'bad'. These instruments are usually designed to identify trends and preferences in behaviour, especially in a work environment.

Many people are cynical about psychometric tests, especially those that try to sum up their personalities. But a properly devised personality test can help the participant to make more informed career decisions and to deal more effectively with people and situations. Results should not be regarded as a final judgement of character, but rather as an extrapolation of ways in which an individual will tend to behave under certain conditions.

Many tests are designed to stimulate role-play and perspective taking. For example, it may become apparent not only how you feel about certain work colleagues, but also why. This often serves to stimulate a dialogue. The process may also allow you to think through the implications of your personality type even before you encounter a particular scenario.

Knowing yourself can give you and employers a common language to work with. And if there is an aspect of your personality you had not fully thought about, or could not quite understand, instead of learning the hard way through a painful confrontation you may later regret, personality testing may provide the kind of insight that will enable you to avoid a confrontational situation. Such knowledge may not be a substitute for real-life experience, but it can enhance personal awareness and understanding of individual differences.

Furnham, A., 1992, *Personality at Work: The Role of Individual Differences in the Work Place*, London: Routledge.

BIOLOGICAL AND GENETIC THEORIES – THE WAY WE ARE MADE

Inhibition and arousal

Why do extraverts seek excitement?

In 1967 Eysenck developed inhibition theory. He argued that individual differences in extraversion–introversion are strongly determined by heredity and have their origins in the central nervous system. According to this theory, information from the environment is transmitted from the sense organs along neural pathways to the brain, where excitatory and inhibitory cortical processes result in either the facilitation or inhibition of behavioural and cognitive responses, in certain specific ways.

Eysenck maintained that extraverts have relatively strong inhibitory processes and weak excitatory processes. Their 'strong' nervous system enables them to tolerate a high degree of stimulation. The brain's slower and weaker reaction to stimuli creates a hunger or desire for strong sensory stimulation. So extraverts seek excitement from the environment.

Introverts, on the other hand, have strong excitory processes and weak inhibitory process. Their nervous systems are 'weak', but they have brains that react more quickly and strongly to stimuli. So they can tolerate only relatively small amounts of stimulation.

Developing the theory

arousal theory developed by Eysenck, this theory provides an account of the physiological systems underlying introversion–extraversion.

Eysenck and Eysenck (1985) redeveloped inhibition theory to formulate *arousal theory*, which identifies the physiological systems underlying introversion–extraversion. The differences in the behaviour of extraverts and introverts are traced to various parts of the ascending reticular activating system (ARAS) – a network of fibres travelling upwards from the lower brain stem to the thalamus and cortex. Stimulation of the ARAS results in increases in alertness and arousal of the cortex. Other fibres descending from the lower brain stem influence bodily musculature and the autonomic nervous system. At the same time, fibres descending from the cortex can modulate the

activity of the brain stem, increasing or inhibiting the excitability of the ARAS. So the relationship between the ARAS and the cortex is reciprocal.

The high cortical arousability of introverts is supposed to amplify incoming stimulation. According to this framework, very high and very low levels of stimulation are considered to produce negative hedonic tone, which is experienced as negative feelings and negative evaluation of the experience. Positive hedonic tone occurs only at intermediate levels of sensory stimulation. The levels at which negative and positive hedonic tone occur will be different for introverts and extraverts.

Testing the theory

Using this theoretical formulation psychologists have been able to make predictions about the behaviour of introverts and extraverts in experiments ranging from sensory deprivation to students' study habits. For example, Campbell and Hawley (1982) predicted that introverts would prefer study locations that minimize intense external stimulation (such as study carrels) whereas extraverts would prefer large, open reading areas where socializing is permitted and both auditory and visual stimulation is high. These researchers gave students the EPQ, noted their preferred seating areas in a campus library, and asked them to fill out a study habits questionnaire. Their predictions turned out to be correct. They also found that extraverts took more study breaks, looking and walking around the room, going out for coffee etc. Davies and Parasuraman (1982) found that extraverts also make more errors than introverts on long vigilance tasks. Eysenck explained this finding by suggesting that extraverts generate reactive inhibition (fatigue) more quickly and at greater levels than introverts when they are performing long tasks.

Despite evidence that appears to support Eysenck's theory, a comprehensive review by Stelmack (1990) showed that introverts and extraverts show no difference in brain-wave activity when at rest or asleep. It therefore seems likely that extraverts and introverts differ in terms of their sensitivity to stimulation, rather than in base rate levels of cortical activity.

Stress and performance

There has not been much direct investigation of how neuroticism affects performance, but many studies have examined the effect of anxiety – one of the component traits of neuroticism. According to Eysenck, the adverse effects of anxiety on performance are attributable to task-irrelevant processing activities, such as worry. Consistent with this, Eysenck and Eysenck (1985) found that students who report high levels of worry perform less well on tests. And when highly anxious people do perform well, it is at the expense of more effort and distress.

Sensation seeking

The differences between those who prefer bungee-jumping and those who world rather watch a good movie can also be addressed using a biological theory of personality.

Zuckerman (1994) conducted research into sensation seeking over a 30-year period, developing a questionnaire to measure the phenomenon and a biological theory to explain it. Zuckerman, Kolin, Price and Zoob (1964) identified four aspects of sensation seeking:

1. thrill and adventure seeking (risky sport)
2. experience seeking (desire for novelty)
3. disinhibition (stimulation through social activity)
4. boredom susceptibility (low tolerance for repetitive events)

Sensation seekers are more likely to have more sexual partners, use illegal drugs, take part in risky sport, be more complex, original and creative, and have more liberal and nonconforming attitudes. Zuckerman (1994) explained differences in sensation seeking in terms of level of arousal in the catecholamine system. (This system comprises neurons communicating via catecholamines, which include epinephrine, or adrenaline, norepinephrine and dopamine; see chapter 3.) According to Zuckerman, those with a low optimal level in this system work to reduce the stimulation in their environment, whereas those with a high optimal level seek to increase it.

Genetics vs. environment

Recent work in behavioural genetics has examined the contribution of genetic and environmental factors to human behaviour. A good example of this approach is represented by the twin studies of intelligence already discussed in chapter 13.

Evidence for and against genetic influence

In 1976 Loehlin and Nicholls examined the scores on self-report personality questionnaires of 800 pairs of twins. Nearly all traits showed moderate genetic influence, with monozygotic (identical) twins being much more similar than dizygotic (fraternal, or non-identical) twins. A more extensive study (Loehlin, 1992) of 24,000 twin pairs in many different countries confirmed that monozygotic twins are much more similar than dizygotic twins on the Big Five personality dimensions. Riemann, Angleitner and Strelau (1997) found the same results when twins were rated by their friends on the same factors.

Studies of genetically unrelated family members (parents and their adopted children) show no similarity in personality traits such as extraversion and neuroticism (Loehlin, 1992). This suggests that family environment itself does not contribute to similarities in personality between family members. Interestingly, recent studies have also shown only very slight similarities in personality between adopted children and their biological parents. A study by Plomin, Corley, Caspi, Fulker and DeFries (1998) found some evidence for a genetic basis for sociability, but almost no similarities in emotionality between biological parents and their adopted-away children, or between adoptive parents and their adopted children.

Thus both adoption studies and twin studies are consistent with a genetic influence on personality. Only identical twins have

Research close-up 1

The Twins Early Development Study

The research issue

The UK Social, Genetic and Developmental Psychiatry Research Centre was launched in 1994 as a partnership between the MRC (Medical Research Council) and the Institute of Psychiatry. This multidisciplinary institution studies child development from a range of complementary perspectives: adult psychiatry, developmental psychopathology, development in the family, personality traits, social epidemiology, cognitive abilities, statistical genetics, and molecular genetics.

The Twins Early Development Study (TEDS) focused on early development, preferentially targeting the three most important psychological problems in childhood that impact upon personality development: communication disorders, mild mental impairment and behavioural difficulties.

The TEDS twins represent a large sample that was assessed longitudinally at two, three, four, seven and nine years of age. Developmental comparisons have been made in order to investigate genetic and environmental contributions to change and continuity in language and cognitive development. The focus is on developmental delays in early childhood and their association with behavioural problems.

Design and procedure

In this study, the monozygotic (MZ) twin differences method was used to investigate non-shared environmental influences on early behavioural development, independent of genetic influences (which were clearly the same for each MZ twin).

The parents of four-year-old MZ twin pairs (N = 2353) assessed themselves on two parenting measures – the need for harsh parental discipline and the occurrence of negative parental feelings towards the child – and assessed the twins on four behavioural measures – anxiety, prosocial behaviour, hyperactivity and conduct problems.

Results and implications

The study found that within-twin pair differences in parenting style correlated significantly with noted within-twin pair differences in behaviour. The findings additionally suggested a stronger influence of non-shared environmental factors in behaviourally 'extremely different' twin dyads. The study also noted that non-shared relationships between parents and MZ twins were also stronger in higher risk environments – that is, families with lower socio-economic status, greater 'family chaos', or greater maternal depression.

The findings indicate that parenting style can influence behavioural (and potentially personality) outcomes over the first four years of life. In particular, differences in parenting style influenced differences in behaviour in identical twins, in a study where the potential genetic influence on behaviour was clearly controlled through the twins being genetically identical.

These findings have potentially important implications for child-rearing practices and for behavioural and personality development in children, indicating that the way in which parents behave towards their children can significantly affect their children's behavioural outcome. The authors conclude that some systematic non-shared environmental relationships can be identified, and these links are stronger for more discordant twins and higher-risk families. However, note the possibility of circular reasoning being applied in this study, given that the parents were rating their own conduct towards their twins.

Asbury, K., Dunn, J.F., Pike, A., & Plomin, R., 2003, 'Nonshared environmental influences on individual differences in early behavioural development: A monozygotic twin differences study', *Child Development*, 74 (3), 933–43.

exactly the same combinations of genes; dizygotic twins, just like ordinary siblings, will each inherit a different random sampling of half of each parent's genes. It is also possible that research findings from twin studies are partly explained by the unique circumstances of being a twin. For example, twins who look similar may be encouraged to act in a similar way, whereas non-identical twins may be encouraged to behave differently.

Genes in the environment

Until researchers began to look at genetic components in personality, psychologists had generally assumed that familial similarities are caused by similar environments. However, it is a mistake to view familial environments as shared between family members (see chapter 13). Children growing up in the same family can experience very different lives, and even common family experiences such as death or divorce are experienced differently by different siblings (Dunn & Plomin, 1990). Therefore, it is perhaps not surprising that more recent studies have tended to downplay the role of the 'shared environment', because often it is not fully shared between family members. A complex interaction between genes and environment may be the key consideration.

Research in behavioural genetics has also begun to consider the effects of genetics on the environment. Parenting behaviour

Pioneer

Figure 14.9

Robert Plomin's research involves identifying genes for personality traits.

Robert Plomin (1948–) is Professor of Behavioural Genetics at the Institute of Psychiatry in London and Deputy Director of the Social, Genetic and Developmental Psychiatry (SGDP) Research Centre. The goal of the SGDP Research Centre is to bring together genetic and environmental research strategies to study behavioural development, a theme that characterizes his research. Plomin's special interest is in harnessing the power of molecular genetics to identify genes for psychological traits in order to advance our understanding of the developmental interplay between genes and environment.

may have a genetic influence, in terms of the parts of the parent's personality which are influenced by genetic factors. In addition, recent research suggests that parenting behaviour may also be influenced by genetic components of the child's personality. Plomin, DeFries and Fulker (1988) found that adoptive parents were more responsive to their adopted children whose natural mother had been high on activity and impulsivity. It is therefore possible that children who are genetically more active and impulsive cause their parents to be more responsive to their needs than do other children. Therefore, the relationship between genes and environment may be an even more complex (two-way) interaction than was previously thought.

SOCIAL–COGNITIVE THEORIES – INTERPRETING THE WORLD

How do cognitive and social processes affect behaviour? And how do different processing strategies result in differing personalities?

Table 14.2 Types of cognitive–affective units in the personality system.

Cognitive–affective units in the personality system	*Explanation*
Encodings	Units or constructs for categorizing events, people and the self
Expectancies and beliefs	Relating to the social world and about outcomes for behaviour; self-efficacy
Affects	Feelings, emotions and affective responses to stimuli
Goals and values	Desirable and aversive affective states and outcomes, life goals, values
Competencies and self-regulatory plans	Behaviours and strategies for organizing actions and influencing outcomes, one's own behaviour and reactions

Source: Mischel and Shoda (1995).

Mischel helps us to answer these questions. In 1973 he proposed a set of psychological person variables for analysing individual differences in cognitive terms. These variables are assumed to interact with each other as we interpret the social world and act on it. After a number of developments and refinements, Mischel and Shoda (1995) renamed the variables as *cognitive–affective units in the personality system*, integrating constructs from research in cognition and social learning.

cognitive–affective units in the personality system a model of categories through which personality can be examined within a social cognitive framework

This model provides a classification system of broad cognitive categories, which describe interacting processes that may lead to personality differences (table 14.2). We will explore social–cognitive theories by taking one category at a time.

ENCODINGS – OR HOW WE PERCEIVE EVENTS

A lecturer ending a class 20 minutes early may delight those who are bored and want to go to the coffee shop but equally irritate those who want to make further progress on the topic being discussed.

Processes such as selective attention, interpretation and categorization cause us to perceive the same events and behaviours in different ways (Argyle & Little, 1972) – a phenomenon that most likely remains stable throughout our lives (Peterson, Seligman & Vaillant, 1988).

Attributional style

Examples of a social–cognitive approach that examines *encoding* are the reformulated model of helplessness and depression (Abramson, Seligman & Teasdale, 1978) and hopelessness theory (Abramson, Metalsky & Alloy, 1989). A key variable here is

Pioneer

Figure 14.10

Martin Seligman – a world authority on learned helplessness, depression and optimism.

Martin Seligman (1942–) is Professor of Psychology at the University of Pennsylvania. Seligman has written numerous books and journal articles on motivation and personality. He is a world authority on learned helplessness, depression and optimism. In recent years, Seligman has taken a leading position in promoting 'positive psychology'. In 1998 he served as President of the American Psychological Association.

attributional style the characteristic patterns of explanation people use to make sense of life-events

attributional style, or stable individual differences in the way people explain events in their lives. Differences in attributional style lead us to explain events in a characteristic way (see chapter 17).

Distinctions are made between particular dimensions of attribution:

- internal–external – the extent to which events are seen as caused by the self, rather than factors external to the self;
- stable–unstable – the extent to which causes are seen to persist across time; and
- global–specific – the extent to which the cause is something that affects many things in our life, rather than just specific situations.

Research based on this theoretical framework shows that people who tend to make stable and global explanations for negative events (relating to unchangeable factors that can affect many things in their lives) will be more likely to become depressed when unpleasant things happen to them.

The hopelessness model of depression (figure 14.11) describes how a negative life event can precipitate depression in people who have depressogenic inferential styles. Metalsky, Halberstadt and Abramson (1987) found that students who failed an exam and had a stable, global attributional style were more likely to suffer from persistent depressed mood than those who had the opposite style.

Attributional style is associated with a variety of behavioural outcomes, ranging from performance (e.g. in sports, insurance sales, academic tasks) to physical health (Buchanan & Seligman, 1995).

Cognitive appraisal

cognitive appraisal determines reactions to stressful events, according to Lazarus

Research by Lazarus (1966, 1990) resulted in the concept of *cognitive appraisal* (see chapter 6). Lazarus investigated people's reactions to stressful situations and concluded that how we view or appraise stress, cognitively, is more important than the actual amount of stress we are experiencing. Lazarus suggested that, in our primary appraisal of an event, we decide whether it is irrelevant to our wellbeing, benign–positive or stressful. Secondary appraisals then determine the cognitive resources available to cope with the event.

Following appraisal, we employ various coping mechanisms. Much of Lazarus's research has involved the identification and evaluation of coping strategies (Lazarus & Folkman, 1984). For example:

- confrontational coping is when you get angry with the person you think has caused the stress you are experiencing;
- seeking social support is finding someone to help or talk to about the situation; and
- escape–avoidance is when you try to think about something else or avoid dealing with the problem.

Expectancies and the importance of self-efficacy

Expectancies are the possible outcomes that we expect or anticipate in a given situation, and how confident we are that we can perform a particular behaviour. To predict how someone will behave in a specific situation, we have to consider their expectations about the possibilities in that situation. These expectancies

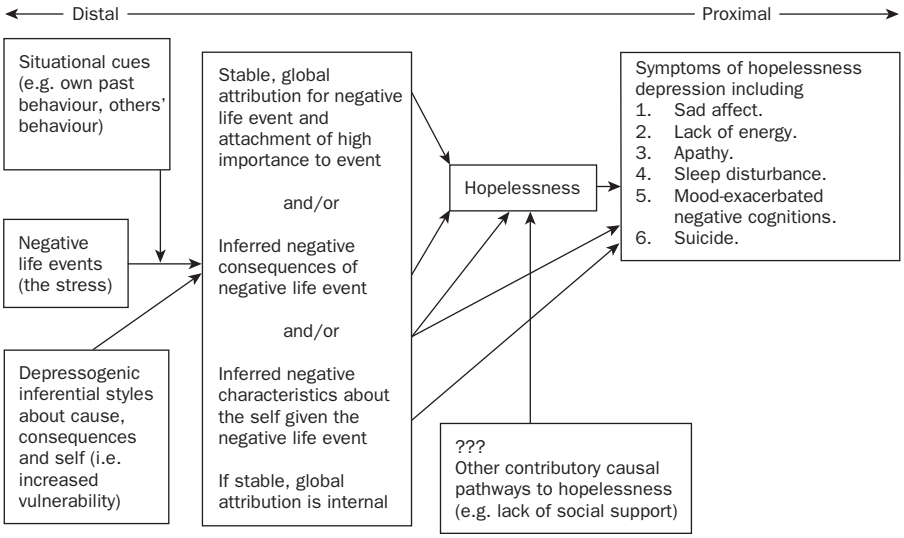

Figure 14.11

The hopelessness model of depression. Source: Adapted from Abramson et al. (1989).

Research close-up 2

Attributional style as a personality factor in insurance sales performance

The research issue

Seligman (1991) summarizes different dimensions of attributional style as forming 'optimistic' and 'pessimistic' explanatory styles for favourable (success) and unfavourable (failure) events. In this study, attributional style, for both positive and negative events, was measured using a questionnaire.

According to the reformulated learned helplessness model of depression, individuals with an optimistic explanatory style are more resilient when faced with unfavourable events (e.g. failure in an exam, loss of a job) compared to individuals with a pessimistic explanatory style.

One occupation in which employees experience frequent success and failure is the selling of financial services. In the USA, Seligman and Schulman (1986) showed that pessimistic style for negative events is negatively related to sales performance, and that an optimistic style for both positive and negative events predicts survival persistence in the job and sales achievement.

More general research in the UK suggests that an optimistic style for positive events is more predictive of high performance than an optimistic style for negative events (e.g. Brewin & Shapiro, 1984; Furnham et al., 1992).

The aim of this study (Corr & Gray, 1996) was to examine the relationship between attributional style and sales in financial services salespeople. It was hypothesized that if attributional style is an important personality variable, then individual differences in attributional style should be related to differences in sales performance.

Design and procedure

Participants were 130 senior salespeople in a UK insurance company, all male. Measures were recorded using the Seligman Attributional Style Questionnaire (SASQ; Peterson et al., 1982). This presents respondents with 12 hypothetical situations (e.g. 'You do a project that is highly praised'). Six of these situations were 'negative' and six 'positive'. Within each of these categories, three situations were related to interpersonal events and three to achievement events.

Composite scores were calculated for positive and negative events. Sales outcomes were measured by the number of policies sold x average value of the policy, and also by company ranking of performance, from 1 (best salesman) to *n* (worst salesman).

Attributional style was measured by questionnaire completion in groups during the training sessions. Sales performance was measured over a six-month period.

Results and implications

Positive attributional style was positively correlated with sales, showing that salespeople scoring higher in positive attributional style were more successful than their lower scoring colleagues. Positive attributional style for achievement-related situations was the best predictor of performance ranking.

The results of this study do not tell us about the direction of causation. Being successful may lead to high levels of optimism, or being optimistic may lead to high levels of success. But prospective studies have shown that differing aspects of attributional style between individuals can predict future performance in sales (Corr & Gray, 1996) and academic achievement (Houston, 1994).

Corr, P.J., & Gray, J.A., 1996, 'Attributional style as a personality factor in insurance sales performance in the UK', *Journal of Occupational and Organisational Psychology*, 69, 83–7.

will determine which behaviour is selected by them from a potentially large number of possibilities.

Mischel (1973/1990) defined three types of expectancy:

1. Behaviour–outcome relations are the relationship between possible behaviour and expected outcomes in any situation – 'if I do this, then that will happen' (see chapter 4). We use our previous experience to determine our behaviour and to guide what we expect to happen. For example, when we go to a wedding, we use information about previous weddings we have attended to guide our expectations. (This is related to the notion of 'scripts' that was referred to in chapter 12.) It is also adaptive to be able to recognize and appreciate new contingencies, as employing outdated ones may lead to inappropriate behaviour.
2. Stimulus–outcome relations – we learn that certain cues or stimuli are likely to lead to certain events, and we learn to react accordingly. Physical characteristics, self-presentational techniques and forms of dress are all examples of stimuli that lead us to have certain expectations about someone's behaviour. For example, we would not expect someone in an expensive suit to begin digging the road. Non-verbal behaviours can also lead us to expect certain kinds of behaviour. If you ask a friend for a favour and they begin to nod and smile, you have a different expectation of the outcome than if they begin to frown and look away. Such cues are often culturally or personally determined.
3. Self-efficacy is a person's belief that they can perform a certain behaviour. People differ in how effective they expect themselves to be in a situation, and these expectations seem to affect their actual performance (Bandura, 1978). Much of the research that has examined expectancies within personality psychology has focused on this third type of expectancy. The concept of *self-efficacy* was first developed by Bandura (1978, 1982) and is defined as the belief that one can bring about certain outcomes. According to Bandura (1986), there are four determinants of self-efficacy beliefs:
   - actual performance accomplishments are what we have achieved in the past, and these are the primary source of self-efficacy information;
   - vicarious experiences are what we observe about others' performance, and how we evaluate ourselves in relation to other people;
   - verbal persuasion relates to what others tell us they think we can do (our own perceived self-efficacy being influenced by how other people convey their confidence in, or doubts about us); and
   - emotional arousal is our awareness of our levels of autonomic and emotional arousal – the cues we receive from our own physical and emotional feelings.

self-efficacy the extent to which people believe that they can bring about outcomes

Self-efficacy has been shown to be a strong predictor of coping with disease (O'Leary, 1992), phobias (Cervone et al., 1991) and academic performance (Houston, 1995). For example, Houston found that efficacy has a protective role for students: those who are high in efficacy are less likely to become depressed when they fail academic tests.

Affects – how we feel

The way we feel can be determined by stable individual differences in personality as well as by immediate responses to situations as they occur. Both types of emotional reaction can have an important impact on the way we behave. Mischel and Shoda (1995) describe this interplay in terms of 'hot' emotions having an impact on 'cool' cognitions. Feeling angry, anxious or happy might impact on any of the other types of cognition, changing the way we respond. So a person who is already feeling happy may react very positively to meeting a friend in the street, someone who is already feeling angry may lose their temper when their car is scraped in the car park. A dispositionally calm person may still become anxious when the elevator they are travelling in becomes stuck between floors.

Goals, values and the effects of reward

Two people with similar encoding styles and expectancies may behave differently because they have different personal values. Subjective values are viewed as acting as a) motivating stimuli and b) incentives. Our actions are often the result of intrinsic motivation, related to personal preferences and values.

Deci and Ryan (1985) made the distinction between i) self-determined and ii) controlled actions. Self-determined actions have some intrinsic interest or value to the individual, whereas controlled actions satisfy external pressures or demands, or are done to gain some form of payment. Many studies have shown that offering reward for certain tasks actually decreases people's motivation to perform those tasks (e.g. Deci & Ryan, 1985). Related to this finding, Deci (1975) distinguished between two aspects of reward – controlling and informational. A reward that has a controlling aspect might make people feel their efforts are not self-determined. Reward that has an informational aspect can have two consequences – it may make people feel they have high levels of competence, which in turn increases motivation, or it may make them feel they are only engaging in the activity for reward, which decreases motivation.

Competencies and self-regulatory plans

These are our rules for and reactions to our own performance. In the absence of external constraints and monitors, we set performance goals for ourselves. We react with self-criticism if we do not meet these standards, and self-praise or satisfaction if we do meet them, or even exceed them. Self-regulation is the process through which we influence our environment and behaviour.

Self-consciousness

control theory of human functioning a metaphorical thermostat system used to model the ways in which people set standards for their own behaviour and how they monitor this behaviour

Carver and Scheier (1981, 1990) developed a *control theory of human functioning*, which states that there are stable individual differences in the extent to which we attend to aspects of the self. Control theory uses a metaphorical thermostat system to model the ways in which people set standards for their own behaviour and how they monitor their behaviour in order to meet these standards. If we perceive ourselves to have reached too high a standard, the personality system will reduce the discrepancy between the standard and the perceived level. If we are not meeting the standard we have set for ourselves, motivation and effort will be set in motion to reduce the discrepancy.

People differ in the levels and kinds of controls included in their self-regulatory system. The extent to which we attend to aspects of the self has been defined as a personality variable called *self-consciousness*. Fenigstein, Scheier and Buss (1975) developed a self-consciousness scale to measure what they considered to be stable individual difference in private and public self-consciousness. Private self-consciousness is attention to our own inner feelings, desires and standards, whereas public self-consciousness is attention to what others think and observe about us.

self-consciousness the tendency to direct attention towards the self

The importance of self-consciousness is illustrated by a study in which participants looked at photographs or slides of people with positive or negative facial expressions (Kleinke, Peterson & Rutledge, 1998). Participants attempted to communicate these facial expressions as accurately as they could to a video camera. Some were able to view themselves in a mirror while doing this, and some were not. Participants in a control group maintained neutral facial expressions. The researchers found that participants experienced increased positive mood when they engaged in positive facial expressions and decreased positive moods with negative facial expressions (see chapter 6). Furthermore, these effects were enhanced when participants viewed themselves in a mirror – and the positive effects were stronger for participants with high private self-consciousness.

Self-guides

In his self-discrepancy theory, Higgins (1987, 1989) suggested that we have self-guides representing internalized standards, which may be unconsciously activated to influence behaviour. There are two particularly important self-guides:

1. The 'ideal self' represents the attributes that we would like to possess (ideals that we and important others hold). It is associated with positive outcomes, and is derived from the positive affect associated with attaining standards set by important figures from childhood owards.
2. The 'ought self' represents the attributes that we feel we should possess (duties and responsibilities). It is associated with negative outcomes, and is derived from negative affects associated with not fulfilling duties and responsibilities. According to Higgins' self-discrepancy theory, we are motivated to reduce two kinds of discrepancy. These are discrepancies between how we actually see ourselves and how we would like to be ideally (this is the 'actual self-ideal self' (AI) discrepancy), as well as between how we actually see ourselves and how we ought to be (the 'actual self-ought self' (AO) discrepancy). All children learn ideal and ought self guides, but Newman, Higgins and Vookles (1992) found that first-born children are more strongly orientated toward the standards of others, and their AI and AO discrepancies are associated with more emotional distress than in the case of second and later-born children.

Self-monitoring and competencies

Snyder (1974) and Snyder and Gangestad (1986) developed a scale designed to assess the degree to which individuals regulate their behaviour in order to make a particular social impression. They found that high self-monitors alter their behaviour in response to specific situational demands, and are therefore likely to display less consistency in their actions.

Competencies (the ability to generate particular cognitions and behaviours) are thought to be related to intelligence and social maturity. Mischel (1990) argued that we develop competencies to create cognitions and behaviours that may be conceptualized as *social intelligence* (Cantor & Kihlstrom, 1987). In other words, we develop abilities to transform and use social information and knowledge actively, and to create thoughts and actions, rather than simply storing a whole load of 'recipe' responses.

social intelligence competencies and skills used in social behaviour

Each individual acquires the capacity actively to construct a multitude of potential behaviours with the knowledge and skills available to him. People vary enormously in the range and quality of the cognitive and behavioural patterns they can generate, and in their social problem-solving strategies.

Social intelligence

Cantor (1990) outlines the cognitive competencies we use to solve everyday life tasks within a theory of social intelligence. She describes the representation of goals, plans for achieving goals, representations of the self and possible selves, the development of coping mechanisms and self-regulation. She uses three concepts to examine the processes that guide social behaviour:

- schemas that channel perception and memory in specific settings;
- life tasks that individuals construct as goals; and
- strategies that are used to pursue the goals.

Cantor describes a series of studies that have examined life tasks and cognitive strategies during major life transitions (e.g. from school to university, and from university to work). This research has identified types of life tasks that are common amongst young people during these transitions, as well as strategies that are used to tackle them.

In identifying strategies used in academic contexts, Norem (1989, Norem & Cantor, 1986) identified a distinction between 'optimists' and 'defensive pessimists'. Optimists feel little anxiety about achievement tasks, work hard and keep their performance expectations high. Defensive pessimists set low expectations and ruminate over the worst potential outcomes. And yet, despite differing strategies, research shows that the two types of student do not differ significantly in terms of actual academic performance. Both strategies are adaptive in different ways: optimists avoid considering what might go wrong, and defensive pessimists play out worst case scenarios in order to deal with anxiety and focus on the task.

FINAL THOUGHTS

This chapter offers only an overview of the world of personality. It has examined different theoretical explanations of why we show consistency in our behaviour, thoughts and actions and why these consistencies make us different from each other.

Psychoanalytic theorists focus on unconscious processes and the impact of early childhood experience; in contrast, humanistic theorists emphasize human experience and positive aspects of behaviour. Trait theorists have been concerned with the labelling and measurement of personality dimensions, based on assumptions of stable genetic and biological explanations for personality. The complex way in which genes and environment determine personality has presented an important puzzle for personality theory. Social–cognitive theories provide an explanation for differences in personality in terms of the ways we process information and perceive our social world.

Within psychology the complexities of how our personality develops and determines our behaviour have resulted in a number of differing theoretical perspectives and debates. These debates – about interactions between genes and environment, biology and experience, the person and the situation – will continue to engage psychologists in the twenty-first century.

Summary

- Personality theorists are concerned with identifying generalizations that can be made about consistent individual differences between people's behaviour and the causes and consequences of these differences.
- Sigmund Freud developed a psychoanalytic approach that emphasized the role of the unconscious in regulating behaviour. Freud produced hypothetical models of the structure of the mind, the way personality works and the ways in which it develops.
- Psychoanalytic theories are not testable in the same way as modern scientific psychology.
- Traits are descriptors for personality, which have their origins in everyday language. Hans Eysenck and Raymond Cattell both developed trait theories that exerted a considerable impact on research in personality.
- In recent years, researchers have developed a five factor model of personality, which might represent evidence of a universal structure for personality.
- Biological theories of personality attempt to explain differences in behaviour in terms of differences in physiology, particularly brain function.
- Hans Eysenck developed explanations for both extraversion and neuroticism based on theories of cortical arousal.
- Research in behavioural genetics has permitted the examination of both genetic and environmental factors in personality.
- Identical twins are much more similar in personality than are fraternal twins, but personality similarities between parents and children, or between siblings, are not always very strong.
- Social–cognitive theories of personality examine consistent differences in the ways people process social information, allowing us to make predictions about individuals' behaviour in particular contexts.
- Mischel devised a framework of broad cognitive categories involving processes that may lead to personality differences.

REVISION QUESTIONS

1. How do personality theorists define personality?
2. Why are both consistency and difference important concepts for the personality psychologist?
3. Why is the unconscious so important in Freud's theory of personality?
4. In what ways did Freud link personality development to physical development?
5. According to Eysenck, what are the three primary dimensions of personality?
6. What are the Big Five?
7. What is more important in determining behaviour – the person or the situation?
8. Is extraversion related to brain-wave activity?
9. Are identical (monozygotic) twins more similar in personality than non-identical (dizygotic) twins?
10. Is our personality an effect of how we interpret the world, or does it cause it?
11. Does the way we perceive stress determine how we cope with it?
12. How do internalized standards affect our behaviour?

Further Reading

Carver, C.S., & Scheier, M.F. (1996). *Perspectives on Personality*. 3rd edn. Needham Heights, MA: Allyn and Bacon.
Divides personality into different perspectives and includes a considerable amount of material on self-regulation.

Mischel, W. (1999). *Introduction to Personality*. 6th edn. Orlando: Harcourt Brace Jovanovich.
An interesting introduction to personality research.

Pervin, L.A. (1996). *The Science of Personality*. New York: John Wiley & Sons.
A readable and reasonably comprehensive account of personality research.

Peterson, C., Maier, S.F., & Seligman, M.E.P. (1993). *Learned Helplessness: A Theory for the Age of Personal Control*. New York: Oxford University Press.
The history and development of learned helplessness theory.

Plomin, R. (1994). *Genetics and Experience: The Interplay Between Nature and Nurture*. London: Sage.
Examines the role of both nature and nurture in the development of individual differences.

Plomin, R., DeFries, J.C., McClearn, G.E., & Rutter, M. (1997). *Behavioral Genetics*. 3rd edn. New York: Freeman.
Introduces the field of behavioural genetics, including genetic factors in ability and disability, personality and psychopathology.

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Abnormal Psychology

15

CHAPTER OUTLINE

Learning Objectives

By the end of this chapter you should appreciate that:

- abnormal psychology (or psychopathology) deals with sets of behaviours or symptoms that produce a functional impairment in people's lives;
- psychological disorders (e.g. schizophrenia) have been documented across time and culture;
- throughout history, the causes of abnormal behaviour have been construed from a number of different perspectives;
- biological/genetic models focus on brain defects, biochemical imbalances and genetic predispositions as causes of psychopathology;
- Freudian, contemporary psychodynamic and attachment models focus on the effects of early parent–child experiences;
- behavioural models focus on the learning experiences that result in psychopathology;
- cognitive models focus on the effect of distorted thought processes;
- the diathesis–stress perspective suggests that the factors identified by each of the other models may work in accordance with one another;
- the developmental psychopathology perspective provides a framework for understanding how psychopathology develops from childhood to adulthood;
- these perspectives can help us understand the numerous disorders documented in classification systems such as the DSM-IV and the ICD-10;
- there are several major forms of psychopathology, including schizophrenia, mood disorders, substance abuse, eating disorders and personality disorders.

INTRODUCTION

Abnormal psychology is the study of mental disorders (also called mental illness, psychological disorders or psychopathology) – what they look like (symptoms), why they occur (etiology), how they are maintained, and what effect they have on people's lives.

Mental disorders are surprisingly common. For example, a study conducted by the World Health Organization examined the prevalence, or frequency, of mental disorders in people visiting medical doctors in primary care settings in 14 countries. As figure 15.1 shows, the study revealed that 24 per cent of these people had diagnosable mental disorders and another 10 per cent had severe symptoms of mental disorders (Üstün & Sartorious, 1995).

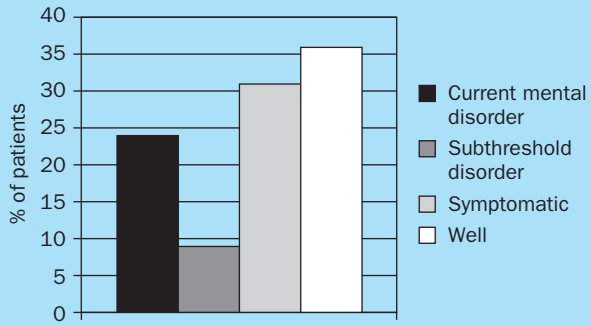

Figure 15.1

Rates of current mental disorder in patients presenting to primary care facilities across the world.
Source: Adapted from Üstün and Sartorius (1995).

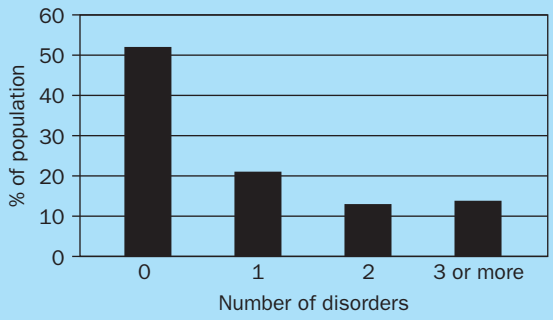

Figure 15.2

Comorbidity in lifetime rates of mental disorders. Comorbidity is the occurrence of two or more disorders at the same time. Of the 48 per cent of people reporting lifetime history of disorder in this study, over half reported two or more simultaneous disorders. These data come from a survey in the US, but similar rates of comorbidity have been found in countries around the world.
Source: Kessler et al. (1994).

Psychopathology can happen to anyone and affects many people around them – there is no age, race or group that is immune. Furthermore, many people experience more than one disorder at the same time (see figure 15.2).

The frequency and widespread suffering caused by mental disorders makes our understanding of them critical.

WHAT DOES 'ABNORMAL' MEAN?

Defining abnormality is deceptively difficult. When asked to describe abnormal behaviour, people typically say that it occurs infrequently, is odd or strange, is characterized by suffering, or is dangerous. All of these are reasonable answers for some types of abnormal behaviour, but none of them is sufficient in itself, and making them all necessary results in too strict a definition.

One parsimonious and practical way to define abnormal behaviour is to ask whether the behaviour causes *impairment* in the person's life. The more a behaviour gets in the way of successful functioning in an important domain of life (including the psychological, interpersonal and achievement/performance domains), the more likely it is to be considered a sign of abnormality. When several such behaviours or symptoms occur together, they may constitute a psychological disorder.

impairment extent to which a behaviour or set of behaviours gets in the way of successful functioning in an important domain of the individual's life

Psychological disorders are formally defined in widely used classification systems, or nosologies: the International Classification of Diseases – 10th edition (ICD-10; World Health Organization, 1992) and the Diagnostic and Statistical Manual of Mental Disorders – 4th edition (DSM-IV; APA, 1994). Although they differ from one another in format, these two systems cover the same disorders and define them in a similar manner.

Importantly, both the ICD-10 and the DSM-IV require that the level of impairment a person is experiencing be taken into account when deciding whether they meet criteria for any mental disorder. For example, the DSM-IV diagnostic criteria for depression specify that: 'The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning' (p. 327). The ICD-10 description of depression also states: 'The extent of ordinary social and work activities is often a useful general guide to the likely degree of severity of the episode' (p. 121).

Finally, it is important to be sensitive to how contextual factors affect judgements about abnormality, so as not to over- or under-pathologize groups or individuals. Such factors include ethnicity and culture, gender, age and socio-political values. For example, homosexuality was once listed as a disorder in the DSM, but, as socio-political values changed to become somewhat more liberal and accepting, it was deleted.

WHAT CAUSES ABNORMAL BEHAVIOUR?

With a basis for understanding how to define abnormal behaviour, we can focus on its causes. Abnormal behaviour is construed from a number of different perspectives. Each of the following models tells us something about different aspects of a multi-faceted group of mental disorders.

Biology and genetics

Biological and genetic models assert that mental disorders are diseases, and symptoms of mental disorders are caused by factors such as brain defects (abnormalities in the structures of the brain), *biochemical imbalances* (complex dysregulation processes involving various neurotransmitters) and *genetic predispositions* (risk for psychopathology carried via our genetic material).

biochemical imbalance complex neurotransmitter dysregulation process involving the various neurotransmitters in the brain

genetic predisposition likelihood of showing condition or characteristic carried by genetic material

By and large, the evidence for brain defects and biochemical imbalances as causes of mental disorders is correlational, which means that, although we know that such biological problems occur among people with mental disorders, we don't know whether they actually cause the disorder. Because the brain is a fairly malleable organ, our behaviour and experiences can also affect our brain functioning, suggesting that the association between biology and abnormal behaviour may be reciprocal rather than unidirectional.

Genetic models of mental disorder suggest that psychopathology is inherited from parents, and there is certainly evidence for the *familial transmission* of many disorders. For example, monozygotic (identical) twins should be more likely than dizygotic (fraternal) twins to have the same disorder because they share 100 per cent of their genetic material, whereas dizygotic twins share only 50 per cent. For many disorders, this is exactly what research shows.

familial transmission genetic transmission of disorders

But given that monozygotic twins share 100 per cent of their genetic material, you might expect them to have the same disorders 100 per cent of the time. But in fact they have the same disorders only about 50 per cent of the time. These findings have led researchers to conclude that, rather than being deterministic, genetics contributes about 50 per cent of the risk for mental illness. Such findings show that it doesn't make sense to question whether mental illness is a function of nature *or* nurture. Instead we need to focus on how the two interact.

Psychodynamics and the parent–child relationship

Freud emphasized the role of the early parent–child relationship in the development of mental illness. According to Freud, to the extent that the child did not successfully negotiate the psychosexual stages (see chapter 14), mental illness would develop.

But Freud didn't focus on what actually occurred in the parent–child relationship (e.g. whether parents were actually poor caretakers). Instead, his focus was on the unconscious internal desires and motivations of the child (e.g. sexual and aggressive impulses) and how the child negotiated them as s/he progressed through the early relationship with the child's parents. For example, if an adult male found himself unable to deal with authority figures, this might be interpreted as unresolved aggressive impulses towards his father. Whether his father behaved as a harsh authority figure or not would be considered less relevant. So, according to Freud, mental illness is due to intrapsychic (i.e. within the mind) conflict. This means a person may have very little insight into the 'true' causes of their symptoms, as these are thought to be occurring at an unconscious level of processing.

Many of Freud's ideas have gone unsupported by research, but a number of them have proven to be fairly accurate. For example, there is ample evidence that people experience and process things at a non-conscious level (see Westen, 1998; also chapter 14) and that early interpersonal experiences affect later outcomes. In fact, this latter hypothesis became central to contemporary psychodynamic models of abnormal behaviour.

Contemporary psychodynamic models (e.g., Kohut, 1977; Kernberg, 1976; Mitchell, 1988) also suggest that the early parent–child relationship is the original source of mental illness, and that what goes on in the mind of the child (and the adult) is important.

But these models differ from Freud's in that they focus more on interpersonal relationships than on intrapsychic conflict. These later models suggest that the early relationship between the child and the primary caregiver is crucial to the development of the self-concept, concepts of others, and the quality of relationships throughout life. The idea is that this early caregiver–child relationship is internalized by children, so that they learn about themselves and others from the manner in which the caregiver treats them. According to this framework, the nature of this internalized relationship and its resulting impact on the sense of self and the sense of others is what can create vulnerability to psychological problems.

Attachment and security

The attachment model of psychopathology, developed by Bowlby (1969; 1973; 1980; see also chapter 9) resembles the contemporary psychodynamic models in that it also emphasizes the early parent–child relationship and how the resulting models of self and others guide development. But rather than being interested in people's perceptions of their early experience, Bowlby was interested in the actual characteristics of the relationship. He relied on observational studies of parents and children to build his theory, rather than on retrospective reports of adults. The theory therefore has a strong empirical foundation.

Attachment theory suggests that when parental behaviour fails to make children feel safe, secure, and able to turn to and trust the parent in times of need, then children will be unable to regulate their emotions and needs adaptively and will develop negative, 'insecure' views of themselves and others. This would put children at risk for developing psychological disorders. Research supports this hypothesis, as 'insecure' children and adults show more psychopathology than 'secure' children and adults (see Dozier, Stovall & Albus, 1999; Greenberg, 1999).

Research close-up 1

Reconciling the roles of genetics and the environment in risk for major depression

The research issue

As you have read in this chapter, genetic and environmental models make very different assumptions about the causes of depression. Kendler et al. (1995) conducted a study in an effort to determine the extent to which genetic and environmental factors contribute to depression. In their study, Kendler and his colleagues examined two important questions: (1) do genetic factors and stressful life events make unique contributions to risk for depression in women? and (2) do genetic factors and stressful life events interact to create risk for depression? In particular, the researchers wondered whether the association between stressful life events and risk for depression would be greater among people at high genetic risk compared to people at low genetic risk.

Design and procedure

To examine these questions, Kender and colleagues studied four groups of women: (1) women with a depressed monozygotic (MZ) twin, (2) women with a depressed dizygotic (DZ) twin, (3) women with a non-depressed MZ twin, and (4) women with a non-depressed DZ twin. Women with a depressed MZ twin are at the highest genetic risk for depression, and women with a non-depressed MZ twin are at the lowest genetic risk for depression. For each woman, they assessed whether the person in question had experienced a depressive episode in any given month over the course of approximately one year, and they recorded whether any severe life events occurred during each month over this one year time period.

Results and implications

Both stressful life events and genetic factors made unique contributions to depression. Regardless of genetic risk, stressful life events were associated with depression, and regardless of life stress, genetic risk was associated with depression.

- However, the impact of stressful life events on risk for depression was greater among women at high genetic risk than it was for women at low genetic risk (see figure 15.3).
- Interestingly, the stressful life events that were found to be most strongly associated with depression were mainly interpersonal in nature (death of a close relative, serious marital problems, divorce/break-up, and assault), highlighting the importance of relationship factors in risk for depression.

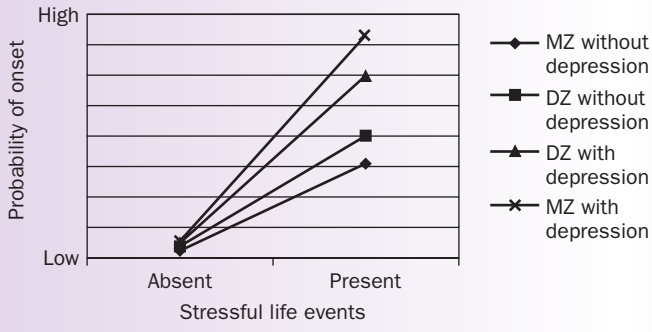

Figure 15.3

Risk of onset of major depression as a function of genetic risk and stressful life events. Source: Kendler et al. (1995).

The findings suggest that both genetic risk and stressful life events are important factors in understanding women's risk for depression. Moreover, consistent with a diathesis-stress model (see p. 319), women at high genetic risk who experience a stressful life event in the interpersonal domain of their lives are at greatest risk of all. Therefore, to understand risk for depression among women best, we must consider both genetic factors and environmental factors.

Kendler, K.S., Kessler, R.C., Walters, E.E. et al., 1995, 'Stressful life events, genetic liability, and onset of an episode of major depression in women', *American Journal of Psychiatry*, 152, 833–42.

Learned behaviour

Behavioural models suggest that all behaviour, abnormal included, is a product of learning – mainly learning by association (see chapter 4).

For example, according to the classical conditioning model of learning (e.g. Pavlov, 1928), if a man experiences chest pains which result in anxiety while shopping in a department store, he may develop a fear of department stores and begin to avoid them because he associates them with anxiety. There is nothing inherently frightening about department stores, but this man fears them because of the association that he has formed with his earlier anxiety about having a possible heart attack. Here is another example which instead uses the operant model of learning (e.g. Skinner, 1953): if a young normal weight woman begins to lose weight and her friends and family praise her for doing so, she may continue to lose weight, even if it means starving herself. Her restricted eating behaviour will continue because she now associates a reduction in her diet with the praise and acceptance of others.

There is a third type of learning that does not rely on personal experiences to establish associations. In observational learning, behaviour is learned simply by watching someone else do something and observing what happens to them (Bandura, 1969). For example, a young boy may learn to be aggressive after watching his peers act aggressively.

Each of these learning models was built on a solid foundation of empirical research, and there is a great deal of evidence that each of the three learning processes plays an important role in abnormal behaviour.

Distorted thinking

Cognitive models of abnormal behaviour focus on the way people think about themselves, others and the world (e.g. Beck et al., 1979). Distorted cognitive processes – such as selectively attending to some information and ignoring other information, exaggerating negative feelings, expecting the worst, or making inaccurate attributions about events (see chapters 14 and 17) – have been shown to play an important role in various types of psychological disorders.

For example, suppose a woman has a bad day at work. If she says to herself, 'Oh well, tomorrow will be better', she will probably feel fine. But if she says to herself, 'Oh, I'm just a horrible person with no future' (i.e. if she exaggerates her negative feelings), she may become depressed. Or suppose a young man loses at a game of cards. If he thinks, 'I sure had bad luck with the cards today', he will feel fine. But if he thinks, 'My rotten friends purposely cheated me!' he may become hostile and aggressive.

Integrative models

The models of abnormal behaviour described above are quite different from one another, and each is more or less well suited to particular disorders. As most disorders are quite complex, no single model can provide a full explanation of their onset and course over time. Instead, each model can help us to understand a different aspect of each disorder. This is where integrative models are useful.

You may have noticed that only some of the models above explicitly focus on childhood factors that may contribute to the development of abnormal behaviour, whereas the others only do so at an implicit level. For example, behavioural models suggest that abnormal behaviour is the product of 'earlier' learning experiences, but they don't elaborate on exactly what those experiences are. By contrast, *developmental psychopathology* provides a more rigorous framework for understanding how psychopathology develops from childhood to adulthood. It is also likely that mental illness results only when particular combinations of factors are present. This notion is at the heart of the *diathesis–stress model*.

developmental psychopathology a perspective suggesting that risk for psychopathology depends on success at negotiating and mastering important developmental tasks

diathesis–stress model suggests that some people possess an enduring vulnerability factor (diathesis), which, when coupled with a proximal stressor, results in psychological symptoms

The diathesis–stress model

The diathesis–stress model of mental illness (figure 15.4) suggests that some people possess an enduring vulnerability factor (a diathesis) which, when coupled with a proximal (recent) stressor, results in psychological disorder. Neither the diathesis nor the stressor alone is enough to lead to symptoms – both must be present.

Diatheses and stressors can be defined broadly. For example, a genetic or biological predisposition to mental illness might be the diathesis, and a troubled parent–child relationship could be the stressor; or a dysfunctional pattern of thinking about the world can be the diathesis, and a major life event the stressor.

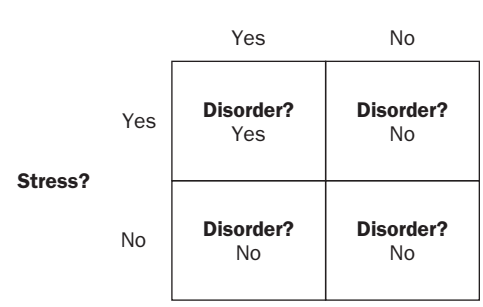

Figure 15.4

The diathesis–stress model of psychopathology. According to this model, psychopathology is most likely to result when a person with a diathesis (vulnerability) experiences a stressor. This model helps us to understand why only some people with vulnerabilities, such as a genetic predisposition, develop psychopathology.

As you read through the following sections on the various disorders, you might want to consider how a diathesis–stress process could describe how each comes about.

Developmental psychopathology

According to this model, psychopathology is best understood using a lifespan development approach. It considers how the negotiation and attainment of earlier developmental tasks affects people's capacities to manage later tasks (e.g. Cicchetti, Rogosch & Toth, 1994).

In other words, people may travel down one of many paths; their success or failure at various junctures along the way determines the subsequent path that they follow. So earlier deficits in functioning may leave us unprepared to successfully negotiate subsequent related situations, putting us at even greater risk for psychopathology.

For example, a young girl who is harshly and chronically criticized by her parents may develop low self-esteem and the expectation that people will not like her, which puts her at risk of becoming depressed. She may then have difficulty making friends in school because she is afraid of rejection. She may feel lonely and undesirable, her withdrawal leading to actual rejection by her peers, continuing her risk for depression. But if this young girl has a teacher who treats her with warmth and care and helps her learn how to make friends, her risk for depression might be reduced. This is because she is acquiring important skills that have the potential to change the course of her subsequent development.

DISORDERS – SYMPTOMS AND CAUSES

For each disorder we will look at its symptoms and the course it takes. Then we will consider its causes, both biological/genetic and psychosocial, and the factors that affect its course. Prevalence rates (i.e. the cross-sectional proportion of occurrences of the disorder in the population) for various disorders are shown in figure 15.5.

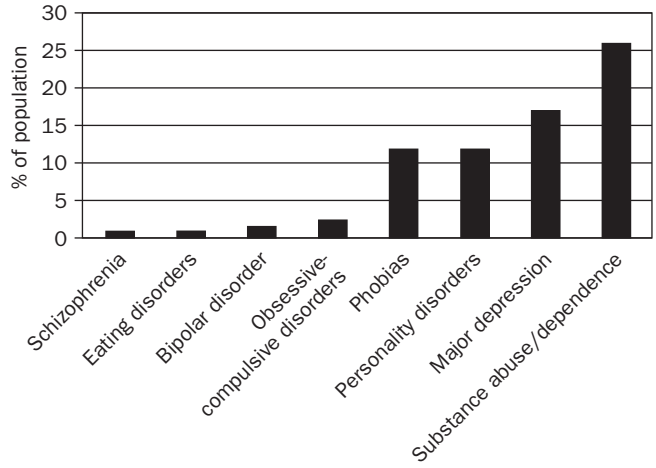

Figure 15.5

Lifetime prevalence rates for psychological disorders. These rates are from studies conducted in the US (Kessler et al., 1994), but cross-national studies indicate similar rates of disorders in other countries such as Switzerland, Germany and Puerto Rico. Source: Kessler et al. (1994).

Table 15.1 Suicide: a serious mental health and public health problem

Facts about suicide	*Risk factors for suicide*
■ Suicide occurs across the world, but rates vary by culture ■ Self-inflicted injuries, including suicide, were the 12th leading cause of death in the world in 1998 ■ In all cultures, men are more likely than women are to complete suicide ■ Rates of suicide in children and adolescents are on the rise ■ People with mental disorders, especially depression, substance use disorders, schizophrenia, and borderline personality disorder, are at high risk for suicide	■ Past history of attempted suicide ■ Talking about committing suicide ■ A clear plan to commit suicide ■ Available means (e.g. firearms, drugs) ■ Depression ■ Substance abuse ■ Hopelessness ■ Impulsivity ■ Stressful life events ■ Lack of social support ■ Saying goodbye to people ■ Giving away personal items

SCHIZOPHRENIA – A LIVING NIGHTMARE

Images of schizophrenia are easy to conjure – a dishevelled person, alone, talking to himself or yelling at someone else that only he seems to see. This is a frightening image, for the symptoms it portrays are extremely odd and disconcerting. Indeed, schizophrenia can be a frightening disorder to deal with, not only for those involved with schizophrenic people, but for the sufferers themselves.

Schizophrenia is a severe mental disorder, experienced by many sufferers as a living nightmare, a fact highlighted by the high rate of suicide among schizophrenics (Caldwell & Gottesman, 1992; see table 15.1).

As you read this section, try to imagine what it might feel like to experience some of the things schizophrenic people experience. For example, many schizophrenic people hear voices. Have you ever heard someone call your name, only to find there was no one there? How did that feel? Rather disconcerting, most likely. Now magnify your feelings about 100 times and you may start to sense how the schizophrenic person feels.

Symptoms

Schizophrenia is characterized by *psychosis*, or a break with reality. People who are

psychosis a break with reality, characteristic of schizophrenia

psychotic think and behave in ways that have little to do with reality, showing significant impairment in just about every important domain of functioning – perception, thought, language, memory, emotion and behaviour. People with schizophrenia may exhibit any of these symptoms:

- Perceiving things that are not there – these hallucinations are usually auditory (e.g. hearing voices), but visual and tactile hallucinations (e.g. seeing God or the devil, or feeling that insects are crawling under your skin) also occur relatively frequently.
- Believing things that are not true – *paranoid delusions* are particularly common. A schizophrenic woman may believe that the government is plotting against her or that aliens plan to kill her. Everything will be interpreted in the context of the delusion, even things that are meant to help, so medication will be seen as poison. Delusions of grandeur are also common: a schizophrenic person may believe that he is someone famous, such as Elvis or Jesus Christ, and may insist on behaving like and being treated as that person.

paranoid delusions elaborate set of beliefs, commonly experienced by schizophrenics, characterized by significant distrust of others and feelings of persecution

- Using odd or bizarre language, such as idiosyncratic meanings for common words or made-up words (neologisms) that only have meaning to them. They may also go off on tangents when they speak.
- Disturbances in affect – flat affect can result in a lack of facial expressions and emotionless, monotone speech, while inappropriate affect is characterized by laughing when nothing funny has happened, crying when nothing sad has happened or getting angry when nothing upsetting has happened.
- Behavioural disturbances in four important areas:
  1. odd mannerisms, such as repetitive movements or behaviours and odd facial expressions (e.g. grimaces);
  2. a significant lack of motivation, called avolition;
  3. difficulty taking care of themselves, including basic life skills such as paying bills, shopping, and dressing; and
  4. poor social skills, being socially withdrawn, and having disturbed relationships with others (the nature of interpersonal relationships plays a key role in the course of the disorder).

positive symptoms in schizophrenia, symptoms that indicate the presence of something unusual, such as hallucinations, delusions, odd speech and inappropriate affect

negative symptoms in schizophrenia, symptoms that indicate the absence of something normal, such as good social skills, appropriate affect, motivation and life skills

The symptoms of schizophrenia are grouped into two categories: positive and negative symptoms. *Positive symptoms* indicate the presence of something unusual (such as hallucinations, delusions, odd speech and inappropriate affect) and *negative symptoms* indicate the absence of something normal (such as good social skills, appropriate affect, motivation and life skills).

The course of schizophrenia

Schizophrenia is a chronic disorder. Although some people have brief episodes of schizophrenic-like behaviour (called brief reactive psychoses), most people with schizophrenia suffer from symptoms for their entire lives.

One common course of schizophrenia is a period of negative symptoms and odd behaviour during which the person's functioning slowly deteriorates (the prodromal phase), followed by a 'first break' – the first episode of positive symptoms. Some people experience an episode of positive symptoms with a few warning signs beforehand. The manifestation of symptoms can also take a number of different forms. For example, some people may be delusional but still be able to take basic care of themselves, carry on a conversation and succeed in school and work, whereas others may be completely debilitated by the disorder.

Schizophrenia typically has its onset in late adolescence or early adulthood. Although it can start in childhood, this is quite rare. Sufferers don't necessarily deteriorate over time, but they do have relapses into episodes of positive symptoms.

Causes of schizophrenia and factors affecting its course

1 Genetic and biological factors These account for our initial vulnerability to schizophrenia, although exactly how they do so is unclear.

What is clear is that schizophrenia tends to be inherited. For example, monozygotic twins have the highest *concordance rates* for schizophrenia (Gottesman, 1991), meaning that they are more likely to both have schizophrenia if one of them has it, compared to people who share less genetic material (such as dizygotic twins or siblings). Interestingly, schizophrenics

concordance rates the extent to which people show the same disorders

Pioneer

Emil Kraepelin (1856–1926), a German psychiatrist and one of the founding fathers of modern psychiatry, made three primary contributions to the field of mental illness. First, Kraepelin believed that mental illness was caused by biological factors. His work in this area helped define the field of biological psychiatry and research now supports a strong biological basis for some of the disorders in which Kraepelin was most interested (e.g. schizophrenia and bipolar disorder). Second, Kraepelin laid the foundation for modern classification systems used to diagnose mental disorders, which use patterns of symptoms rather than any one symptom in isolation. This led to his third contribution, which was the classification of and distinction between schizophrenia and bipolar disorder.

and their close family members show some similar types of neuropsychological functioning, even if these family members do not suffer from the illness itself. This suggests that it may be the biological risk factors for schizophrenia that are inherited from family members, rather than the disorder itself (Cannon et al., 1994).

Adoption studies also support the notion of genetic transmission of vulnerability to schizophrenia. Children born to a schizophrenic parent and adopted away to a non-schizophrenic parent are more likely to have schizophrenia, compared to children born to a non-schizophrenic parent (Kety et al., 1994). However, one study has shown that adopted-away children with a genetic predisposition to schizophrenia are more likely to become schizophrenic if they are also raised in a disturbed family environment. This supports a diathesis–stress model of schizophrenia (Tienari et al., 1987).

Several biological problems may cause schizophrenia, as various forms of brain dysfunction occur among sufferers, including enlarged ventricles, reduced blood flow to frontal brain regions and an excess of dopamine (Andreasen et al., 1992; Davis et al., 1991; Flaum et al., 1995). But we don't know for sure whether these problems are a cause or a consequence of the disorder.

A current debate focuses on the neurodegenerative hypothesis (that schizophrenia leads to progressively deteriorating brain functioning) versus the neurodevelopmental hypothesis (that brain deficits are present at birth, influence the onset of schizophrenia and remain fairly stable). Research supports the neurodevelopmental hypothesis, but there is also evidence that the brains of some schizophrenic people show greater deterioration over time than would otherwise be expected.

2 Psychosocial factors An early hypothesis of the 'schizophrenogenic mother' suggested that inadequate parenting causes schizophrenia (e.g. Arieti, 1955). There is absolutely no evidence of this, nor that any *psychosocial factors* cause schizophrenia. The evidence overwhelmingly points to genetic and biological factors as providing the initial vulnerability. But there is evidence, consistent with a diathesis–stress model, that psychological and social factors influence the course of schizophrenia, such as the timing of onset and the likelihood of relapse.

psychosocial factors psychological, environmental and social factors that may play a role in psychopathology

The most well researched psychosocial predictor of the course of schizophrenia is a phenomenon called *expressed emotion (EE)*. This doesn't refer to the level of emotion the sufferer expresses, as the name implies, but to a specific set of feelings and behaviours directed at people with schizophrenia by their family members. A family that is high in EE tends to be critical and resentful of their schizophrenic relative and may be overprotective or over-involved in his life (Brown et al., 1962). A family that is low in EE tends to be more caring and accepting, and less enmeshed in the sufferer's life.

expressed emotion (EE) specific set of feelings and behaviours directed at people with schizophrenia by their family members

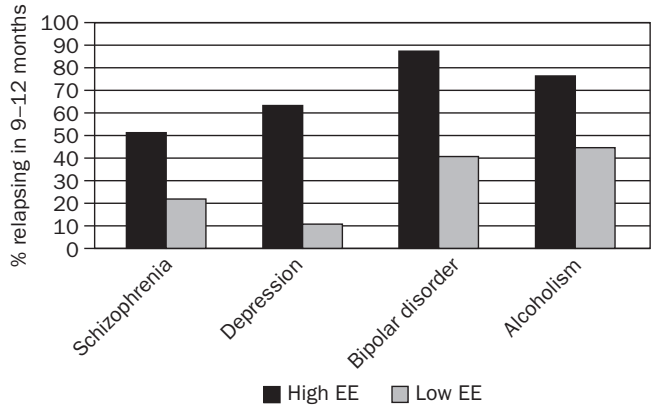

Figure 15.6

Expressed emotion and relapse. Across many disorders, people who have family members who are high on EE are more likely to relapse than are people who have family members who are low on EE. Source: Adapted from Butzlaff & Hooley (1998); O'Farrell et al. (1998).

The level of EE in the family plays an important role in what happens to the schizophrenic person. Schizophrenic people who have families that are high in EE are more likely to suffer a relapse of symptoms (figure 15.6). This association between EE and relapse is also true for a number of other disorders.

Caring for a schizophrenic family member is a stressful, tiring undertaking, which can, in itself, lead to high EE behaviours. Fortunately, psycho-educational programmes can help families and their schizophrenic relatives learn better ways of communicating. These programmes, in conjunction with appropriate medication for the sufferer, can lower relapse rates (e.g. Leff et al., 1982; McFarlane et al., 1995).

Mood disorders – depression

Although mood disorders have some symptoms in common, they are very different in terms of their prevalence and causes.

Major depressive disorder, also called unipolar depression, is one of the most common of these disorders, whereas bipolar disorder (also known as manic-depression), like schizophrenia, is less prevalent.

Both disorders often result in severe impairment. Figure 15.7 shows that depression results in as much impairment as common physical health problems, if not more.

Symptoms of major depressive disorder

The primary symptom of major depressive disorder is, not surprisingly, a depressed or sad mood. Almost everyone experiences a sad mood some time in their life, but major depressive disorder goes much further than simply feeling sad. Other symptoms include:

- Losing interest or pleasure in things that you usually enjoy – an experience called anhedonia.

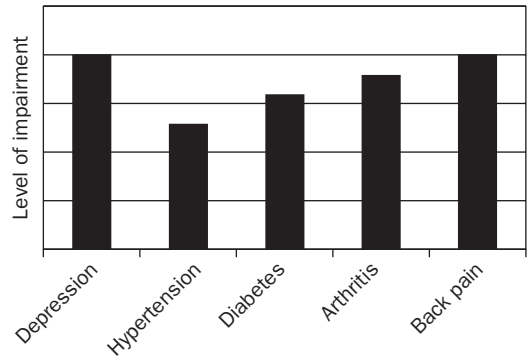

Figure 15.7

Level of impairment caused by depression in comparison to physical disorders. Notice that depression is as impairing or more impairing than many common health problems. The impairment scale should be interpreted with regard to the relative impairment across disorders, rather than absolute impairment of each disorder. Source: Adapted from Üstün and Sartorius (1995).

Figure 15.8

A depressed person will tend to withdraw socially, feel insecure, elicit rejection from others and experience high levels of interpersonal conflict and stress.

- Changes in appetite – some find nothing appealing and have to force themselves to eat, resulting in significant weight loss, while others want to eat more and gain a lot of weight.
- Changes in sleep habits – depressed people may be unable to sleep or want to sleep all the time.
- A very low level of energy, extreme fatigue and poor concentration. Depressed people have no motivation to do anything, often find themselves unable to get out of bed and unable to complete school or work assignments. They may move through their lives very slowly, feeling that even simple activities require too much energy.
- Feeling very badly about themselves – low self-esteem, feeling worthless and blaming themselves for all that has gone wrong in their lives and the world. Depressed people tend to feel hopeless about the future and don't believe they will ever feel better.

Major depressive disorder has negative consequences not only for how people feel about themselves and their future, but also for their relationships. During a depressive episode people tend to withdraw socially, feel insecure in relationships, elicit rejection from others and experience high levels of interpersonal conflict and stress. Romantic, family and peer relationships all suffer.

Given their level of suffering, impairment and hopelessness, it is hardly surprising that depression is one of the biggest risk factors for suicide, with around 15 per cent of depressed people committing suicide (Clark & Goebel-Fabbri, 1999).

The course of the disorder

Major depressive disorder follows a recurrent course. Although some people have isolated episodes, most experience multiple episodes of depression that may become more severe over time (e.g. Lewinsohn, Zeiss & Duncan, 1989). Mild forms of depression with just a few symptoms rather than full-blown major depressive disorder can predict the onset of more serious depression later on (e.g. Pine et al., 1999).

Although depression was once thought to be a disorder of adulthood, we now know that it affects people of all ages, including children (figure 15.9). In fact, the age of onset of major

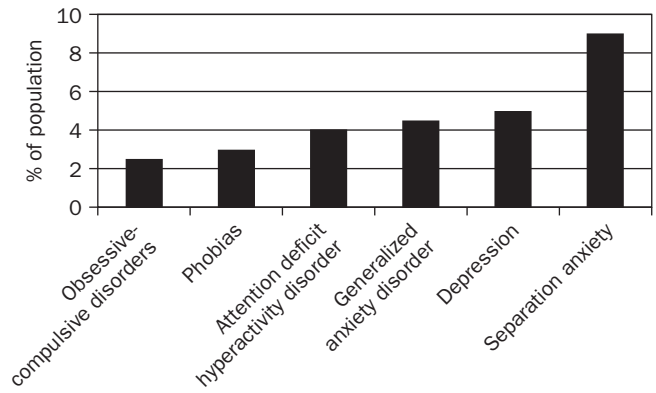

Figure 15.9

Children experience psychological disorders too. These rates are from studies in the US. Cross-national studies indicate that rates may differ somewhat in different countries because of differing cultural values that result in different definitions of abnormality and different symptom expression. However, children in all cultures suffer from various psychological disorders.

depressive disorder is decreasing, and the rates of major depressive disorder in childhood and adolescence are increasing rapidly. Early onset predicts a worse course of depression over time (e.g. Lewinsohn et al., 1994), so depression in childhood and adolescence is a serious problem that can lead to ongoing difficulties throughout life.

Causes of major depressive disorder and factors affecting its course

1 Genetic and biological factors Like schizophrenia, major depressive disorder can be genetically transmitted (e.g. McGuffin et al., 1996).

As for biological factors, the current view is that no single neurotransmitter is associated with major depressive disorder. Instead, it most likely involves dysregulation of the entire neurotransmitter system (Siever & Davis, 1991). Indeed, it may be the balance of various neurotransmitters that regulate mood.

Major depressive disorder may also involve neuroendocrine dysfunction. Depressed people tend to have elevated cortisol levels (e.g. Halbreich, Asnis & Shindledecker, 1985). Cortisol is involved in regulating the body's reaction to stress and becomes elevated under stress. This suggests that, physiologically, depressed people may be in a state of chronic stress and they are perhaps more reactive to stress than are non-depressed people (e.g. Gold, Goodwin & Chrousos, 1988). As we see in the next section, stress plays an important role in vulnerability to major depressive disorder.

2 Psychosocial factors Unlike schizophrenia, which almost certainly has a genetic and/or biological trigger, major depressive disorder can be caused by either genetic/biological or psychosocial factors.

One of the primary psychosocial factors is life stress, including significant negative life events and chronically stressful circumstances (e.g. Brown & Harris, 1989). Of course, many people experience stressful situations, but they don't all become depressed, suggesting that a diathesis–stress process might be occurring. Specifically, it may be the particular way we perceive and think about life stressors that leads to depression. Consistent with a cognitive model of psychopathology, people who think about life events in a pessimistic, dysfunctional way are more likely to get depressed than people who think about life events in an optimistic way (e.g. Metalsky, Halberstadt & Abramson, 1987).

cognitive distortions dysfunctional ways of thinking about the self, the world, other people and the future that can make people vulnerable to depression and other negative emotions

Beck (1967; Beck et al., 1979) describes pessimistic ways of thinking about ourselves, the world and the future as *cognitive distortions*. Examples are viewing things in a black and white manner, focusing on and exaggerating negative aspects and minimizing our positive qualities. When people engage in cognitive distortions, like those below, to explain their life circumstances, they put themselves at risk for experiencing negative moods like depression:

- All or nothing thinking – 'I'm a total loser!'
- Overgeneralization – 'I'm always going to be a total loser!'
- Catastrophizing – 'I'm so bad at my job that I'm sure to fail, then I'll get fired, I'll be totally humiliated, nobody will ever hire me again, and I'll be depressed forever!'
- Personalization – 'It's all my fault that my sister's boyfriend broke up with her – if I hadn't been so needy of her attention, she would have spent more time with him and they would have stayed together!'
- Emotional reasoning – 'I feel like an incompetent fool, therefore I must be one!'

Similarly, Seligman and colleagues (e.g. Abramson, Seligman & Teasdale, 1978) suggest that people who are vulnerable to depression tend to offer internal, global and stable causal explanations for negative events (see also chapter 14). For example, if a date goes badly, reactions might include:

- It's all because of me (internal);
- I always do the wrong thing (global); and
- I'll never have a proper boyfriend (stable).

Negative interpersonal circumstances are particularly likely to play a role in depression. Marital, family and peer relations are often troubled, and interpersonal forms of stress – such as relationships ending, conflicts and lack of supportive relationships – are consistently associated with depression (see Beach & Fincham, 1998; Davila, 2000; Hammen, 1991).

Interpersonal models of depression highlight how the disorder can be both a cause and a consequence of interpersonal problems. For example, Coyne (1976) suggested that depressed people engage in behaviours that elicit rejection from others, and this rejection leads to further depression. Similarly, Hammen (1991) proposed that depressed people generate interpersonal stress in their lives, which then makes them more depressed. It's possible that, for some people, depression has its roots in childhood experiences (Cicchetti et al., 1994). An insecure attachment in childhood may set the stage for depression by putting children at a disadvantage in four important areas:

1. Low self-esteem puts them at risk for a pessimistic way of viewing themselves and the world.
2. Inability to successfully regulate their negative emotions leaves them unable to fend off feelings of depression.
3. Never having learned to cope well with stress, they may employ inappropriate strategies (such as keeping problems hidden or ruminating on them).
4. Negative views of others and learned dysfunctional ways of interacting with others (e.g. excessive dependence on, or complete avoidance, of others) puts them at risk for depression through the negative effect it has on their interpersonal relationships.

Symptoms of bipolar disorder

In bipolar disorder, depression alternates with periods of mania, which is virtually the polar opposite of depression. During a

Research close-up 2

Identifying neural correlates of vulnerability to psychopathology

The research issue

Affective neuroscience is a rapidly growing field in psychology that has the potential to help us understand how brain functioning is related to risk for emotional disorders. By using brain imaging techniques (e.g. Positron Emission Tomography, PET; Functional Magnetic Resonance Imaging, fMRI) researchers may be able to identify areas of the brain that are associated with different emotions and motivational states.

Liotti and his colleagues (2002) attempted to do just that in order to determine whether there are any disease markers in brain functioning for unipolar depression. Specifically, they were interested not just in whether depression was associated with certain aspects of brain functioning, but whether there are brain changes that may play a causal role in the onset of unipolar depression.

Design and procedure

In order to test their question, Liotti et al. compared three groups of participants:

- remitted depressed individuals – people who were diagnosed with major depressive disorder, but who were no longer symptomatic;
- currently depressed individuals – people diagnosed with major depressive disorder; and
- healthy comparisons – people with no personal or family history of depression or any other psychiatric disorder.

Each participant underwent PET scans during (1) a resting state and (2) a sad-mood induction in which he or she thought about personal events that induced sadness. Then the researchers compared changes in brain functioning from the resting state to the sad state in the three groups.

Results and implications

Comparisons of brain functioning changes across the three groups resulted in two important findings:

1. Of most importance, the brain functioning of the currently depressed was very similar to that of the remitted groups, but they were both different from the healthy comparisons. Therefore, when remitted depressed people (who are not currently depressed) are made to feel sad, their brains function more like those of people who are currently depressed than like those of people who are not currently depressed. So these common aspects of brain functioning may be markers of risk for unipolar depression. Of course, this research design does not tell us for sure whether the observed changes are a marker of vulnerability to depression or a reflection of brain changes that follow from having the disorder.
2. Some aspects of changes in brain functioning were similar across all three groups. This suggests that some types of brain functioning may reflect processes that are common to mood regulation among all people.

In conclusion, the results of this study provide intriguing evidence that there may be neural markers of risk for psychopathology. You can be certain that this will be an exciting area of research for future generations.

Liotti, M., Mayberg, H.S., McGinnis, S., Brannan, S.L., & Jerabek, P., 2002, 'Unmasking disease-specific cerebral blood flow abnormalities: Mood challenge in patients with remitted unipolar depression', *American Journal of Psychiatry*, 159, 1830–40.

manic period, people feel euphoric or elated. And just as major depression isn't the same as simply feeling sad, mania is not the same as simply feeling happy. Mania is characterized by these symptoms:

- An excessively euphoric mood typically associated with a sense of grandiosity. Manic people feel unbelievably good about themselves, to the extent that they often believe they can do anything. And they frequently try to!
- Engaging in many more activities than usual. This increase in activity often becomes excessive to the point of being dangerous. For example, manic people may go on shopping sprees, spend amounts of money that go well beyond their means, and incur enormous levels of debt. They may take

off on a trip in their car, driving recklessly and leaving responsibilities behind. They may engage in frequent sexual indiscretions, putting themselves at risk for sexually transmitted diseases, pregnancy and relationship conflict.
- A decreased need for sleep – even staying awake for days at a time.
- High distractibility and poor concentration as the mind races with a million thoughts.
- Speaking very quickly – others can barely get a word in during conversations.

The course of the disorder

The most common onset for bipolar disorder is in early adulthood, but, like major depressive disorder, it can occur earlier. Bipolar disorder is a lifelong, recurrent disorder that can take a variable course. Although some people regularly alternate between mania and depression, the number of episodes, their timing and their order can vary widely.

Bipolar disorder can be seriously debilitating, but with appropriate medication many sufferers live highly productive, normal lives between episodes.

Causes of bipolar disorder and factors affecting its course

1 Genetic and biological factors There is even more evidence of genetic transmission for bipolar disorder than for major depressive disorder (Gershon, 1995).

There is also evidence of dysfunction of various neurotransmitters, including serotonin, dopamine and norepinephrine, although it may not be the levels of neurotransmitters themselves that are problematic, but the pattern of neuronal firing. Sodium ions are critical in proper neuronal firing (see chapter 1), and lithium, which is used to treat bipolar disorder, is chemically similar to sodium, so lithium may work by regulating dysfunctional neuronal firing (e.g. Goodwin & Jamison, 1990).

Pioneer

Kay Redfield Jamison (1946–), Professor of Psychiatry at Johns Hopkins University School of Medicine, is an award-winning psychologist and expert in the field of bipolar disorder, a condition from which she suffers. With Frederick K. Goodwin, she wrote one of the classic texts on bipolar disorder, *Manic-depressive Illness*. Her autobiography, *An Unquiet Mind*, has made a lasting impact because of the candid and caring manner in which she describes life with bipolar disorder. She has also produced three television programmes about bipolar disorder. Jamison has served on the first National Advisory Council for Human Genome Research, and is clinical director for the Dana Consortium on the Genetic Basis of Manic-Depressive Illness.

2 Psychosocial factors Like schizophrenia, there is no evidence that psychosocial factors are the initial cause of bipolar disorder. But they do influence the course of the disorder. Stressful life events, particularly those that disrupt social and biological regularities (e.g. birth of a child, change in work hours, travel), may lead to relapse (see Johnson & Roberts, 1995).

Negative social relations may also lead to relapse. In particular, sufferers with high EE families are more likely to relapse (Miklowitz et al., 1988; see figure 15.6).

ANXIETY DISORDERS – WHEN FEAR TAKES OVER

Anxiety is a set of symptoms:

- emotional (e.g. fear, worry)
- physical (e.g. shortness of breath, heart pounding, sweating, upset stomach)
- cognitive (e.g. fear of dying, losing control, going crazy).

When someone experiences this cluster of symptoms, it is often called a panic attack.

Like depressed mood, anxiety is a common experience – almost everyone has felt some level of anxiety in their lives. In many circumstances, it is a normal adaptive experience, physiologically preparing our bodies to respond when we sense danger. Our autonomic nervous system (see chapter 3) gets us ready for fight or flight and then, when the danger has passed, calms us back down again so that we can go back to normal functioning.

So how do we differentiate 'normal' fear from an anxiety disorder? In addition to the level of impairment caused by the anxiety, a disorder often involves fear and anxiety in response to something that is not inherently frightening or dangerous. For example, it is normal to feel anxiety in response to poisonous snakes, but it less normal to feel anxiety in response to pictures of snakes.

Anxiety disorders have four things in common:

1. each is defined by a specific target of fear (the thing the person is afraid of);
2. anxiety or panic attacks are experienced in response to the target of fear;
3. the target of fear is avoided by the sufferer; and
4. anxiety disorders tend to be chronic – they tend to persist rather than come in episodes.

Symptoms and course of anxiety disorders

1 Specific phobias The most common and straightforward of the anxiety disorders are specific phobias – fear and avoidance of a particular object or situation (e.g. dogs, heights, flying). This anxiety may be very circumscribed, occurring only in response to the target of fear, and may result in impairment in only a very specific domain.

For example, someone who is afraid of flying may lead a very normal, productive life but simply isn't able to fly. This may impair their work if they are expected to travel for business, or

Pioneer

David Barlow (1942–), Professor of Psychology and Director of the Center for Anxiety and Related Disorders at Boston University, is an expert on the nature and treatment of anxiety and related disorders (e.g. sexual dysfunction). In his classic text, *Anxiety and its Disorders*, he describes the predominant cognitive-behavioural approach to understanding anxiety disorders. He has developed a series of empirically supported cognitive-behavioural treatments for various anxiety disorders and is particularly well known for his panic control treatment.

Figure 15.10
A specific phobia will involve fear and avoidance of a particular object or situation.

their relationships if, for example, they can't take a vacation with their partner. But it won't usually affect other areas of their life.

2 Social phobia Social phobia tends to be more impairing because it often results in significant social isolation. You might think that people with social phobia are afraid of people or of social situations – but this isn't the case. They are actually afraid of negative evaluation and rejection by others and will attempt to avoid it at all costs.

Social phobia ranges from relatively mild (e.g. fearing and avoiding public speaking only) to extremely pervasive (e.g. fearing and avoiding all social interaction except with family members).

agoraphobia fear of situations in which escape would be difficult or help is not available should panic or anxiety occur

3 Panic disorder Panic disorder can also be quite debilitating, especially when it is coupled with *agoraphobia*. Literally 'fear of the marketplace', agoraphobia is often thought of as fear of leaving the house. More accurately, it is fear of situations in which escape would be difficult or there would be no one to help should panic occur.

Panic disorder begins with sudden panic attacks that occur out of the blue. The disorder develops when people worry about having another panic attack and subsequently begin to avoid places and situations they associate with it. For example, if you had a panic attack while driving, you might avoid driving again.

When someone avoids so many places and situations that they are finally unable to leave their home, they are said to have agoraphobia.

obsessions unwanted, persistent, intrusive, repetitive thoughts

compulsions ritualistic, repetitive behaviours that a person feels compelled to engage in

4 Obsessive-compulsive disorder You won't be surprised to find that obsessive-compulsive disorder (OCD) is characterized by *obsessions* (unwanted, persistent, intrusive, repetitive thoughts) and *compulsions* (ritualistic, repetitive behaviours).

When someone with OCD experiences obsessions, such as fear of contamination, anxiety is generated. To reduce this anxiety, she might engage in compulsions, such as repetitive hand-washing. The compulsions reduce anxiety briefly, but the obsessions soon return, and the sufferer becomes caught in a vicious cycle.

Sometimes OCD is fairly circumscribed, but often it begins to dominate people's lives, causing significant impairment. Typical obsessions involve religion, contamination, fear of hurting someone, fear of losing something important, and fear of saying or doing something inappropriate or dangerous. Typical compulsions are hand-washing, checking, counting and hoarding.

5 Post-traumatic stress disorder Experiencing a traumatic event can lead to post-traumatic stress disorder (PTSD). It was first documented among war veterans who had been exposed to wartime atrocities, but we now know that it can occur in response to many types of event, including natural disasters, accidents, rape and physical abuse. And it isn't just the victim who is vulnerable to the disorder. Someone who observes severe physical abuse, for example, is also at risk.

PTSD has a paradoxical set of symptoms. The target of fear is the trauma itself, which creates tremendous anxiety, so the sufferer will desperately try to avoid anything associated with the trauma. They may even lose their memory for the event. On the

other hand, people with PTSD might be plagued with unwanted and intrusive thoughts about the event, such as flashbacks and nightmares.

Sufferers also tend to become psychologically numb. Their emotions shut down, and they can't derive pleasure from things or even envision the future. But again, paradoxically, they may also experience symptoms of hyper-arousal. They are usually hyper-vigilant to their environment, they startle easily, can't sleep or concentrate, and are irritable and easily angered. This complex set of symptoms makes PTSD is a very debilitating disorder.

6 Generalized anxiety disorder In some ways, generalized anxiety disorder is the simplest, and in other ways the most complex, anxiety disorder. It is characterized by an extended period – say, six months or more – of chronic, uncontrollable worry about numerous things. This sounds simple. Sufferers spend their lives worried and tense all the time, they are easily irritated, and they have trouble sleeping and concentrating.

On the other hand, it isn't entirely clear what people are attempting to avoid and what function their worry serves. Some theorists have suggested that people with this disorder fear that they will not be able to control their lives or themselves, and worry is a way to exert control (Borkovec, 1985). It doesn't work, of course, but sufferers may feel completely out of control if they stop worrying. They may have no other coping strategies to rely on.

Causes of anxiety disorders and factors affecting their course

1 Genetic and biological factors The extent of heritability varies across disorders. For example, panic disorder shows relatively high rates of heritability, whereas generalized anxiety disorder shows lower rates (e.g. Hettema et al., 2001; Kendler et al., 1992). There is also evidence that people who are prone to anxiety disorders are born with something called *behavioural inhibition* (see Kagan & Snidman, 1991). Children who are behaviourally inhibited are shy, quiet, fearful, socially avoidant and have high levels of physiological arousal (i.e. they are aroused easily and are very reactive to stimulation and stress). These children are more likely to develop an anxiety disorder (e.g. Hirschfeld et al., 1992).

behavioural inhibition shyness, quietness, fearfulness, social avoidance, and high levels of physiological arousal and stress reactivity in young children

Regarding biological factors, there a number of pathways in the limbic system that are hypothesized to produce various types of anxiety reactions (e.g. Gray, 1982). In addition, people with anxiety disorders show low levels of the neurotransmitter gamma aminobutyric acid (GABA). This is a central nervous system inhibitor that works to lower physiological arousal and keep us calm and relaxed. Low levels of GABA can therefore lead to increased neuronal firing, which may in turn lead to high levels of physiological arousal and, consequently, anxiety.

Although some forms of biological dysfunction may be associated with anxiety in general, each anxiety disorder may also have unique biological causes. For example, some research indicates there is a specific brain circuit that, when over-activated (e.g. in times of stress), results in repetitive patterns characteristic of OCD (e.g. Rapoport, 1989).

Research also suggests that vulnerability to panic disorder may be the result of a biological sensitivity to physical sensations (e.g., Klein, 1993). Our bodies may have an 'alarm system' that is hypersensitive to certain sensations (e.g. lack of oxygen). When the alarm sounds, we may experience a panic attack. This is an interesting model, but it doesn't indicate how exactly this process leads to panic disorder (i.e. how fear and avoidance of panic attacks develop).

2 Psychosocial factors Cognitive, behavioural and life stress factors all affect risk for anxiety disorders. In fact, stress is, by definition, the cause of PTSD.

When fear is generated by life experiences, be they actual experiences, things we see or even things we are told about, this can serve as a powerful conditioning experience. But, like depression, the way we view a frightening event affects whether it results in an anxiety disorder. Anxiety is associated with viewing the world as dangerous and uncontrollable and viewing the self as helpless (e.g. Beck & Emery, 1985).

The development of panic disorder is a good example of how various causal factors may interact. Imagine you are biologically sensitive to physiological changes in your body. Suppose one day you suddenly feel short of breath for no identifiable reason. You assume the shortness of breath means something terrible is about to happen ('I'm going to die!', 'I'm going to lose control of myself!'), and so you experience more anxiety, likely resulting in a full-blown panic attack. Because this frightening event is made even more so by your catastrophic interpretation, you develop a fear of the panic attack (Clark, 1986; see also figure 15.11). If the panic attack occurs while you are driving, you might also develop a fear of driving and begin to avoid it. This avoidance is reinforced, because it reduces the likelihood of further panic attacks.

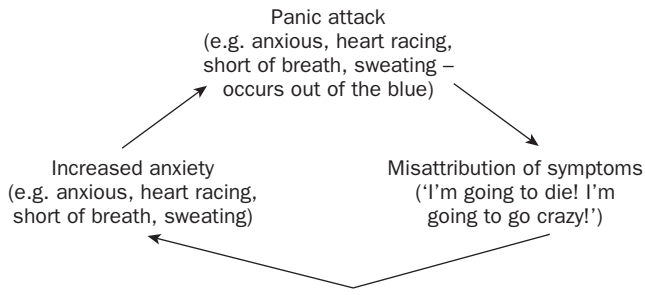

Figure 15.11

Cognitive model of panic disorder. According to this model, people develop panic disorder after misinterpreting a set of physical symptoms, such as pounding heart or shortness of breath. The misinterpretation serves to make them more anxious and increase the likelihood of a panic attack. This results in a vicious cycle of physical symptoms, misinterpretation and panic attacks.

Eating disorders – bulimia and anorexia

Eating disorders have attracted a great deal of attention in recent years, particularly in university settings where they tend to be prominent. Yet despite greater public awareness, certain misconceptions still exist. For example, many people think eating disorders are brought about by vanity. This couldn't be further from the truth. Rather than being vain, people with eating disorders struggle with issues about who they are, what they are worth, whether they will be able to take care of themselves and how to negotiate relationships. Eating disorders are complex and difficult to overcome.

There are currently two eating disorders included in the ICD-10 and DSM-IV – bulimia nervosa and anorexia nervosa. Although they differ in important ways, they have four things in common:

1. a distorted body image (inaccurate assessment about shape and weight);
2. an intense fear of being fat;
3. a sense of self that revolves around the individual's body and weight; and
4. eating that is regulated by psychological rather than physiological processes, although the form of eating regulation is quite different for the two disorders.

Symptoms

People with bulimia tend to be of normal weight and are sometimes even overweight. Bulimia nervosa is characterized by recurrent episodes of binge eating and purging. During a binge, bulimic people consume an enormous number of calories in a brief period of time and feel an overwhelming loss of control as they are doing so. The binge is then followed by purging behaviour – usually vomiting, taking laxatives, taking diuretics or using enemas, and sometimes fasting or excessive exercise.

Other symptoms may include:

- somewhat chaotic lives;
- a tendency to be impulsive, emotionally labile, sensitive to rejection and in need of attention;
- depression and/or substance abuse.

Anorexia nervosa is characterized by a refusal to maintain normal body weight. People with anorexia restrict their food intake through diet and typically engage in excessive exercise. Their weight often becomes so low that their bodies stop functioning normally (e.g. females stop menstruating), and they often appear emaciated.

Anorexics also tend to:

- be perfectionist, rule-bound and hard-working;
- have a strong need to please others, but never feel special themselves;
- be high-achievers, but also feel uncertain of their capacity to be independent.

Figure 15.12

People with anorexia nervosa refuse to maintain normal body weight; they restrict their food intake and tend to engage in excessive exercise.

Some people with anorexia also engage in binging and purging and have other features of their personalities and lives in common with bulimics.

The course of eating disorders

Both bulimia and anorexia typically begin in adolescence and can become chronic. For example, about one third of people with anorexia will have a lifelong disorder.

Both anorexia and bulimia pose significant health risks. This is particularly true for anorexia, in which almost 5 per cent of people die from malnutrition and other related complications.

Causes of eating disorders and factors affecting their course

1 Genetic and biological factors Research supports genetic transmission, but some suggest that it may not be the disorder itself that is inherited. They believe that a set of personality traits – such as obsessiveness, rigidity, emotional restraint in the case of anorexia and impulsivity and emotional instability in the case of bulimia – might increase the likelihood of poor coping. The eating disorder is seen as a maladaptive way of coping with stress (e.g. Strober, 1995).

Biological models focus on dysfunction in the hypothalamus (the part of the brain related to eating behaviour; see chapter 5)

and on serotonin dysregulation (e.g. Wolfe, Metzger & Jimerson, 1997; see Ferguson & Pigott, 2000). There is presently no evidence that these dysfunctions actually cause eating disorders, but they may affect their course.

2 Psychosocial factors One of the primary sets of psychosocial factors in the development and course of eating disorders are social pressures and cultural forces.

In cultures where thinness is the ideal of beauty, eating disorders are most prevalent. There are expectations of thinness everywhere – in the media, in the family, and in society at large. Adolescents, particularly young women, often internalize these expectations, and their entire sense of self-worth may become dependent on being thin. Furthermore, they are usually socially reinforced for being thin. Think how often you have heard someone say, or have even said yourself, 'Oh, you've lost weight – you look great!' For vulnerable young people, a seemingly benign comment like this reinforces the belief that they must be thin in order to be worthy of attention.

But if everyone in a culture that values thinness grows up facing the same pressures, why do some develop eating disorders and some not? Apart from possible genetic or biological vulnerabilities, the way people think about themselves and the world may make them vulnerable. Cognitive distortions such as, 'If I eat one cookie, I will be a fat, horrible person' or 'Being thin will make all the problems in my life go away,' may increase vulnerability to eating disorders (e.g. Butow, Beumont & Touyz, 1993).

People who come from certain types of families may also be more vulnerable to particular types of eating disorders (Bruch, 1978; Minuchin, Rosman & Baker, 1978). For example, anorexia is thought to develop when families are very concerned about external appearances and prefer to maintain an impression of harmony at the expense of open communication and emotional expression. These families tend to be enmeshed (family members are unaware of or unable to maintain personal boundaries), overprotective, rigid and conflict-avoidant. Anorexia might be a rebellion or an assertion of independence and autonomy, or it may serve to mask the real problems in the family. Other risk factors include families who diet, or parents who are critical of their child's weight or appearance (e.g. Pike & Rodin, 1991).

A recent perspective, which fits with family and genetic/personality models, suggests that eating disorders are the product of maladaptive emotion regulation processes (e.g. Wiser & Telch, 1999). So food is used to help regulate emotions (typically negative ones) when the person has not developed more adaptive strategies. Attachment theorists take a similar position, suggesting that people with certain forms of insecure attachment (e.g. avoidant) may distract themselves from upsetting, attachment-related concerns (e.g. fear of intimacy, low self-worth) by focusing on food and weight (Cole-Detke & Kobak 1996).

Everyday Psychology

Eating disorders

As discussed in chapter 5, obesity is one of the so-called 'diseases of affluence' that beset many contemporary Western societies. But modern developed societies also manifest a range of disorders at the other end of the weight spectrum, known as eating disorders (i.e. anorexia nervosa and bulimia nervosa). These disorders appear to develop as outward signs of inner emotional or psychological distress or problems. For the sufferer, they seem to be a way of coping with difficulties in their life. Eating, or not eating, can be used to block out painful feelings. Without appropriate help and treatment, eating problems may persist throughout the sufferer's life.

Anyone can develop an eating disorder regardless of age, race, gender or background, but young women seem to be most vulnerable, particularly between the ages of 15 and 25. This may well relate to the changes and challenges occurring in young women's lives at around this period of personal development.

Biological research suggests that genetic make-up may make someone more or less likely to develop an eating disorder. Within the psychosocial domain, a key person or people (for example, parents or relatives) may adversely influence other family members through their attitudes to food. Or someone might focus on food and eating as a way of coping with the stresses of high academic expectations or other forms of social and/or family pressure.

Traumatic events can also trigger anorexia or bulimia nervosa. These events may be especially prominent during the teenage and young adulthood periods, such as the death of a parent or other close relative, being bullied or abused at school or at home, upheaval in the family environment (such as divorce) or concerns over sexuality.

Eating disorders are complex illnesses with critical psychological elements requiring treatment as well as the physical aspects (such as the disturbed eating pattern and its biological consequences). A regular eating pattern, including a balanced diet, is needed to restore balanced nutrition. And helping someone to come to terms with the fundamental emotional issues underlying their eating disorder will enable them to cope in their future lives with personal difficulties in a way that is not harmful to them.

Striegel-Moore, R.H., Seeley, J.R., & Lewinsohn, P.M., 2003, 'Psychosocial adjustment in young adulthood of women who experienced an eating disorder during adolescence', *Journal of the American Academy of Child and Adolescent Psychiatry*, 42, 587–93.

Substance use disorders – abuse and dependence

Regardless of what people may experience as positive effects of drugs and alcohol, they both have negative effects on our health and ability to function, especially when used repeatedly. This recurrent use may result in a substance use disorder.

Symptoms

There are two substance use disorders – abuse and dependence. Substance abuse is defined entirely on the criterion of impairment. If someone's repeated use of a substance causes significant impairment in even one area of life, he can be described as a substance abuser. Common impairments include:

- failure to fulfil major role obligations – e.g. constantly late to or absent from work;
- recurrent use in dangerous situations – e.g. while driving;
- frequent substance-related legal problems – e.g. arrests for disorderly conduct; and
- social and interpersonal problems – e.g. conflict with partner or other family members.

Substance dependence is indicated by physical or psychological dependence or addiction. Physical dependence includes:

- tolerance – the need for increased amounts of the substance or diminished effect with same amount; and
- withdrawal – the experience of physical symptoms when the substance is stopped, or turning to another substance to relieve or avoid those symptoms.

Psychological dependence is indicated by:

- taking substances in larger amounts or over longer periods of time than intended;
- a persistent desire to use or unsuccessful efforts to cut down or control use;
- spending a great deal of time trying to obtain, use or recover from the substance;
- giving up important activities; and
- continued use, despite knowledge of a problem that is exacerbated by the substance.

The course of substance use disorders

Substance abuse and dependence can be chronic, progressive, degenerative problems with severe negative outcomes. But the course they take varies, depending on the substance being used. Alcoholism in particular can have tragic outcomes, including health problems, interpersonal problems and early death. People who use substances frequently will often use more than one kind of substance.

Substance disorders can begin at any age and are becoming more prevalent, particularly among adolescents. Although most adult substance abusers began using in adolescence, most adolescents who try drugs don't progress to severe abuse. So experimentation doesn't necessarily lead to lifelong addiction or adverse consequences.

Figure 15.13

Substance use disorders are becoming more prevalent, particularly among adolescents.

Some people with substance use disorders show remission, especially late in life, but relapse is frequent, particularly in response to high-risk situations, such as negative emotional states, social pressure and interpersonal conflict. Unfortunately, because of the high relapse rates, few people fully recover from substance disorders.

Causes of substance use disorders and factors affecting their course

1 Genetic and biological factors Most research into substance abuse involves alcohol, as alcohol is legal and very widely available. So evidence of genetic transmission comes primarily from alcoholism research. This research supports the role of heredity, particularly among men (e.g. Goodwin, 1979).

Consistent with a biological approach, substance use disorders are considered by some to be diseases (e.g. Jellinek, 1960). Some theorists have suggested that alcoholics may be biologically sensitive to alcohol, which may lead to progressive and irreversible alcoholism (e.g. Pollock, 1992). The body's ability to metabolize alcohol is another possible explanation. The liver produces an enzyme called aldehyde dehydrogenase, which breaks down alcohol in the body. If alcohol isn't broken down, it can build up and lead to illness. In some groups of East Asians, this enzyme is absent or reduced – a possible reason for the relatively lower rates of alcoholism in these groups (e.g. Higuchi et al., 1992).

We know very little about other biological causes of substance abuse, but researchers continue to study the effects of neurotransmitter functioning, brain-wave functioning and biological sensitivities to substances in order to elucidate relevant mechanisms and relationships.

2 Psychosocial factors Numerous psychosocial factors have been implicated in the onset and course of substance problems. Reinforcement certainly plays an important role. Consistent with the *tension-reduction hypothesis*, continued substance use is reinforced because substances often lead to positive feelings and help people escape negative feelings through use of these substances (Conger, 1956). Substance users are said to engage in 'self-medication', using substances to help relieve tension or temporarily eliminate feelings of anxiety or depression.

tension-reduction hypothesis the notion that people use substances in order to reduce tension and negative affect

People also learn to use substances through observation. Those whose families or peers use substances are at high risk for substance use disorders (e.g. Jessor & Jessor, 1975). Learned associations also affect the course of substance use. If someone comes to associate particular people, places or circumstances with substance use, they are more likely to use the substance in similar circumstances (Collins & Marlatt, 1981). That is why people who get treatment for substance problems often relapse when they return to their former environment and social group.

Cognitive factors also play a role in the development and course of substance problems, at least in the case of alcoholism. People who expect positive results from using alcohol (e.g. they think it will make them feel good or improve their social standing) are more likely to use it and to develop alcohol problems (Marlatt, 1987; Smith, 1980).

In addition, people who fall prey to the *abstinence violation effect* are more likely to relapse than are others (Marlatt, 1978). This effect occurs when a minor relapse (a violation of abstinence) leads to guilt, which then leads to a more severe relapse. So if an abstinent alcoholic has one drink, she may feel guilty and decide that, having already failed at abstinence, she may as well drink more. She ends up having a full-blown relapse instead of a momentary one.

abstinence violation effect a more severe relapse resulting from a minor violation of substance use abstinence (e.g. one forbidden drink leading to more)

The notion of an 'addictive' personality has been suggested. This is a controversial topic. So far, there is no evidence for its existence, but research does indicate that some aspects of personality may contribute to substance problems. A disinhibited personality style that includes impulsivity and antisocial traits may be the best personality predictor of substance problems (e.g. Shedler & Block, 1990). Consistent with the tension-reduction hypothesis discussed earlier, it is also possible that substance problems are masking some other form of psychopathology. But the research on this topic is mixed and suggests that problems such as depression are as likely to follow from substance problems as they are to precede them (e.g. Schuckit, 1994).

There are also broader environmental factors that may contribute to substance abuse, such as the extent to which substance use is condoned by a particular culture (e.g. Westermeyer, 1999; Yeung & Greenwald, 1992). For example, groups whose religious values prohibit or limit the use of alcohol (e.g. Muslims, Mormons, Orthodox Jews) show relatively low rates of alcoholism.

Perhaps the best way to approach substance use disorders is from a multiple risk factor perspective, which suggests that the more risk factors someone experiences, the more likely he is to develop a problem (e.g. Bry, McKeon & Pandina, 1982). In addition to the risk factors already discussed, many others for substance abuse have been identified, including low socio-economic status, family dysfunction, peer rejection, behaviour problems, academic failure and availability of substances. Of course, because of the nature of the research in this field, some of these factors may be consequences of substance abuse instead of (or as well as) being risk factors.

Personality disorders – a way of being

So far, the disorders we have described have traditionally been considered syndromes, which – like physical illnesses – are not part of people's basic character structure. When treated appropriately, these syndromes usually remit and people return to normal functioning, at least for a while.

But personality disorders are different. They are disorders of people's basic character structure – so there is no 'normal functioning' to return to. The personality disorders themselves are people's 'normal' way of functioning, and appropriate treatment means learning entirely new ways of being.

Symptoms

All personality disorders have a number of things in common. They are:

- longstanding – i.e. begin at a relatively early age;
- chronic – i.e. continue over time; and
- pervasive – i.e. occur across most contexts.

The thoughts, feelings and behaviours that characterize personality disorders are:

- inflexible – i.e. they are applied rigidly and resistant to change; and
- maladaptive – i.e. they don't result in what the person hopes for.

People with personality disorders usually don't realize they have them. They experience themselves as normal and often feel that the people they interact *with* are the ones with the problems. The primary personality disorders and their key traits, as described in the DSM-IV (APA, 1994) are:

Cluster A – the odd and eccentric cluster

Paranoid – suspicious, distrustful, makes hostile attributions

Schizoid – interpersonally and emotionally cut off, unresponsive to others, a 'loner'

Schizotypal – odd thoughts, behaviours, experiences; poor interpersonal functioning

Cluster B – the dramatic and erratic cluster

Histrionic – dramatic, wants attention, emotionally shallow

Narcissistic – inflated sense of self-importance, entitled, low empathy, hidden vulnerability

Antisocial – behaviours that disregard laws, norms, rights of others; lacking in empathy

Borderline – instability in thoughts, feelings, behaviour and sense of self

Cluster C – the fearful and avoidant cluster

Obsessive-compulsive – rigid, controlled, perfectionistic

Avoidant – fears negative evaluation, rejection and abandonment

Dependent – submissive, dependent on others for self-esteem, fears abandonment

As you can see, this organization of the personality disorders puts them into clusters. These clusters are thought to reflect disorders with common traits. Although the disorders within each cluster do show commonalities, it is also the case the there are high levels of comorbidity among disorders across clusters.

Borderline personality disorder and antisocial personality disorder (similar to what is often called psychopathy) have received more attention than the others, as they tend to have some of the most negative consequences, including suicide and violence.

Causes of personality disorders and factors affecting their course

1 Genetic and biological factors There is evidence of modest genetic transmission for some personality disorders, especially antisocial personality disorder, although environmental factors also play an important role (e.g. Cadoret et al., 1995).

There is also evidence that children are born with different temperaments, which may serve as vulnerability factors. For example, inhibition – which predisposes children towards shyness and anxiety – may put them at risk for personality disorders characterized by those traits. Disinhibited children are outgoing, talkative, impulsive and have low levels of physiological arousal. These children may be at risk for personality disorders characterized by impulsivity, erratic or aggressive behaviour, or lack of empathy.

Biological factors are also being explored as causes of some personality disorders, such as antisocial personality disorder. For example, research suggests that people with antisocial personality traits show low levels of physiological arousal, which may account for their ability to engage in behaviours that normally cause people to feel anxious (e.g. Raine, Venables & Williams, 1990).

2 Psychosocial factors Cognitive, psychodynamic and attachment theorists all suggest that negative early experiences in the family put people at risk for developing personality disorders. The assumption is that this happens, at least in part, through the cognitions that people develop.

Early experiences with people who fail to validate a child's self-worth may be internalized and result in a deep-seated set of severely rigid and dysfunctional thoughts about the self, others and the world, which then translate into rigid behavioural patterns. For example, if parents are not available to help a child cope with stress but are critical or abusive instead, the child will learn that she can't rely on her parents, even though she may desperately want to. She may learn to hide her feelings, to expect that she will be criticized and rejected by others, and so to avoid close interpersonal relationships, even if she secretly yearns for them. If this pattern continues to develop and becomes rigid as the child grow up, she may eventually develop an avoidant personality disorder.

Research is beginning to suggest that temperamental and psychosocial factors interact. Kochanska (1995) found that children of different temperaments show more adaptive moral development in response to different qualities of the parent–child relationship. For example, fearful children respond better to gentle discipline, whereas non-fearful children respond better when they are securely attached to a parent. This suggests that the closer the parenting style matches the needs associated with that particular children's temperament, the more adaptive their children will become. When a mismatch occurs, children may develop compensatory coping strategies, possibly leading to the rigid patterns that are associated with personality disorders.

Pioneer

Marsha Linehan (1943–), Professor of Psychology and Director of the Behavioral Research and Therapy Clinics at the University of Washington, is best known for her contributions to the understanding and treatment of suicidal behaviour and borderline personality disorder. Linehan proposed that borderline personality disorder can be best understood from a biopsychosocial approach, which bases the disorder in the interaction of an underlying biological dysfunction and an invalidating, non-accepting family environment. Linehan developed dialectical behaviour therapy (DBT) as a treatment for borderline personality disorder and suicidal behaviour. DBT is an empirically supported treatment, which combines traditional Western approaches with Eastern Zen approaches.

FINAL THOUGHTS

In this chapter you read about some of the major psychological disorders – schizophrenia, mood disorders, anxiety disorders, eating disorders, substance use disorders and personality disorders. Although these disorders (and their various subtypes) are among the most prevalent and impairing in the field of psychopathology, they by no means exhaust the number of psychological disorders that have been documented. Our goal has been to help you understand what these disorders look like, how they progress, and what causes them, highlighting potential biological and psychosocial causes.

In addition to getting a sense of what we know about these disorders, it should be clear that there is still a lot that we do not know. That is part of what makes the study of abnormal psychology so intriguing. There is so much left to learn, particularly with regard to how our biology and our environments interact to cause and affect psychological problems. As research on abnormal behaviour progresses, we can expect not only to better understand current disorders and their causes, but also to discover new ones.

Summary

- The field of abnormal psychology, or psychopathology, deals with sets of behaviours, or symptoms, that result in impairment in people's lives. These sets of symptoms constitute psychological disorders or mental illness.
- Although the definition of 'abnormal behaviour' is sensitive to a number of contextual factors, psychological disorders (e.g. schizophrenia) have been documented across time and culture.
- Throughout history, the causes of abnormal behaviour have been construed from a number of different perspectives, each of which tells us something unique about different aspects of psychological disorders.
- Biological/genetic models focus on brain defects, biochemical imbalances and genetic predispositions as causes of psychopathology.
- In contrast, Freudian, contemporary psychodynamic and attachment models focus on the effects of early parent–child experiences.
- Behavioural models focus on the learning experiences that result in psychopathology, whereas cognitive models focus on the effect of distorted thought processes.
- Other perspectives integrate various models. The diathesis–stress perspective suggests that the factors identified by each of the other models may work in accordance with one another, so that psychopathology only results when certain combinations of factors (e.g. genetic, environmental) are present.
- Similarly, the developmental psychopathology perspective provides a framework for understanding how psychopathology develops from childhood to adulthood.
- These perspectives can help us understand the numerous disorders documented in nosologies such as the DSM-IV and the ICD-10.

REVISION QUESTIONS

1. Do mental disorders reflect brain dysfunction and genetic abnormalities? If so, does this mean that biological interventions (e.g. drugs) would necessarily be the treatment of choice?
2. There are several models of abnormal behaviour. Discuss the extent to which they can be integrated. In particular, do psychodynamic models share any common ground with behavioural and cognitive models?
3. Do you think that the origins of mental disorders in adulthood can be found in childhood? What should we look for in childhood as precursors of adult abnormal behaviour?
4. Imagine you had the power to create a human being with a mental disorder. What disorder would you give them so that they were: (a) maximally dysfunctional; (b) minimally dysfunctional; (c) had the best chance of recovering from the disorder? Discuss why you made the choices that you did.
5. A friend hears that you are studying abnormal psychology and comes to ask you about some experiences she or he has had, wanting to know if they are signs of mental disorder. What would you do? What would you tell him or her?
6. Why are some disorders more common than others? What might be some of the cultural, societal, and biological reasons involved?
7. What kinds of things do the different disorders discussed in this chapter have in common?
8. Does it make sense to think about these disorders as exemplifying different categories of disorder? Or are there underlying problems that characterize all of these disorders?

Further Reading

Clarkin, J.F., & Lenzenweger, M.F. (1996). *Major Theories of Personality Disorder*. New York: Guilford Press.
A historical overview of many of the most prominent theories of personality disorders.

Hammen, C. (1997). *Depression*. Hove: Psychology Press/Lawrence Erlbaum and Associates.
Research-based information on causes and treatments of depression from various theoretical viewpoints.

Jamison, K.R. (1996). *An Unquiet Mind*. New York: Random House.
The author's personal account of her battle with bipolar disorder.

Leonard, K.E., & Blane, H. (1999). *Psychological Theories of Drinking and Alcoholism*. 2nd edn. New York: Guilford Press.
Recent reviews of all of the major psychological and genetic/biological theories of alcoholism.

Nasar, S. (1988). *A Beautiful Mind*. New York: Simon & Schuster.
Biography of John Forbes Nash, Jr, a mathematical genius whose career was cut short by schizophrenia and who miraculously recovered and was honoured with a Nobel Prize.

Rachman, S. (1998). *Anxiety*. Hove: Psychology Press/Lawrence Erlbaum and Associates.
Psychological approaches to the conceptualization and treatment of anxiety disorders, drawing on recent empirical work.

Zuckerman, M. (1999). *Vulnerability to Psychopathology: A Biosocial Model*. Washington, DC: American Psychological Association.
Describes how psychopathology can be understood from a diathesis–stress perspective, emphasizing interactions between biology/genetics, personality and stressful life events.

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Therapy 16

CHAPTER OUTLINE

LEARNING OBJECTIVES

INTRODUCTION

BIOLOGICAL TREATMENTS – FROM SURGERY TO DRUGS

Psychosurgery and ECT
Pharmacotherapy – the role of medication
Assessing the effects of psychotropic drugs

PSYCHOLOGICAL TREATMENTS

Psychoanalysis and psychodynamic therapy
Behaviour therapy
Cognitive therapy
Humanistic therapy
Family and couples therapy
Assessing the effects of psychotherapy

BIOLOGICAL OR PSYCHOLOGICAL TREATMENT?

FINAL THOUGHTS

SUMMARY

REVISION QUESTIONS

FURTHER READING

Learning Objectives

By the end of this chapter you should appreciate that:

- there are various forms of therapy (biological and psychological) for treatment of mental illness;
- an illness with a biological manifestation does not necessarily have a biological cause;
- in severe cases, it may be necessary to administer biological forms of therapy, but psychological forms of treatment (psychotherapy) should also be considered to address the cause of the illness comprehensively;
- different forms of psychotherapy emphasize different elements of the human condition (e.g. developmental, behavioural, phenomenological, interpersonal);
- when considering the efficacy of different forms of treatment, it is important to consider possible placebo effects, ideally via the double-blind randomized clinical trial.

INTRODUCTION

Chapter 15 gave a clear picture of the devastation caused by many psychological disorders in the lives of countless people. The obvious question to ask next is: what can we do to treat these disorders?

Given the various models of abnormal behaviour outlined in chapter 15, you won't be surprised to discover that there are numerous therapies for psychological disorders. This chapter examines the two major approaches to treatment – biological and psychological.

Biological treatments make direct changes to the nervous system and are typically used by psychiatrists or other medically qualified practitioners in a hospital or outpatient setting. They include invasive surgical techniques, electroconvulsive therapy, and a range of drugs designed to control or moderate the severity of symptoms experienced.

Psychological treatments include a variety of psychotherapies administered by numerous professionals (e.g. psychologists, psychiatrists, social workers) whose qualifications are regulated by the country in which they live. The main types of therapy are psychodynamic, behavioural, cognitive, humanistic and family- or couple-oriented therapy. Of course, we have to find a way to assess the impact and effectiveness of each type of therapy, and this too is covered.

Finally, this chapter considers the relative merits of biological and psychological approaches. Both are clearly useful, and combining treatments may be especially helpful in preventing relapse.

BIOLOGICAL TREATMENTS – FROM SURGERY TO DRUGS

Until the late eighteenth century, people suffering from a psychological disorder were thought to be possessed by demons or evil spirits. Treatment was designed to alter the body in order to let out the spirits or make it an inhospitable habitat for them.

Among the earliest biological treatments was 'trepanning', or removing part of the skull bone to allow evil spirits out of the body – a practice that endured until the twentieth century. Numerous other equally unpleasant biological assaults on the afflicted included bloodletting, beatings, purgatives and immersion in water to the point of near drowning.

With the demise of witchcraft, people with psychological disorders came to be seen as ill, and the traditional methods of medicine began to be applied to them. But until the advent of the twentieth century, medical treatments were little different from the methods used to drive out evil spirits and were equally unsuccessful.

PSYCHOSURGERY AND ECT

Psychosurgery

Psychosurgery involves severing or otherwise disabling areas of the brain to treat a psychological disorder in the absence of any clear organic cause. Its use was triggered by research on chimpanzees that demonstrated the role of the temporal and frontal cortex in the control of emotional behaviour and aggression.

Antônio Egas Moniz, of the University of Lisbon Medical School, developed a procedure in which the nerve fibres connecting the frontal lobe with other parts of the brain were cut. The prefrontal *lobotomy* became particularly popular in the USA, where a simple technique (that came to be known as 'ice pick' surgery) was administered during an outpatient visit (see figure 16.1). As a result, over 50,000 lobotomies had been performed in the United States by the mid 1950s (Cosgrove, 2000).

lobotomy (or leucotomy) surgical operation in which white nerve fibres connecting the frontal lobes with other parts of the brain are severed

The lobotomy has been replaced by the *cingulotomy*, in which neurosurgeons make lesions in the cingulate gyrus, a section of the brain connecting the prefrontal cortex to the limbic system (brain structures involved in autonomic body functions and some emotion and behaviour – see chapter 3). Baer and colleagues (1995) found that this procedure, which had few side effects, successfully decreased anxiety and obsessive behaviour. But recent studies demonstrate that cingulotomy produces substantial benefits in only about a third of patients (Cosgrove, 2000).

cingulotomy surgical procedure in which neurosurgeons make lesions in the cingulate gyrus, a section of the brain connecting the prefrontal cortex to the limbic system

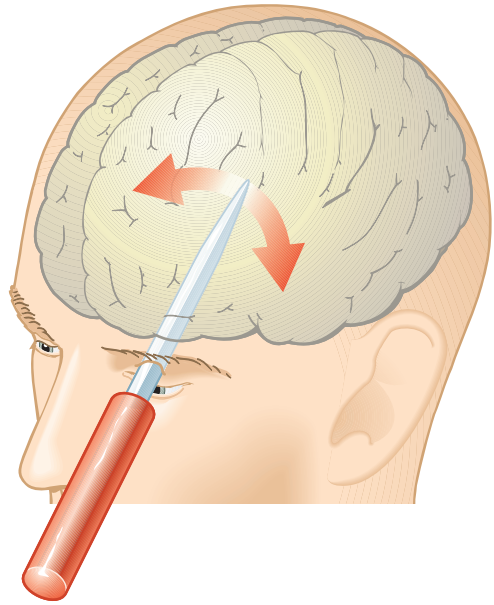

Figure 16.1

In the 'ice pick' lobotomy a sharp piece of metal was inserted under the eyelid and above the eye so that it entered the base of the frontal lobe. Sideways movement severed the connections between the frontal lobe and the rest of the brain.

Although the number of psychosurgeries performed worldwide today isn't known, it is estimated that fewer than 25 occur annually in Britain and the United States, about five a year in Sweden and one or two in Australia. Only people with very severe, disabling psychological disorders that resist other forms of treatment are even considered for psychosurgery today.

Electroconvulsive therapy

Another controversial treatment, and one that is still used fairly widely, is *electroconvulsive therapy (ECT)*. In England 11,340 patients received ECT in 1999 (Department of Health, 1999).

electroconvulsive therapy (ECT) a treatment for severe depression in which two electrodes are placed on the scalp and a moderately intense electric current is passed between them for about half a second

Two electrodes are placed on the scalp and a moderately intense electric current is passed between them for about half a second. This produces a 30- to 60-second seizure, similar to those experienced by epileptics. Today, short-acting anaesthetics and muscle relaxants are given prior to ECT, reducing the seizure to a few visible twitches. The usual course involves between four and twelve treatments over a one- or two-week period.

ECT was initiated in the 1930s to treat schizophrenia, in the mistaken belief that epilepsy and schizophrenia are incompatible. It proved to be an ineffective treatment for schizophrenia but is

Pioneer

Figure 16.2

Antônio Egas Moniz won a Nobel Prize for developing a form of psychosurgery known as the frontal lobotomy, which involved severing the nerve fibres connecting the frontal lobe with other parts of the brain – a radical procedure for treating severe psychological disorders.

Antônio Egas Moniz (1874–1955) was born in Portugal and studied neurology in Bordeaux and Paris. He became Chair of Neurology at the University of Coimbra before entering politics, where he served as a deputy in the Portuguese parliament, Minister of Foreign Affairs and Ambassador to Spain. He left politics to return to the University of Lisbon, where, in 1936, he developed the prefrontal leucotomy (also known as frontal lobotomy) as a surgical approach for the radical treatment of several kinds of mental disorder. Moniz was awarded the Nobel Prize for Medicine and Physiology in 1949 for developing this procedure.

Figure 16.3

Electroconvulsive therapy is a controversial treatment, still used fairly widely.

now widely believed to be effective in treating severe depression (Royal College of Psychiatrists, 1995). It is often used to treat depressed people who have not responded to antidepressant medication, can't take medication because of the risk of suicide or other medical considerations, or risk death through refusal to eat.

Despite claims of 'marked improvement . . . in 80% to 90% of patients' (Silver, Yudovsky & Hurowitz, 1994, p. 983), the case for ECT is far from clear-cut. The consensus from clinical practice is that it can have beneficial effects, but research shows that the effects are relatively short-term. For example, compared to a sham treatment (i.e. the same procedure but with no current passed), ECT shows advantages four weeks later but not six months later (Buchan et al., 1992).

Relapse rates are also high. But this might not be due to the failure of ECT as a treatment. ECT is rarely incorporated into a broader, ongoing therapeutic strategy, possibly because its dramatic, rapid impact on depressive symptoms obscures the need for follow-up care. This failure to address the sociological or psychological stresses that might have initiated or exacerbated the depression could equally explain the high relapse rates for ECT.

Other criticisms include temporary disorientation following ECT, and memory loss that can last for months (indeed, it has been suggested that memory loss is one of the reasons why ECT 'works'). ECT is now often administered to the right hemisphere only in order to minimize its impact on verbal memories. In addition, up to 33 per cent of patients describe ECT as 'a very distressing experience' (Johnstone, 2003a, p. 239), and there are claims that ECT causes brain damage (Breggin, 1997), although there is no compelling evidence for this.

In contrast, the Royal College of Psychiatrists (1997) views ECT as 'among the safest medical treatments given under general anaesthesia' (p. 3) – a view echoed by the psychiatric establishment in many countries. Together with the perceived utility of ECT, these views are likely to ensure its continued use.

Pharmacotherapy – the role of medication

psychotropic drugs a loosely defined grouping of drugs that have effects on psychological function

The advent of *psychotropic drugs* revolutionized the treatment of psychological disorders. By controlling (or at least moderating) the manifestation of some disorders, these drugs have allowed sufferers to be treated without hospitalization.

An estimated 90 per cent of patients who see a psychiatrist are prescribed medication (Glenmullen, 2000; Olfson, Pincus & Sabshin, 1994), and general practitioners also frequently prescribe psychotropic medications, especially antidepressants and anxiolytics. So, although they can't prescribe these drugs themselves (Resnick, 2003), clinical psychologists will have clients who are either taking or in need of medication. This is why knowledge of effective medications, indications for their use, and insight into their side effects is critical for practising clinical psychologists.

Antipsychotics – a treatment for schizophrenia

antipsychotics drugs used to treat the symptoms of schizophrenia

The first psychotropic drugs introduced in the 1950s were *antipsychotics*, which have come to dominate the treatment of schizophrenia. Typical antipsychotics, such as chlorpromazine and haloperidol, reduce psychotic, or so-called 'positive' symptoms of schizophrenia (hallucinations and delusions), apparently by blocking dopamine receptors in certain brain systems (see figure 16.4). The stronger the dopamine blockade, the greater the apparent impact on symptoms (Snyder, 1976).

But what of the other, 'negative', schizophrenic symptoms – lack of social skills, appropriate affect, motivation and life skills? Atypical antipsychotics, such as clozapine and risperidone, reduce both positive and negative symptoms. These drugs appear to block both dopamine and serotonin receptors, implying a dopamine–serotonin interaction in schizophrenia (though some researchers argue that their effectiveness is due to selective dopamine blockade).

How effective are antipsychotic drugs? The first controlled studies of antipsychotics showed that they were clearly superior to placebos (inactive pills) for improving psychotic symptoms (73 per cent vs. 23 per cent), and subsequent research has replicated this finding. A review of 35 studies shows a similar superiority (16.2 per cent vs. 57.6 per cent) when it comes to relapse (Davis & Andriukaitis, 1986). But antipsychotics neither cure schizophrenia nor alter its progress, and they have potent side effects, including constipation, blurred vision, restlessness and difficulty sitting still (akathisia), cardiac arrhythmia, diminished spontaneity and difficulty initiating usual activities (akinesia). Prolonged treatment can lead to 'rabbit syndrome' (rapid movement of the lips that mimics the chewing movement of rabbits).

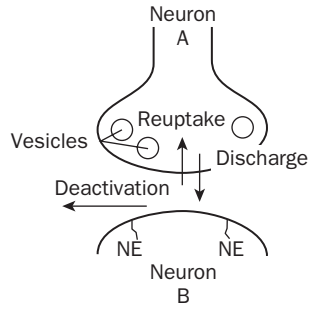

Figure 16.4

Two ways in which a drug may increase the available supply of a neurotransmitter. A neurotransmitter (e.g. norephinephrine, NE) is discharged by neuron *A* to stimulate neuron *B*. The amount of NE available to *B* can be decreased through reuptake (a process in which NE is pumped back into *A*) or through deactivation (where enzymes such as MAOs break down the NE and make it ineffective). Tricyclic drugs (such as Tofranil) and MAO inhibitors (such as Nardil; see p. 341) increase the amount of NE (and serotonin) available but in different ways. Tricyclics interfere with reuptake whereas MAO inhibitors prevent breakdown of the neurotransmitters. SSRIs (such as Prozac and Seroxat) block neurotransmitter reuptake, but act selectively on serotonin and do not appreciably alter reuptake of other neurotransmitters.

Particularly troubling is that antipsychotics interfere with dopamine systems that control movement. These systems sometimes degenerate in older people, giving rise to Parkinson's disease, and so this side effect of antipsychotic medication is known as pseudo-parkinsonism. The symptoms are just as real as parkinsonism, and include tremors, drooling, slowed movements, muscular rigidity, difficulty breathing and small handwriting (micrographia). Additional drugs are usually prescribed in schizophrenia to deal with these side effects. Because antipsychotics can mimic neurological disease, they are sometimes referred to as *neuroleptics*.

neuroleptics antipsychotic drugs

Prolonged use of antipsychotics can also result in *tardive dyskinesia*, 'tardive' meaning 'late developing' and 'dyskinesia' meaning 'disturbance in movement'. This serious disorder is characterized by involuntary movements of the face, trunk or extremities.

tardive dyskinesia a serious movement disorder, characterized by involuntary movements, that can arise as a side-effect of taking antipsychotic drugs

As a consequence of these side effects and risks, many schizophrenic patients don't take their medication reliably, resulting in periodic worsening of symptoms and rehospitalizations. In fact, it is not uncommon for people suffering from schizophrenia to become 'revolving door patients'.

Antidepressants and antimanics – treatments for mood disorders

Treatments for the two major mood disorders that were discussed in chapter 15 (major depressive disorder and bipolar disorder) were developed soon after the introduction of antipsychotics.

1 Antidepressants Two classes of drugs for the treatment of depression were introduced in the late 1950s, tricyclic antidepressants (so-called because of their three-ring chemical structure) and monamine oxidase inhibitors (MAOIs). Both these drugs increase the availability of catecholamine neurotransmitters (norepinephrine and serotonin) though they do so by different mechanisms (see figure 16.4). The tricyclics were more widely used because strict dietary restrictions must be followed when using MAOIs (Burke & Preskorn, 1995). While relatively safe, tricyclics have many side effects, including weight gain, increased pulse, dry mouth, dizziness, concentration difficulties and sexual dysfunction.

Drug treatment of depression changed dramatically in 1988 with the introduction of the first 'designer drug' (Kramer, 1993). Prozac (designed to have a minimal effect on norephinephrine and a maximal effect on serotonin) marked the development of a new class of anti-depressants called selective serotonin reuptake inhibitors (SSRIs). SSRIs have fewer side effects and are much safer to use than tricyclics and MAOIs. An overdose of SSRIs is not as lethal as one involving tricyclics, with MAOIs falling in between the two. This is an important consideration given the increased incidence of suicide attempts in depressed patients. The safety of SSRIs is no doubt one of the factors that has facilitated their widespread use (perhaps over-use) by physicians in general practice. But SSRIs can cause nausea, diarrhoea, insomnia and a loss of sexual desire or response (Montgomery, 1995).

Approximately 70 per cent of patients respond positively to antidepressants, with declines in symptoms apparent within two to six weeks for tricyclics, one to three weeks for MAOIs and two to four weeks for SSRIs (Silver, Yudofsky & Hurowitz, 1994). Patients may do better on one type of antidepressant than another, and sound clinical judgement is needed to find the best antidepressant for each individual. If a patient doesn't respond to a standard antidepressant, his depression is said to be refractory, and he will most likely be treated with two antidepressants simultaneously.

In 1997 a dual-action antidepressant became available, which both blocks serotonin receptors and inhibits its reuptake. Although too early to document its effectiveness, it is likely that this, like other antidepressants, is more than just an antidepressant. This medication has also proven useful in treating panic disorder, eating disorders like bulimia, migraine headache and obsessive–compulsive disorder (Heninger, 1995; Montgomery, 1995).

2 Antimanics People with bipolar disorder are often resistant to taking medication because they miss the 'high' experienced in the initial phase of a manic episode. Yet not taking medication is dangerous, because patients often engage in risky behaviours during their manic phase and are at particularly high risk for suicide during the depressive phase.

Despite their name, antimanics help to prevent depressive episodes in bipolar disorder (they are also referred to as mood stabilizers). The first antimanic used was lithium carbonate, which remains the treatment of choice for preventing both manic and depressive episodes in bipolar disorder. Acute manic episodes respond to lithium within seven to fourteen days. Because acute mania has the potential to seriously disrupt patients' lives, a supplemental medication (usually an antipsychotic) is administered in the acute phase of the condition, to bring behaviour under control as soon as possible.

Lithium is effective with about 60–70 per cent of bipolar patients. The mechanism by which it works remains largely unknown (Calabrese & Woyshville, 1995), although it may work by regulating dysfunctional neuronal firing (see chapter 15). Patients remain symptom-free for years, provided they keep taking the medication. Commonly occurring side effects are nausea, diarrhoea, excessive urine production, fine hand tremor and fatigue. Because lithium is toxic at high levels, it is a risky treatment when there is a suicide risk involved, and patients need to have their blood levels checked regularly.

Two newer antimanics are anticonvulsant drugs that have been used to treat epilepsy. These drugs – carbamazepine and valproate – often work for bipolar patients who have not responded to lithium. They tend to be tolerated much better by many patients.

Anxiolytics – a treatment for anxiety disorders

anxiolytics drugs that produce sedation and reduce anxiety, popularly known as tranquillizers

Popularly known as tranquillizers, *anxiolytics* are the most widely used psychotropic drugs.

In 1960, a new class of drugs, benzodiazepines, was developed that had a specific effect on anxiety. Some, such as Valium (diazepam), Librium (chlordiazepoxide) and Xanax (alprazolam) have been prescribed so often that they have almost become household words. Benzodiazepines slow nerve cell electrical activity by augmenting the effect of gamma-aminobutyric acid (GABA), an inhibitory neurotransmitter. They are fast acting and can affect anxiety following a single dose. Although useful in treating generalized anxiety disorder, post-traumatic stress disorder, panic disorder and insomnia, they are highly addictive, interact dangerously with alcohol and impair psychomotor performance (so patients are advised to avoid driving during treatment).

A newer generation anxiolytic is buspirone, a drug that is chemically distinct from other anxiolytics, is not addictive and does not interact with alcohol or impair psychomotor performance. On the other hand, nausea, headache, insomnia, dizziness and lightheadedness are more common with buspirone. It also has a slow onset action and full therapeutic action takes weeks, making it unsuitable for transient or acute anxiety, where fast relief is needed. Buspirone is as effective as the benzodiazepines in treating generalized anxiety disorder, but less so for panic disorder (Sheehan et al., 1990).

In 1962, imipramine, a tricyclic antidepressant, was found to be effective in treating panic attacks. Since then, other antidepressants have been shown to be useful in treating not only panic disorder, but also social phobia and obsessive–compulsive disorder (OCD). But because most OCD patients achieve only a 35–50 per cent decrease in obsessions and compulsions with drug treatment (Jenike, 1990), they need to undergo psychotherapy at the same time.

Assessing the effects of psychotropic drugs

Why a whole section on testing drugs for effectiveness? Don't we simply give the drug to a group of patients and compare their symptoms before and after?

This pre–post treatment design seems sensible, but it has many weaknesses. Most obviously, as with any form of therapy, it ignores the possibility that the symptoms may have remitted spontaneously, without the treatment. It also neglects the fact that symptoms of several disorders fluctuate over time. Improvement in the condition may therefore simply reflect spontaneous remission or natural fluctuation rather than any actual drug effect. As we saw in chapter 2, a control group is critical to assessing the effect of an experimental manipulation – in this case the administration of a drug. When we compare the effect and value of treatment(s) against a control using patients, it is termed a clinical trial.

The placebo effect and double-blind procedure

So is it sufficient to have two groups of equivalent patients – one receiving the drug and one not? Certainly, in this design, any differences after treatment would not be due to spontaneous remission or the natural course of the disorder, as these factors would affect both groups. But neither could the differences be unequivocally attributed to the drug. We also have to account for the *placebo effect* – a widely documented phenomenon in the treatment of various diseases from flu to heart disease. It has been shown that up to 70 per cent of patients actually show some real functional improvement after being treated with an inert substance (a placebo) such as a sugar pill. Interestingly, practitioners often make use of the placebo effect in treating patients (Benson & Friedman, 1996). But researchers must eliminate it. Can we do so by simply administering a placebo to our control group, so that they get the same amount of attention and 'treatment' as the group treated with the real drug?

placebo effect phenomenon whereby patients show some form of real improvement after being treated with an inert substance (a placebo) such as a sugar pill

While this is a dramatic improvement on the basic pre treatment–post treatment design, there is still a problem with this *single-blind procedure* – so-called because the patient is kept 'blind' to the true nature of the treatment. But it is essential that all the patients believe they are receiving real medicine, and this can't be guaranteed when the administering staff themselves know who is getting the real drug and who is getting the placebo. Even without explicitly revealing the true nature of the treatment to the patient, the knowledge of the staff can subtly influence the patient. It is therefore imperative for all staff who have contact with the patients to remain unaware throughout the study about who is receiving which treatment. This is called a *double-blind procedure*. A very powerful experimental technique is the combination of the double-blind procedure with random assignment of patients to treatment condition – *randomized clinical trial* (RCT).

single-blind procedure in order to evaluate the effect of a therapy, the patient is kept uninformed (blind) as to the true nature of the treatment

double-blind procedure in order to evaluate treatment efficacy, the patient and all staff having contact with the patient remain uninformed (blind) as to the true nature of the treatment

randomized clinical trial (RCT) random assignment of patients to treatment conditions in order to evaluate the efficacy of a treatment

But we still have another couple of problems to overcome. It is unethical to withhold an acceptable treatment in order to administer a placebo, so many RCTs compare the impact of a new drug to treatment as usual. This helps address another problem that sometimes arises with the use of a placebo – side effects can make it apparent to both staff and patients who is receiving the experimental drug. Obvious differences in side effects between treatments tend to be muted when the comparison is with a standard treatment. In RCTs of new drugs, the question is usually one of relative efficacy compared to the currently best available treatment. But even if a new drug is only equivalent to an existing treatment, it may be preferred because of lower cost, or fewer side effects. For example, among antidepressants the newer drugs are generally preferred over older ones, not because they are more effective overall, but because of more acceptable side effects (Thase, 1999).

Criteria for effectiveness

Finally, we must consider the criteria used to judge the efficacy of a treatment. Usually we look at patient reports and, where possible, ratings by hospital or clinic staff. Assessments by psychologists and medical tests may also be used. But how do we decide if a change is clinically meaningful, rather than simply a statistical measure? This is an important issue that can dramatically alter the inferences we draw about a treatment's efficacy.

For example, suppose reports from depressed patients are statistically different from a comparison group after treatment (see chapter 2), and yet these same patients show little difference in their ability to function in everyday life and remain severely depressed. One way to address this issue is to test whether patient self-reports fall into the non-depressed range of scores. Another method that can be used is to apply more novel statistical techniques (beyond the scope of this book) such as comparing the 'effect size' underlying the statistical difference. A further criterion that is increasingly emphasized is the cost-effectiveness of

a treatment. So we might ask whether a new treatment for drug dependence leads to fewer arrests and days in prison, or whether a new antidepressant leads to fewer lost work days, and so on. In economically difficult times, care is sometimes subordinated to cost, making the use of psychotropic drugs particularly attractive for the treatment of psychological disorders. The fact that they are often fast acting only adds to their appeal (although, as we have seen, the duration of these beneficial effects may be a quite different matter – we explore this question further in the next section).

The limits of drug therapy

There is no doubt that modern psychotropic drugs have revolutionized the treatment of psychological disorders and restored the lives of many sufferers. No one should be treated for schizophrenia or bipolar disorder without suitable medication being available, and drugs can be appropriate for many other psychological disorders too. And yet the use of psychotropic drugs is controversial, with some asserting that the beneficial effects are quite limited (Fisher & Greenberg, 1989). Others have raised concerns about over-use (Olfson et al., 1998), abuse (especially regarding anxiolytics such as valium) and possible addiction. Furthermore, some researchers have argued that the impact of psychotropic drugs largely reflects a placebo effect (Kirsch & Sapirstein, 1998).

In any event, drug treatments have some obvious limits:

1. Not everyone responds to the drug.
2. Side effects may preclude their use for some patients, and may lead others to discontinue their use – a particularly important consideration for treatments like antipsychotics and antimanics, when ongoing maintenance doses are needed to control symptoms effectively.
3. Drug treatment does nothing to help patients learn how to cope with life experiences that may have contributed to the disorder in the first place.

This leads us neatly into the essential role of psychological treatments.

PSYCHOLOGICAL TREATMENTS

Treatments that use psychological methods rather than direct changes to the body are known collectively as psychotherapy.

There are many different kinds of psychotherapy (see table 16.1). Treatment is always by a trained therapist with expertise in handling psychological disorders, and the clients enter into a professional relationship with the therapist to work on alleviating the disorder. Training in psychotherapy usually involves completion of an advanced degree and supervised treatment experience, but its exact nature depends on the disciplinary background of the therapist (who might be a psychiatrist, psychologist, social worker or psychiatric nurse), and the regulations that govern practice in their country. In many countries, people with minimal or no training may still call themselves 'psychotherapists', so it is essential to exercise good judgement in seeking psychotherapy.

Psychotherapy may take place in outpatient or inpatient settings. Either way, the psychotherapeutic relationship is a purposeful, nurturant alliance. The psychotherapist needs good communication and relationship-building skills, self-awareness and self-monitoring, and other specific skills associated with their particular type of therapy.

In the next sections we consider some of the major forms of psychotherapy that are currently in clinical use.

PSYCHOANALYSIS AND PSYCHODYNAMIC THERAPY

Classical psychoanalysis

Classical psychoanalysis was developed by Freud (see chapter 15). Its goals are to help the person gain *insight* into the 'true' (usually

insight an individual's understanding of the unconscious reasons for his or her maladaptive behaviour – central to psychoanalysis

Table 16.1 Treatments for psychological disorders, organized according to the model of abnormal behaviour on which they are based.

Model	*Examples of treatment*	*Examples of treatment techniques*	*Goals of treatment*
Biological	Psychosurgery, medication	Lobotomy, monoamine oxidase inhibitor	Alter neurological system, correct chemical imbalance
Psychoanalytic/ contemporary psychodynamic	Psychoanalysis, interpersonal therapy	Free association, interpretation, analysis of transference	Psychosexual maturity via insight, strengthening ego functions
Behavioural	Systematic desensitization, contingency management	Counter-conditioning, modelling	Changes in behaviour via new learning
Cognitive	Cognitive therapy, rational-emotive therapy	Collaborative empiricism, identifying automatic thoughts	Changing cognitive processing of events
Humanistic	Client-centred therapy	Unconditional positive regard, active listening	Personal growth, self-acceptance, self-actualization
Family and couples/ relationship dysfunction	Behavioural marital therapy, strategic family therapy	Communication training, paradoxical directive	Change interpersonal context of psychological disorder

unconscious) reasons for their maladaptive behaviour, to work through their implications and associated feelings, and to strengthen the ego's control over the id and superego.

1 Uncovering repressed memories In this framework, recovery of unconscious memories is facilitated by the method of free association, in which the client says whatever comes to mind without editing or censorship. This is a difficult procedure, which rarely reveals repressed memories clearly. According to the traditional view, the analyst has to piece together patterns of association while dealing with the patient's 'resistance' (the tendency to avoid the task at hand by, for example, changing topic or forgetting what they were about to say). Resistance is seen as a sign that the patient is on the verge of recalling a painful memory.

Freud also used dreams to uncover unconscious material by regarding the content of the dream as symbolic of something else. But he believed that recollection without emotion has little therapeutic value, so psychoanalysis is considered useful only if the patient is released from the emotional forces that had kept the insight repressed.

2 Transference and countertransference Central to psychoanalysis is *transference*. This is the notion that the client projects (transfers) onto the analyst characteristics that are unconsciously associated with parents and other important interpersonal figures from the client's past. Using the transference-charged relationship, the analyst effectively holds up a mirror, allowing the client to see how he reacts to important people in his life. Through many experiences like this, it is argued that the patient's symptoms gradually diminish. To be able to 'stand in' for significant others in the patient's early life, it is important for the analyst to remain neutral. They must not allow countertransference (i.e. their own unconscious feelings towards the patient) to distort the process. Not surprisingly, trainees must undergo psychoanalysis themselves before qualifying as a psychoanalyst.

transference projection by a client onto the therapist of characteristics that are unconsciously associated with parents and other important figures

Contemporary psychodynamic therapy

The now stereotypical analytic couch is foregone in contemporary psychodynamic therapies in favour of chairs and face-to-face interaction. Classical psychoanalysts focused on what happens during analysis, so the patient's life outside the consultation room ideally needed to remain stable until the analysis was complete. In contrast, contemporary psychodynamic therapists use a model of abnormal behaviour that involves not only intrapsychic conflict relating to early childhood, but also current interpersonal relationships. They therefore pay close attention to the links between what goes on during therapy and the client's life in between sessions.

Emphasis on accountability and cost-effectiveness in health care have no doubt played a role in the recent emergence of short-term dynamic psychotherapy (Levenson & Strupp, 1999). Here the goal is pragmatic – to help the client cope with a current problem or crisis in 20 sessions or fewer. Therapists are usually more active and may refer clients to self-help groups, ask them to do homework between sessions and use other procedures not typically associated with psychoanalytically derived psychotherapies.

Do these therapies work?

A major limitation of psychoanalytic and psychodynamic therapies is that they seem best suited to verbal, intelligent people with relatively mild psychological problems who are motivated to spend a substantial amount of time trying to uncover unconscious conflicts. Psychoanalysis is also expensive and usually only available to those who can afford private practice.

The basic principles that underlie these therapies have received very little empirical attention. In a study of free association, Erdelyi (1985) found that the method resulted in more material being reported, but it wasn't clear whether this reflected actual memory enhancement (see chapter 11). In fact, it may not be possible to test these therapies at all because the theoretical framework underpinning them frequently seems to explain all possible outcomes equally well (see chapter 15). For example, when a patient obtains insight and changes behaviour, this is said to provide evidence of treatment efficacy. But when a patient obtains insight but shows no behaviour change, in the psychoanalytic framework this doesn't reflect on treatment efficacy as the insight is said to be merely 'intellectual'. The picture is brighter when it comes to some of the more recent psychodynamic therapies. There is some evidence that interpersonal therapy (a short-term psychodynamic therapy that focuses on the client's interpersonal relationships and current circumstances) is effective in treating depression (Weissman & Markowitz, 1994). For the most part, however, the jury is still out when it comes to research evaluations of contemporary psychodynamic therapies.

BEHAVIOUR THERAPY

Just as behaviourism was a rejection of existing systems in psychology (see chapter 1), behaviour therapy represented a rejection of psychoanalytic and psychodynamic thinking. Behaviour therapy is concerned with what the person does that causes distress. The problematic behaviour is seen to be learned, just like any other behaviour, and is not viewed as a symptom of an underlying 'illness'. The therapist uses techniques based on the principles of learning to change the maladaptive behaviour. Consistent with its roots in the work of Pavlov, Thorndike and Skinner (see chapter 4), behaviour therapy is highly pragmatic and focuses on the 'here and now' rather than early experiences.

And yet it would be a mistake to conclude that behaviour therapy is a completely mechanistic, impersonal procedure. Like other psychotherapists, behaviour therapists emphasize the need for a strong, supportive therapeutic relationship between the therapist and the client in their work.

Exposure techniques

As the name implies, exposure techniques involve exposing clients to stimuli that, through pairing with anxiety responses (classical conditioning), have come to evoke anxiety or fear. Exposure is extensively used to treat agoraphobia and the panic attacks that often precede its development. In severe cases, it is usually combined with drug treatment.

The most widely used technique is systematic desensitization, developed in laboratory studies of cats by the South African psychiatrist Joseph Wolpe. Wolpe reasoned that, 'If a response antagonistic to anxiety can be made to occur in the presence of the anxiety-evoking stimuli so that it is accompanied by a complete or partial suppression of the anxiety responses, the bond between these stimuli and anxiety responses will be weakened' (1958, p. 71). When this principle of *reciprocal inhibition* (counter-conditioning) is applied to humans, muscle relaxation is usually used to inhibit anxiety. The client is first taught progressive muscle relaxation (tensing and then releasing muscle groups) until she is able to relax her muscles on cue. Then the therapist works with her to develop a hierarchy of situations that she finds increasingly anxiety-provoking.

reciprocal inhibition loosening of the ability of stimuli to evoke anxiety when a response antagonistic to anxiety (e.g. relaxation) is made to occur in the presence of the stimuli

For example, suppose the target behaviour is fear of speaking up in class. The following hierarchy might be developed:

At home, the night before I go to class.
Driving to school before the class.
Walking to my class.
Walking inside the classroom.
Looking around at the people in the room.
Walking in and saying 'hello' to someone in the room.
Sitting down in the front row.
Catching the professor's eye and smiling.
Nodding or agreeing with a comment made in class.
Asking the professor a question from the front of the room.
Asking the professor a question from the back of the room.
Answering a short question from the front of the room.
Answering a short question from the back of the room.
Answering a longer question.
Making a comment on a particular point to the class.

The client is therefore exposed to the least frightening situation while deeply relaxed. When the situation no longer evokes anxiety, the therapist moves on to the next stage in the hierarchy, progressing accordingly until the client can encounter the most anxiety-provoking situation while still remaining relaxed. Exposure to the anxiety-provoking situation is usually achieved through imagination, but can also be achieved in real life. More recently, simulated environments created using virtual reality technology have been used effectively to treat acrophobia (fear of heights), aviophobia (fear of flying) and post traumatic stress disorder (Rothbaum et al., 1995; 2001; 2002).

Figure 16.5

Flooding is a technique used to reduce anxiety, such as that associated with particular phobias like arachnaphobia, by prolonged exposure to the trigger of the anxiety – i.e. spiders.

An alternative to the brief/graduated exposure used in systematic desensitization is *flooding* – a technique that involves prolonged exposure to highly threatening events. The client's anxiety response diminishes through habituation and eventually disappears completely. When used to treat obsessive–compulsive disorder, exposure is accompanied by response prevention (clients are prevented from performing the rituals they normally use to reduce their anxiety). For example, suppose someone has a fear of contact with objects 'contaminated' by other people, such as doorknobs. If they normally reduce their anxiety in such situations with repetitive hand-washing, they would be prevented from doing so at the same time as flooding therapy is administered.

flooding a technique used in behaviour therapy that involves exposing the patient to highly threatening events for a prolonged period of time

Operant techniques

Operant, or instrumental, conditioning occurs when behaviour is governed by the consequences that immediately follow it. A family of therapeutic techniques has emerged from this type of conditioning, generically termed 'contingency management'. One example is the token economy – in a controlled environment (such as a psychiatric ward or classroom), tokens are used to increase the likelihood of targeted behaviours. The tokens can be exchanged for desired items or activities (e.g. snacks, TV), much as we use money in everyday life. Token economies are widely used in hospitals that treat people with chronic, severe psychological disorders like schizophrenia, and have proved to be highly effective (Chambless et al., 1998). Contingency management is also used in individual behaviour therapy. In the context of a warm, supportive relationship with the client, a behaviour therapist uses social reinforcers (e.g. nods, smiles, approval) to help bring about behaviour change.

Time out is a form of contingency management that can reduce the frequency of an undesirable behaviour by removing the person from the situation in which the behaviour is reinforced. For example, sending a child to a quiet, boring location for a short period following misbehaviour is an effective way of changing the behaviour, especially when it is coupled with positive reinforcement of appropriate behaviour. Another punishment contingency is response cost, which involves loss of a reward following a behaviour that we seek to change (such as smoking, aggression or self-abuse). Response cost suppresses behaviour longer than other forms of punishment and is considered more acceptable than more severe forms of punishment, such as are used in aversion therapy.

Aversion therapy

aversion therapy a problem behaviour is paired with an aversive stimulus in an attempt to establish an aversive response to the behaviour (e.g. fear, disgust)

Aversion therapy can draw on the principles of both classical and operant conditioning. When based on classical conditioning, a problem behaviour is paired with exposure to an aversive unconditioned stimulus in an attempt to establish an aversive response to the behaviour (e.g. fear or disgust). For example, an alcoholic is made nauseous (by the drug emetine) and is then given a glass of his favourite drink. After a few pairings the nausea becomes associated with the drink. In one study using this technique, abstinence was successfully induced for a year in 63 per cent of 685 hospitalized alcoholics, and 33 per cent were still dry after three years (Wiens & Menustik, 1983; see review by Elkins, 1991). However, a problem with this method is that exposure to the original stimulus (in this case drinking alcohol) over time tends to weaken the classically conditioned response enough to result in relapse.

When based on operant conditioning, the aversive stimulus acts as a punishment and is delivered immediately after the problematic behaviour. The *Everyday psychology* box in chapter 1 gives an example of how aversion therapy was used in this way to treat ruminative vomiting and save a child's life.

Aversion therapy has been used to treat a variety of problems, including alcoholism, smoking, overeating, compulsive gambling, self-injurious behaviour and some sexual deviations such as exhibitionism. One of the drawbacks, however, is that it does not teach alternative behaviours to replace the problem activities. There are also serious ethical problems, especially when the cognitive functioning of the client prevents them giving informed consent (as in the case of young children). So aversion therapy tends to be used as a last resort after other treatments have failed, to control acute behaviours that threaten the client's or others' wellbeing (such as self-abuse or uncontrollable physical violence).

covert sensitization a form of aversion therapy in which the client imagines a problem behaviour followed by an aversive stimulus

A more acceptable and less intrusive form of aversion therapy is *covert sensitization*. Here the client imagines both the problem behaviour and the aversive stimulus. Perhaps surprisingly, in many patients a nauseous response to alcohol, for instance, can be induced in this way.

Figure 16.6

Using the 'rapid smoking technique', behaviour therapists force smokers to puff every few seconds for a prolonged period of time until they feel sick and disgusted with cigarettes.

Modelling

Vicarious learning by observing and imitating the behaviour of others is also used in behaviour therapy. The therapist models the behaviour for the client, who is then reinforced for performing it and encouraged to try it outside the therapy session. For example, a therapist can treat phobias by encouraging the client to exhibit the modelled behaviour when in the feared situation. The client first observes the model, then makes gradual contact with the feared object. Modelling is most effective when the model is similar to the client, has high status and is reinforced (e.g. receives social approval such as praise) for his action (Bandura, 1986). The similarity between the client and the model can be increased by having the model initially display fear before successfully performing the desired behaviour (Meichenbaum, 1971).

Social skills

A lack of social skills necessary for interpersonal relationships can exacerbate or even partly account for psychological disorders. So behaviour therapists include social skills training in treatment of depression (Bellack et al., 1983), anxiety disorders (van Dam-Baggen & Kraaimat, 2000) and schizophrenia (McQuaid et al., 2000).

The first step is to determine skill deficits in concrete terms (e.g. avoiding eye contact, speaking too softly) before developing more appropriate behaviour through modelling and social reinforcement. Assertiveness training is widely used, especially when the inability to express personal needs appropriately leads someone to be depressed or aggressive. It is designed to help clients express their feelings in ways that don't infringe upon the rights of others, rather than suffering in silence or exploding in anger. Social skills training has been expanded in recent years to promote a broader array of skills, such as making conversation and participating in interpersonal problem solving.

Does it work?

Critics of behaviour therapy argue that it is superficial and deals only with symptoms rather than their root causes. As a result, critics argue that new symptoms are likely to arise (a process known as *symptom substitution*). While it is no doubt true that many problem behaviours arise in response to past circumstances, there is no evidence for symptom substitution. A second criticism is that behaviour therapy doesn't pay attention to thought processes that might support problem behaviour. One view of abnormal behaviour is that it results from distorted thinking (see chapter 15). Is it therefore possible that it isn't just stimulus–response connections or reinforcement that matter, but also the way we perceive events in our life? The internal psychological processes deemed irrelevant by strict behavioural therapists might themselves be maladaptive and need to be changed.

symptom substitution the emergence of new symptoms after treating the symptoms of a disorder (as opposed to its 'root' cause)

In response to these concerns, a range of techniques have been developed to influence maladaptive ways of thinking directly.

Cognitive therapy

Cognitive therapy is a relatively short-term treatment (about 20 sessions) designed to get clients thinking about events in their life – including the symptoms of their disorder – in new ways. Sessions focus on concrete problems and help clients to challenge their beliefs about the problem. Although the cognitive therapist engages the client in behavioural tasks, cognitive therapy differs from behaviour therapy in focusing on the patient's internal (cognitive and affective) experiences.

Central to cognitive therapy is the identification of the client's latent dysfunctional *schema* – or underlying rules of life. For example, if a person evaluates everything he does in terms of his competence, his thinking might be dominated by the schema, 'Unless everything I do is perfect, I'm a failure.' To change dysfunctional schemas such as this one, the cognitive therapist uses an active, structured and directive approach, focusing on the 'here and now', and not offering interpretations of the unconscious origins of problems in childhood.

Beck's cognitive therapy

Aaron Beck developed one of the most influential cognitive therapies to treat depression. Beck maintains that the depressed person's negative view of self, the world and the future (the 'cognitive triad') results from the operation of maladaptive *automatic thoughts* – the spontaneously generated thoughts associated with specific moods or situations (e.g. 'Everything I do turns out wrong'). In depression, these cognitive distortions can take many forms including dichotomous thinking ('I'm either a success or a failure'), overgeneralization ('Whatever I say just shows how stupid I am'), arbitrary inference ('He glanced over my shoulder while talking to me. I'm a social failure') and magnification ('My mistake in answering the test question just shows that I'm an idiot who shouldn't be at university').

automatic thoughts used in cognitive therapy to refer to spontaneously generated thoughts associated with specific moods or situations

Whatever form the cognitive distortion takes, a primary goal in cognitive therapy is to help the client identify automatic thoughts and evaluate them. The therapist helps the client to do this by asking questions like, 'What is the evidence for this idea?', 'Is there another way to look at the situation?', 'Are these facts, or your interpretation of the facts?' The therapist also formulates a hypothesis regarding the automatic thought and invites the client to test the validity of the hypothesis in a systematic way – a process called *collaborative empiricism*. In taking this approach, ultimately more realistic, accurate interpretations should replace the automatic thoughts, distorted beliefs and assumptions.

collaborative empiricism cognitive therapy procedure in which the therapist formulates a hypothesis and then helps the client test the validity of the hypothesis

Here's an example of cognitive therapy in action. A depressed, attractive woman in her twenties had the following interchange with her therapist. Notice how the therapist engages her in collaborative empiricism when dealing with her automatic thoughts about being ugly and undesirable.

Therapist: Other than your subjective opinion, what evidence do you have that you are ugly?
Client: Well, my sister always said I was ugly.
Therapist: Was she always right in these matters?
Client: No. Actually, she had her own reasons for telling me this. But the *real reason* I know I'm ugly is that men don't ask me out. If I weren't ugly, I'd be dating now.
Therapist: That is a possible reason why you are not dating. But there's an alternative explanation. You told me that you work

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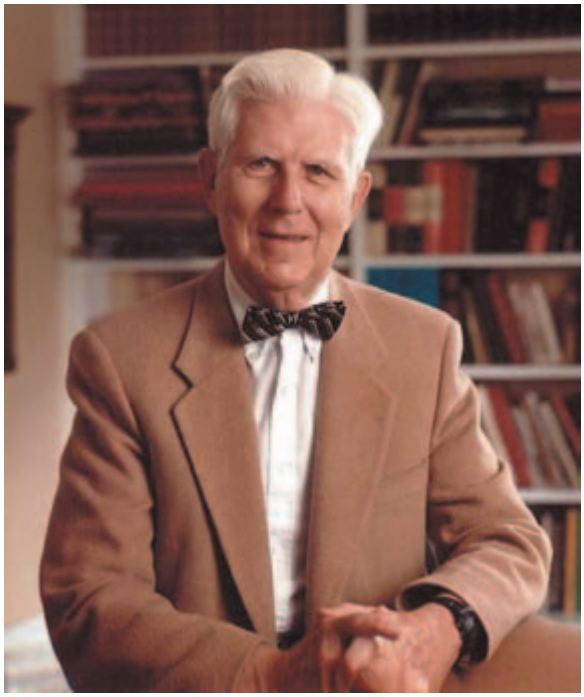

Figure 16.7

Aaron Beck rejected the psychoanalytic approach and developed a cognitive therapy for depression, based on the belief that a depressed person's negative view of self, the world and the future results from maladaptive automatic thoughts.

Aaron T. Beck (1921–) graduated from Yale University in psychiatry in 1946 and completed formal training in psychoanalysis at the Philadelphia Psychoanalytic Institute in 1956. He then began to conduct research to validate psychoanalytic theories. But when his research did not support his hypotheses, he rejected the psychoanalytic approach and developed a cognitive therapy for depression. His well-known tests to assess depression include the Beck Depression Inventory and the Scale for Suicide Ideation. Among his several influential books are *Depression: Clinical, Experimental, and Theoretical Aspects* (1967), *Cognitive Therapy and the Emotional Disorders* (1979) and *Cognitive Therapy of Depression* (1979, with Rush, Shaw and Emery).

in an office by yourself all day and spend your nights alone at home. It doesn't seem like you're giving yourself opportunities to meet men.

Client: I can see what you're saying but still, if I weren't ugly, men would ask me out.

Therapist: I suggest we run an experiment: that is, for you to become more socially active, stop turning down invitations to parties and social events and see what happens.

Following this interchange, the client became more active and was able to relinquish the thought that she was ugly. Therapy then focused on helping her change her assumption that her worth was based on her appearance. The treatment went on to deal with her assumption that she could not be happy without love (or attention from a man).

Therapist: On what do you base this belief that you can't be happy without a man?

Client: I was really depressed for a year and a half when I didn't have a man.

Therapist: Is there another reason why you were depressed?

Client: As we discussed, I was looking at everything in the distorted way. But I still don't know if I could be happy if no one was interested in me.

Therapist: I don't know either. Is there a way we could find out?

Client: Well, as an experiment, I could not go out on dates for a while and see how I feel.

Therapist: I think that's a good idea. Although it has its flaws, the experimental method is still the best way currently available to discover the facts. . . . If you find you can be happy without a man, this will greatly strengthen you and also make your future relationships all the better.

(Beck et al., 1979, pp. 253–4)

Although initially formulated to treat depression, Beck's cognitive therapy has been applied to the treatment of anxiety disorders, personality disorders, eating disorders and as a complement to antipsychotic drug therapy for schizophrenia (Wright & Beck, 1994). Numerous controlled studies show that cognitive therapy is effective for depression, producing acute symptomatic relief and lower relapse rates than drug treatment. In one study the relapse rate was just 23 per cent at two years, as opposed to 78 per cent after drug treatment (Blackburn et al., 1981). There is also evidence of effectiveness for anxiety disorders, particularly generalized anxiety disorder and panic disorder.

Rational emotive therapy

Albert Ellis developed one of the earliest forms of cognitive therapy – rational emotive therapy (RET). According to Ellis (1973), when an emotional consequence (C) follows an activating event (A), it is not A that causes C but the individual's beliefs (B) (figure 16.8).

The goal of RET is to change pervasive patterns of irrational thinking. It 'largely consists of the use of the logico-empirical

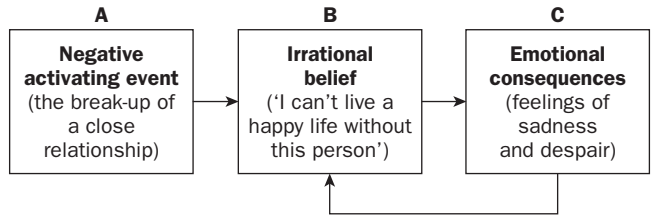

Figure 16.8

A-B-C model that underlies the use of rational emotive therapy. According to Ellis (1973), emotional distress is caused by irrational beliefs. This distress, in turn, helps to sustain irrational beliefs.

method of scientific questioning, challenging and debating' (Ellis, 1977, p. 20). So the RET therapist is challenging and confrontational, asking questions like, 'Where is it written that life has to be fair?' or 'Who says you'll have a breakdown if your partner breaks up with you?'

A common technique used in this form of therapy is to engage in shame-attacking exercises, in which clients are encouraged to deliberately do something they find embarrassing to show that the consequences are not catastrophic.

Does it work?

Two criticisms of cognitive therapy are that the linear causality on which it is based (cognition → behaviour) is too simple, and that it emphasizes internal events (cognition) at the expense of contextual events. But the cognitive perspective on which cognitive therapy is based is actually closer to a diathesis–stress model, in which life events, thoughts, behaviour and emotions are inextricably linked and exert reciprocal effects on each other. Indeed, attention to behaviour is central to cognitive therapy, and so the distinction between behavioural and cognitive therapy has been blurred. Beck's therapy is generally viewed as a cognitive–behavioural therapy, and RET is now often referred to as rational emotive behaviour therapy (Ellis, 1993; 2001).

Although criticized for being too simplistic, RET itself can be useful in clinical practice. But, while there is evidence that the tendency to endorse irrational thoughts is associated with a variety of disorders (Alden & Safran, 1978), Ellis's a priori identification of a core set of irrational beliefs has been questioned. Critics argue that the utility of beliefs needs to be taken into account when we decide on their rationality. A client's 'irrational' belief can be effective and desirable in their circumstances, while a 'rational' belief may be maladaptive in a certain situations (Arnkoff & Glass, 1982). Finally, critics question whether the positive effects of cognitive therapy reflect something specific to cognitive therapy, or to some mechanism that it shares with other psychotherapies.

HUMANISTIC THERAPY

Humanistic therapies focus on the phenomenology (conscious experience) of the client and view psychological problems as disturbances in awareness or undue restrictions on existence. According to this framework, a client's problems can be understood only when viewed from his or her own point of view. The aims of humanistic therapies (also called experiential or phenomenological therapies) are to help people get in touch with their feelings, experience their 'true selves' and develop meaning in their life. This is done through the nature of the therapeutic relationship and the client's tendency to grow as a unique individual (a process known as self-actualization).

Gestalt therapy

Developed by Fritz Perls, Gestalt therapy reflects the view that people often control their own thoughts, behaviours and feelings too much, losing touch with their emotions and authentic selves. The Gestalt therapist aims to enhance the client's awareness of herself, which helps the client to grow (Perls, 1969). According to this viewpoint, talking about the past or future obstructs therapy, as it is an escape from the reality of the 'here and now', which is

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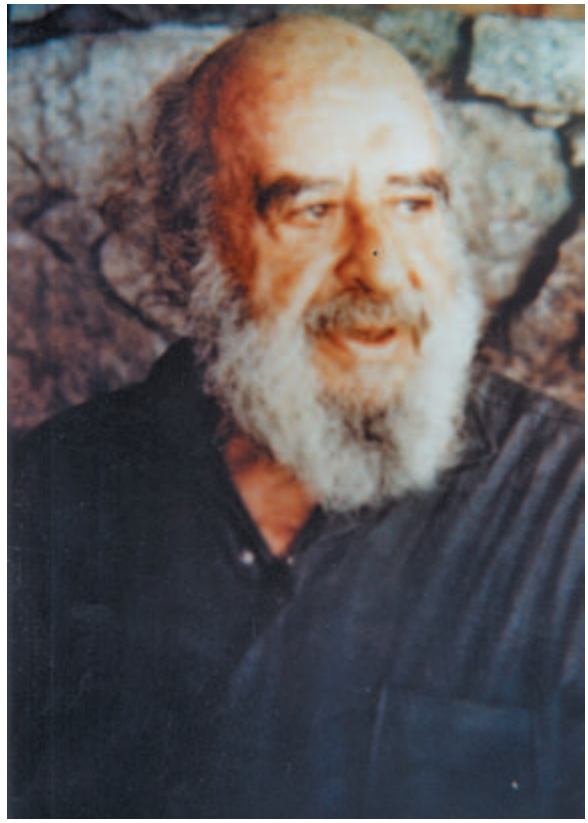

Figure 16.9

Frederick 'Fritz' Perls founded Gestalt therapy, which roots the client in the 'here and now' and helps them to achieve a whole sense of the self.

Frederick 'Fritz' Perls (1893–1970) was born in Germany, earned his MD degree in 1926, and then worked at the Institute for Brain Damaged Soldiers in Frankfurt. He became a psychoanalyst before developing Gestalt therapy. Perls moved to South Africa in the early 1930s, where he wrote *Ego, Hunger, and Aggression: A Revision of Freud's Theory and Method* (1946). In 1946 he moved to New York City and wrote *The Beginning of Gestalt Therapy* (with Ralph Hefferline and Paul Goodman) in 1951. Perls and his wife organized the New York Institute of Gestalt Therapy before moving to California in 1960, where he continued to offer Gestalt therapy workshops until his death in 1970.

of paramount importance in Gestalt therapy. Awareness in the here and now supposedly leads to change. Consistent with the Gestalt principle of holism (the whole is greater than the sum of the parts; see chapter 1), the goal is to help the client, through change, to integrate polarities (e.g. feminine and masculine sides of the personality), and achieve a whole sense of the self. The Gestalt therapist may often be quite confrontational in forcing the client to focus on the here and now and deal honestly with his feelings. Indeed, according to one commentator, Perls 'was often seen as inhumane in application of his technique' (Cottonne, 1992, p. 148).

Role-playing is used extensively in Gestalt therapy to explore interpersonal games, conflicts between different parts of the self, and so on. Sometimes an empty chair is placed near the client, and he is asked to imagine that the person towards whom he experiences repressed emotions is sitting in the chair. The client can then safely experience his feelings by 'talking' to the person. In a similar vein, two chairs might be used to allow the client to 'seat' two different sides of the same conflict, one in each chair. The client then plays the part of each side of the conflict, as a way of learning to allow the polarities to exist. Enactment (or putting feelings or thoughts into action) is another form of role-play used in this approach.

Gestalt therapy has been aptly summarized as follows: 'The Gestalt therapist places more value in action than in words, in experience than in thoughts, in the living process of therapeutic interaction, and the inner change resulting thereby, than in influencing beliefs' (Naranjo, 1970, p. 47).

Client-centred therapy

This most influential humanist therapy was developed by Carl Rogers, who believed that 'it is the client who knows what hurts, what directions to go, what problems are crucial, what experiences have been deeply buried' (1961, pp. 11–12). In his system, called either client-centred or person-centred therapy, the client determines what to talk about and when to do so, without direction, judgement or interpretation by the therapist.

Rogers argued that a person's natural tendency to grow as a unique individual (self-actualize) is thwarted by judgements imposed on them by other people – what he called *conditions of worth*. He therefore emphasized the importance of affirming the worth of the client, who typically is not interrupted or questioned by the therapist. This is achieved by the exercise of three therapeutic attitudes:

1. Unconditional positive regard is established by showing the client that she is valued, no matter what. It conveys that the therapist cares about the client, accepts her and trusts in her ability to change. It does not mean that the therapist must agree with or approve of what the client says, but it does mean that the therapist non-judgementally accepts everything the client says as a reflection of her as a person. Given these tenets, Rogerian therapists understandably do not offer advice – to do so would imply that the client is not competent and is dependent on help.

Pioneer

Figure 16.10

Humanist Carl Rogers developed a client-centred approach to therapy, in which the client's self-worth is reinforced by keeping sessions free from judgement, direction or interpretation by the therapist.

Carl Rogers (1902–87) was reared in a strict religious environment. He entered the Union Theological Seminary, New York, in 1924 and became involved in working with disturbed children. When his interests shifted to clinical psychology, he obtained a doctoral degree from Columbia University. He taught at Ohio State University, the University of Chicago and the University of Wisconsin, before settling at the Center for Studies of the Person in La Jolla, California. As the founder of nondirective (later relabelled person-centred, or client-centred) therapy, he wrote many influential books, including *Counseling and Psychotherapy: Newer Concepts in Practice* (1942), *Client-Centered Therapy* (1951), *On Becoming a Person* (1961) and *A Way of Being* (1980). He was nominated for a Nobel Peace Prize in 1987.

2. Also essential to the Rogerian therapist is empathy – an emotional understanding of what the client is experiencing by seeing things from his point of view. Empathy is conveyed by active listening and the use of reflection – a paraphrasing of what the client has said, which identifies the

feelings and meanings underlying the statement. Clients often elaborate on their feelings and concerns following a reflection, so this technique helps the client to raise material without the therapist having to ask disruptive questions. The impact of reflection is evident in everyday life: people who reflect back what has been said to them are often viewed as good listeners.

The following interaction between Carl Rogers and a young man illustrates the technique of reflection. Rogers skilfully helps the client clarify his feelings for his stepfather. Without direct prompting from Rogers, the client moves from a blunt assertion of mutual hatred to one of unilateral hatred to one in which he expresses respect for his stepfather and the reasons for that respect.

Client: You see I have a stepfather.
Therapist: I see.
Client: Let's put it this way. My stepfather and I are not on the happiest terms in the world. And so, when he states something and, of course, she goes along, and I stand up and let her know that I don't like what he is telling me, well, she usually gives in to me.
Therapist: I see.
Client: Sometimes, and sometimes it's just the opposite.
Therapist: But part of what really makes for difficulty is the fact that you and your stepfather, as you say, are not . . . the relationship isn't completely rosy.
Client: Let's just put it this way, I hate him and he hates me. It's that way.
Therapist: But you really hate him and you feel he really hates you?
Client: Well, I don't know if he hates me or not, but I know one thing, I don't like him whatsoever.
Therapist: You can't speak for sure about his feelings because only he knows exactly what those are, but as far as you are concerned . . .
Client: . . . he knows how I feel about it.
Therapist: You don't have much use for him?
Client: None whatsoever. And that's been for about eight years now.
Therapist: So for about eight years you've lived with a person whom you have no respect for and really hate?
Client: Oh, I respect him.
Therapist: Ah. Excuse me. I got that wrong.
Client: I have to respect him. I don't have to, but I do. But I don't love him, I hate him. I can't stand him.
Therapist: There are certain things you respect him for, but that doesn't alter the fact that you definitely hate him and don't love him?
Client: That's the truth. I respect anybody who has bravery and courage and he does . . .
Therapist: . . . You do give him credit for the fact that he is brave, he has guts or something?
Client: Yeah. He shows that he can do a lot of things that, well, a lot of men can't.
Therapist: M-hm, m-hm.
Client: And also he has asthma, and the doctor hasn't given him very long to live. And he, even though he knows he's going to die, he keeps working and he works at a killing pace, so I respect him for that, too.
Therapist: M-hm. So I guess you're saying that he really has . . .
Client: . . . what it takes.

(Raskin, 1985, pp. 167–8)

3. Finally, congruence between the therapist's actions and feelings, sometimes called genuineness, is important in this form of therapy. A therapist who is experiencing fatigue in the therapy session would not mention it in most psychotherapy approaches, but, for Rogers, mentioning the fatigue 'strengthens the relationship because the therapist is not trying to cover up a real feeling. It may reduce or eliminate the fatigue and restore the therapist to a fully attending and empathic state' (Raskin & Rogers, 1989, p. 172).

Does it work?

Humanistic therapy has been criticized for emphasizing 'awareness', which is seen as counterproductive when distressed individuals may well be already over-aware. Gestalt therapy is also sometimes said to border on game-playing, despite its positive view of human nature (Cottone, 1992).

Ironically, Rogers was among the first to recognize the need to evaluate psychotherapy using scientific research, and yet there is little data available to substantiate the effectiveness of his client-centred therapy. He was the first to record therapy sessions, but analysis of those sessions shows that out of eight different categories of client statement, Rogers consistently followed only one type of statement (i.e. those expressing progress) with a positive response, such as 'Uh-uh. That's nice' or 'Oh really. Tell me more.' It perhaps comes as no surprise, then, that his clients increasingly expressed progress during therapy. But this observation doesn't in itself invalidate client-centred therapy. It merely shows the power of social reinforcers in influencing behaviour. In recognition of this form of therapeutic control, Rogers changed the original description of his therapy from 'non-directive' (which it clearly was not) to 'person-centered'.

Family and couples therapy

Individual psychological disorders often reflect disturbance in family relationships – Framo said that 'whenever you have a disturbed child you have a disturbed marriage' (1965, p. 154). And the association between problems in couple relationships and various psychological disorders is well documented (Fincham, 2003). So it's hardly surprising that couples and family therapies have become major psychotherapeutic approaches.

Family therapy

We can trace family therapy back to the family theories of schizophrenia in the 1950s (recall the concept of the 'schizophrenogenic mother' described in chapter 15). The proponents of these theories, such as Bateson and colleagues (1956) emphasized distorted communication as the cause of schizophrenia. They offered a radical new perspective on psychological disorders by focusing on the interaction taking place when the behaviour occurs and moved away from considering individual behaviour isolated from an interpersonal context.

The goal of family therapy is to change dysfunctional patterns of interaction. Structural family therapy (Minuchin, 1974), as the name suggests, focuses on the organization or structure of the family and uses direct, active interventions to disrupt dysfunctional interactions. For example, a therapist working with a family who had an anorexic daughter discovered that the father felt closer to his daughter than to his wife and forbade his children to close their bedroom doors. The therapist surmised that a breakdown in generational boundaries might underlie the girl's refusal to eat. So the first stage of treatment was a directive from the therapist for the daughter to be allowed to close her bedroom door for two hours a day, and for the husband and wife to spend an hour together each evening in their bedroom with the door shut (Hoffman, 1981). This constituted the beginning of a successful intervention in which family boundaries were redefined.

Couples therapy

Traditionally focused on the marital dyad, couples therapy is also used with gay and lesbian couples and non-married heterosexual couples. Like family therapy, various types of couple therapy are practised in an attempt to change interactional patterns. An example of such a pattern is a husband who withdrew whenever the wife raised a topic on which they disagreed – a response pattern that was extremely distressing to the wife. This response to conflict was a pattern developed in his family of origin. The conflict between his mother and father had been so distressing that, with help, the husband was eventually able to recall climbing into his wardrobe and covering his ears when his mother and father disagreed with each other. The therapist also discovered that a prior attempt to stop the conflict between his parents had

Research close-up 1

Can family involvement improve treatment of drug abuse?

The research issue

A resurgence in heroin use is making it the most commonly used illicit drug by people entering drug abuse treatment programmes. And the UK has the fastest-growing number of heroin users of any country in Europe (*The Guardian*, July 6, 2003).

Naltrexone is a medication that blocks the effects of heroin and other opioids (a class of drugs that includes heroin, morphine and codeine). Although an effective treatment for opioid abuse, naltrexone has not been widely used in drug abuse treatment, largely because of poor patient compliance in taking the medication. The present study examined whether behavioural family counselling, which involved a 'recovery contract' with a family member, would improve patient compliance and treatment outcomes.

Design and procedure

Participants were male opioid-dependent patients seeking outpatient treatment for substance abuse who lived with a parent, a spouse or other intimate partner, or other family member willing to participate in the treatment (and who did not also have a current substance use disorder).

At the beginning of treatment all patients were given a prescription for naltrexone (50 mg/day) and were then randomly assigned to one of two treatment groups: behavioural family counselling (BFC) or individual-based treatment (IBT). In BFC, patients had an individual and a family session each week for 16 weeks and took naltrexone daily while the family member observed and verbally reinforced the patient's medication ingestion (e.g. 'I really appreciate you taking your medication'). In IBT, patients were started on naltrexone and were asked in their twice-weekly counselling sessions whether they had taken their daily dose, but there was no family involvement or compliance contract.

Results and implications

Patients in the two treatment groups were equally satisfied with the therapy they received. But BFC patients took naltrexone on more days during treatment than did IBT patients. Urine screening also showed that they had longer periods of continuous abstinence from opioid use during treatment and in the 12-month follow-up period than patients in the IBT condition. Finally, patients who received BFC had better secondary outcomes: that is, they had more days of abstinence from drugs other than opioids and displayed more positive psychosocial functioning (they experienced fewer drug-related, legal and family problems).

This study demonstrates the importance of involving the patient's significant others in treatment. It shows how a daily recovery contract can serve as a noncoercive method to encourage compliance with pharmacotherapy and commitment to treatment. Its significance is emphasized by the fact that medication can only be effective if it is taken.

Fals-Stewart, W., & O'Farrell, T., 2003, 'Behavioral family counseling and naltrexone for male opioid-dependent patients', *Journal of Consulting and Clinical Psychology*, 71, 432–42.

Figure 16.11

In couples therapy, participants are encouraged to develop communication and problem-solving skills.

resulted in a severe beating, so avoidance of conflict had been adaptive. Decades later, this response was now unconsciously guiding his interaction with his wife.

The most thoroughly evaluated couple therapy is based on the premise that 'distress results from couples' aversive and ineffectual response to conflict' (Koerner & Jacobson, 1994, p. 208). Interactions of distressed couples are characterized by negative reciprocity – the tendency for one partner to respond with negative behaviour when the other partner behaves negatively, resulting in long chains of escalating negative interaction. In such cases, the goal of therapy is to help couples develop communication and problem-solving skills that will allow them to avoid such cycles, and to break out of them should they occur. This form of therapy therefore tends to focus on changing behaviour and so is really a form of behaviour therapy.

Do couples and family therapies work?

Because many family therapies have been developed by highly skilled, charismatic therapists, some critics argue that the attraction of these therapies may reflect little more than this charisma. This concern is reinforced by the relative lack of research on many of these therapies. Indeed, when fifteen different approaches to family and couples therapy were cross-tabulated across ten different psychological disorders, it was found that systematic evaluations of the efficacy of these therapies had been conducted on only 35 of the 150 method-by-problem combinations (Gurman et al., 1986). This is a circumstance that has improved only slightly since this time. Nevertheless, it has been reported that bona fide treatments produce beneficial outcomes for about two-thirds of cases in 20 sessions or fewer, and these treatments are probably as effective or even more effective than many individual treatments for problems relating to family or relationship conflict (Alexander, Holtzworth-Munroe & Jameson, 1994).

Assessing the effects of psychotherapy

In 1994, 180,000 subscribers to *Consumer Reports*, a popular magazine in the USA, were asked to respond to questions about mental health, including whether they had received help for a mental health problem since 1991. Of the 2,900 respondents who had received psychotherapy, 90 per cent stated that the therapy helped at least 'somewhat', with 54 per cent reporting that it had 'helped a great deal'. Martin Seligman, an eminent psychologist (see chapter 15), has argued that these findings contribute to the 'empirical validation of psychotherapy' (1995, p. 895).

The earlier discussion of evaluating psychotropic drugs applies equally well to the appropriate evaluation of psychotherapy. Clearly the absence of a control group in the *Consumer Reports* study means that we cannot attribute any individual change to treatment. Also, relying solely on client report is dubious at best, given the client's stake (for example, his/her personal investment in terms of time and money) in believing the psychotherapy worked – a clear example of cognitive dissonance (see chapter 17). In the end the *Consumer Reports* survey was dismissed as uninterpretable (Hollon, 1996; Jacobson & Christensen, 1996) for several reasons, including:

- the minimal response rate – 1.9 per cent of the original sample;
- the unknown nature and metric of the outcome variable – what exactly constitutes being 'helped' and the scale used by clients to rate this outcome are both unknown; and
- the self-selected nature of the sample.

Yet, although best viewed as an informal survey of client satisfaction rather than a systematic study of psychotherapy efficacy, the controversy generated by this piece had the salutary effect of forcing both proponents and critics of psychotherapy to clarify issues regarding the its evaluation.

How can we assess psychotherapies?

There has been sustained attention to evaluating the effectiveness of psychotherapy since the 1950s. The continued need to clarify how best to do this attests to the difficulty of the task.

The first difficulty is one of sheer magnitude. With some 400 therapies and over 150 psychological disorders (Garfield & Bergin, 1994), there are potentially 60,000 treatment/disorder combinations to evaluate. To do so systematically would require 47 million comparisons. Needless to say, only a minute fraction of this number of analyses has been conducted. Some treatments have not been investigated at all, as their proponents assert simply that they 'work' and that objective verification is unnecessary.

Taking drug assessment as a model in fact raises more difficulties. For example, what constitutes an appropriate control group in evaluating psychotherapy? In drug evaluations, a placebo group is a useful starting point, and placebo effects also occur in psychotherapy. But suppose in our evaluation of psychotherapeutic efficacy we set up an 'attention placebo control group', in which regular meetings with another human being involve theoretically inert therapeutic content. Is this truly a placebo, when the experimental treatment is premised on the therapeutic value of a human relationship? Moreover, while it is possible to use single-blind procedures in psychotherapy research, it is virtually impossible to conduct double-blind studies.

Another vexing problem in applied settings is that clients choose whether to seek psychotherapy, choose the type of psychotherapy and determine how long they will remain in therapy. This self-selection means that different types of people are likely to select and remain in different type of therapies, resulting in biased samples. Added to this is the difficulty of obtaining a stable group sample (clients may change therapists or discontinue therapy completely).

These are just a few examples from a long list of problems confronting psychotherapy evaluation.

What do we know about psychotherapy's effectiveness?

Recognizing the evolving nature of its evaluation, what have we learned about the effectiveness of psychotherapy over the last 50 years?

Hans Eysenck published a landmark paper on the topic in the early 1950s. Although he was not the first to address psychotherapy outcome, it was distinguished from its predecessors by its reliance on empirical data and by its unpopular conclusions. Eysenck (1952) concluded that approximately two thirds of neurotic patients (i.e. patients with anxiety disorders and depression) recovered spontaneously, compared to 60 per cent who received psychotherapy. In other words, in these groups of patients psychotherapy had no beneficial effect! However, the studies reviewed failed to meet even the minimal methodological criteria that must now be met to qualify for systematic evaluation. Nevertheless, when Eysenck reviewed the literature again eight years later, including studies that were more adequate methodologically, he reached the same conclusion: 'With the single exception of therapeutic methods based on learning theory, results of published research . . . suggest that the therapeutic effects of psychotherapy are small or non-existent' (1960, p. 245).

The value of Eysenck's work may lie in the stimulus it provided to improve the quality of psychotherapy outcome research, which has since dramatically increased. In hindsight, it is also clear that Eysenck overestimated the rate of spontaneous improvement, which, according to a subsequent review, is around 30 per cent, depending on the diagnostic composition of the group (Bergin, 1971). From this revised perspective, the 60 per cent improvement rate found for psychotherapy provides some modest evidence for its efficacy.

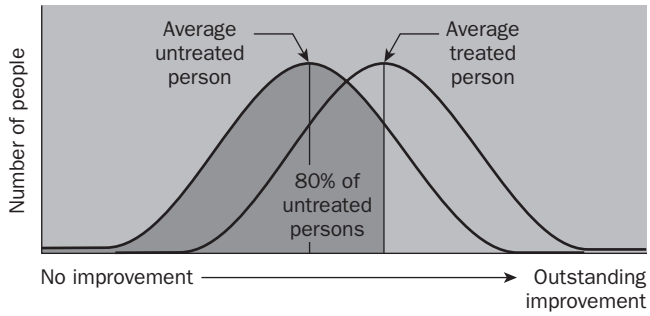

Figure 16.12

The effects of psychotherapy. Using meta-analysis to summarize the results of 475 studies, Smith et al. (1980) found that the average psychotherapy client shows more improvement than 80 per cent of the no treatment controls. From these results, the authors concluded that 'psychotherapy benefits people of all ages as reliably as schooling educates them, medicine cures them, or business turns a profit'.
Source: Smith, Glass and Miller (1980).

In an analysis of 475 studies involving 25,000 patients treated by a variety of psychotherapies, substantial data were accumulated. Smith, Glass and Miller (1980) executed this monumental task using meta-analysis, a quantitative method for combining results across a number of studies. Meta-analysis involves examining effect sizes (a measure of association between two variables in a standard metric that can be applied across studies). In this case, effect sizes were the average difference in improvement in treated and untreated clients in each study. These average differences were computed from a variety of outcome variables, including client report, therapist rating of client improvement and improvement observed by friends and family. Smith, Glass and Miller averaged the effect sizes across outcome variables in each study, and then averaged them across all studies. They found that the average client who received treatment was better off than 80 per cent of the clients who went untreated (figure 16.12). These findings were repeated when clients were studied months or years after their treatment (Nicolson & Berman, 1983).

More recent meta-analyses have reached similar conclusions (e.g. Anderson & Lambert, 1995; Shadish et al., 1997; Weisz et al., 1995). We now know that for 50 per cent of clients, beneficial effects begin to appear after about six to eight sessions of psychotherapy, and that 75 per cent of those who show improvement do so by the 26th session (Howard et al., 1996).

What can we conclude?

Can we therefore conclude that psychotherapy is effective? The data certainly support this conclusion, but there are still some concerns. For example, examine figure 16.12 carefully and you will see that some treated clients end up worse off than the

Everyday Psychology

Young men and suicide

Youth suicide has long been a topic of concern. Indeed, suicide among high school students was the theme of the first meeting of the Viennese Psychoanalytic Society, attended by Sigmund Freud and Alfred Adler in 1910. With the recent rise in suicide rates among young people, especially young men, it has become a major issue.

A recent survey conducted in Ireland indicated that the suicide rate for men aged 15 and over in 1977 was 8.9/100 000 population (Swanwick & Clare, 1997). By 1996 this figure had risen to 17.38/100 000 (NWHB, 1998). This increase may partly be due to better recording of the relevant data, but better recording should affect data relating to both men and women of all ages. So the increased incidence appears to be real rather than artefactual. It affects most acutely men aged between 20 and 24 years.

Apart from being male, other factors that appear to increase the risk of suicide include being unemployed, living alone or with parents (for young males), being married (for young females), rural living (particularly for males) and underlying mental illness or personality disorders.

Foster et al. (1997) conducted 'psychological autopsies' on 118 of 154 deaths due to suicide in Northern Ireland (July 1992 – July 1993) and ascribed DSM-III-R axis I and/or axis II diagnoses to 90 per cent of these deaths. Major DSM-III-R axis I diagnoses implicated were: alcohol dependence (37 per cent), unipolar depression (32 per cent) and anxiety disorders (10 per cent).

Remember, though, that these diagnoses don't necessarily indicate direct causality (see chapter 2): for example, dependence on alcohol may be a reaction to a more fundamental problem, which itself causes both the alcohol dependency and the ultimate suicide.

Using similar 'psychological autopsy' techniques, Lesage et al. (1994) compared 75 young men (aged 18–35) who had committed suicide with 75 living young men matched for age and socio-economic background. They found that 88 per cent of the suicide group, compared with only 37 per cent of the controls, were diagnosed with DSM-III-R axis I disorders. Furthermore, young people who have been psychiatric patients during childhood and adolescence are known to be at increased risk from suicide.

Working with Men, a London-based organization, published a report in 1997 (*Young Men and Mental Health Project*) on work carried out by agencies dealing with young people. The report notes that young men aged 16–25 tend to approach these agencies seeking advice on practical issues rather than for personal counselling. Younger boys seem to prefer short visits and want immediate answers to problems. Men tend to come alone, delay help-seeking (48 per cent left their problems more than a month before tackling them) and have difficulty asking for help. The report recommends:

- working with young men on help-seeking, recognition of feelings, and relationships in school or youth club environments;
- developing public education initiatives targeted at young men;
- improving drop-in services, as self-referral to the agencies seems most popular with young men;
- more information sharing among those working with young men in order to identify best practice.

Lesage, A.D. et al., 1994, 'Suicide and mental disorders: A case control study of young men', *American Journal of Psychiatry*, 151 (7), 1063–8.

average untreated client. So you might justifiably wonder whether psychotherapy can be harmful.

It is estimated that about 5–10 per cent of clients deteriorate after psychotherapy, but the causes of such changes are poorly understood (Shapiro & Shapiro, 1982; Smith et al., 1980). In addition to a bad therapist–client relationship and therapist incompetence (Hadley & Strupp, 1976; Smith et al., 1980), it is also possible that for some clients psychotherapy disrupts a stable pattern of functioning without offering a clear substitute (Hadley & Strupp, 1976).

Clearly much remains to be learned if we are to answer the 'ultimate question' about psychotherapy: 'What treatment, by whom, is most effective for this individual with that specific problem, under what set of circumstances?' (Paul, 1969, p. 44).

BIOLOGICAL OR PSYCHOLOGICAL TREATMENT?

Both psychotropic medication and psychotherapy are clearly useful in treating psychological disorders. But if medication reduces psychological symptoms, does this mean that the roots of psychological disorders lie in biological dysfunction? On the other

Research close-up 2

Combining psychotropic drugs and psychotherapy in the treatment of depression

The research issue

Major depression tends to be both chronic and recurrent (see chapter 15). Biological and psychological therapies are both effective in treating depression. However, there is little evidence that administering both types of treatment at the same time yields better outcomes than administering either treatment alone. This study adopts a different approach to combining treatments by examining their sequential application. In particular, the researchers wondered whether cognitive behavioural treatment (CBT) after successful pharmacological treatment of depression would improve relapse rates.

Design and procedure

To examine this question, Fava et al. randomly assigned consecutive outpatients who had experienced three or more episodes of depression, to one of two treatment groups: pharmacotherapy and CBT, or pharmacotherapy and clinical management (CM). CBT consisted of Beck's cognitive therapy and 'lifestyle modification' (patients were instructed that relapse might ensue if inappropriate lifestyle behaviours continued and were encouraged to modify their schedules, arrangements, etc. accordingly). CM consisted of monitoring medication, reviewing the patient's clinical status and providing the patient with support and advice if necessary.

Results and implications

Short-term CBT after successful antidepressant drug therapy decreased relapse rate after discontinuation of antidepressants. As shown in figure 16.13, those who experienced CBT had a much lower relapse rate (25 per cent) during the two-year follow-up than those assigned to CM (80 per cent).

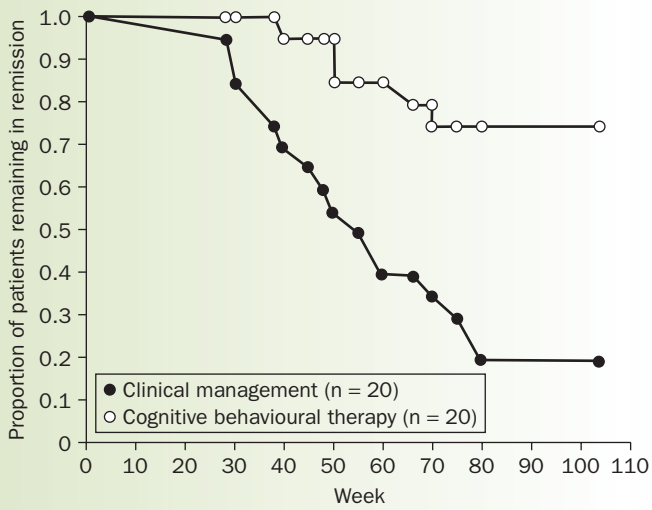

Figure 16.13

The proportion of patients who remain in remission as a function of treatment received and time since the completion of treatment. Source: Fava et al. (1998).

This study challenges the widely held view that long-term drug treatment is the best tool to prevent relapse in patients with recurrent depression. Although maintenance pharmacotherapy may be necessary for some patients with recurrent depression, CBT appears to offer an alternative for others. This study adds to an emerging body of research (e.g. Paykel et al., 1999) that emphasizes the value of cognitive therapy in preventing relapse in depression.

Fava, G.A., Rafanelli, C., Grandi, S., Conti, S., & Belluardo, P., 1998, 'Prevention of recurrent depression with cognitive behavioral therapy: Preliminary findings', *Archives of General Psychiatry*, 55, 816–20.

hand, does successful psychotherapy mean that the causes of psychological disorders are necessarily psychological?

An affirmative answer to either question would mean we have fallen prey to the *treatment–etiology fallacy* – a logical error in which treatment mode is assumed to imply the cause of the disorder. After all, very few people would wish to argue that because aspirin relieves headache, headache is actually due to the lack of aspirin in the body. So even though an antidepressant medication regulates neurotransmitters in the brain, it is quite possible that a psychological event gave rise to the neurotransmitter changes in the first place. How then do we choose between biological and psychological treatments? In trying to answer this question we must watch out for another logical error, *similia similibus curantur* – like is cured by like (a principle used in homeopathy). In fact, psychotherapy can be used to treat biologically caused psychological disorders and vice versa, although treatment of bipolar disorder, schizophrenia and other psychotic disorders without medication would be irresponsible.

treatment–etiology fallacy a logical error in which treatment mode (e.g. psychopharmacology) is assumed to imply the cause of the disorder (e.g. biological)

For anxiety disorders and depression, neither biological nor psychological treatment appears to be clearly superior (Antonuccio, Danton & DeNelsky, 1995). A large-scale, multi-site study of 240 people suffering from depression found that two forms of psychotherapy (i.e. cognitive and interpersonal) administered together were generally as effective as a tricyclic antidepressant (Elkin et al., 1989). However, drug treatment effects appeared sooner, were more consistent across sites and appeared to be more effective in treating severe depression. Similar findings have been obtained in studies of generalized anxiety disorder (Gould et al., 1997) and obsessive–compulsive disorder (Abramowitz, 1997).

What about combining the two forms of treatment? Surprisingly, studies that address this issue have found that concurrent, joint use of medication and psychotherapy produces little additional advantage (Elkin, 1994; Hollon, Shelton & Loosen, 1991). But it does appear that combined treatment can be more effective for some disorders, including attention deficit hyperactivity disorder in children, alcoholism, panic disorder and obsessive–compulsive disorder (e.g. DeBeurs et al., 1995; Engeland, 1993).

Recent evidence suggests that combining treatments sequentially may be helpful, especially in preventing relapse. A combined treatment approach is particularly valuable with clients who may initially be too depressed or anxious to participate fully in psychotherapy. In these cases, symptomatic relief through drug therapy may be adequate, but if it is not, the drugs will most likely alleviate the symptoms sufficiently to allow the person to participate in, and benefit from, psychotherapy. An alternative, conservative approach would be to treat the patient with psychotherapy first (as it usually has no major side effects) and to add or change to medication only when it becomes apparent that the psychotherapy is not producing results. However, such an approach may be risky when there is perceived to be significant risk of suicide.

FINAL THOUGHTS

We have explored biological and psychological interventions for psychological disorders and noted that great progress has been made since the traditional methods of medicine were first applied to the treatment of psychological disorders.

What has emerged from this brief survey is that there is a role for both biological and psychological forms of treatment. Each may be implemented in a variety of ways, and these implementations require careful evaluation in clinical trials to rule out placebo effects and demonstrate that they are effective.

Determining disorders and conditions under which biological and psychological interventions are best used alone or combined, either concurrently or sequentially, presents a challenge for future research. Just as the biological vs. psychological source of a disorder is not determinative in deciding the best course of treatment, nor is the validity of a theoretical framework that has been formulated to *explain* the disorder. As we saw, the models used to account for psychological disorders in chapter 15 do inform their treatment. But the validity of a model used to account for a psychological disorder is quite distinct from the efficacy of a treatment regime derived from it. There is simply no substitute for establishing the efficacy of a treatment directly by means of empirical research.

Summary

- The last chapter dealt with the field of abnormal psychology (i.e. behavioural syndromes or sets of symptoms that result in impairment in people's lives). In this chapter, we considered the kinds of therapy that are available to treat these disorders.
- We first considered the major biological approaches to treating mental disorders. We noted that, because an illness has a biological manifestation, this does not necessarily mean that the illness has a biological cause.
- Treatment with drugs can be very useful for certain types of mental illness, especially in the acute stages, but this form of therapy alone does not necessarily help the client come to terms with some of the key psychological issues that may underlie their functional impairment. The same consideration may be applied to other forms of biological intervention, such as ECT and psychosurgery.
- In extreme cases, it may be necessary to administer these forms of therapy (e.g. where there is a serious risk of harm to the client or to others, or even suicide). However, psychological forms of treatment should also be considered to address the cause of the illness.
- Different forms of psychotherapy emphasize different elements of the human condition (e.g. developmental, behavioural, phenomenological). It is frequently important to consider the status of the individual's mental health within the context of his or her family and other significant relationships.
- When considering the efficacy of different forms of treatment (e.g. biological, psychological), it is important to consider possible placebo effects. The best way of addressing this is via the double-blind randomized clinical trial. However, this is not always possible (for example, in evaluating psychotherapy).

REVISION QUESTIONS

1. What are the major biological approaches to treating mental disorders?
2. Is psychosurgery merely of historical interest, or does it have a future in the treatment of psychological disorders?
3. Is the decision to administer ECT simply a medical judgement, or is it also an ethical judgement?
4. What are the limitations of pharmacotherapy for treating psychological disorders?
5. What is a double-blind randomized clinical trial, and what advantages does it confer in evaluating the efficacy of a drug treatment?
6. What is psychotherapy? How do you account for the existence of different types of psychotherapy?
7. What assumptions do humanistic therapies make about human behaviour that distinguishes them from other therapies?
8. Is psychotherapy effective?
9. What are the relative advantages of biological treatments over psychotherapy and vice versa? Are there clear indicators for the use of psychotropic medication with some clients regardless of their receipt of psychotherapy? If so, what are they?

Further Reading

Dattilio, F.M. (ed.) (1998). *Case Studies in Couple and Family Therapy*. New York: Guilford Press.
A useful complement to Oltmanns et al. (1995; see below) as DSM–IV does not have a relationship dysfunction diagnosis.

Kazdin, A.E. (1994). *Behavior Modification in Applied Settings*. Pacific Grove, CA: Brooks/Cole.
Numerous illustrations of the application of behaviour therapy in a variety of settings.

Nietzel, M.T., Bernstein, D.A., Kramer, G.P., & Milich, R. (2003). *Introduction to Clinical Psychology*. 6th edn. Englewood Cliffs, NJ: Prentice Hall.
A very user-friendly introduction to clinical interventions and other tasks performed by the clinical psychologist.

Oltmanns, T.F., Neale, J.M., & Davison, G.C. (1995). *Case Studies in Abnormal Psychology*. 4th edn. Chicester: John Wiley & Sons.
Case studies of all the major disorders found in DSM–IV, each including a section on treatment.

Snyder, C.R., & Ingram, R.E. (eds) (2000). *Handbook of Psychological Change: Psychotherapy Processes and Practices for the 21st Century*. New York: John Wiley & Sons.
Comprehensive analyses of a variety of topics pertaining to psychological treatment of mental disorders.

Vervaeke, G.A.C., & Emmelkamp, P.M.G. (1998). Treatment selection: What do we know? *European Journal of Psychological Assessment*, 14, 50–9.
A short review of the main findings in psychotherapy research that contribute to the selection of a successful treatment.

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Attitudes, Attributions and Social Cognition

17

Learning Objectives

By the end of this chapter you should appreciate that:

- attitudes summarize beliefs, feelings and past behaviour regarding attitude objects – they can also predict behaviour;
- attitude–behaviour relations are strongest when attitudes are measured at the same level of specificity as the target behaviour;
- attitudes predict behaviour in conjunction with other variables (e.g. social norms, perceived control);
- people tend to be more influenced by message arguments when they are motivated and able to process the arguments;
- attribution theory concerns itself with the processes by which we use causal explanations for everyday events and behaviour in an effort to understand and make sense of the social world;
- schemas help us to categorize, evaluate and process social information quickly and efficiently;
- the processing of social information can occur anywhere along a continuum ranging from category-based processing (which is fast, automatic and unconscious) to data-based processing (which is slow, strategic, conscious and requires cognitive effort).

INTRODUCTION

People often try to influence others. Salespeople urge customers to buy goods or services; politicians exhort people to vote for them; dating partners try to make a good impression on each other; managers attempt to maintain employees' dedication to work; and advertisers try to raise interest in consumer products. In all of these examples, people try to make others like or dislike particular objects, ideas, individuals, groups or tasks.

Attitudes are tendencies to like or dislike something – such as an idea, person or behaviour – and the object of these tendencies (the thing being liked or disliked) is often called the *attitude object*. Attitudes indirectly or directly affect behaviour in virtually every social interaction. This is why the study of attitudes and attitude change is a fundamental area of social psychological research.

attitude object the thing (e.g. idea, person, behaviour) that is accorded a favourable or unfavourable attitude

We will tackle each of these questions before turning to a related topic – *attribution* theory. In everyday

attribution an individual's belief about causality

life, we try to make sense of events and the behaviour of other people. Why did I get so angry in the meeting yesterday? Why did Sally leave Harry? Why does Hannah's baby have leukemia? Why did Manchester United fail to make the cup final this year? Attribution theory is the process of deriving causal explanations for events and behaviour – an important field of investigation in social psychology. The Austrian psychologist Fritz Heider (1958) saw this process as part of a commonsense or naive psychology – a basic property of human thinking that fulfils a need to predict and control the environment.

The final topic of this chapter binds the first two topics together. Attitudes and attributions summarize vast amounts of information from our complex social world. How do we process this information? And how do we use it to make judgements and draw inferences? These questions are central to the study of social cognition. Many of the concepts and experimental methods central to this field have been borrowed from work in cognitive psychology. But, while cognitive psychology concerns itself with how we perceive physical stimuli and objects, social cognition focuses on the perception and processing of social objects, such as people, social groups and events.

ATTITUDES

How do you measure an attitude?

An attitude cannot be recorded directly. We cannot view someone's tendency to like something in the way we can see physical attributes, such as eye colour or running speed. Another difficulty is that attitudes can be expressed through many behaviours. For example, a person who likes music might listen to it all the time, buy countless CDs, attend numerous music concerts, and buy several magazines about music. How does a researcher go from information about such a variety of behaviours to an estimate of the person's fundamental attitude towards music?

One general approach is to examine one or more specific behaviours that are seen as directly reflecting attitude. For example, a person who has a negative attitude towards a particular immigrant group is likely to seek more physical distance from members of that group, avoid eye contact with them, show unpleasant facial expressions, and so on. Another general approach employs self-report questionnaires, which ask participants to express their attitude towards the particular object. The most common version simply asks respondents to indicate their attitudes towards a named object using *semantic-differential scales*. So people might be asked to rate their attitude towards immigrants using a scale from −3 (extremely bad) to +3 (extremely good). Typically, though, people rate their attitude using several different scales, each labelled by different adjective pairs (negative/positive, worthless/valuable, unfavourable/favourable). Responses to the scales are then averaged to form an attitude score for each participant (see figure 17.1).

semantic-differential scales these measure attitudes by using a dimension that depicts a strongly negative attitude at one end to a strongly positive attitude at the other

Of course, self-report measures can be affected by people's desire to state socially desirable attitudes. So while our respondents above may reveal negative attitudes towards immigrants in their behaviour, their self-reports may appear more positive because they are reluctant to seem prejudiced. Contemporary research therefore frequently uses non-self-report measures in cases like this – i.e. when people's ability to rate their attitudes accurately is questionable. Despite this weakness, self-report measures have predicted a variety of relevant behaviours in past research, which suggests that we are at least somewhat accurate in reporting our own attitudes.

Other measures elicit attitudes without relying on self-reports and without relying on overt behaviours towards the attitude object. For example, a common approach is to present the names of objects that people might like or dislike on a computer screen. Then the computer presents an adjective (e.g. terrible, pleasant) and respondents are asked to decide whether it means a good thing or bad thing. This question is easy to answer, and most people can answer correctly every time. Nonetheless, responses to adjectives with a positive meaning (e.g. delightful) tend to be faster after people have seen something they like than after seeing something they do not like, whereas responses to adjectives with a negative connotation (e.g. awful) tend to be slower after people have seen something they like than after seeing something they dislike. By contrasting the speed of responses to the positive and negative adjectives, researchers can obtain a measure of attitude that predicts behaviour towards an attitude object (Fazio et al., 1995).

The three components of attitude

An important feature of attitudes is their ability to sum up several types of psychological information. Consider an American who favours US membership in a global pact to reduce air pollution. Her positive attitude towards the pact may summarize relevant cognitions, emotions and behaviours. She may:

- *believe* that the pact will be good for the environment (cognition);
- *feel* excited when she hears plans for the pact (emotion); and
- *sign* a petition supporting the pact (behaviour).

Using the scales below, please indicate your attitude towards immigrants. Immigrants are:

			Bad or Good?			
Extremely bad −3	Very bad −2	Slightly bad −1	Neither 0	Slightly good +1	Very good (+2)	Extremely good +3
			Harmful or Beneficial?			
Extremely harmful −3	Very harmful −2	Slightly harmful −1	Neither 0	Slightly beneficial +1	Very beneficial +2	Extremely beneficial (+3)
			Dislikeable or Likeable?			
Extremely dislikeable −3	Very dislikeable −2	Slightly dislikeable −1	Neither (0)	Slightly likeable +1	Very likeable +2	Extremely likeable +3
			Negative or Positive?			
Extremely negative −3	Very negative −2	Slightly negative −1	Neither 0	Slightly positive (+1)	Very positive +2	Extremely positive +3

Attitude = Mean rating
= (2+3+0+1) / 4
= 1.50

Figure 17.1
Sample semantic–differential scale.

three-component model states that beliefs, feelings and behaviour towards an object can influence attitudes towards it, and that these attitudes can reciprocally influence the beliefs, feelings and behaviours

This example illustrates the *three-component model* of attitude structure, which states that beliefs, feelings and behaviours form three distinct types of psychological information that are closely tied to attitudes (figure 17.2). This model predicts that:

1. beliefs, feelings and behaviour towards an object can influence attitudes towards it; and reciprocally
2. attitudes towards an object can influence beliefs, feelings and behaviours towards it.

In other words, any particular attitude affects these three components and/or is affected by them.

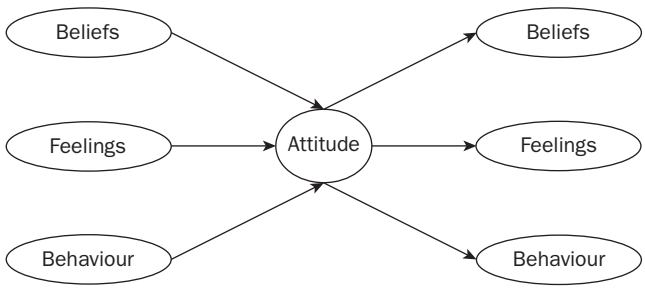

Figure 17.2
The three-component model of attitudes.

Effects of beliefs

It could be argued that persuasive messages such as advertisements often change attitudes by changing people's beliefs about the object of the message. For example, anti-smoking ads attempt to change people's beliefs about the consequences of smoking, and those beliefs should in turn influence their attitude towards smoking.

Consider a simple experiment in which Canadian participants received a booklet describing a study of a new immigrant group to Canada (Maio, Esses & Bell, 1994). The information in the booklet was manipulated to create positive and/or negative beliefs about the group. For example, some participants read that the immigrants scored above average on desirable personality traits (e.g. hardworking, honest), whereas other participants read that the group members scored below average on these traits. After reading the information, participants rated their attitudes towards the group. Not surprisingly, the results indicated that those who received positive information indicated more favourable attitudes towards the immigrant group than those who received negative information.

This simple demonstration is important from a practical perspective, because it demonstrates how even second-hand information about others can have a powerful effect on our attitudes towards them. When prejudice has arisen largely from indirect information, interventions encourage direct, positive interactions to change beliefs and reduce the prejudice.

Effects of feelings

If you look carefully at advertisements, you will find that many give very little information about the objects they are promoting. For example, an advertisement for a Citroen car shows

Figure 17.3

Anti-smoking advertisements aim to change people's beliefs about the consequences of smoking as a way of changing their attitudes.

supermodel Claudia Schiffer smiling and undressing on her way to the car, while upbeat music plays in the background. Rather than focusing on concrete information (e.g. performance, fuel economy), ads like this work by linking the product with positive feelings.

Research supports this technique. Many studies use a classical conditioning approach (see chapter 4), which exposes participants to the name of an attitude object together with an accompanying positive or negative stimulus (e.g. Cacioppo, Marshall-Goodell, Tassinary & Petty, 1992; Zanna, Kiesler & Pilkonis, 1970). Sometimes the stimulus is a direct, pleasant or unpleasant experience (e.g. presence or absence of a shock), and sometimes it is simply a word that has positive or negative association (e.g. 'happy' vs. 'sad'). The stimuli evoke positive or negative affective responses (figure 17.4), which in turn become linked in memory with the attitude object. So, whenever the attitude object is presented, the positive or negative affective response is recalled and experienced by association.

As you might expect, results typically indicate that people come to like objects that are paired with positive stimuli more than those that are paired with negative stimuli. This effect occurs even when the attitudes are measured in a different context. For example, one clever experiment exposed participants to a series of names, each followed by a positive or negative word. In this list, (a) positive words were linked with the name 'Ed' and negative words with the name 'George' or (b) positive words were linked with the name 'George' and negative words with the name 'Ed' (Berkowitz & Knurek, 1969). Participants then went to an ostensibly unrelated experiment, where they had a brief discussion with two confederates. The confederates' first names were George and Ed. Later, the confederates rated each participant's friendliness towards them as an indication of their attitudes. As expected, the participants were friendlier (i.e. they had a more positive attitude) towards the confederate whose name had been paired with the positive stimuli.

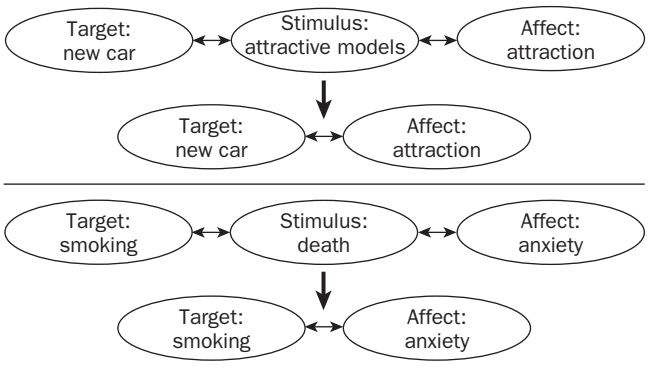

Figure 17.4

Classical conditioning approach to attitude formation.

Effects of behaviour

Initiation rituals have often been prerequisites for acceptance into social groups, such as military squads and college fraternities and sororities. Would-be new members may be asked to perform embarrassing acts, such as streaking nude at a public event or dressing in a strange costume during classes. Why do new recruits not leave a group after enduring such ordeals? One possible explanation is that the behaviour of submission to group rules leads to more positive attitudes towards the group. In other words, the new recruit's behaviour affects his attitudes.

For many decades, the general effect of behaviour on attitudes has captured a great deal of interest. Researchers first began to notice an interesting effect arising from role-playing. For example, participants assigned to play the role of a person diagnosed with terminal lung cancer later reported more negative attitudes towards smoking than those who had listened to an audiotape of the role-play (Janis & Mann, 1965). Similarly, people assigned to debate a particular position on an issue such as legalized abortion subsequently express a more favourable attitude towards the position they have been required to advocate (e.g. Janis & King, 1954). People who merely listen to the participants' arguments do not show so much attitude change. Something about the role-playing behaviour drives the change.

What if the role-playing task explicitly requires *counter-attitudinal advocacy* – presenting an attitude or opinion that opposes the person's previous attitude? Suppose university students are asked to write an essay arguing for increased tuition fees – a position that obviously contradicts most students' feelings on this issue. Amazingly, they still tend to change their attitudes towards the position they have advocated (see Cooper & Fazio, 1984; Harmon-Jones & Mills, 1999). Another interesting finding is that this attitude change is more likely when participants are given only a small incentive to argue the counter-attitudinal position than when they are given a large incentive.

counter-attitudinal advocacy presenting an attitude or opinion, within a role-play context, which opposes the person's initial attitude

Several theories help to explain this effect (e.g. Schlenker, 1982; Steele, 1988), but two are particularly prominent.

On the one hand, *cognitive dissonance theory* suggests that a small incentive makes people feel guilt or tension from having acted, behaviourally, against their original attitude without sufficient reason. To reduce their discomfort, they change their attitude (Festinger, 1957). This idea has also been used to explain the effects of initiation rituals. On the other hand, *self-perception theory* suggests that small incentives cause people to assume that their attitude must actually match the position they have advocated (Bem, 1972), because they can see no external reasons why they performed the behaviour.

cognitive dissonance theory describes how people may feel an aversive tension when their behaviour is inconsistent with their attitude, and in order to reduce their discomfort, will change their behaviour to be consistent with their attitude

self-perception theory indicates that people may guess their own attitude from their behaviour towards the attitude object, particularly when they can see no external reasons for the behaviour

Current evidence suggests that both theories have some validity. Apparently, cognitive dissonance processes may occur when people perform a behaviour that strongly contradicts their initial attitude (like the tuition fees example), whereas self-perception processes may occur when people perform a behaviour that is not so strongly contradictory (Fazio, Zanna & Cooper, 1977).

How do attitudes influence behaviour?

Ever since the beginning of attitude research, investigators have puzzled over the relation between attitudes and behaviour. Why do people sometimes say they like something and then act as if they do not? Are these instances much less frequent than instances where the attitude and behaviour match perfectly?

Measuring the attitude–behaviour link

Researchers were intrigued by the results of some early research that revealed very weak relations between attitudes and behaviour. In one study (LaPiere, 1934), a researcher and a young Chinese couple travelled around the Western portion of the US, visiting 250 restaurants, inns and hotels. Despite widespread American prejudice against Chinese people at that time, the researcher and his visitors were refused service at only one of the establishments. Yet, when he later wrote to these establishments requesting permission to visit with 'a young Chinese gentleman and his wife', 92 per cent refused permission! These refusals are often interpreted as indicators of negative attitudes towards Chinese people. Viewed this way, they provide some of the earliest evidence that people's behaviours (in this case, accepting the Chinese couple) can fail to match their attitudes towards the behaviour (i.e. their desire to refuse permission). This raised some doubts about the ability of attitudes to predict behaviours.

There were many methodological limitations to LaPiere's study, however (Campbell, 1963). For example:

- the attitude and behaviour were measured at different times and locations;
- the attitude measure itself was, at best, indirect (LaPiere did not ask the restaurant owners to complete an attitude scale);
- the young couple may have looked more pleasant than the proprietors had imagined;
- the proprietors may have followed the norm of hospitality to guests once they entered the restaurant; and
- the situation in which behaviour was measured may simply have made it too difficult for most proprietors to refuse the Chinese couple, because of the embarrassing scene that might ensue.

Subsequent studies used more stringent procedures (see Wicker, 1969). Using a correlational technique, these studies tested whether people with positive attitudes towards a particular object exhibit more favourable behaviour towards the object than do people with negative attitudes towards the object. Even so, until 1962, researchers still found only weak relations between attitudes and behaviour.

The consistent failure to find strong attitude–behaviour correlations led researchers to search for explanations. Fishbein and Ajzen (1975) pointed out that past research often failed to measure a behaviour that directly corresponded to the attitude being measured. For example, suppose we measure the relation between (a) attitudes towards protecting the environment and (b) using a recycling facility in a particular week. Even if someone is a strong environmentalist, there are many reasons why they might fail to recycle in a particular week (lack of a nearby facility, lack of time to sort recyclables, and so on). The problem is that the measured behaviour (recycling in a particular week) is very specific, whereas the attitude object (protecting the environment) is much more general.

To better measure 'general' behaviour, Fishbein and Ajzen (1975) proposed the *multiple-act criterion*, which involves measuring a large number of behaviours that are relevant to the general attitude being studied. For example, to measure pro-environment behaviour, we could measure numerous pro-environment behaviours, including recycling across several weeks, willingness to sign pro-environment petitions and tendency to pick up litter. This would give us a more precise and reliable measure of behaviour. Weigel and Newman (1976) did just this and found much stronger attitude–behaviour relations by taking

multiple-act criterion assessment of many behaviours that are relevant to the attitude being measured

Research close-up 1

The effects of behaviour on attitudes

The research issue

Before this experiment was conducted, most researchers were primarily interested in the effects of attitudes on behaviour. In contrast, Festinger and Carlsmith (1959) set out to show that our behaviour can occasionally be awkwardly inconsistent with our true attitude and, to resolve this uncomfortable inconsistency, we may change our attitude to match the behaviour.

Design and procedure

The experiment consisted of three stages. In the first stage, the experimenter attempted to make participants dislike a series of boring tasks. Participants were falsely told that they were taking part in a study of 'measures of performance'. They were asked to put 12 spools on a tray, empty the tray, and refill it. Participants repeated this task for half an hour, using one hand, while the experimenter pretended to record their performance.

Next, participants were asked to use one hand to turn 48 square pegs on a board (a quarter turn one way, then the other way) for half an hour, while the experimenter continued to monitor their performance. Presumably, participants came to hate these dull tasks.

In the second stage, the experimenter asked the participants to tell a new participant that the tasks were interesting and enjoyable. The experimenter justified this request by stating that he was comparing the performance of participants who had been told nothing about the task with the performance of participants who had been given specific, positive expectations. The experimenter indicated that his colleague usually gave specific (positive) information to participants, but that this colleague had not arrived yet.

The experimenter then asked whether the participant could temporarily fill in and be 'on call' for future elements of the study. Virtually all of the participants agreed to this request. The participants then attempted to persuade the next participant (who was actually a confederate of the experimenter) that the tasks were interesting, fun, enjoyable, intriguing and exciting.

In the third stage, participants were asked to meet an interviewer to answer questions about the previous tasks (e.g. turning the pegs). One of the questions was about the extent to which participants enjoyed the tasks.

Festinger and Carlsmith expected that participants' intervening behaviour would cause them to like the tasks to a greater extent only when they believed they had been given little external incentive for engaging in the behaviour. If the behaviour was performed with little reward, participants should feel a need to justify the behaviour to themselves. To do this, they should change their attitude to support the behaviour. In other words, participants should come to believe that they actually liked the tasks that they had undertaken during the intervening period.

To test this reasoning, the experiment included a crucial manipulation: participants were offered either $20 (a lot of money in the 1950s!) or $1 to describe the dull tasks favourably to the other 'participant'.

Results and implications

As shown in figure 17.5, the results support this prediction. After the experimental manipulation, participants were more favourably disposed towards the tasks if they had been offered $1 than if they had been offered $20. In addition, participants who were offered $1 were more favourably disposed than those who were not asked to say anything about the tasks (control condition).

Overall, these results support cognitive dissonance theory by showing that people can alter their attitudes to justify their past behaviour. Since this experiment, abundant research has shown that this attitude change helps to reduce an unpleasant arousal that people experience after performing the attitude-incongruent behaviour, while also finding some limitations to this effect (see Cooper & Fazio, 1984).

Festinger, L., & Carlsmith, J.M., 1959, 'Cognitive consequences of forced compliance', *Journal of Abnormal and Social Psychology*, 58, 203–10.

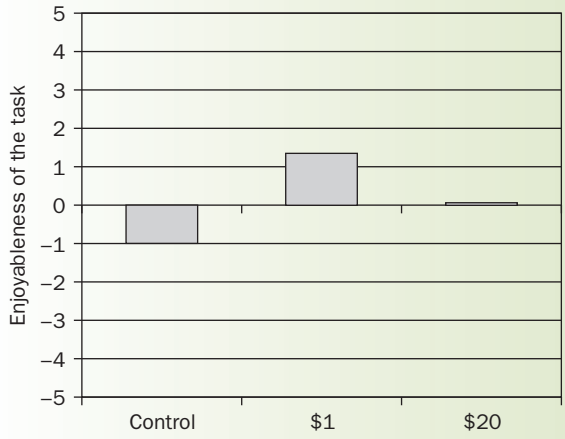

Figure 17.5

The effects of reward on participants' enjoyment of the dull tasks in Festinger and Carlsmith's (1959) experiment.

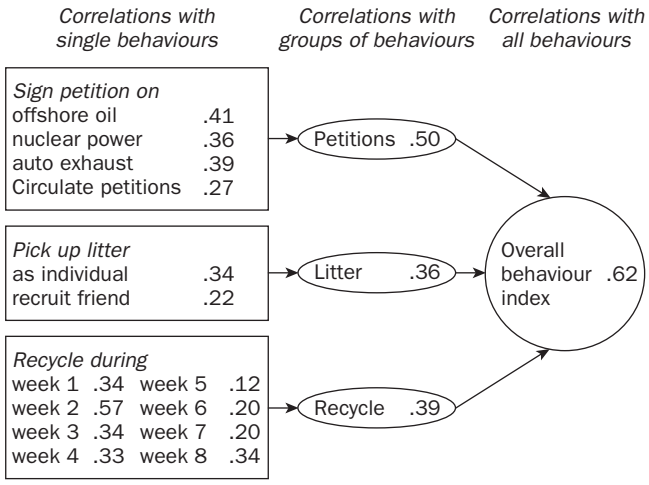

Figure 17.6

Correlations between attitudes towards environmental preservation and measure of environmental behaviour. Source: Weigel and Newman (1976).

Pioneers

Martin Fishbein (1936–) and **Icek Ajzen**'s (1942–) research has provided valuable insights into the relations between attitudes and behaviour, attitude theory and measurement, communication and persuasion, behavioural prediction and change, and behaviour change intervention. They conducted many influential studies of these topics in both field and laboratory settings, many of which applied and evaluated the theory of planned behaviour. Their theories of attitude–behaviour relations have laid the foundation for hundreds of studies attempting to predict important health-related behaviours (e.g. cessation of smoking, condom use). Their research has particularly focused on the relation between verbal attitudes and overt behaviour.

an average measure of all of the behaviours, rather than any single behaviour (figure 17.6).

Predicting behaviour

Behaviour is normally influenced by more than attitudes alone. For instance, as we discussed previously, the behaviour of people towards the Chinese couple in LaPiere's study would also have been influenced by social norms – the socially prescribed ways of behaving in a situation (Campbell, 1963).

Ajzen (1991) developed a model of attitude–behaviour relations that recognized the impact of social norms. According to this theory of planned behaviour (figure 17.7), actual behaviour is influenced by *behavioural intentions* – intentions to perform or not to perform the behaviour (see also chapter 19). These intentions, in turn, are influenced by:

behavioural intentions intentions to perform or not to perform a specific behaviour

- the attitude towards the behaviour – the individual's evaluations of the positive and negative consequences of performing the behaviour;
- the subjective norms regarding the behaviour – the individual's desire to behave in the same way as people who are important to him think he should behave; and
- perceived control over performance of the behaviour – the extent to which the individual believes he can control whether he performs the behaviour.

According to the theory, when attitudes and subjective norms support a target behaviour and perceived control over the performance of the behaviour is high, intentions to perform the behaviour should be stronger. People who form strong intentions should be more likely to perform the behaviour. Abundant research has supported these predictions (see Conner & Armitage, 1998), while also making it clear that the theory neglects several additional important predictors of behaviour – such as a sense of moral obligation to perform the target behaviour (Schwartz, 1977) and the pattern of the individual's past behaviour in similar situations (Ouellette & Wood, 1998).

Accessible vs. inaccessible attitudes

According to Fazio (1990), attitudes often influence behaviour through a spontaneous process. Effects of attitudes can occur quickly, but only for people whose attitude is accessible (easy to retrieve). When attitudes are accessible, they come to mind instantly when we see the attitude object. The attitude then influences how we behave towards the object. If the attitude is less accessible, it doesn't come to mind, and so it doesn't influence our behaviour.

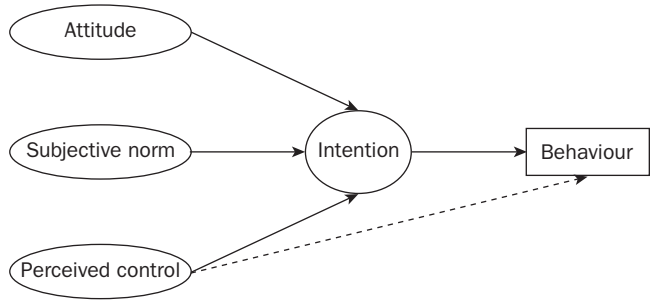

Figure 17.7

The theory of planned behaviour. The dashed line indicates that the effect of perceived control on behaviour occurs only when perceived control matches actual control.

For example, suppose you are walking by an ice cream seller. You may spontaneously recall your passion for ice cream, and this attitude may motivate a decision to buy some. But if you don't spontaneously recall your attitude (because it is inaccessible – perhaps you are distracted by a more pressing thought at the time you walk past the ice cream seller), it will lie dormant and not elicit the decision to buy. Indeed, there's a great deal of evidence that attitudes do exert a stronger influence on behaviour when they are accessible than when they are difficult to retrieve (Fazio, 2000).

Forming and changing attitudes

Incentive for change

attitude function the psychological needs that an attitude fulfils

To understand how attitudes can be changed, it is first important to understand *attitude functions* – the psychological needs that attitudes fulfil (Maio & Olson, 2000). Early theories proposed a number of important attitude functions (table 17.1). For example, people may have a positive attitude towards objects that help them become popular among people they like, but not objects that make them estranged from those people. This is the social adjustment function, which provides the basis for the entire fashion industry: people tend to like clothing that is popular among people they like.

In the earliest model of attitude change, Hovland, Janis and Kelley (1953) suggested that persuasive messages change people's attitudes when they highlight some incentive for this change. For example, an advertisement might describe the utilitarian benefits of buying a particular model of car (e.g. good fuel economy) or the social-adjustment benefits (e.g. a sporty look). The incentives must seem important if the message recipients are to change their attitude.

Hovland et al.'s theory also suggests that processing of any message must occur in stages if it is to be successful. The intended audience must:

1. pay attention to the message,
2. comprehend the message, and
3. accept the message's conclusions.

Table 17.1 Seminal theories of attitude function.

Function	*Definition*
Object appraisal/ utilitarian	Summarize the positive and negative attributes of objects in our environment.
Social adjustment	Help identify with people whom we like and dissociate from people whom we dislike.
Ego-defence/ externalization	Protect the self from internal conflict.
Value expression	Express self-concept and personal values.

Source: Selected functions from Katz (1960); Smith, Bruner and White (1956).

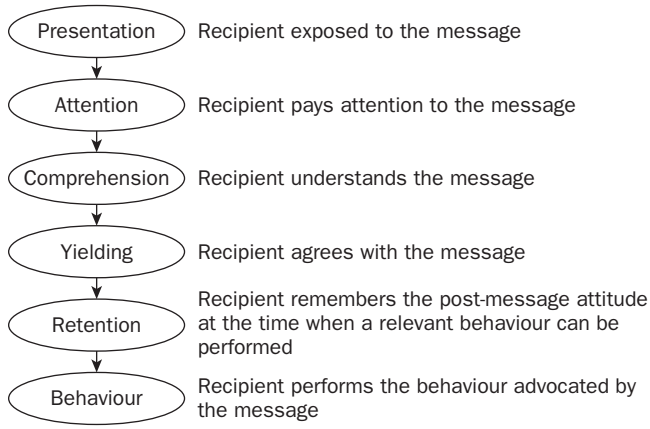

Figure 17.8
McGuire's (1969) information-processing approach to persuasion.

McGuire (1969) extended this theory further. According to his model, a message will elicit the desired behaviour only if it succeeds at six stages (figure 17.8). People must:

1. encounter the message (presentation stage);
2. attend to it (attention stage);
3. understand it (comprehension stage);
4. change their attitude (yielding stage);
5. remember their new attitude at a later time (retention stage); and
6. the new attitude must influence their behaviour (behaviour stage).

Interestingly, even if the odds of passing each stage are quite good, the chances of completing all the stages can be low. For example, we might optimistically assume that a Nike running shoe ad has an 80 per cent chance of success at each stage. If this were the case, the laws of probability indicate that the odds of successfully completing all of the stages would be only 0.26 ($0.8 \times 0.8 \times 0.8 \times 0.8 \times 0.8 \times 0.8$). In other words, the ad would have a 26 per cent chance of getting someone to buy the running shoes.

In reality, the odds of completion of each stage (especially yielding and behaviour) may be far lower, creating even lower chances of success (possibly less than 1 per cent). For this reason, modern marketing initiatives take steps to compel completion of each stage, where this is possible. So advertisers will present the message many times, make it attention-grabbing and memorable, and make the message content as powerful as they can.

Motivation and ability

Two newer models of persuasion, the 'elaboration likelihood model' (Petty & Cacioppo, 1986) and the 'heuristic–systematic model' (Chaiken, Liberman & Eagly, 1989), predict that the effects of persuasive messages depend on people's motivation and ability to think carefully about them. If someone is highly motivated and able to process a persuasive message, they should be heavily

Figure 17.9

Advertisements often use attractive or well-known people to endorse their products. Under what conditions is this strategy effective?

influenced by the strength of the arguments in the message. But if they are less motivated or able to process the message, then they should be strongly affected by simple cues within the message, such as the presenter's attractiveness or expertise. Many variables influence motivation and ability. Motivation is high when the message is relevant to personal goals and there is a fear of being wrong. Ability is high when people are not distracted and when they possess high cognitive skills. Although all of these variables have been studied in connection with both models of persuasion, most of this research has focused on the personal relevance of the message.

For example, Petty et al. (1983) found that the attractiveness of the spokesperson presenting a message influences attitudes when the issue is not personally relevant, but has no effect when the issue is personally relevant. In contrast, the strength of the argument within the message influences attitudes when the issue is personally relevant, but not when the issue is not personally relevant. These findings support the predictions of the elaboration likelihood model and the heuristic–systematic model.

Although many experiments have revealed similar effects, the heuristic–systematic model suggests that high personal relevance should not always lead to the lower use of cues such as the presenter's attributes. For example, when a personally relevant message contains ambiguous arguments (i.e. it has strengths and weaknesses), people may be more persuaded by a message from an expert source than from an inexpert source (Chaiken & Maheswaran, 1994). According to this model, high personal relevance causes people to use environmental cues when the message arguments themselves provide no clear conclusions. This prediction has received some experimental support (Chaiken & Maheswaran, 1994).

ATTRIBUTIONS

Early theories of attribution

We said earlier that attributions are explanations for events and behaviour. Heider differentiated between two types of causal attribution – personal and situational. Personal attributions refer to factors within the person, such as their personality characteristics, motivation, ability and effort. Situational attributions refer to factors within the environment that are external to the person. For example, if we were discussing why a particular student has failed an important university examination, we would consider personal factors (such as her academic ability and how much effort she invested in preparing for the exam). But we might also look at situational attributions (such as whether she had good tuition, access to library facilities and sufficient time to study).

Heider noted that we tend to overestimate internal or personal factors and underestimate situational factors when explaining behaviour. This tendency has become known as the fundamental attribution error, which we'll return to in the next section.

In a similar vein, Jones and Davis (1965) found that we tend to make a correspondent inference about another person when we are looking for the cause of their behaviour. In other words, we tend to infer that the behaviour, and the intention that produced it, correspond to some underlying stable quality. For example, a correspondent inference would be to attribute someone's aggressive behaviour to an internal and stable trait within the person – in this case, aggressiveness. Jones and Davis argued that this tendency is motivated by our need to view people's behaviour as intentional and predictable, reflecting their underlying personality traits. But in reality, making correspondent inferences is not always a straightforward business. The information we need in order to make the inferences can be ambiguous, requiring us to draw on additional cues in the environment, such as the social desirability of the behaviour, how much choice the person had, or role requirements.

Like Heider, Kelley (1967) likened ordinary onlookers to naive scientists who weigh up several factors when attributing causality. Kelley's covariation model of attribution states that, before two events can be accepted as causally linked, they must co-occur. The covariation of events and behaviour was assessed across three important dimensions:

Research close-up 2

Personal relevance and the processing of persuasive messages

The research issue

Petty, Cacioppo and Goldman (1981) were interested in exploring whether the personal relevance of a topic affects the way in which people process persuasive messages about that topic.

According to their elaboration likelihood model (Petty & Cacioppo, 1986), people should process a message carefully when it is highly relevant to them. This careful processing should lead to positive thoughts about strongly argued personally relevant messages and negative thoughts about weakly argued personally relevant messages, and these thoughts should influence attitudes towards the topic of the message.

In contrast, when the message is not personally relevant, people should process the message superficially. This superficial processing should lead to the use of easily discernible cues (such as the expertise or attractiveness of the speaker) when evaluating the message.

Design and procedure

Participants were undergraduate university students. They were told that their university was re-evaluating its academic policies, and that the chancellor had asked several groups to prepare policy recommendations to be broadcast on the campus radio station. Participants then heard a recording that advocated the implementation of new comprehensive examinations of students' knowledge in their area of specialization (e.g. psychology) prior to graduation. These exams would be added to the existing exams for each course.

Three variables were manipulated in this experiment:

1. the personal relevance of the issue – some participants were told that the new exams would be implemented in the following year (high relevance), whereas others were told that the exams would be implemented in ten years' time (low relevance);
2. the expertise of the source of the proposal – half the participants were told that the proposal had been formulated by the Carnegie Commission on Higher Education (high expertise), and the others were told that it had been formulated by a class at a local high school (inexpert source); and
3. the exam proposal, which contained either strong or weak arguments – the strong arguments provided substantial evidence to support the proposal, including evidence that the new exams led to better scores on standardized achievement tests at other universities, while the weak arguments relied on anecdotes and little evidence.

After reading the proposal, participants were asked to rate their attitudes towards the implementation of the comprehensive exams. Based on the Elaboration Likelihood Model, Petty et al. expected that attitudes would be influenced by the strength of the message when the issue was made to seem personally relevant, and by source expertise when the issue was made to seem personally irrelevant.

Results and implications

As shown in figure 17.10, the results support these predictions.

When the issue was personally relevant, participants who read the strong arguments formed more positive attitudes than those who read the weak arguments. When the issue was of low relevance, participants who read the strong arguments did not form significantly more positive attitudes.

When the issue was personally relevant, participants who received the proposal from an expert source did not form more positive attitudes than those who received the proposal from an inexpert source. When the issue was not personally relevant, participants who received the proposal from an expert source did form more positive attitudes.

It seems that high personal relevance of an issue can cause people to consider more thoroughly logically relevant arguments and to be less influenced by simple cues. Since this experiment, numerous other studies have replicated this pattern in a variety of settings (Petty & Cacioppo, 1990).

Petty, R.E., Cacioppo, J.T., & Goldman, R., 1981, 'Personal involvement as a determinant of argument-based persuasion', *Journal of Personality and Social Psychology*, 41, 847–55.

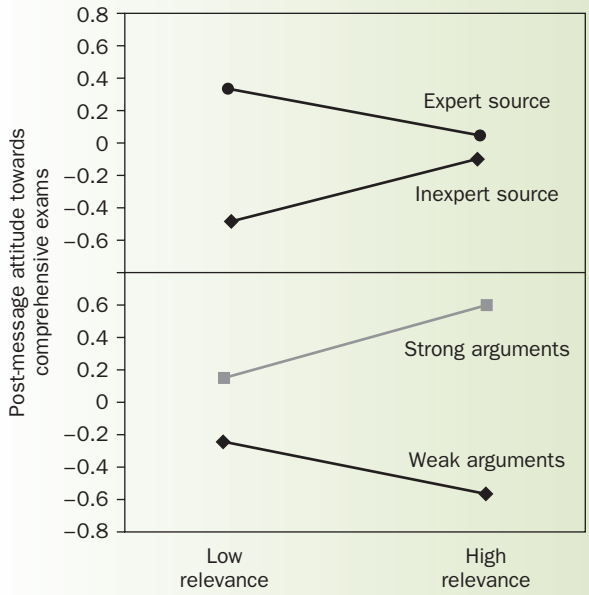

Figure 17.10

Results from Petty et al. (1981).

1. consistency – does the person respond in the same way to the same stimuli over time?
2. distinctiveness – do they behave in the same way to other different stimuli, or is the behaviour distinctively linked to specific stimuli?
3. consensus – do observers of the same stimuli respond in a similar way?

Kelley argued that we systematically analyse people- and environment-related information, and that different combinations of information lead to different causal attributions.

For example, while attributing causality for behaviour like 'John laughed at the comedian', we would run through the following considerations:

1. If John always laughs at this comedian, then his behaviour is highly consistent.
2. If John is easily amused by comedians, then his behaviour has low distinctiveness.
3. If practically no one else in the audience laughed at the comedian, then his behaviour has low consensus.

A combination of high consistency, low distinctiveness and low consensus would lead to a dispositional (internal) attribution for John's laughter, such as 'John has a peculiar tendency to laugh at all comedians; he must be very easily amused.' In contrast, a combination of high consistency, high distinctiveness and high consensus would lead to an external attribution, such as 'John likes this comedian, but he doesn't like many other comedians, and other people like this comedian too; this comedian must be funny' (McArthur, 1972).

The effects of bias

Both the Jones–Davis and the Kelley models of attribution view the social perceiver as a rational person who uses logical principles of thinking when attributing causality. But empirical research has discovered persistent biases in the attributional processes. According to Fiske and Taylor (1991), bias occurs if the social perceiver systematically distorts (over-uses or under-uses) what are thought to be correct and logical procedures. We will now look in more detail at four of the most pervasive biases: the fundamental attribution error, the actor–observer effect, the self-serving bias and the ultimate attribution error.

Pioneer

Harold Kelley (1921–2003), Professor Emeritus of Psychology at the University of California, Los Angeles (UCLA), was a distinguished pioneer and contributor to social psychology. He provided two seminal models of the attribution process, which explained attributions across multiple and single events and stimulated abundant subsequent research in the field. In making attributions, Kelley regarded individuals as applied scientists who also use cognitive heuristics or 'causal schemata'. His work described the kinds of attribution scenarios in which these schemata would be engaged. In addition to his seminal work in attribution theory, Kelley contributed to classic theories of attitude change and of interdependence in relationships.

Pioneer

Susan Fiske (1952–) has been at the forefront of research in the field of social cognition since the late 1970s. She has contributed important research on a number of topics, including the development of schemas, schema-triggered affect, categorical processing, stereotypes, prejudice and discrimination, and is co-author with Shelley Taylor of two editions of the leading source book in this field, *Social Cognition*. Beginning with the premise that people readily categorize other people (especially based on race, gender and age), Fiske's research addresses how stereotyping, prejudice and discrimination are encouraged or discouraged by social relationships, such as cooperation, competition and power.

The fundamental attribution error

Ross (1977) defined the fundamental attribution error (FAE) as the tendency to underestimate the role of situational or external factors, and to overestimate the role of dispositional or internal factors, in assessing behaviour.

The earliest demonstration of the FAE was an experiment by Jones and Harris (1967), in which American college students were presented with another student's written essay that was either for or against the Castro government in Cuba. Half the participants were told that the essay writer had freely chosen whether to write a 'pro' or 'anti' Castro essay (choice condition), and the other half were told that the essay writer was told which position to take (no-choice condition). After reading the essay, participants were asked what the essay writer's 'true' attitude was towards Castro's Cuba. The participants tended to view the writer's attitude as consistent with the views expressed in the essay, regardless of the choice/no-choice condition. While they didn't totally disregard that the no-choice writers had been told what position to take, they viewed this as less important than their attitudinal disposition. In other words, they underestimated the impact of the no-choice condition. In another classic study, Ross, Amabile and Steinmetz (1977) randomly assigned pairs of participants in a quiz game to act as contestant and questioner. Questioners were instructed to set ten difficult general knowledge questions of their own choosing. Despite the relative situational advantage of the questioners, both the contestants and observers of the quiz game rated the questioners as significantly more knowledgeable than the contestants.

Pioneer

Carl Hovland (1912–61) After researching the effects of propaganda for the US military, Carl Hovland founded the Yale communication and attitude change program. The program established a reinforcement perspective on attitude formation and change and conducted numerous seminal experiments on various aspects of the persuasion process including effects of audience, message, and source variables.

Heider put forward a largely cognitive explanation for the FAE. He suggested that behaviour has such salient properties that it tends to dominate our perceptions. In other words, what we notice most in (a) behaviour and (b) communication is (c) the person who is central to both. People are dynamic actors – they move, talk and interact, and these features come to dominate our perceptual field. Supporting this cognitive explanation, Fiske and Taylor (1991, p. 67) argued that situational factors such as social context, roles and situational pressures are 'relatively pallid and dull' in comparison with the charisma of the dynamic actor. While this is a commonsense and intuitive explanation, we discuss later in this chapter how this bias is only pervasive in Western individualistic cultures. So the FAE turns out to be not so fundamental after all!

The actor–observer effect

While we tend to attribute other people's behaviour to dispositional factors, we tend to attribute our own behaviour to situational factors (Jones & Nisbett, 1972). This is called the actor–observer effect (AOE).

Consider how easily we explain our own socially undesirable behaviour (such as angry outbursts) to extenuating, stressful circumstances, and yet we are less sympathetic when others behave in this way. Instead, we often conclude that the person is intolerant, impatient, unreasonable, selfish, etc. This bias has been found in both laboratory experiments (Nisbett et al., 1973) and applied clinical settings. For example, psychologists and psychiatrists are more likely to attribute their clients' problems to internal stable dispositions, whereas the clients are more likely to attribute their own problems to situational factors (Antonio & Innes, 1978). There are several competing explanations for the AOE, but we will outline just two of them here.

1 Perceptual salience As for the FAE, one explanation is perceptual and essentially argues that actors and observers quite literally have 'different points of view' (Storms, 1973). As actors, we can't see ourselves acting. From an actor's point of view, what is most salient and available are the situational influences on behaviour – the objects, the people, the role requirements and the social setting. But from an observer's point of view, other people's behaviour is more dynamic and salient than the situation or context. These different vantage points for actors and observers appear to lead to different attributional tendencies, i.e. situational attributions for actors and dispositional attributions for observers.

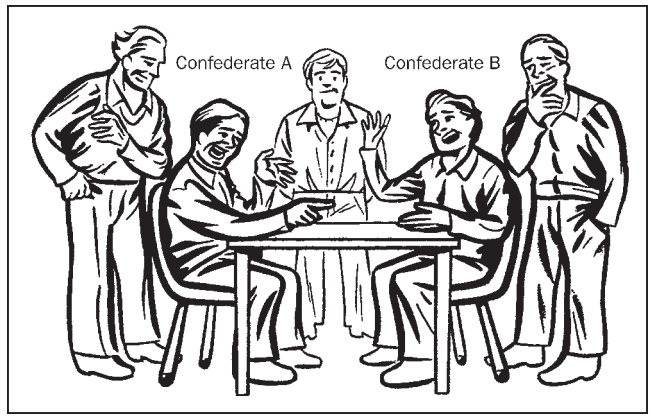

Figure 17.11

A schematic figure of a study that attempted to test the perceptual salience hypothesis. Two confederates sat facing each other and were engaged in conversation. They were observed from three different vantage points – from behind Confederate A, from behind Confederate B, and from midway between A and B. Consistent with the perceptual salience hypothesis, the results showed that observers sitting behind A, watching B, rated B as more causal, while those sitting behind B, watching A, saw A as more causal. The observers watching from midway between A and B perceived both as equally influential.
Source: Based on Taylor and Fiske (1975).

Taylor and Fiske (1975) attempted to test the perceptual salience hypothesis by placing observers at three different vantage points around two male confederates who sat facing each other engaged in conversation. Observers sat either behind confederate A with confederate B in their direct visual field, or behind B, watching A, or to the side, between A and B with both in sight (figure 17.11). After A and B had interacted for five minutes, each observer was asked to rate each confederate on various trait dimensions, and the extent to which their behaviour was caused by dispositional and situational factors. They also rated how much each confederate (a) set the tone of the conversation, (b) determined the kind of information exchanged and (c) caused the other's behaviour.

Consistent with the perceptual salience hypothesis, Taylor and Fiske found that the two observers sitting behind A, watching B, rated B as more causal, while those sitting behind B, watching A, saw A as more causal. The observers sitting in between A and B perceived both confederates as equally influential.

In a similar vein, McArthur and Post (1977) manipulated the salience of two people engaged in conversation through the use of lighting. When one participant was made more salient than the other by being illuminated by bright light, observers rated the behaviour of the illuminated person as more dispositionally and less situationally caused.

2 Situational information Another explanation for the AOE focuses on information. Actors have more information about the

situational and contextual influences on their behaviour, including its variability and flexibility across time and place. But observers are unlikely to have such detailed information about the actors unless they know them very well, and have observed their behaviour over time and in many different situations. It therefore seems that observers assume more consistency in other people's behaviour compared to their own, and so make dispositional attributions for others, while making situational attributions for their own behaviour (Nisbett et al., 1973).

The self-serving bias

It is well known that people tend to accept credit for success and deny responsibility for failure. More generally, we also tend to attribute our success to internal factors such as ability, but attribute failure to external factors such as bad luck or task difficulty. This is known as the self-serving bias.

How often have we heard governments taking credit when there is national economic growth and prosperity, attributing it to their economic policies and prudent financial management? And yet, in times of economic hardship, they are quick to blame external causes, such as the international money markets or worldwide recession. Although the strength of the self-serving bias varies across cultures, it has been found to occur cross-culturally (Fletcher & Ward, 1988; Kashima & Triandis, 1986).

The usual explanation is motivational factors: that is, the need for individuals to enhance their self-esteem when they succeed and protect their self-esteem when they fail. Attributing success to internal causes has been referred to as the self-enhancing bias, and attributing failure to external causes as the self-protection bias (Miller & Ross, 1975). But Miller and Ross argue that there is only clear support for the self-enhancing bias, and that people do often accept personal responsibility for failure. They also claim that the self-enhancing bias can be explained by cognitive factors without recourse to motivational explanations. For example, we are more likely to make self-attributions for expected than unexpected outcomes, and most of us expect to succeed rather than fail. Even so, it is difficult to argue against the motivational hypothesis, and the prevailing consensus is that both motivational and cognitive factors have a part in the self-serving bias (Ross & Fletcher, 1985).

The motivation for self-enhancement is also linked to achievement attributions. According to Weiner's (1985; 1986) attributional theory of motivation and emotion, the attributions people make for success and failure elicit different emotional consequences, and are characterized by three underlying dimensions – locus, stability and control (table 17.2).

- The locus dimension refers to whether we attribute success and failure internally or externally. Consistent with the self-enhancement bias, we are more likely to feel happier and better about ourselves if we attribute our success internally (to factors such as ability and effort) rather than externally (to good luck or an easy task). In contrast, attributing failure internally is less likely to make us feel good about ourselves than attributing it externally.

Table 17.2 Achievement attributions for success and failure, and their characteristics on the three underlying dimensions of locus, stability and control.

	Locus	*Stability*	*Control*
Ability	internal	stable	uncontrollable
Effort	internal	unstable	controllable
Luck	external	unstable	uncontrollable
Task difficulty	external	unstable	uncontrollable

Source: Adapted from Weiner (1985; 1986).

- The stability dimension refers to whether the cause is perceived as something fixed and stable (like personality or ability) or something changing and unstable (such as motivation or effort).
- The controllability dimension refers to whether we feel we have any control over the cause.

The tendency to attribute negative outcomes and failure to internal, stable and uncontrollable causes is strongly associated with clinical depression and has been referred to as a depressive attributional style (see chapters 14 and 15). The reformulated learned helplessness model of depression (Abramson et al., 1978) views this attributional style as directly causing depression. But others have argued that it is merely a symptom, reflecting the affective state of the depressed individual. Whether it is a cause or symptom, attributional retraining programmes (Försterling, 1985), in which people are taught to make more self-enhancing attributions, are widely accepted as an important therapeutic process for recovery from depression.

The ultimate attribution error

The self-serving bias also operates at the group level. So we tend to make attributions that protect the group to which we belong. This is perhaps most clearly demonstrated in what Pettigrew (1979) called the ultimate attribution error (UAE).

By extending the fundamental attribution error to the group context, Pettigrew demonstrated how the nature of intergroup relations shapes the attributions that group members make for the same behaviour by those who are in-group and out-group members. So prejudicial attitudes and *stereotypes* of disliked out-groups lead to derogating attributions, whereas the need for positive enhancement and protection of the in-group leads to group-serving attributions. People are therefore more likely to make internal attributions for their group's positive and socially desirable behaviour, and external attributions for the same positive behaviour displayed by out-groups. In contrast, negative or socially undesirable in-group behaviour is usually explained externally, whereas negative out-group behaviour is more frequently explained internally.

stereotype mental representations of social groups and their members that include behavioural and trait characteristics that are widely shared in society

Figure 17.12

In a study by Hunter et al., both Catholic and Protestant students attributed their own group's violence to external causes and the opposing group's violence to internal causes.

This intergroup bias has been found in a number of contexts (Hewstone, 1990). Taylor and Jaggi (1974) found it among Hindus in southern India, who gave different attributions for exactly the same behaviour performed by Hindu and Muslim actors. Duncan (1976) found that white American college students categorized the same pushing behaviour as 'violent' if perpetrated by a black actor but as 'just playing around' when perpetrated by a white actor. The most dramatic illustration of the UAE is an investigation by Hunter, Stringer and Watson (1991) of how real instances of violence are explained by Protestants and Catholics in Northern Ireland. Catholic students made predominantly external attributions for their own group's violence but internal, dispositional attributions for Protestant violence. Similarly, Protestant students attributed their own group's violence to external causes and Catholic violence to internal causes.

There is also substantial evidence of the tendency to make more favourable attributions for male success and failure. Studies have found that both men and women are more likely to attribute male success to ability and female success to effort and luck, especially in tasks that are perceived to be 'male' (Deaux & Major, 1987; Swim & Sanna, 1996). The same bias is found for failure attributions – male failure is explained by lack of effort, whereas female failure is attributed to lack of ability. Bear in mind though that most of these studies were conducted in the seventies and eighties, and relatively few have been published more recently (Swim & Sanna, 1996). Given the social and attitudinal changes associated with women's roles over this time, and the fact that the effects were relatively small, it is possible that these biases have now diminished in Western societies (Hill & Augoustinos, 1997).

Cultural differences

There is now strong evidence that people in non-Western cultures do not make the same kinds of attributions as people in Western individualistic societies. The fundamental attribution error, which was originally thought to be a universal cognitive bias, is not found in collectivist cultures. Instead, many non-Western people place less emphasis on internal dispositional explanations, and more emphasis on external and situational explanations (Shweder & Bourne, 1982).

Miller (1984) was among the first social psychologists to suggest that such differences arise from different cultural representations of the person that are learned during social development, rather than from cognitive and perceptual factors. Western notions of the person are predominantly individualistic, emphasizing the central importance and autonomy of the person, whereas non-Western notions tend to be holistic, stressing the interdependence between the person and their social relationships, role obligations and situational norms.

Miller (1994) conducted a cross-cultural study to compare the attributions made for prosocial and deviant behaviours by a sample of Americans and Indian Hindus of three different age groups (eight, eleven and fifteen years) and an adult group with a mean age of 40. Miller found that the older Americans made significantly more dispositional attributions than the older Hindus, and Hindus made significantly more situational attributions. There were few significant differences between the American and Hindu children aged eight and eleven. But Miller found a significant linear age increase in dispositional attributions among Americans, and a similar linear age increase in situational attributions for the Indian sample (figure 17.13). It therefore appears that the FAE is very culture specific, and the cognitive and perceptual explanations originally advanced for the FAE need to be reconsidered in light of Miller's findings.

Moscovici and Hewstone (1983) proposed that attributions are not only cognitive, but also social and cultural phenomena that are based on social representations – consensually shared knowledge, beliefs and meaning systems that are learned and socially communicated through language (Moscovici, 1984). Every society has its own stock of common sense and culturally agreed explanations for a wide range of phenomena, such as health and illness, success and failure, wealth and poverty, prosocial and deviant behaviour. People do not necessarily engage in an exhaustive cognitive analysis to explain events around them, as some of the early models of attribution suggest (Kelley, 1967). Instead, they draw on socially shared and readily culturally available explanations.

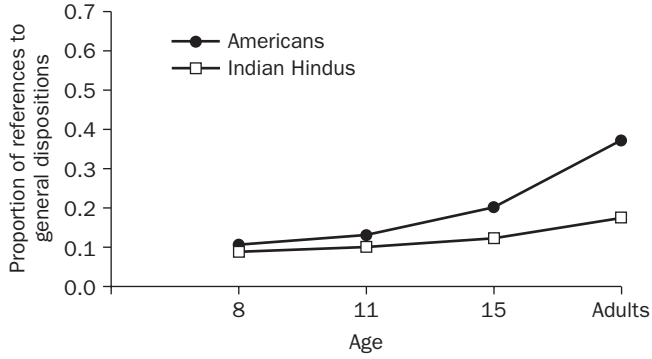

Figure 17.13

Cultural and developmental patterns of dispositional attribution. Source: Based on Miller (1984).

SOCIAL COGNITION

Social schemas

It would be very difficult to function if we went about our everyday lives without prior knowledge or expectations about the people, roles, norms and events in our community. Social cognition research suggests that our behaviour and interactions in the social world are facilitated by cognitive representations in our minds called schemas – mental or cognitive structures that contain general expectations and knowledge of the world (see chapters 11 and 12).

A schema contains both abstract knowledge and specific examples about a particular social object. It 'provides hypotheses about incoming stimuli, which includes plans for interpreting and gathering schema-related information' (Taylor & Crocker, 1981, p. 91). Schemas therefore give us some sense of prediction and control of the social world. They guide what we attend to, what we perceive, what we remember and what we infer. All schemas appear to serve similar functions – they all influence the encoding (taking in and interpretation) of new information, memory for old information and inferences about missing information.

cognitive miser someone who minimizes effort and energy when processing information, making 'top of the head' judgements, evaluations and inferences, with little thought or considered deliberation

person schemas a configuration of personality traits used to categorize people and to make inferences about their behaviour – also referred to as person prototypes

self schemas cognitive representations of the self that organize and process all information that is related to the self

role schemas knowledge structures of the behavioural norms and expected characteristics of specific role positions in society based on people's age, gender, race, occupation, etc.

event schemas cognitive structures that describe behavioural and event sequences in everyday activities such as eating at a restaurant, attending a lecture or shopping at a supermarket

Not only are schemas functional, but they are also essential to our well-being. A dominant theme in social cognition research is that we are *cognitive misers*, economizing as much as we can on the effort we need to expend when processing information. Many judgements, evaluations and inferences we make in the hustle and bustle of everyday life are said to be 'top of the head' phenomena (Taylor & Fiske, 1978), made with little thought and considered deliberation. So schemas are a kind of mental short-hand used to simplify reality and facilitate processing.

Schema research has been applied to four main areas: *person schemas*, *self schemas*, *role schemas* and *event schemas* (Fiske & Taylor, 1991).

Person schemas

Person schemas – often referred to as person prototypes – are configurations of personality traits that we use to categorize people and to make inferences about their behaviour. (The prototype is the 'central tendency', or average, of the category members.) In most Western cultures we tend to categorize individuals in terms of their dominant personality traits. We may infer from our observations and interactions with A that he is shy, or that B is opinionated. Most people would agree that Robin Williams is a prototypical extrovert and Woody Allen is a prototypical neurotic.

Trait or person schemas enable us to answer the question: 'what kind of person is he or she?' (Cantor & Mischel, 1979). In so doing, they help us to anticipate the nature of our social interactions with individuals, giving us a sense of control and predictability.

Self schemas

Just as we represent and store information about others, we do the same about ourselves, developing complex and varied schemas that define our self-concept based on past experiences.

Self schemas are cognitive representations about ourselves that organize and process all related information (Markus, 1977). They develop from self-descriptions and traits that are salient and important to our self-concept. Indeed, they can be described as components of self-concept that are central to our identity and self-definition. For example, people who value independence highly are said to be self-schematic along this dimension. People for whom dependence–independence is not centrally important are said to be aschematic on this dimension. Different self schemas become activated depending on the changing situations and contexts in which we find ourselves (Markus & Kunda, 1986; Markus & Wurf, 1987). For example, your self schema as fun-loving and frivolous when you are with your friends may be quite different from your self schema as serious and dutiful when you are with your family. You will have schemas for your real self and also for your 'ideal' and 'ought' selves (Higgins, 1987) (see chapter 15).

Role schemas

The norms and expected behaviours of specific roles in society are structured into role schemas. They will include both achieved roles – including occupational and professional roles, such as doctor or teacher – and ascribed roles, over which we have little control – such as age, gender and race.

The roles and expectations associated with these categories are commonly referred to as stereotypes – mental representations of social groups and their members that are widely shared (Hamilton & Sherman, 1994; Macrae, Stangor & Hewstone, 1996; Stangor & Lange, 1994). Prolific empirical research on stereotypes views the process of categorizing individuals into their respective social groups as highly functional in that it simplifies the inherent complexity of social information.

Social categories such as male/female, black/white, old/young are viewed as highly salient and prior to any other kind of person categorization. Fiske (1998) refers to age, gender and race as the

Figure 17.14

According to Fiske (1998) race is one of the top three physical cues used to help us to categorize people. With increased familiarity, these physical cues become less important.

'top three' because they are the most central and visually accessible categories. So when we meet someone for the first time, we attend to obvious and salient physical cues in guiding our interactions with them. With increased familiarity, the notion is that stereotypes based on physical cues become less important, and we may subsequently employ trait-based or person schemas.

Event schemas

Commonly referred to as cognitive scripts (see chapter 12), event schemas describe behavioural and event sequences in everyday activities (Schank & Abelson, 1977). They provide the basis for anticipating the future, setting goals and making plans. We know, for example, that the appropriate behavioural sequence for eating at a restaurant is to enter, wait to be seated, order a drink, look at the menu, order the meal, eat, pay the bill and leave. The key idea here is that our commonsense understanding of what constitutes appropriate behaviour in specific situations is stored in long-term memory, and it is activated unconsciously whenever we need it.

Categorization and stereotyping

Before we can apply a schema to a social object, we have to categorize (or label) it as something – a book, a tree, an animal, or whatever. In other words, we identify objects, people and events as members of a category, similar to others in that category and different from members of other categories. Mostly we employ categories automatically and with little conscious effort. Categories help to impose order on the stimulus world, and are fundamental to perception, thought, language and action (Lakoff, 1987; see chapter 12). Research on categorization stems from the pioneering work of cognitive scientist Eleanor Rosch and her colleagues (Rosch, 1975; 1978).

Models for social categorization

The categorization of social objects, people and events is assumed to be a more complex process than categorization of inanimate objects because social objects are variable, dynamic and interactive. Nevertheless, members of a social category share common features. Some instances contained in the category are considered to be more typical than others – the most typical, or prototypical, representing the category as a whole.

The more features an instance shares with other category members, the more quickly and confidently it is identified as a member. For example, you may quickly decide that Sue is a prototypical politician because she is publicity seeking, charming, cunning and ambitious, whereas Paul, who is shy, indecisive, and avoids publicity would be considered atypical of the category 'politician'.

In contrast to the prototype model, an exemplar-based model suggests that categories are represented by specific and concrete instances (exemplars) of the category (Smith & Zarate 1992). For example, arriving at an abstracted average of two very different politicians, such as Bill Clinton and Margaret Thatcher, may be too cognitively demanding. These extreme instances may be better represented as concrete exemplars within an overall general category of 'politician'.

People may rely on a combination of prototype and exemplar-based models, depending on the social objects in question and the conditions under which the information is processed (Brewer, 1988; Fiske & Neuberg, 1990; Hamilton & Sherman, 1994).

Hierarchichal structure of categories

Categories are hierarchically structured, with more abstract and general categories of information at the top of a pyramid structure and more specific categories at the bottom. Information can be processed at different levels of abstraction, moving from a concrete specific instance to a more general level of inference.

Like natural object categories, social stereotypes can be differentiated into lower-order sub-categories, or sub-types (Fiske, 1998). For example, a super-ordinate category (such as 'woman') may comprise a number of sub-types (such as career woman, housewife and feminist). Listing the prototypical features of these category sub-types is considerably easier, as they contain more detailed information than broader and more abstract super-ordinate categories (Andersen & Klatzky, 1987). Brewer, Dull and Lui (1981) found this to be the case with young people's representations of the elderly. The 'elderly' category was differentiated further into three elderly sub-types – the senior citizen, the elderly statesman and the grandmotherly type. In turn, each of these sub-types was associated with distinctive characteristics and traits (figure 17.15).

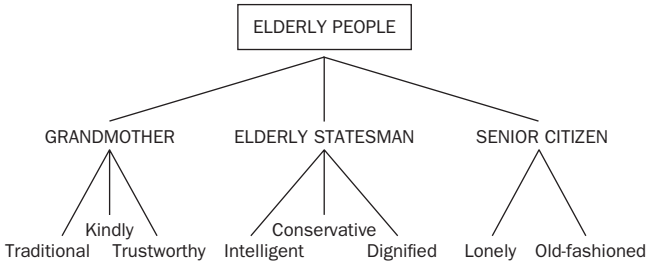

Figure 17.15

The social category 'elderly people' differentiated hierarchically into lower-order subtypes that are associated with distinctive personality traits. Source: Adapted from Brewer, Dull and Lui (1981).

How do schemas work?

What do schemas do in information-processing terms? How do they function as organizing structures that influence the encoding, storing and recall of complex social information?

Schemas are theory-driven

Because schemas are based on our prior expectations and social knowledge, they have been described as 'theory-driven' structures that lend organization to experience. We use these background theories to make sense of new situations and encounters, which suggests that schematic processing is driven by background

Everyday Psychology

Is there any harm in national stereotypes?

It's not necessarily that the Irish drink more than the rest – it's just they get more uproariously drunk.
The British believe it's all about arriving at an answer, which they can then claim credit for, while the French are great believers in the debate. Arriving at a conclusion is not a priority.
The Italians are a mixture of Hollywood and Mafia, but get there in real style . . .

(**Ann Cahill, EU Stereotypes Too Close for Comfort, *Irish Examiner*, 19 June 2002**)

Stereotypes can be defined in a number of ways:

1. A simplified and relatively fixed image of all members of a culture or group; the group is typically based on race, religion, ethnicity, age, gender or national origins.
2. Generalizations about people that are based on limited, sometimes inaccurate, but often easily available information (see discussion of the availability heuristic in chapter 12), and are characterized by no or minimal contact with members of the stereotyped group and on second-hand information rather than first-hand experience.
3. A single statement or attitude about a group of people that does not recognize the complex, multidimensional nature of individual human beings irrespective of race, religion, ethnicity, age, gender or nationality.

Stereotypes can be positive, negative or mixed, but they are usually unfair and misleading. In general, they reduce individuals to a rigid, inflexible image. They do not account for the fact that human beings are individually complex, each person possessing a unique constellation of personal attributes. Instead, stereotypes suggest that everyone within a group is the same.

An especially worrying aspect of stereotypes in a geopolitical context is that they tend to dehumanize people, placing all members of a group into one, homogeneous category (e.g. 'The Jews', 'The Arabs'; 'The Protestants', 'The Catholics').

From reading this chapter, you will know that the basis for stereotyping lies in the nature of human cognition. When we stereotype people, we pre-judge them; we assume that all people in a group have the same traits. This form of blanket categorization leads to false assumptions about people and can lead to misunderstandings, hostile and abusive behaviours, conflicts, discrimination, and prejudice.

These generalizations may have their roots in experiences we have had ourselves, read about in books and magazines, seen in films or television, or have had related to us by friends and family. In some cases, they may seem reasonably accurate. Yet, in virtually every case, we are resorting to prejudice by inferring characteristics of an individual person based on a group stereotype, without knowledge of all the facts.

The difficulty is that stereotypes are sometimes hard to recognize because they are fixed beliefs. As children and teenagers, all of us face peer pressure when confronted with a joke that puts down a certain minority group. But after identifying stereotypes, we can work towards tackling them. When stereotypical judgements are reduced, it is easier to acknowledge and appreciate individual differences and cultural diversity.

Macrae, C.N., Stangor, C., & Hewstone, M. (eds), 1996, *Stereotypes and Stereotyping*, New York: Guilford Press.

theories and suppositions rather than actual enviromental data (Fiske & Taylor, 1991). This isn't always the case, however, as we will see later.

Schemas facilitate memory

Schemas help us process information quickly and economically and facilitate memory recall. This means we are more likely to remember details that are consistent with our schema than those that are inconsistent (Hastie & Park, 1986; Stangor & McMillan, 1992).

For example, Cohen (1981) presented participants with a video of a woman having dinner with her husband. Those who were told that she was a librarian were more likely to remember that she wore glasses, whereas those who were told she was a waitress were more likely to remember her drinking beer. It seems that these occupational categories were used as organizing frameworks to attend to and/or encode and/or subsequently recall information that was consistent with stereotypic expectations of librarians and waitresses (see chapter 11 for some suggestions of ways in which we may try to tease apart which of these three memory components were affected in this study).

Schemas are energy-saving devices

Simplifying information and reducing the cognitive effort that goes into a task preserves cognitive resources for more important tasks. Schemas, such as stereotypes, therefore function as energy-saving devices (Macrae, Milne & Bodenhausen, 1994).

In ambiguous situations, schemas help us to 'fill in' missing information with 'best guesses' and 'default options' based on our expectations and previous experience. They can also provide short cuts by utilizing heuristics such as representativeness (Kahneman & Tversky, 1972, 1973a). With limited information, we can use the *representativeness heuristic* to determine the degree to which a stimulus is representative of a more general category. Is John, who is shy and mild-mannered, more likely to be an accountant or a business executive? See chapter 12 for a discussion of situations in which these heuristics may be useful or misleading.

Schemas are evaluative and affective

Schemas also serve to evaluate social stimuli as good or bad, normal or abnormal, positive or negative, and some contain a strong affective component, so that when they are activated the associated emotion is cued.

For example, the prototypic used-car salesman may automatically evoke suspicion, or a prototypic politician may trigger cynicism and distrust (Fiske, 1982; Fiske & Pavelchak, 1986). This is probably an important feature of some people's race stereotypes, eliciting strong negative emotions and evaluations.

Figure 17.16

Through schemas that serve to evaluate social stimuli, we automatically become suspicious of the prototypic used-car salesman.

Schemas are unified, stable structures that resist change

Once developed and strengthened through use, schemas become integrated structures. Even when only one of its components is accessed, strong associative links between the components activate the schema as a unitary whole (Fiske & Dyer, 1985).

Well-developed schemas that are activated frequently resist change and persist, even in the face of disconfirming evidence. So a male chauvinist with a highly accessible and frequently activated stereotype that women are less capable than men is rarely convinced otherwise, even when presented with evidence to the contrary. Consistent with the ultimate attribution error described above, instances that disconfirm the stereotype are treated as 'exceptions to the rule'. This notion is consistent with the *subtyping model* of stereotype change, which predicts that disconfirming instances of the stereotype are relegated to 'exceptional' sub-categories or subtypes that accommodate exceptions while leaving the overall stereotype largely intact (Weber & Crocker, 1983). For example, Hewstone, Hopkins and Routh (1992) found that, despite a one-year school liaison programme that facilitated positive interactions between a police officer and secondary school students, this experience did not change the students' overall negative representations of the police. Instead, these particular officers were judged by the school students to be atypical of the police in general.

subtyping model predicts that disconfirming instances of a stereotype are relegated to subcategories or subtypes, which accommodate exceptions to the stereotype but by and large leave the overall stereotype intact

There is considerable empirical support for the subtyping model (Hewstone, 1994; Johnston & Hewstone, 1992). Other

book-keeping model suggests that stereotypes and schemas are constantly fine-tuned with each new piece of information

conversion model predicts dramatic and sudden change in schema and stereotypes in the face of salient contradictions

models have received less empirical support. These include the *book-keeping model*, which proposes that there is constant fine-tuning of a schema with each new piece of information (Rumelhart & Norman, 1978), and the *conversion model*, which proposes that there is dramatic and sudden change in the schema in response to salient contradictions (Rothbart, 1981).

Recent research into social processing

The continuum model of processing

We have seen how our preconceptions and prejudices can lead to biases and distortions. But we don't always behave like *cognitive misers*. By contrast, in certain situations we engage in a careful and piecemeal analysis of the 'data'. Fiske and Neuberg (1990) proposed that the processing of social information is a kind of continuum, as we move from schema or *category-based processing* to more piecemeal *data-based processing* (figure 17.17). These authors propose that we use category-based processing when the data are unambiguous and relatively unimportant to us and piecemeal processing when the data are ambiguous, relatively important, and the need for accuracy is high.

category-based processing information processing that is fast, non-strategic, efficient, can be automatic and beyond conscious awareness, and is more likely to occur when the data are unambiguous and relatively unimportant

data-based processing information processing that is slow, deliberate, and requires conscious effort and attention, used where the need for accuracy is high

For example, the time and effort we spend forming impressions of others depends on their relative importance to us and on our motivations for getting to know them. Everyday superficial encounters are usually based on people's salient social group memberships, such as gender, race, age and occupation. These social categories access for us an associated range of expectations that are usually stereotypical. If we are motivated to move beyond this category-based processing, we take a more piecemeal and data-driven approach.

Fiske and Neuberg's (1990) continuum model of processing has led to a significant revision of the cognitive miser model that characterized the approach to social cognition in the 1980s. More recent research has demonstrated that perceivers are more like *motivated tacticians* (Fiske, 1992; 1998), using processing strategies that are consistent with their motivations, goals and situational requirements.

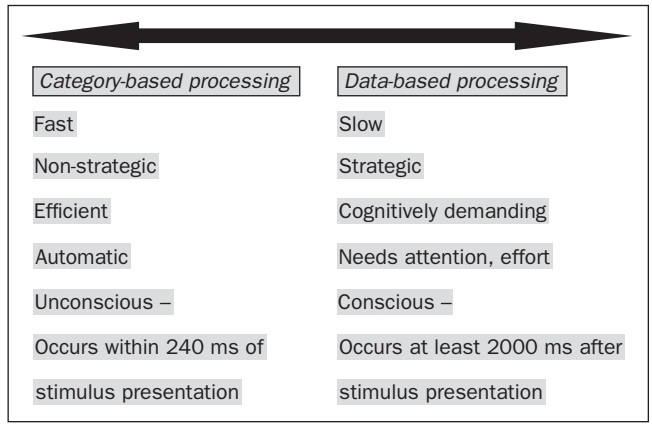

Figure 17.17

Continuum model of processing. Source: Based on Fiske and Neuberg (1990).

motivated tactician someone who deploys flexible information-processing strategies that are consistent with their motivations, goals and situational requirements

Automatic vs. controlled processing

While processing can take place anywhere along the continuum just described, most person impressions seem to be first and foremost category-based (this kind of schematic processing apparently being the 'default option'). This is why so much recent attention has focused on the primacy and importance of stereotypes in perception.

In-depth processing requires controlled attention, intention and effort, whereas it appears that category-based perception can occur automatically and beyond conscious awareness (Bargh, 1994; Wegner & Bargh, 1998). This distinction between *automatic* and *controlled processing* was applied by Devine (1989) to the activation of stereotypes. Devine argues that most people, through socialization, acquire knowledge of social stereotypes early in childhood and that, through repeated exposure, stereotypes of salient social groups become well-learned knowledge structures that are automatically activated without deliberate thinking.

automatic processing the processing of information that is beyond conscious awareness and extremely fast – in experimental studies, within 240 ms of stimulus presentation

controlled processing the processing of information that is deliberate, conscious, and strategic; in experimental studies, this occurs after 2000 ms of the presentation of a stimulus

This model suggests that this unintentional activation of the stereotype is equally strong for high and low prejudiced people.

For example, Devine (1989) found that the activation of a negative stereotype associated with African Americans ('hostile') occurred for both high and low prejudiced participants when stereotypic primes were presented subliminally (beyond conscious awareness). So when people do not have the opportunity to consciously monitor and appraise information, the ability to suppress the stereotype becomes difficult, even for unprejudiced people.

This, of course, suggests that stereotyping may be inevitable, and in some situations difficult to control. Given that stereotyping is usually linked to prejudice and discrimination, it paints a rather bleak picture for intergroup relations. But Devine argues that, while stereotypes can be automatically activated, what distinguishes low prejudiced from high prejudiced people is the conscious development of personal beliefs that challenge the stereotype. These egalitarian beliefs are deployed during conscious processing, and are able to override the automatically activated stereotype. In contrast, people high in prejudice have personal beliefs that are congruent with negative stereotypes, so during conscious processing they need not control or inhibit the automatically activated stereotype.

While several studies now support Devine's claim that stereotypes of salient social groups are widely known and shared, there is less support for the claim that stereotypes are automatically activated equally for everyone, regardless of their prejudice levels (Augoustinos, Ahrens & Innes, 1994; Lepore & Brown, 1997; Locke, MacLeod & Walker, 1994). For example, Locke et al. (1994) found that the predominantly negative stereotype of Australian Aboriginal people was only activated in people high in prejudice. Similarly, Lepore and Brown (1997) found that only highly prejudiced respondents activated the negative stereotype of African-Caribbean people in Britain. So, according to these studies, it seems that stereotypes are not activated to the same extent for all people, and are therefore not necessarily inevitable. Rather, people's attitudes and values – in this case, low levels of prejudice – inhibit and constrain the activation of stereotypes, not only consciously, but also unconsciously.

The power of stereotypes

In our discussion of attribution theory, we argued that attributions are not only internal cognitive phenomena but also social and cultural explanations shaped by widely shared representations within a society, community or group.

The same can be said for schemas, categories and stereotypes. While these have been largely discussed as cognitive constructs, it is important to recognize that they are also essentially cultural and social in nature, i.e. cultural knowledge that is determined by dominant and consensual representations learned by members of a society.

Because they are acquired early in life, widely shared and pervasive, stereotypes of groups are more than just 'pictures in our heads'. They are socially and discursively reproduced in the course of everyday communication (Augoustinos & Walker, 1998). They are also ideological in nature, because they are often used to rationalize and justify why some groups are more powerful and more dominant than others (Jost & Banaji, 1994). So social stereotypes can be used as political weapons to justify existing group inequalities, gender stereotypes have been used to justify gender inequalities, and race stereotypes have been used to justify racism and prejudice.

Other approaches in social psychology, such as social representations theory (Augoustinos & Walker, 1995), social identity theory (Tajfel & Turner, 1979) and self-categorization theory (Oakes, Haslam & Turner, 1994), regard social categories and stereotypes very differently from the predominantly cognitive and information-processing account we have outlined above. Rather than energy-saving devices that facilitate cognition by simplifying reality, stereotypes (and the social categories on which they are based) are viewed within these contrasting frameworks as rich in symbolic meaning, and as being used to make sense of the power and status relations between different social groups (Oakes et al., 1994: Leyens, Yzerbyt & Schadron, 1994). See chapter 18 for more on intergroup relations.

FINAL THOUGHTS

Attitudes are among the most important constructs in social psychology because they encompass powerful tendencies to feel, believe *and* act in a positive or negative way. Attributions are also among our most important constructs because they are part of what makes us human – our tendency to attempt to explain the events around us. The study of social cognition helps to integrate these two important constructs, by examining the impact of these basic cognitive processes across social contexts, and how these cognitive processes influence attitudes and attributions.

In fact, most of the chapters in this text refer to social cognition in some way, because virtually all of them consider processes of judgement that may be influenced by social contexts. A challenge for future research is to provide theoretical models that explain these diverse social psychological topics with the same basic principles.

Summary

- Attitudes are tendencies to evaluate an object favourably or unfavourably. They can be measured using both non-self-report and self-report techniques.
- Useful features of attitudes are that (a) they summarize beliefs, feelings and past behaviour regarding the attitude objects, and (b) they can predict behaviour.
- Attitude–behaviour relations are strongest when attitudes are measured at the same level of specificity as the target behaviour.
- Contemporary models of attitude–behaviour relations describe how attitudes predict behaviour in conjunction with other variables (e.g. social norms, perceived control) that influence behaviour. These models also specify how accessible attitudes automatically influence behaviour.
- Classic theories suggest that attitudes change when a persuasive message provides motivational incentive to change the attitude.
- People tend to be more influenced by message arguments when they are motivated and able to process the arguments. When motivation and ability are low, people may rely heavily on heuristic cues (e.g. source expertise) to determine their new attitude.
- Attribution theory concerns itself with the processes by which we use causal explanations for everyday events and behaviour in an effort to understand and make sense of the social world.
- A number of biases have been found to characterize causal attributions, including the fundamental attribution error, actor–observer effect, self-serving bias and ultimate attribution error.
- The process of attributing causality is influenced by internal cognitive factors, group membership and identity and socio-cultural values.
- We also come to understand the social world through the activation and use of mental cognitive representations called schemas. These contain both abstract and specific knowledge about people, roles, social groups and events.
- Schemas help categorize, evaluate and process social information quickly and efficiently. They are energy-saving devices that facilitate memory and resist change even in the face of disconfirming evidence.

REVISION QUESTIONS

1. Why are attitudes important constructs in social psychology?
2. If you were interested in predicting whether people's attitudes towards low-fat foods predict their consumption of low-fat foods, which model of attitude-behaviour relations would you use to examine this issue, and why?
3. Imagine that you are designing a new ad campaign against careless driving. Using your knowledge of models of attitude change, how would your ads look and where would you place them?
4. Why are attributions important constructs in social psychology?
5. It could be suggested that the 'fundamental attribution error' is not really an error, because it helps us form useful judgements in a complex social world. Discuss the pros and cons of this argument.
6. Given the effects of culture on the occurrence of the fundamental attribution error, how would you set up an intervention to make people less likely to commit this 'error'?
7. Why are schemas important constructs in social psychology?

Further Reading

Augoustinos, M., & Walker, I. (1995). *Social Cognition: An Integrated Introduction*. London: Sage.
Describes research studies in social cognition.

Bohner, G., & Wänke, M. (2002). *Attitudes and Attitude Change*. London: Psychology Press.
This book reviews basic aspects of attitudes and attitude change.

Forsterling, F. (2001). *Attribution: An Introduction to Theories, Research and Applications*. London: Psychology Press.
Provides a thorough and up-to-date introduction to the field of attribution.

Kunda, Z. (1996). *Social Cognition*. London: MIT Press.
Describes research on many aspects of social cognition.

Contributing authors:
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Interpersonal Relations and Group Processes

18

CHAPTER OUTLINE

LEARNING OBJECTIVES

INTRODUCTION

INTERPERSONAL BEHAVIOUR

- Being in the presence of other people
- The influence of authority
- Affiliation, attraction and close relationships

GROUP PROCESSES

- Taking our place in the group
- How groups influence their members
- How groups get things done

INTERGROUP RELATIONS

- Deindividuation, collective behaviour and the crowd
- Cooperation and competition between groups
- Social categories and social identity
- Prejudice and discrimination
- Building social harmony

FINAL THOUGHTS

SUMMARY

REVISION QUESTIONS

FURTHER READING

Learning Objectives

By the end of this chapter you should appreciate that:

- the presence of other people can have significant effects on our behaviour;
- under certain conditions people obey the orders of an authority figure to the extent of harming innocent others;
- social support and close interpersonal relationships benefit our health and happiness;
- membership of groups can have both positive and negative consequences on people's behaviour and judgement, depending on the context;
- membership of groups can help us to withstand authoritarian influences, but it can also inhibit our tendency to help others and can increase prejudice and conflict;
- knowledge of the interpersonal processes and mechanisms involved can help to reduce the negative aspects of group membership.

INTRODUCTION

One of the most distinctive aspects of human beings is that we are social. We are each affected by the presence of other people, we form relationships with other people, we join groups with other people, and we behave in certain ways towards members of our own and other groups.

The previous chapter focused on various aspects of social evaluation and how we process social information – intra-personal processes. In this chapter, we look more broadly at the ways in which our behaviour is genuinely social. How are we influenced by, and how do we influence, other people?

First, we here ask the elementary question of how we are affected by simply being in the presence of other people. We then look at ways in which people interact with one another – particularly how people form close relationships with one another. Next, we look at how people in groups, and how groups as a whole, behave. How does being in a group affect what we think and do? How do groups perform typical group tasks and activities?

Finally, we consider how groups interact with and perceive one another; how people as group members relate to people who are not in their group; and how both cooperative and competitive forms of intergroup behaviour arise and can be changed.

INTERPERSONAL BEHAVIOUR

BEING IN THE PRESENCE OF OTHER PEOPLE

Social facilitation

Intuitively, most of us probably think the term 'social' means doing things with (or being in the presence of) other people, and that social psychology is therefore about the causes and effects of this 'social presence'. Although social psychologists use the term 'social' in a much broader way than this, the effect of the physical presence of other people on our behaviour remains an important research question (Guerin, 1993).

In fact, in 1898 Triplett designed one of the earliest social psychology experiments to address this very question. He discovered from analysis of published records that cyclists go faster when paced by another cyclist, and he decided to investigate this phenomenon under more controlled conditions. Triplett had 40 children reel in fishing lines, either alone or in pairs, and he discovered that the children tended to perform the task more quickly when in the presence of someone else doing the same task. Triplett attributed this 'quickening effect' to the arousal of a competitive instinct.

social facilitation an increase in dominant responses in the presence of others of the same species, leading to improved performance on well-learned/easy tasks and deterioration in performance on poorly learned/difficult tasks

Some years later, F. Allport (1920) coined the term *social facilitation* to refer to a more clearly defined effect in which the mere presence of conspecifics (i.e. members of the same species) would improve individual task performance. These conspecifics might be co-actors (i.e. doing the same task but not interacting) or simply a passive audience (i.e. observing the task performance).

Research (much of it with an exotic array of different species) seemed to confirm this. We now know that cockroaches run faster, chickens, fish and rats eat more, and pairs of rats copulate more when being 'watched' by members of their own species (see Zajonc, Heingartner & Herman, 1969). However, later research found that the presence of conspecifics sometimes impairs performance, although it was often unclear what degree of social presence produced impairment (i.e. coaction or a passive audience).

Zajonc (1965) put forward a drive theory to explain social facilitation effects. He argued that, because people are unpredictable, the mere presence of a passive audience instinctively and automatically produces increased arousal and motivation. This was proposed to act as a drive that produces dominant responses for that situation (i.e. well learned, instinctive or habitual behaviours that take precedence over alternative responses under conditions of heightened arousal or motivation). But do dominant responses improve task performance? Zajonc argued that if the dominant response is the correct behaviour for that situation (e.g. pedalling when we get on a bicycle), then social presence improves performance (social facilitation). But if the dominant response is an incorrect behaviour (e.g. trying to write notes in a lecture before we have understood properly what is being said), then social presence can impair performance (social inhibition) (see figure 18.1 and Markus, 1978).

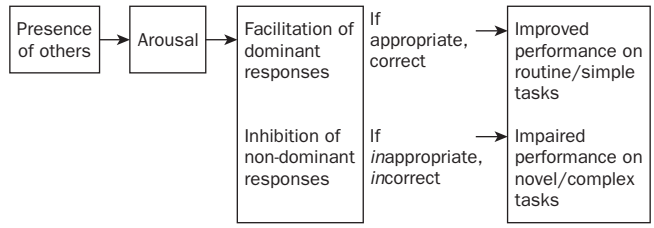

Figure 18.1

Zajonc's (1965) explanation of social facilitation/inhibition. Source: Hewstone and Stroebe (2001).

Zajonc believed that drive was an innate reaction to the mere presence of others. Other views are that drive results from an acquired apprehension about being evaluated by others (Cottrell, 1972) or from conflict between paying attention to a task and to an audience (e.g. Sanders, 1981). Still other researchers discard the notion of drive entirely. They suggest that social facilitation may occur because of distraction and subsequent narrowing of attention, which hinders performance of poorly learned or difficult tasks but leaves unaffected or improves performance of well learned or easy tasks (Baron, 1986; Manstead & Semin, 1980).

Alternatively, social presence might motivate concern with self-presentation – i.e. how we appear to others (rather than concern specifically about being evaluated by them) (Bond, 1982) or make us more self-aware (Wicklund, 1975). This might then increase cognitive effort, which is considered to improve performance on easy tasks but not on difficult tasks (where failure and social embarrassment might be anticipated).

Overall, then, the empirical finding from this body of research is that the presence of others improves performance on easy tasks, but impairs performance on difficult tasks (see Bond & Titus, 1983). But no single explanation seems to account for social facilitation and social inhibition effects (Guerin, 1993). Instead, several concepts – including arousal, evaluation apprehension, and distraction conflict – are involved.

Bystander apathy and intervention

One type of behaviour that might be affected by the presence of other people is our inclination to offer help to someone who needs it. This question can be studied from many perspectives. One of these is evolutionary psychology – do people help others simply as members of their own species, or only those with whom they shares genes? (see Batson, 1983; and Dawkins', 1976, notion of the 'selfish gene'). Another perspective is that of socialization – do we learn to help others as a result of direct instructions, reinforcement, social learning and modelling (see Bandura, 1973)?

Two of the most important lines of research on helping by social psychologists have focused on situational factors that

encourage or discourage helping, and on what motives may underlie helping others.

bystander intervention occurs when an individual breaks out of the role as a bystander and helps another person in an emergency

A critical feature of the immediate situation that determines whether by standers help someone who is in need of help (*bystander intervention*) is the number of potential helpers who are present. This approach was stimulated by the widely reported murder of Kitty Genovese in New York in 1964: although 38 people admitted witnessing the murder, not a single person ran to her aid. To explain bystander intervention (or its opposite – apathy), Darley, Latané and others carried out a series of classic experiments (Darley & Batson, 1973; Darley & Latané, 1968; Latané & Rodin, 1969).

Numerous studies indicate that the willingness to intervene in emergencies is higher when a bystander is alone (Latané & Nida, 1981). In one of the first experiments showing this effect (Latané & Rodin, 1969), students overheard that a woman working in the office next door had climbed onto a chair, fallen on the floor and lay moaning in pain. This incident lasted 130 seconds. In one condition, the student who overheard the information was alone. In a second condition, another student (a confederate of the experimenter, who had been instructed to be passive) was also present. In a third condition, the student participant was with a stranger at the time of the accident, and in a fourth condition the student participant was with a friend.

Although two people could have intervened in the third and fourth conditions, in only 40 per cent of stranger dyads and 70 per cent of friend dyads did at least one student intervene. The individual likelihood of intervention has to be calculated according to a special formula that corrects for the fact that two people are free to act in two conditions (with stranger; with friend), but only one person is free to act in the remaining two conditions (with passive confederate; alone). The individual likelihood of intervention was in fact twice as high when students were with a friend (i.e. fourth condition) compared with a stranger (i.e. third condition). Both of these corrected intervention rates for the third and fourth conditions were lower than in the condition where the participant was alone (first condition), but higher than in the second condition, where there was a passive confederate present at the time of the accident (see figure 18.3).

Subsequent research indicated that three types of social process seem to cause the social inhibition of helping in such situations:

1. diffusion of responsibility (when others are present, our own perceived responsibility is lowered);
2. ignorance about how others interpret the event; and
3. feelings of unease about how our own behaviour will be evaluated by others present.

So, witnesses to the Kitty Genovese murder may have failed to intervene because:

1. they saw other people present, and so did not feel responsible;

Figure 18.2

When there are several bystanders, it is less likely that a victim will receive help.

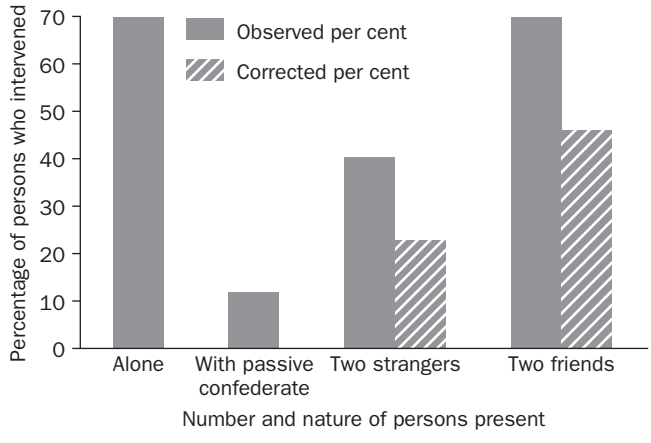

Figure 18.3

The effect of the presence and identity of others on bystander intervention in an emergency. Source: Hewstone and Stroebe (2001), based on Latané & Rodin (1969).

2. they were unsure about how the others present interpreted the situation; and
3. they were embarrassed about how they might look if they rushed in to help when, for some reason, this might be inappropriate.

On the basis of studies such as this, Latané and Darley (1970) proposed a cognitive model of bystander intervention. Helping (or not) was considered to depend on a series of decisions:

1. noticing that something is wrong;
2. defining it as an emergency;
3. deciding whether to take personal responsibility;
4. deciding what type of help to give; and
5. implementing the decision.

Bystanders also seem to weigh up costs and benefits of intervention vs. apathy before deciding what to do. Piliavin, Dovidio, Gaertner and Clark (1981) proposed a bystander calculus model that assigns a key role to arousal. They proposed that emergencies make us aroused, situational factors determine how that arousal is labelled and what emotion is felt (see chapter 6), and then we assess the costs and benefits of helping or not helping before deciding what to do.

To summarize findings from this area of research, the presence of multiple bystanders seems the strongest inhibitor of bystander intervention due to diffusion of personal responsibility, fear of social blunders and social reinforcement for inaction. In addition, the costs of not helping are apparently reduced by the presence of other potential helpers. People tend to help more if they are alone or among friends, if situational norms or others' behaviour prescribe helping, if they feel they have the skills to offer effective help, or if the personal costs of not helping are high.

Motives for helping

A rather different line of research has concentrated on the motives underlying helping (or, more generally, prosocial behaviour) – in particular, whether people help for altruistic or egoistic motives. A discussion of the genetic argument is beyond this chapter (see Dawkins, 1976; Bierhoff, 2002).

Batson and colleagues (1981) had female students observe 'Elaine', an experimental confederate, who was apparently receiving electric shocks. In the second trial of the experiment, Elaine appeared to be suffering greatly from the shocks, at which point the experimenter asked the female observer whether she would be willing to continue with the experiment by taking Elaine's place.

In one condition, participants believed that Elaine shared many attitudes with them. In another condition, they were led to think that she held dissimilar attitudes. The experiment also manipulated difficulty of escape. In the 'easy escape' condition, participants knew that they could leave the observation room after the second trial, which meant that they would not be forced to continue observing Elaine's plight if the experiment continued with her. In the 'difficult escape' condition, they were instructed to observe the victim through to the end of the study.

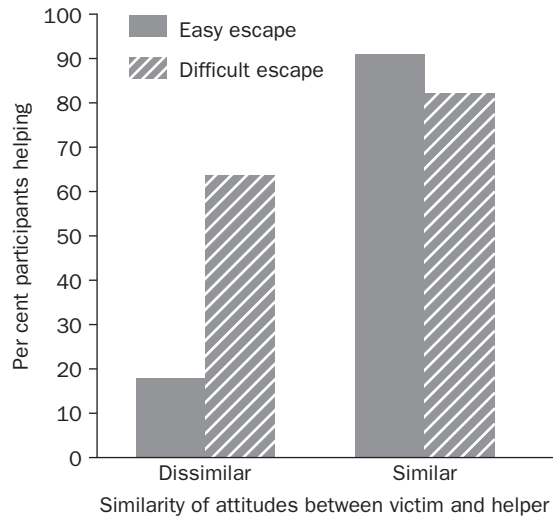

Figure 18.4

Percentage of participants who helped Elaine, depending on similarity/empathy and difficulty of escape. Source: Hewstone and Stroebe (2001), based on Batson et al. (1981).

As figure 18.4 shows, participants only took up the option offered by the 'easy escape' condition and failed to help when the victim had dissimilar attitudes. These results were interpreted as being consistent with the hypothesis that high attitude similarity increases altruistic motivation, whereas low attitude similarity encourages egoistic motivation.

Batson's altruism theory was opposed by the view that people were, in fact, helping for selfish, rather than altruistic, motives. So helping could sometimes be motivated by an egoistic desire to gain relief from a negative state (such as distress, guilt or unhappiness) when faced with another person in need of help. Although a meta-analysis by Carlson and Miller (1987) did not support this idea, there is continued controversy between the 'altruists' and 'egoists' as to why we help others (see Batson et al., 1997; Cialdini et al., 1997; Schaller & Cialdini, 1988). Batson (e.g., 1991) continues to maintain that helping under the conditions investigated by him is motivated positively by the feeling of 'situational empathy', rather than by an egoistic desire to relieve the 'situational distress' of watching another person suffer.

Helping is also increased by prosocial societal or group norms. These can be general norms of reciprocity ('help those who help you'; Gouldner, 1960) or social responsibility ('help those in need;' Berkowitz, 1972), or more specific helping norms tied to the nature of a social group (e.g. 'we should help older people'). Other factors that increase helping include being in a good mood (Isen, 1987) and assuming a leadership role in the situation (Baumeister, Chesner, Senders & Tice, 1988). Research has also shown that, relative to situational variables, personality and gender are poor predictors of helping (Huston & Korte, 1976; Latané & Darley, 1970).

Note that many of these studies on helping are 'high impact' experiments – fascinating to read about but potentially distressing to participate in. Because of the greater sensitivity to ethical issues

in research today (see chapter 2), it would be difficult now to conduct some of these studies, as well as other studies described in this chapter.

The influence of authority

The research on both social facilitation and helping shows that the mere presence of other people can have a clear effect on behaviour. But this effect can be tremendously amplified if those others actively try to influence us – for example, from a position of authority.

Legitimate authority figures can be particularly influential; they can give orders that people blindly obey without really thinking about the consequences. This has been the focus of one of social psychology's most significant and socially meaningful pieces of research (Blass, 2000; Miller, 1986; Miller, Collins & Brief, 1995). Milgram (1963; and see chapter 1) discovered that quite ordinary people taking part in a laboratory experiment were prepared to administer electric shocks (450V), which they believed would harm another participant, simply because an authoritative experimenter told them to do so. This study showed that apparently 'pathological' behaviour may not be due to individual pathology (the participants were 'normal') but to particular social circumstances. The situation encouraged extreme obedience.

Milgram (1965, 1974) subsequently conducted a whole series of studies using this paradigm. One of his most significant findings was that social support is the single strongest moderator of the effect. So, obedience is strengthened if others are obedient, and massively reduced if others are disobedient.

Milgram investigated the role of peer pressure by creating a situation with three 'co-teachers', the participant and two confederates. The first confederate presented the task, the second registered the learner's responses, and the participant actually administered the shocks. At 150V, the first confederate refused to continue and took a seat away from the shock generator. At 210V, the second confederate refused to continue. The effect of their behaviour on the participants was dramatic: only 10 per cent of the participants were now maximally obedient (see figure 18.5). In contrast, if the teacher administering the learning task was accompanied by a co-teacher, who gave the shocks, 92 per cent of the participants continued to be obedient to the end of the study. The powerful role of interpersonal factors (i.e. peers who had the temerity to disobey) was evident from this investigation (see Blass, 2000).

One unanticipated consequence of Milgram's research was a fierce debate about the ethics of social psychological research (Baumrind, 1985; Miller, 1986). Although no electric shocks were actually given in Milgram's study, participants genuinely believed that they were administering shocks and showed great distress. Was it right to conduct this study?

This debate led to strict guidelines for psychological research. Three of the main components of this code are (i) that participants must give their fully informed consent to take part, (ii) that they can withdraw at any point without penalty, and (iii) that after participation they must be fully debriefed (see discussion of research ethics in chapter 2).

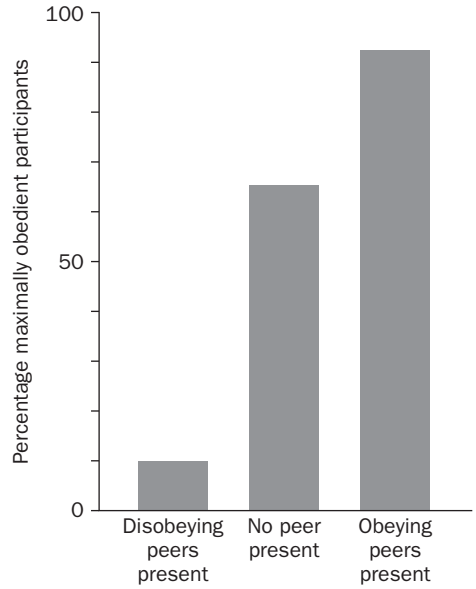

Figure 18.5

Obedience as a function of peer behaviour. Source: Hewstone and Stroebe (2001), data from Milgram (1974).

Affiliation, attraction and close relationships

Seeking the company of others

Human beings have a strong need to affiliate with other people, through belonging to groups and developing close interpersonal relationships. The consequences of social deprivation are severely maladaptive (ranging from loneliness to psychosis), and social isolation is a potent punishment that can take many forms (solitary confinement, shunning, ostracism, the 'silent treatment').

Most of us choose to spend a great deal of time with others, especially when we experience threat (Schachter, 1959) or feel anxious (Buunk, 1995). Our motives for affiliation include *social comparison* (we learn about ourselves, our skills, abilities, perceptions and attitudes; Festinger, 1954), anxiety reduction (Stroebe & Stroebe, 1997) and information seeking (Shaver & Klinnert, 1982). Hospitals now routinely encourage surgical patients who have undergone the same medical procedure to talk to others to help reduce anxiety (Gump & Kulik, 1997).

social comparison the act of comparing oneself, usually with similar others, to assess one's attitudes, abilities, behaviours and emotions; these comparisons are most likely to occur when people are uncertain about themselves

People usually seek out and maintain the company of people they like. We tend to like others whom we consider physically attractive, and who are nearby, familiar and available, and with

Research close-up 1

Milgram's study of obedience

The research issue

There were two significant triggers for this research. First, Milgram wanted to understand how individual acts of obedience could have taken place that led to the systematic annihilation of the Jews during the Holocaust. Second, he was fascinated with the trial in Jerusalem of the arch-architect of the 'Final Solution', Adolf Eichmann.

Milgram wondered whether most people would show destructive obedience and, prior to this research, he doubted it. Indeed, this study represents what was intended to be the 'baseline', a situation in which few people were expected to obey. The original idea was that later research would then manipulate key variables, and investigate their impact on rates of obedience (see Milgram, 1965, 1974).

This study is one of the most widely known in psychology – because of what it found, as well as the ethical issues it raised about social-psychological research.

Design and procedure

The work was conducted at Yale University. Forty males (aged 20–50 years) drawn from in and around the city of New Haven, Connecticut (USA), were recruited to participate in a study on 'memory and learning'. No mention was made at any stage that the study concerned obedience.

There was no experimental design as such, because no factors were manipulated. The teacher–learner scenario was explained, and participants were led to believe that roles had been determined by chance, although the 'victim' (the 'learner') was, in fact, an experimental confederate (i.e. he was instructed how to behave by the experimenter). The experimenter explained that, by means of a 'shock generator', the participant (as 'teacher') was to deliver increasingly more intense electric shocks to the 'learner' each time they made a mistake on the learning task. The shock generator had a row of 30 push-buttons, each marked by the appropriate intensity (from 15 V to 450 V). Successive shock levels were clarified by verbal labels ranging from slight shock (to 60 V), through moderate shock (to 120 V), strong shock (to 180 V) and very strong shock (to 240 V), to intense shock (to 300 V), extreme intensity shock (to 360 V) and 'danger: severe shock' (to 420 V). The two final shock levels were marked 'XXX'. In fact, no shocks were delivered, but the teacher did not know this as the learner pretended to suffer, convincing the participants that they were administering real shocks.

The procedure was carefully scripted so that the experimental scenario had a very high impact on participants, without sacrificing control over the situation. Both the victim's responses (a predetermined set of grunts, screams etc.) and the experimenter's commands (four levels of 'prods') were held constant throughout the study.

The study ended with a detailed debriefing, which included uniting the participant with the victim and conveying the assurance that no shocks had in fact been delivered in the study.

Results and implications

No statistics are reported on the data, nor are they needed, since no experimental variations were compared in the study. The primary dependent measure was the maximum shock a participant administered before refusing to go any further, on a scale from 0 (i.e. refusing to administer the first shock) to 30 (a 450 V shock). Unexpectedly, given Milgram's prior suppositions, no participant discontinued before administering at least a 300 V shock. Across the sample, maximal obedience was shown by 26 of 40 respondents, or 65 per cent (see table 18.1). Milgram concluded that ordinary people were capable of high levels of destructive obedience in response to strong situational pressures.

This study triggered an outcry regarding ethical issues. Milgram was severely criticized for inducing suffering in his participants.

Could this extent of suffering be dealt with in normal debriefing? How might participants be affected by learning that they could be so easily deceived and that they were (apparently) capable of committing great harm under instruction? Should the experiment have even been carried out? Was the research sufficiently important to justify such deception and stress? These are just some of the issues that you may wish to reflect upon . . .

Milgram, S., 1963, 'Behavioral study of obedience', *Journal of Abnormal and Social Psychology*, 67, 371–8.

Table 18.1 Number of participants who proceeded to each level of shock.

Verbal designation and shock indication	*No. of participants for whom this was maximum shock level*
Slight shock (15–60 volts)	0
Moderate shock (75–120 volts)	0
Strong shock (135–180 volts)	0
Very strong shock (195–240 volts)	0
Intense shock (255–300 volts)	5
Extreme intensity shock (315–360 volts)	8
Danger: severe shock (375–420 volts)	1
XXX (435–450 volts)	26

Source: Adapted from Milgram (1963).

whom we expect continued interaction. How many of your friends at college live close to you on campus? The likely answer is 'many of them' (see Festinger, Schachter & Back, 1950). We also tend to like people who have similar attitudes and values to our own (Byrne, 1971), especially when these attitudes and values are personally important to us.

The importance of social support

social support the feeling of being supported by others, whether in one's broader social network (which impacts positively on health and stress) or within a small group (which helps one to resist pressures to comply with an outside majority or obey an immoral authority)

Generally, having appropriate *social support* is a very powerful 'buffer' against stressful events. Cohen and Hoberman (1983) found that, among individuals who felt that their life was very stressful, those who perceived themselves to have low social support reported many more physical symptoms (e.g. headaches, insomnia) than those who felt they had high social support (see figure 18.6). Overall, the evidence is clear – social integration is good for our physical and psychological health (Stroebe & Stroebe, 1997).

Social exchange theory

social exchange theory a general theoretical model that views relationships in terms of rewards and costs to participants; expected outcomes are based on personal standards, prior experience, partner's outcomes, and the outcomes of comparable others

A general theoretical framework for the study of interpersonal relationships is *social exchange theory* (Thibaut & Kelley, 1959). This approach regards relationships as effectively trading interactions, including goods (e.g. birthday presents), information (e.g. advice), love (affection, warmth), money (things of value), services (e.g. shopping, childcare) and status (e.g. evaluative judgements). A relationship continues when both partners feel that the benefits of remaining in the relationship outweigh the costs and the benefits of other relationships.

According to this framework, these considerations apply to even our most intimate friendships. We now turn to a consideration of these closest relationships in our lives. It is argued that these relationships are also based on complex cost–benefit analyses ('she brings the money in and is practical, but I have a secure pension and do more for the children'). According to the more specific *equity theory*, partners in such relationships are happier if they feel that both partners' outcomes are proportional to their inputs, rather than one partner receiving more than they give (Walster, Walster & Berscheid, 1978).

equity theory assumes that satisfaction in a relationship is highest when the ratio of one's own outcomes to inputs is equal to that of a referenced other (individuals will try to restore equity when they find themselves in an inequitable situation)

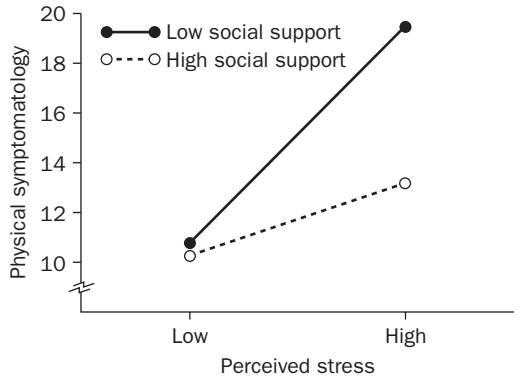

Figure 18.6

The relationship between perceived stress and physical symptomatology for individuals low and high in social support. Source: Hewstone and Stroebe (2001), based on Cohen and Hoberman (1983).

Happy vs. distressed relationships

A major characteristic of happy, close relationships is a high degree of intimacy. According to Reis and Patrick (1996), we view our closest relationships as intimate if we see them as:

- caring (we feel that the other person loves and cares about us);
- understanding (we feel that the other person has an accurate understanding of us); and
- validating (our partner communicates his or her acceptance, acknowledgement and support for our point of view).

Unhappy or 'distressed' relationships, on the other hand, are characterized by higher rates of negative behaviour, reciprocating with such negative behaviour when the partner behaves negatively towards us. Reciprocation, or retaliation, is the most reliable sign of relationship distress (Fincham, 2003). Those in unhappy relationships also tend to ignore or cover up differences (Noller & Fitzpatrick, 1990), compare themselves negatively with other couples (Buunk et al., 1990) and perceive their relationship as less equitable than others (van Yperen & Buunk, 1991). They also make negative causal attributions of their partner's behaviours and characteristics (Fincham & Bradbury, 1991). For example, being given flowers might be explained away with 'He's just trying to deal with his guilt; he'll be the same as usual tomorrow.' In a happy relationship, the explanation is more likely to be something like 'It was nice of him to find time for that; I know how stressed he is at the moment.'

The investment model

Ultimately, what holds a relationship together is commitment – the inclination to maintain a relationship and to feel psychologically

investment model a theory that proposes that commitment to a relationship is based upon high satisfaction, and/or a low quality of alternatives, and/or a high level of investment

attached to it (Rusbult, 1983). According to the *investment model* (Rusbult & Buunk, 1993), commitment is based on one or more of the following factors: high satisfaction, low quality of alternatives, and a high level of investments. Highly committed individuals are more willing to make sacrifices for their relationship, and to continue it even when forced to give up important aspects of their life (Van Lange et al., 1997).

Close relationships do, regrettably, often dissolve, sometimes as a result of extreme levels of violence committed within intimate relationships (Gelles, 1997). The ending of a relationship is often a lengthy, complex process, with repeated episodes of conflict and reconciliation (Cate & Lloyd, 1988). Women tend to terminate intimate relationships more often than do men (Gray & Silver, 1990) and are more distressed by relationship conflict (Surra & Longstreth, 1990).

But for both partners the consequences can be devastating. The physical and mental health of divorced people is generally worse than that of married people, or even people who have been widowed or never married (Stroebe & Stroebe, 1987). Factors that predict better adjustment to divorce include having taken the initiative to divorce, being embedded in social networks, and having another satisfying and intimate relationship (Price-Bonham et al., 1983).

GROUP PROCESSES

TAKING OUR PLACE IN THE GROUP

Almost all groups are structured into specific roles. People move in and out of roles, and in and out of groups. Groups are dynamic in terms of their structure and their membership. But first of all, of course, people need to join groups.

Joining groups

We join groups for all sorts of reasons, but in many cases we are looking for company (e.g. friendships and hobby groups) or to get things done that we cannot do on our own (e.g. therapy groups, work groups and professional organizations). We also tend to identify with large groups (social categories) that we belong to – national or ethnic groups, political parties, religions, and so forth.

Research on group formation generally examines the process, not the reasons. One view is that joining a group is a matter of establishing bonds of attraction to the group, its goals and its members. So a group is a collection of people who are attracted to one another in such a way as to form a cohesive entity (Festinger et al., 1950). This approach has been used extensively to study the cohesiveness of military groups, organizational units and sports teams (Widmeyer, Brawley & Carron, 1985).

Another perspective, based on social comparison theory (Festinger, 1954), is that we affiliate with similar others in order to obtain support and consensus for our own perceptions, opinions and attitudes.

A third approach rests on social identity theory (Hogg & Abrams, 1988; Tajfel & Turner, 1986). According to this framework, group formation involves a process of defining ourselves as group members, and conforming to what we see as the stereotype of our group, as distinct from other groups. We categorize ourselves in terms of our group's defining features (Hogg, 1993) – e.g. 'we are psychology students, we are studying a useful subject'. This process describes and evaluates who we are and is responsible for group phenomena such as group cohesion, conformity to norms, discrimination between different groups, and so forth.

Group development

The process of joining and being influenced by a group doesn't generally happen all at once. It is an ongoing process. The relevant mechanisms have been investigated by many social psychologists interested in group development, or how groups change over time.

One very well established general model of group development is Tuckman's five-stage model (1965; Tuckman & Jensen, 1977):

forming – initially people orient themselves to one another;
storming – they then struggle with one another over leadership and group definition;
norming – this leads into agreement on norms and roles;
performing – the group is now well regulated internally and can perform smoothly and efficiently;
adjourning – this final stage involves issues of independence within the group, and possible group dissolution.

More recently, Levine and Moreland (1994) have provided a detailed account of group socialization – how groups and their members adapt to one another, and how people join groups, maintain their membership and leave groups. According to this account, groups and their members engage in an ongoing cost–benefit analysis of membership (similar to the kinds of analyses that we have already discussed as being relevant in regulating dyadic interpersonal relationships). If the benefits of the group membership outweigh the costs, the group and its members become committed to one another.

This approach highlights five generic roles that people occupy in groups:

prospective member – potential members reconnoitre the group to decide whether to commit;
new member – members learn the norms and practices of the group;
full member – members are fully socialized, and can now negotiate more specific roles within the group;
marginal member – members can drift out of step with group life, but may be re-socialized if they drift back again; and

ex-member – members have left the group, but previous commitment has an enduring effect on the group and on the ex-member.

Levine and Moreland believe that people move through these different roles during the lifetime of the group.

Roles

roles patterns of behaviour that distinguish between different activities within a group, and that help to give the group an efficient structure

Almost all groups are internally structured into *roles*. These prescribe different activities that exist in relation to one another to facilitate overall group functioning. In addition to task-specific roles, there are also general roles that describe each member's place in the life of the group (e.g. newcomer, old-timer). Rites of passage, such as initiation rites, often mark movement between generic roles, which are characterized by varying degrees of mutual commitment between member and group.

Roles can be very real in their consequences. In the famous Stanford Prison Study (Zimbardo et al., 1982), researchers randomly assigned students to play the roles of prisoners or guards in a simulated prison set-up. The 'prison' was located in the basement of the psychology department at Stanford University. Before the study began, all participants were carefully screened to ensure they were psychologically stable. Zimbardo and his team planned to run the study for two weeks, while observing the participants. In fact, they had to terminate it after six days because the participants were conforming so extremely to their roles. The guards harassed, humiliated and intimidated the prisoners, often quite brutally, and the prisoners increasingly showed signs of individual and group disintegration, including severe emotional disturbance and some psychosomatic problems. The importance of this classic study was shown recently by the appalling treatment of Iraqi prisoners recorded inside Abu Ghraib jail in 2003.

Roles also define functions within a group, and the different parts of the group normally need to communicate with one another. Research on communication networks (Bavelas, 1968; Leavitt, 1951) focuses on centralization as the critical factor (see figure 18.7). More centralized networks have a hub person or group that regulates communication flow, whereas less centralized networks allow free communication among all roles. Centralized networks work well for simple tasks (they liberate peripheral members to perform their role) but not for more complex tasks – the hub becomes overwhelmed, delays and mis-communications occur, frustration and stress increase, and peripheral members feel loss of autonomy.

Leadership

The most basic role differentiation within groups is into leaders and followers. Are some people 'born to lead' (think of Lady Margaret Thatcher, Sir Ernest Shackleton or Sir Alex Ferguson), or do they acquire leadership personalities that predispose them to leadership in many situations?

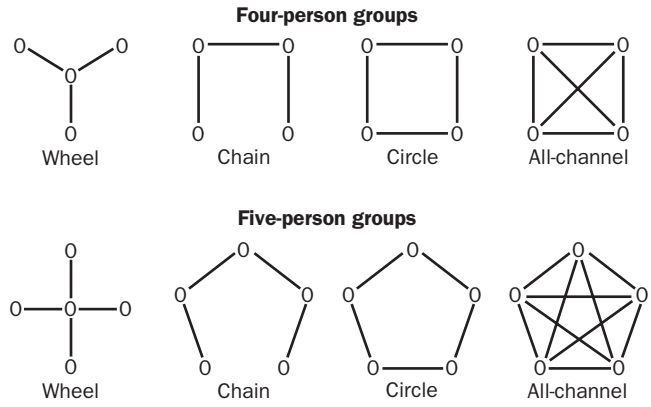

Figure 18.7

Some communication networks that have been studied experimentally. Source: Hewstone and Stroebe (2001), based on Leavitt (1951).

Figure 18.8

Are some people 'born to lead', or do they acquire leadership personalities that predispose them to leadership?

Extensive research has revealed that there are almost no personality traits that are reliably associated with effective leadership in all situations (Yukl, 1998). This finding suggests that many of us can be effective leaders, given the right match between our leadership style and the situation. For example, leader categorization theory (Lord & Maher, 1991) states that we have leadership schemas (concerning what the leader should do and how) for different group tasks, and that we categorize people as effective leaders on the basis of their 'fit' to the task-activated schema. A

social identity theory theory of group membership and intergroup relations which explains much intergroup behaviour in terms of the desire to belong to groups which are valued positively compared to other non-membership groups

contingency theory Fiedler's interactionist theory, specifying that the effectiveness of particular leadership styles depends on situational and task factors

variant of this idea, based on *social identity theory* (see below), is that in some groups what really matters is that you fit the group's defining attributes and norms and that, if you are categorized as a good fit, you will be endorsed as an effective leader (Hogg, 2001).

Perhaps the most enduring leadership theory in social psychology is Fiedler's (1965) *contingency theory*. Fiedler believed that the effectiveness of a particular leadership style was contingent (or dependent) on situational and task demands. He distinguished between two general types of leadership style (people differ in terms of which style they naturally adopt):

- a relationship-oriented style that focuses on the quality of people's relationships and their satisfaction with group life; and
- a task-oriented style that focuses on getting the task done efficiently and well.

Relationship-oriented leaders are relaxed, friendly and sociable, and derive satisfaction from harmonious group relations. Task-oriented leaders are more aloof and directive, are not concerned with whether the group likes them, and derive satisfaction from task accomplishment.

Fiedler measured leadership style using his 'least preferred co-worker' (LPC) scale. The idea is to measure how positively a leader views the co-worker that they hold in lowest esteem. He predicted that relationship-oriented leaders would be much more positive about their least preferred co-worker than task-oriented leaders. So, for relationship-oriented leaders, even the least-liked group member is still quite liked.

Fiedler was also able to classify situations in terms of how much control was required for the group task to be effectively executed. A substantial amount of research has shown that task-oriented leaders are superior to relationship-oriented leaders when situational control is very low (i.e. poorly structured task, disorganized group) or very high (i.e. clearly structured task, highly organized group). But relationship-oriented leaders do better in situations with intermediate levels of control (Strube & Garcia, 1981).

Fiedler's model of leadership is, however, a little static. Other approaches have focused instead on the dynamic transactional relationship between leaders and followers (Hollander, 1985). According to these approaches, people who are disproportionately responsible for helping a group achieve its goals are subsequently rewarded by the group with the trappings of leadership, in order to restore equity. Hollander (1958) suggested that part of the reward for such individuals is their being able to be relatively idiosyncratic and innovative. So, people who are highly conformist and attain leadership in a democratic manner tend to accumulate significant *idiosyncrasy credits* that they can then expend on innovation once they achieve leadership. In other words, you first have to conform before you can innovate. (For a different view to this one, see the section below on 'minority influence'.)

idiosyncrasy credits Hollander's transactional theory proposes that followers reward leaders for achieving group goals by allowing them to be relatively idiosyncratic in their behaviour and opinions

Leaders who have a high idiosyncrasy credit rating are imbued with charisma by the group, and may be able to function as *transformational leaders* (see chapter 20). Charismatic transformational leaders are able to motivate followers to work for collective goals that transcend self-interest and transform organizations (Bass, 1998; Bryman, 1992). They are proactive, change-orientated, innovative, motivating and inspiring and have a vision or mission with which they infuse the group. Transformational leaders are also interested in others, able to create commitment to the group and can extract extra effort from (and generally empower) members of the group.

transformational leader a leader seen by followers as being endowed with exceptional personal qualities, and who works to change or transform followers' needs and redirect their thinking

How groups influence their members

We have seen how the presence of other people can make us less inclined to help someone, and how other people can persuade us to obey their orders. Groups can also exert enormous influence on individuals through the medium of *norms* (Turner, 1991).

norms attitudes and behaviours that group members are expected to show uniformly; these define group membership and differentiate between groups

Group norms

Although group norms are relatively enduring, they do change in line with changing circumstances to prescribe attitudes, feelings and behaviours that are appropriate for group members in a particular context. Norms relating to group loyalty and central aspects of group life are usually more specific, and have a more restricted range of acceptable behaviour than norms relating to more peripheral features of the group. High-status group members also tend to be allowed more deviation from group norms than lower-status members (Sherif & Sherif, 1964).

Sherif (1935, 1936) carried out one of the earliest, and still most convincing, demonstrations of the impact of social norms, deliberately using an ambiguous stimulus. He placed participants alone or in groups of two or three in a completely darkened room. At a distance of about 5 m, a single and small stationary light was presented to them. In the absence of reference points, the light appeared to move rather erratically in all directions – a

autokinetic effect optical illusion in which a stationary point of light shining in complete darkness appears to move about

perceptual illusion known as the *autokinetic effect*.

Sherif asked his participants to call out an estimate of the extent of movement of the light, obviously without informing them of the autokinetic effect. Half of the participants made their first 100 judgements alone. On three subsequent days they went through three more sets of trials, but this time in groups of two or three. For the other half of the participants, the procedure was reversed. They underwent the three group sessions first and ended with a session alone.

Participants who first made their judgements alone developed rather quickly a standard estimate (a personal norm) around which their judgements fluctuated. This personal norm was stable within individuals, but it varied highly between individuals. In the group phases of the experiment, which brought together people with different personal norms, participants' judgements converged towards a more or less common position – a 'group norm'. With the reverse procedure employed with the other half of the participants, this group norm developed in the first session and persisted into the later session, when participants were evaluated alone.

Figure 18.9 illustrates both sets of findings. The funnel effect in the left panel reveals the convergence in the (median) judgements of three participants who first judged alone (session I) then later on in each other's presence (sessions II, III and IV). The right panel shows the judgements of a group of three participants who went through the procedure in the reverse order (i.e. first judged together, then alone). Here the group convergence is already present in the first session, and there is no sign of funnelling out in the final 'alone' session.

In subsequent studies, Sherif found that, once established, this group norm persisted, and that it strongly influenced the estimations of new members of the group.

In another study, Jacobs and Campbell (1961) used a group of confederates who unanimously agreed upon a particular judgement. After every 30 judgements, they replaced a confederate by a naive participant until the whole group was made up of naive participants. Their results indicated that the norm had a significant effect on the naive participants' judgements, even after all the confederates had been removed from the judgement situation.

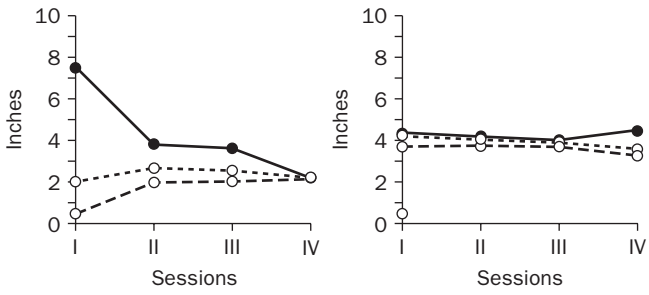

Figure 18.9

Median estimates of movement under solitary (I) or group (II, III, IV) conditions (left), and under group (I, II, III) or solitary (IV) conditions (right) in a research study on norm formation which used the autokinetic phenomenon. Source: Hewstone and Stroebe (2001), based on Sherif (1935).

Pioneer

Muzafer Sherif (1906–78) made ground-breaking contributions to the psychology of attitudes, the study of group norms and intergroup relations. Born in Izmir, Turkey, he took a higher degree at Harvard and spent most of his life as professor at the University of Oklahoma. His research work on the development of group norms (using the autokinetic phenomenon) showed that other group members provide us with a frame of reference – especially, but not only, when stimuli are ambiguous. His Robber's Cave study demonstrated the powerful impact of goals on intergroup relations, and showed that group conflict is easier to induce than reduce. This research contributed to the development of his Realistic Group Conflict Theory.

Conformity

Sherif's autokinetic experiments show how norms develop and influence people – but the actual process through which people conform is less obvious. The participants in Sherif's study were publicly calling out their estimates of a highly ambiguous stimulus. Perhaps they were worried about looking foolish, or were simply uncertain. People may have conformed for one of two reasons, each linked to a distinct form of social influence (Deutsch & Gerard, 1955):

1. They may have been concerned about social evaluation (e.g. being liked or being thought badly of) by the others in the group (*normative influence*).
2. They may have used the other group members' judgements as useful information to guide them in an ambiguous task on which they had no previous experience (*informational influence*).

normative influence social influence based on the need to be accepted and approved of by other group members

informational influence social influence based on acquiring new information from other group members, which is accepted as evidence about reality

A series of experiments by Asch (1951, 1952, 1956) tried to rule out informational influence by using clearly *un*ambiguous stimuli. In his first study, Asch invited students to participate in an experiment on visual discrimination. Their task was simple enough: they would have to decide which of three comparison lines was equal in length to a standard line. On each trial, one

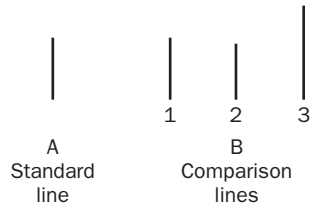

Figure 18.10

An example of the stimuli presented in Asch's (1956) research on conformity. Source: Hewstone and Stroebe (2001).

comparison line was equal in length to the standard line, but the other two were different (see figure 18.10).

The task was apparently very easy: a control group (who made their judgements in isolation) made almost no errors, ruling out the informational influence component of this study. In the experimental condition, participants were seated in a semicircle and requested to give their judgements aloud, in the order in which they were seated, from position 1 to position 7. In fact, there was only one real participant, seated in position 6. All the other 'participants' were in fact confederates of the experimenter who, on each trial, unanimously gave a predetermined answer. On six 'neutral' trials (the first two trials and four other trials distributed over the remaining set), the confederates gave correct answers. On the other 12 'critical' trials, the confederates unanimously agreed on a predetermined, incorrect line. The neutral trials, particularly the first two trials, were added to avoid suspicion on the part of the real participant, and to ensure that the confederates' responses were not attributed to poor eyesight by the participant.

Like Milgram's obedience study, this paradigm had a tangible impact on the real participants. They showed signs of being uncomfortable and upset, gave the experimenter and the other participants nervous looks, sweated nervously and gesticulated in vain.

The results reveal the powerful influence of an obviously incorrect but unanimous majority on the judgements of a lone participant. In comparison with the control condition (which yielded only 0.7 per cent errors), the experimental participants made almost 37 per cent errors. Not every participant made that many errors, but only about 25 per cent of Asch's 123 participants did not make a single error. Presumably, *conformity* was produced through normative social influence operating in the line judgement task.

conformity social influence resulting from exposure to the opinions of a majority of group members and/or to an authority figure – typically superficial and short-lived

Subsequent Asch-type experiments have investigated how majority influence varies over a range of social situations (e.g. Allen, 1975; Wilder, 1977). These studies found that conformity reaches full strength with three to five apparently independent sources of influence. Larger groups of independent sources are not stronger, which perhaps runs counter to our intuitions, and non-independent sources (e.g. several members of the same coalition or subgroup) are seemingly treated as a single source. Conformity is significantly reduced if the majority is not unanimous. Dissenters and deviates of almost any type can produce this effect. For example, Allen and Levine (1971) showed that conformity is even reduced by a deviate who has visibly thick lenses in his glasses, although this 'invalid' supporter had much less impact than a 'valid' supporter with no glasses (see figure 18.11).

Pioneer

Solomon E. Asch (1907–96) was born in Warsaw, Poland, and received his Ph.D. from Columbia University in the United States, where he was influenced by Wertheimer and the Gestalt approach. He taught at Swarthmore College for 19 years, and is best known for his famous experiments on conformity (or 'Group forces in the modification and distortion of judgements'). These studies show that most people succumb to the pressure to conform to majority opinion, even when stimuli are unambiguous. Asch influenced many subsequent social psychologists and their research, including Milgram's classic studies of obedience, and wrote a distinctive and authoritative textbook on *Social Psychology*, first published in 1952 and reprinted in 1987.

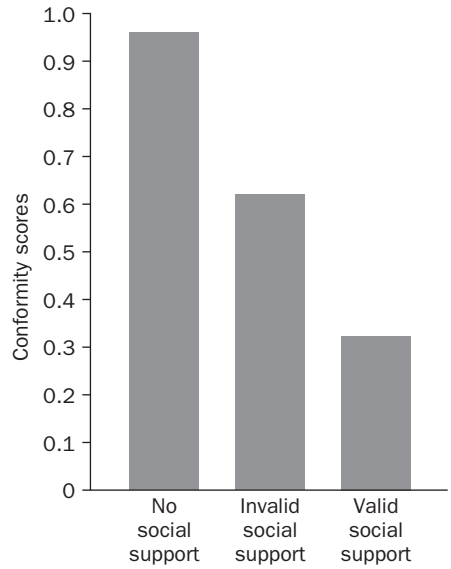

Figure 18.11

Conformity as a function of social support. Source: Hewstone and Stroebe (2001), based on Allen and Levine (1971).

Minority influence

For most of us, conformity means coming into line with majority attitudes and behaviours. But what about minority influence?

Minorities face a social influence challenge. By definition, they have relatively few members; they also tend to enjoy little power,

can be vilified as outsiders, hold 'unorthodox' opinions, and have limited access to mainstream mass communication channels. And yet minorities often prevail, bringing about social change.

Research suggests that minorities must actively create and accentuate conflict to draw attention to themselves and achieve influence (Moscovici, 1976; Mugny, 1982). Members of the majority may be persuaded to move in the direction of the minority, in order to reduce the conflict they provoke. To have an impact, minorities need to present a message that is consistent across group members and through time, but not rigidly presented. Minorities are also more effective if they appear to be acting on principle and making personal sacrifices for their beliefs. These strategies disrupt majority consensus and raise uncertainty, draw attention to the minority as a group that is committed to its perspective, and convey a coherent alternative viewpoint that challenges the dominant majority views. It also helps if the minority can present itself as an ingroup for the majority. For example, you might be opposed to increased tuition fees at university. But a minority of students from your own university (an ingroup minority) could conceivably win you round by arguing that such fees would provide bursaries for less well-off students.

The film *Twelve Angry Men* provides a dramatic fictitious example of how minority influence occurs. Twelve jurors have to decide over the guilt or innocence of a young man charged with the murder of his father. At the outset, all but one of the jurors are convinced of the youth's guilt. The lone juror (played by Henry Fonda) actively attempts to change their minds, standing firm, committed, self-confident and unwavering. One by one the other jurors change sides, until in the end they all agree that the accused is not guilty.

Other examples of minority influence include Bob Geldof's Band Aid movement to raise money for famine relief, and new forms of music and fashion.

Moscovici (1980) proposed a dual-process theory of majority/minority influence. He suggested that people conform to majority views fairly automatically, superficially and without much thought because they are informationally or normatively dependent on the majority. In contrast, effective minorities influence by *conversion*. The deviant message achieves little influence in public, but it is processed systematically to produce influence (e.g. attitude change) that emerges later, in private and indirectly.

conversion a change in covert (private) opinion after exposure to others' opinions (who often represent a minority within the group)

Subsequent research has demonstrated minority influence occurring after the main part of the experiment has finished, i.e. later, revealed by written answers rather than spoken responses, i.e. in private, and on indirectly related issues as opposed to the target issue, e.g. attitude change regarding euthanasia, following direct influence on the topic of abortion (see Wood et al., 1994).

Support for Moscovici's dual-process theory is mixed. Using the framework of cognitive theories of persuasion (see discussion of the 'elaboration likelihood model' in chapter 17), it appears that both minorities and majorities can instigate either superficial or systematic processing of their message, depending on situational factors and constraints. But overall, the weight of evidence is tipped slightly towards Moscovici's claim that minorities instigate deeper processing of their message (see Martin & Hewstone, 2003a, b).

Nemeth (1986, 1995) proposed that minorities induce more divergent thinking (thinking beyond a focal issue), whereas majorities induce more convergent thinking (concentrating narrowly on the focal issue). Evidence supporting this contention reveals that exposure to a consistent, dissenting minority leads to generation of more creative and novel judgements or solutions to problems, use of multiple strategies in problem solving, and better performance on tasks that benefit from divergent thinking (Nemeth & Kwan, 1987). In contrast, convergent thinking induced by majorities tends to lead to mere imitation of the belief or course of action that is proposed by the majority source.

How groups get things done

Most groups exist to get things done, including making decisions and collaborating on group projects. Working in groups has some obvious attractions – more hands are involved, the human resource pool is enlarged, and there are social benefits. Yet group performance is often worse than you might expect.

Potential group gains in effectiveness and creativity seem to be offset by negative characteristics of group performance, including the tendency to let others do the work, sub-optimal decision making, and becoming more extreme as a group than as individual members. As we shall see, some of these drawbacks are due to problems of coordination, and others are due to reduced individual motivation (Steiner, 1972).

Social loafing

Individual motivation can suffer in groups, particularly where the task is relatively meaningless and uninvolving, the group is large and unimportant, and each individual's contribution to the group is not personally identifiable (Williams, Harkins & Latané, 1981). This phenomenon has been termed *social loafing* (Latané, Williams & Harkins, 1979) (see chapter 20).

social loafing a reduction in individual effort when working on a collective task (in which one's outputs are pooled with those of other group members), compared with when one is working alone

Latané and colleagues asked experimental participants (who were blindfolded and wearing headsets that played loud noise) to shout as loudly as they could under three conditions: as a single individual, as a member of a dyad or as a member of a six-person group. In a further twist, this experiment also manipulated whether participants actually did shout either alone or in the presence of one or five other group members ('real groups'), or were merely led to believe that they were cheering with one or five others (while, in fact, they were shouting alone; so-called 'pseudo-groups'). The blindfolds and the headphones made this deception possible.

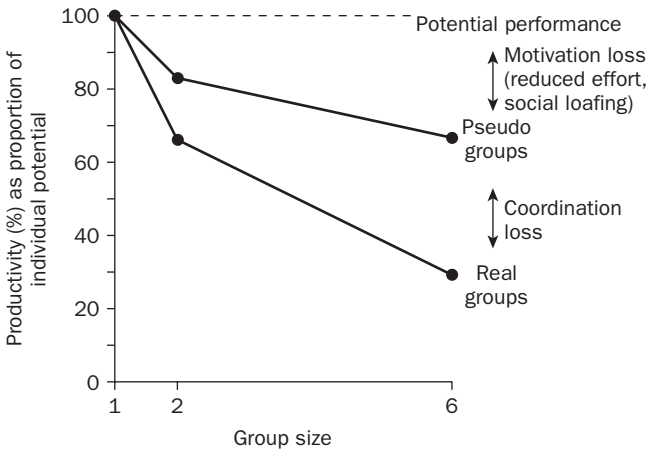

Figure 18.12

Intensity of sound generated *per person* (as proportion of individual potential) when cheering as a single individual, or as a member of *real* or *pseudo* two-person or six-person groups. Source: Hewstone and Stroebe (2001), based on Latané, Williams and Harkins (1979).

Although groups obviously produced more noise in total than single individuals, group productivity failed to reach its full potential, since it was found that individual productivity decreased as group size increased. In figure 18.12, the dashed line along the top represents the potential performance we would expect if there were no losses or gains as individuals were combined into groups. The line marked 'real groups' shows actual group performance.

By creating both real and pseudo groups, Latané et al. were able to estimate how much performance loss was due to coordination and motivation losses (about 50 per cent was in fact due to each). Any productivity loss observed in the pseudo groups could only be attributed to reduced motivation, not faulty coordination, since there were no 'co-workers' engaged in the shouting. In the real groups, however, coordination loss could occur due to the physical phenomenon of 'sound cancellation' – when multiple sources produce sound, some of it is cancelled out by other sound.

Subsequent research using this and similar paradigms has shown that social loafing is minimized when groups work on challenging and involving tasks, and when group members believe that their own inputs can be fully identified and evaluated through comparison with fellow members (Harkins & Jackson, 1985) or with another group (Harkins & Szymanski, 1989). In fact, when people work either on important tasks or in groups which are important to them, they may even work harder collectively than alone – so, in these circumstances, 'social loafing' turns into 'social striving' (Gabrenya, Wang & Latané, 1985; Williams, Karau & Bourgeois, 1993; Zaccaro, 1984).

Group decision making

An important group function is to reach a collective decision, through discussion, from an initial diversity of views. Research

Figure 18.13

We often work harder on group activities, especially when the task is challenging and involving.

on *social decision schemes* identifies a number of implicit or explicit decision-making rules that groups can adopt to transform diversity into a group decision (Stasser, Kerr & Davis, 1989). These include:

social decision schemes explicit or implicit decision rules specifying the processes by which individual inputs are combined into a group decision

unanimity – discussion puts pressure on deviants to conform;
majority wins – discussion confirms the majority position, which becomes the group decision;
truth wins – discussion reveals the position that is demonstrably correct; and
two-thirds majority – discussion establishes a two-thirds majority, which becomes the group decision.

The type of rule that is adopted can affect both the group atmosphere and the decision-making process (Miller, 1989). For

Figure 18.14

A jury rarely changes its overall decision during discussion.

example, unanimity often creates a pleasant atmosphere but can make decision making painfully slow, whereas 'majority wins' can make many group members feel dissatisfied but speeds up decision making.

Juries provide an ideal context for research on decision schemes. Not only are they socially relevant in their own right, but they can be simulated under controlled laboratory conditions. For example, Stasser, Kerr and Bray (1982) found that a two-thirds majority rule prevails in many juries. Furthermore, they discovered that it was possible to predict accurately the outcome of jury deliberations from knowledge of the initial distribution of verdict preferences ('initial' here means before any discussion has taken place). If two thirds or more initially favoured guilt, then that was the final verdict, but if there was initially no two-thirds majority, then the outcome was a hung jury.

Group polarization and 'groupthink'

Popular opinion and research on conformity both suggest that groups are conservative and cautious entities, and that they exclude extremes by a process of averaging. But two phenomena that challenge this view are group polarization and groupthink.

group polarization tendency for group discussion to produce more extreme group decisions (in the same direction as the mean of the group) than would be indicated by the mean of members' pre-discussion opinions

Group polarization is the tendency for groups to make decisions that are more extreme than the average of pre-discussion opinions in the group, in the direction towards the position originally favoured by the average (Lamm & Myers, 1978; Myers, 1982). For example, four students whose averaged individual attitudes are mildly against abortion are likely to form an attitude as a group that is more extremely against abortion. Group polarization therefore makes group decisions more extreme. Furthermore, it can sometimes shift individual members' enduring attitudes towards the more polarized group position.

The explanation for this lies partly in the same processes of informational and normative social influence we discussed earlier (Isenberg, 1986). Group members learn from other group members' arguments, and engage in mutual persuasion, but they are also influenced by where others stand on the issue, even if they do not hear each other's arguments.

This polarization is particularly likely to occur when an important group to which an individual belongs (i.e. an ingroup) confronts a salient group to which she does not belong (i.e. an outgroup) that holds an opposing view. Here, group members seem to conform to what they see as the prototypical view held by other ingroup members (i.e. the view or position that is most similar to that of all the other ingroup members, but most different from that of the outgroup members). It is thought that conformity to the prototypical view helps to differentiate the ingroup from the outgroup (Hogg, Turner & Davidson, 1990).

Finally, mere repetition of arguments, which also tends to occur within groups (especially when the discussion lasts a long time, and all group members wish to express their views) can also produce polarization (Brauer & Judd, 1996).

groupthink a mode of thinking in highly cohesive groups in which the desire to reach unanimous agreement overrides the motivation to adopt appropriate, rational decision-making procedures

Groupthink is a more extreme phenomenon. Janis (1972) argued that highly cohesive groups that are under stress, insulated from external influence, and which lack impartial leadership and norms for proper decision-making procedures, adopt a mode of thinking (groupthink) in which the desire for unanimity overrides all else. The members of such groups apparently feel invulnerable, unanimous and absolutely correct. They also discredit contradictory information, pressurize deviants and stereotype outgroups.

The consequences can be disastrous – particularly if the decision-making group is a government body. A dramatic example attributed to groupthink is the decision of NASA officials to press ahead with the launch of the space shuttle *Challenger* in 1986, despite warnings from engineers (see Esser & Lindoerfer, 1989). The shuttle crashed seconds into its flight (see next Everyday Psychology box).

Brainstorming

brainstorming technique of uninhibited generation of as many ideas as possible in a group (concerning a specific topic) to enhance group creativity

A popular method of harnessing group potential is *brainstorming* – the uninhibited generation of as many ideas as possible, regardless of quality, in an interactive group (e.g. Stroebe & Diehl, 1994). Although it is commonly thought that brainstorming enhances individual creativity, research shows convincingly that this is not the case.

Everyday Psychology

The *Challenger* and *Columbia* space shuttle disasters: consequences of groupthink?

NASA's shuttle programme, initiated in the 1970s, aimed to create reusable spacecraft for transporting cargo and people into space. Previous spacecraft (such as the *Apollo* series) could only be used once and were then discarded. The first space shuttle was launched in 1981. One year later, the second shuttle of the American fleet, *Challenger*, rolled off the assembly line and flew nine successful missions before the disaster of 1986.

Shuttle mission 51L was much like most other shuttle missions, but from the beginning it was plagued by problems, with several postponements (largely related to inclement weather). Then, 73 seconds after lift-off, *Challenger* exploded, killing the entire crew.

The *Challenger* space shuttle disaster is frequently cited as an example of groupthink. It has been suggested that the organizational culture of NASA in the early 1980s discouraged dissenting opinions and encouraged risk taking. As a result, the NASA management may not have thoroughly considered the possible danger of launching the *Challenger* on an unusually cold day.

Seventeen years later, NASA faced a very similar situation. The official report on the 2003 *Columbia* space shuttle disaster, released by the Columbia Accident Investigation Board (CAIB), raised the fact that information about potential shuttle damage caused by *Columbia*'s foam insulation never made it to the management level.

What doomed the Columbia and its crew, said the report, was not an inadequacy of technology or ability, but missed opportunities and a lack of leadership and open-mindedness within NASA management. The 2003 disaster was, according to the report, rooted in a flawed management culture that downplayed risk and suppressed dissent: 'We are convinced that the management practices overseeing the space shuttle program were as much a cause of the accident as the foam that struck the left wing.'

The CAIB listed 15 recommendations that NASA must comply with before the next shuttle takes off. One of the changes is a new table for the Mission Management Team! The table is designed to encourage engineers to speak up when they are concerned about a problem with the shuttle. According to a NASA spokesperson, 'We are trying to encourage people to speak what's on their mind, to bring us options, to bring us dissenting opinions.'

Esser, J.K., & Lindoerfer, J.S., 1989, 'Groupthink and the space shuttle *Challenger* accident: Toward a quantitative case analysis', *Journal of Behavioral Decision Making*, 2, 167–77.

Stroebe and Diehl considered various possible explanations for this finding. They hypothesized that 'process loss' in brainstorming groups is due to an informal coordination rule of such groups which specifies that only one group member may speak at a time. During this time, other group members have to keep silent, and they may be distracted by the content of the group discussion, or forget their own ideas. Stroebe and Diehl termed this phenomenon 'production blocking', because the waiting time before speaking and the distracting influence of others' ideas could potentially block individuals from coming up with their own ideas.

Stroebe and Diehl tested their hypothesis by creating five different conditions. In one condition, participants brainstormed in real interacting four-person groups ('interactive group' condition). Participants in four other conditions were physically separated from one another in different cubicles. Even though participants in these conditions were seated alone, they expressed their ideas via a clip-on microphone so that they could be tape-recorded. In an 'alone, individual, no communication' condition participants brainstormed individually. In the three remaining 'alone' conditions, each cubicle contained an intercom and a display with lights, each light representing one specific group member. These lights functioned like a set of traffic lights. As soon as one member of the four-person group started to speak, a voice-activated sensor switched her light to green in all of the other three cubicles. Meanwhile the other three lights on the display were red. Each individual could only speak when his or her light was green, and all the other lights were red. This technology allowed the researchers to create three different 'alone' conditions. In the 'alone, blocking, communication' condition participants took their turns following the lights, and were able to hear via the earphones what was being said by the other participants. In the 'alone, blocking, no communication' condition participants also had to wait for their turn before expressing their ideas, but could not hear each other's ideas via the intercom. In the 'alone, no blocking, no communication' condition participants were instructed to disregard the lights and the intercom and to express their ideas whenever they wanted to.

To compare the productivity of participants working under these different conditions afterwards, Diehl and Stroebe pooled the ideas expressed by the four individuals who brainstormed

alone and without communication, to make a 'nominal group' product. Since the same idea might be suggested several times by four people working alone, without communication, whereas such repetition would not be allowed in case of free communication, redundant ideas were eliminated from the pooled set of ideas that constituted the 'nominal group' product.

The results of this clever study were clear-cut. Participants generated approximately twice as many ideas when they were allowed to express their ideas as they occurred (i.e. in the two non-blocking conditions) than when they had to wait their turn (i.e. in the three blocking conditions). These results suggest that 'production blocking' is indeed an important factor explaining the inferiority of interactive brainstorming groups. This suggests that it may be more effective to ask group members to develop their ideas separately, and only then have these ideas expressed, discussed and evaluated in a subsequent joint meeting (see Delbecq, van de Ven & Gustafson, 1975).

Of interest, electronic brainstorming (via computers linked on a network) can be very effective, because the lack of face-to-face interaction minimizes production blocking (Valachich, Dennis & Connolly, 1994).

Figure 18.15

In a crowd, individuals will often identify very strongly with the group and adhere very closely to group norms.

INTERGROUP RELATIONS

Through the study of intergroup relations – how people in one group (the 'ingroup') think about and act towards members of another group (the 'outgroup') – social psychologists (e.g. Brewer & Brown, 1998; Hewstone, Rubin & Willis, 2002) seek to understand a range of critical issues, including:

- crowd behaviour;
- cooperation and competition between groups;
- social identity;
- prejudice and discrimination; and
- how to replace social conflict with social harmony.

DEINDIVIDUATION, COLLECTIVE BEHAVIOUR AND THE CROWD

Many researchers have emphasized the tendency of group members to act in unison, like a single entity. Early writers on crowd behaviour (who were not trained social psychologists) tended to view collective behaviour as irrational, aggressive, antisocial and primitive – reflecting the emergence of a 'group mind' in collective/crowd situations (e.g. LeBon 1896/1908). The general model is that people in interactive groups such as crowds are anonymous and distracted, which causes them to lose their sense of individuality and become deindividuated.

deindividuation a psychological state in which rational control and adherence to norms is weakened, leading to greater readiness to respond in an extreme manner and to violate social norms

Deindividuation is thought to prevent people from following the prosocial norms of society that usually govern behaviour, because they are no longer identifiable (and hence no longer feel compelled to conform to social norms). It is argued that people regress to a primitive, selfish and uncivilized behavioural level. Research that has manipulated anonymity by placing people in dark rooms, or having them wear hoods and robes reminiscent of the Ku Klux Klan, has generally found that deindividuation does increase aggression and antisocial behaviour (Zimbardo, 1970). On the other hand, when participants were deindividuated by wearing nursing uniforms, anonymity produced more prosocial behaviour (Johnson & Downing, 1979).

More recent research has discarded the idea that crowds are irrational, and has concentrated instead on understanding how people in crowds develop a shared identity, a shared purpose and shared norms (Turner & Killian, 1972). In crowd situations, people often identify very strongly with the group defined by the crowd, and therefore adhere very closely to the norms of the crowd (Reicher, 2001). Crowds may only appear irrational and fickle from the outside – more often than not, their behaviour seems rational to members of the crowd, who may also identify specific other groups (e.g. the police, ethnic/racial groups) as a legitimate target for aggression.

COOPERATION AND COMPETITION BETWEEN GROUPS

Sherif (1966; Sherif et al., 1961; Sherif, White, & Harvey, 1955) provided a far-reaching and influential perspective on intergroup behaviour. In a series of naturalistic field experiments on conflict and cooperation at boys' camps in the United States in the early 1950s, Sherif and colleagues studied group formation, intergroup competition and conflict reduction.

In the group-formation phase, Sherif divided new arrivals at the camps into two groups and isolated them in separate living

quarters to allow them to develop their own internal structures and norms.

In the intergroup competition phase, Sherif then brought the two groups together for a series of zero-sum competitions (what one group won, the other group lost), such as tug-of-war. The typical finding at this stage was 'ingroup favouritism' – each group judged fellow ingroup members' performance to be superior to that of outgroup members (see figure 18.16).

Of especial note, the competitiveness of the between-group interactions subsequently pervaded all aspects of intergroup behaviour, becoming so extreme and conflictual (e.g. involving negative stereotyping of, and aggression towards, the outgroup) that most of Sherif's studies had to be concluded at this stage. In a replication conducted in the Lebanon, the study had to be stopped because members of one group came out with knives to attack the other group (Diab, 1970).

Having found it so easy to trigger intergroup hostility, in the conflict reduction phase Sherif discovered how hard it was to reduce conflict. The most effective strategy was to introduce a series of *superordinate goals*, i.e. goals that both groups desired but could only attain if they acted together. For example, when the camp truck broke down delivering supplies, neither group could push-start it on their own; but both groups working together managed to move the truck by pulling on a rope attached to the front bumper. As figure 18.17 shows, negative stereotypes of the outgroup which resulted after a period of intergroup competition were considerably less negative after the manipulation of superordinate goals.

superordinate goals a goal desired by two or more groups, but which can only be achieved by the groups acting together, not by any single group acting on its own

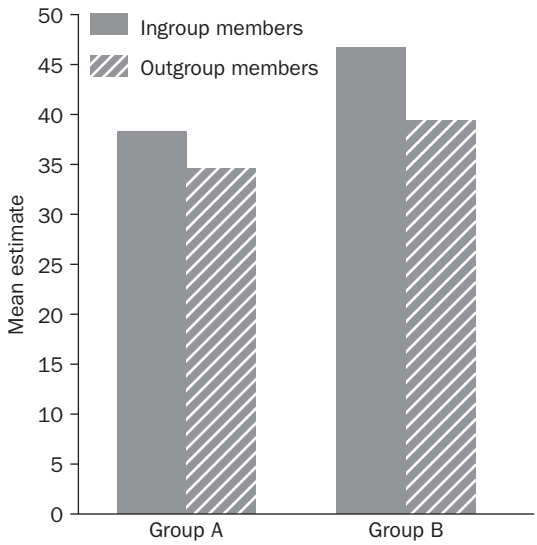

Figure 18.16

Ingroup favouritism in estimates of performance by other ingroup and outgroup members during intergroup competition. Source: Hewstone and Stroebe (2001), from Sherif et al. (1961).

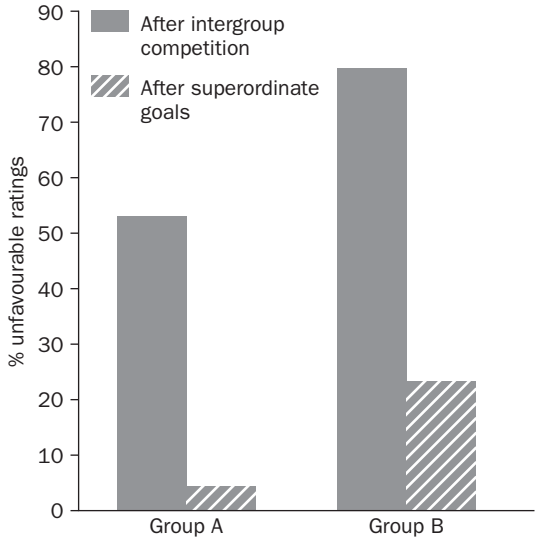

Figure 18.17

Impact of competition vs. superordinate goals on negative stereotypes of the outgroup. Source: Hewstone and Stroebe (2001), from Sherif et al. (1961).

To explain his findings, Sherif focused on the importance of goals. Mutually exclusive goals cause competitive intergroup behaviour, and superordinate goals improve intergroup relations. As he pointed to the real nature of goal relations determinining intergroup behaviour, Sherif's theory is often called *realistic conflict theory*.

realistic conflict theory Sherif's theory of intergroup conflict, which proposes that goal relations (e.g. competition vs. cooperation) determine the nature of intergroup relations (e.g. conflict vs. harmony)

But Sherif's studies also found that first expressions of ingroup favouritism occurred in the group formation phase, when the groups were isolated from one another and knew only of each other's existence. So the mere existence of two groups seemed to trigger intergroup behaviour, before any mutually exclusive goals had been introduced.

Social categories and social identity

Experiments by Tajfel and colleagues provided the most convincing evidence that competitive goals are not a necessary condition for intergroup conflict. In fact, merely being categorized as a group member can cause negative intergroup behaviour (Tajfel, Flament, Billig & Bundy, 1971). In Tajfel's studies, participants were randomly divided into two groups and asked to distribute points or money between anonymous members of their own group and anonymous members of the other group. There was no personal interaction, group members were anonymous, and the groups had no 'past' and no 'future' – for these reasons these groups are called 'minimal groups', and this experimental

minimal group paradigm an experimental procedure designed to investigate the isolated effect of social categorization on intergroup behaviour

procedure is called the *minimal group paradigm*.

The consistent finding of this research is that the mere fact of being categorized is enough to cause people to discriminate in favour of the ingroup and against the outgroup.

This research spawned the 'social identity perspective' on group processes and intergroup relations (Tajfel & Turner, 1986; see also Hogg & Abrams, 1988). According to this perspective, the groups that we belong to define who we are. Part of our identity and how we feel about ourselves is derived from the groups we belong to, and how we evaluate them. When we categorize ourselves and others in groups, we stereotype ourselves and outgroup members in terms of our respective group memberships, and our own group identity helps to determine our attitudes, feelings and behaviours. This process produces a sense of group identification and belonging, as well as ingroup solidarity, conformity and bias.

According to this social identity perspective, because groups define and evaluate who we are, intergroup relations are a continual struggle to gain superiority for the ingroup over the outgroup. How the struggle is conducted – and the specific nature of intergroup behaviour (e.g. competitive, conflictual, destructively aggressive) – is thought to depend on people's beliefs about the status relations between groups. Are status relations between groups stable or unstable, legitimate or illegitimate? And is it possible to pass from one group to another (see Tajfel, 1978)?

Prejudice and discrimination

Some of the most negative forms of intergroup behaviour are demonstrations of prejudice and discrimination. Prejudice refers to a derogatory attitude towards a group and its members, whereas discrimination refers to negative behaviour. The two are often closely interconnected.

Pioneer

Henri Tajfel (1919–82) was born in Wloclawek, Poland. He escaped from the Nazis to join the French army and owed his life to being captured in this uniform – it meant that he was treated as a (French) prisoner of war, rather than being sent to the death camps as a Polish Jew. This experience taught him the impact of social categorization. He came to the UK and studied at Birkbeck College, then taught at Oxford University before becoming the first Professor of Social Psychology at the University of Bristol. It was here that the first minimal group experiments were carried out, which showed that mere social categorization could affect intergroup behaviour. These studies stimulated the development of social identity theory, the most significant influence of European social psychology on the discipline as a whole.

Prejudiced personalities

Some theories of prejudice focus on personality, arguing that there are certain personality types that predispose people to intolerance and prejudice. The best known of these theories concerns the *authoritarian personality* (Adorno, Frenkel-Brunswik, Levinson & Sanford, 1950). According to this view, harsh family rearing strategies produce a love–hate conflict in children's feelings towards their parents. The conflict is resolved by idolizing all power figures, despising weaker others and striving for a rigidly unchanging and hierarchical world order. People with this personality syndrome are predisposed to be prejudiced.

authoritarian personality a particular type of personality (originating in childhood and oversubmissive to authority figures) that predisposes individuals to be prejudiced

This 'personality' approach has now been largely discredited, partly because it underestimates the importance of current situations in shaping people's attitudes, and partly because it cannot explain sudden rises or falls in prejudice against specific racial groups (Brown, 1995). On the other hand, a fairly small number of people do hold generalized negative attitudes towards all outgroups (e.g. the stereotypical bigot who dislikes blacks, Asians, gays and communists), and authoritarianism is indeed associated with various forms of prejudice (Altemeyer, 1988).

Society and identity

Contrary to personality explanations, by far the best predictor of prejudice is the existence of a culture of prejudice legitimized by societal norms. For example, Pettigrew (1958) measured authoritarianism and racist attitudes among whites in South Africa, the northern United States and the southern United States. He found more racist attitudes in South Africa and the southern United States than in the northern United States, but he found no differences in authoritarianism between these two groups.

How do such prejudiced 'cultures' arise? Both social identity theory (e.g. Tajfel & Turner, 1986) and social dominance theory (Pratto, 1999; Sidanius & Pratto, 1999) may provide part of the answer.

According to social identity theory, group members strive to promote a favourable identity for their group. They do this by maximizing their group's real status advantage over other groups, and by developing belief systems that justify and legitimize their superiority. Group members achieve or maintain a positive social identity by differentiating their group from outgroups.

From the perspective of social dominance theory, people also differ in their social dominance orientation (SDO) – the extent to which they desire their own group to be dominant and superior to outgroups. According to this framework, people who have a high SDO are likely to be more prejudiced (Pratto, 1999).

Modern forms of prejudice

Prejudiced attitudes are often deeply entrenched, may be passed from parents to children and are supported by the views of

significant others. Yet societal norms for acceptable behaviour can and do change, sometimes creating a conflict between personal feelings and how they can be expressed.

For example, modern liberal norms and legislation in the United States stand against prejudice, and yet centuries of history have entrenched racist attitudes in US society. Researchers suggest that, rather than abolishing prejudice, this dynamic transforms overt 'redneck' prejudice into more 'modern' forms (Gaertner & Dovidio, 1986; McConahay, 1986). Modern prejudice often presents itself as denial of the claim that minorities are disadvantaged, opposition to special measures to rectify disadvantage, and systematic avoidance of minorities and the entire question of prejudice against these minorities.

New, more subtle measures are required to detect these modern forms of prejudice (Pettigrew & Meertens, 1995). For example, increasing use is being made of implicit measures (see chapter 17), which are beyond the intentional control of the individual, and so can detect prejudice even when people are aware of societal norms regarding tolerance or political correctness (see Cunningham, Preacher & Banaji, 2001). Research using the 'Implicit Association Test' (Greenwald, McGhee & Schwartz, 1998) has shown that white Americans have relatively strong automatic negative associations with African Americans, but positive associations with whites (they respond faster to pairings of white faces with 'good' words and black faces with 'bad' words, than to pairings of white faces wth 'bad' words and black faces with 'good' words).

Building social harmony

Prejudice and conflict are significant social ills that produce enormous human suffering, ranging from damaged self-esteem, reduced opportunities, stigma and socio-economic disadvantage, all the way to intergroup violence, war and genocide (Crocker, Major & Steele, 1998; Hewstone & Cairns, 2001).

Prejudice can be attacked by public service propaganda and educational campaigns, which convey societal disapproval of prejudice and may overcome some of the anxiety and fear that fuel it. But the problem with these strategies is that the very people being targeted may choose not to attend to the new information. Two prominent social-psychological approaches to building social harmony avoid this problem by promoting increased positive intergroup contact and changing the nature of social categorization (Hewstone, 1996).

Intergroup contact

contact hypothesis the idea that contact between members of different groups, under specified conditions, reduces prejudice and hostility

There is now extensive evidence for the *contact hypothesis*, which states that contact between members of different groups, under appropriate conditions, can improve intergroup relations (G.W. Allport, 1954; see Pettigrew, 1998, for a recent review). Favourable conditions include cooperative contact between equal-status members of the two groups in a situation that allows them to get to know each other on more than a superficial basis, and with the support of relevant social groups and authorities.

Contact appears to work best by reducing 'intergroup anxiety' about meeting members of the other group (Voci & Hewstone, 2003) and by promoting positive intergroup orientations, such as empathy and perspective taking (Batson et al., 1997).

One difficulty is that, even if they do come to view some individuals from the other group more positively, participants in such studies do not necessarily generalize their positive perceptions beyond the specific contact situation or contact partners with whom they have engaged, to the group as a whole (Hewstone & Brown, 1986).

Recent work supports the idea that clear group affiliations should be maintained in contact situations, and that participating members should be seen as being (at least to some extent) typical of their groups (Brown & Hewstone, in press). Only under these circumstances does it appear that cooperative contact is likely to lead to more positive ratings of the outgroup as a whole.

A further limitation is that optimal intergroup contact may be hard to bring about on a large scale. Wright and colleagues therefore proposed an 'extended contact effect', in which knowledge that a fellow ingroup member has a close relationship with an outgroup member is used as a catalyst to promote more positive intergroup attitudes (Wright, Aron, McLaughlin-Volpe & Ropp, 1997). This extended contact is therefore second-hand, rather than involving the participants in direct intergroup contact themselves, and so could potentially bring about widespread reductions in prejudice without everyone having to develop outgroup friendships (which anyway may be impracticable, depending on the nature of the groups).

Paolini, Hewstone, Cairns and Voci (2004) have recently shown that, by reducing intergroup anxiety, both direct and extended forms of contact contribute towards more positive views of the outgroup among Catholics and Protestants in Northern Ireland.

Decategorization and recategorization

Prejudice depends on ingroup–outgroup categorizations. So if the categorization disappears, then so should the prejudice. Is this the case, and are these kinds of interventions practical?

There are various ways in which dissolution of categories might occur, two of the most prominent being:

1. decategorization, where people from different groups come to view each other as individuals (Brewer & Miller, 1984); and
2. recategorization, where people from different subgroups, such as Scots and English, come to view each other as members of a single superordinate group, such as British (see Gaertner, Dovidio, Anastasio, Bachman & Rust, 1993).

Decategorization can be difficult to achieve when groups are very obviously different (e.g. Muslim girls and women who wear headscarves, compared with non-Muslims who typically do not), and where feelings run high it can be almost impossible to

Research close-up 2

Changing prejudice through intergroup contact

The research issue

In the first of three experiments on intergroup contact, Wilder considered what form of contact is required to improve attitudes towards, and stereotypes about, an outgroup.

Wilder highlighted a problem with stereotyping. When an outgroup member behaves in a negative way during intergroup contact, the effect is simply to reinforce existing negative expectations about the outgroup as a whole. And yet when an outgroup member behaves in such a way as to disconfirm the stereotype, people holding the stereotyped view often react, not by changing their view of the outgroup as a whole, but by considering the positive outgroup member as 'the exception to the rule'.

In order to overcome this tendency, Wilder suggested that intergroup contact should involve members of the outgroup who are clearly perceived to be 'typical' of that group. Only then will positive contact with those few members 'generalize' to a new, more positive view of the outgroup as a whole.

Design and procedure

Participants were 62 female students from two rival colleges. A quasi-experimental design capitalized on one pre-existing factor and manipulated the two remaining factors between subjects:

- college identity of the outgroup member (Douglass College/Rutgers College);
- behaviour of the outgroup member ('positive'/'negative'); and
- typicality of the outgroup member ('typical'/'atypical').

Participants were randomly assigned to one level of each of the latter two independent variables. Participants always experienced contact with a single member of the outgroup (in fact, a conferate of the experimenter). Data were later collapsed across college affiliation since this factor was shown to be non-significant in the data analysis. There was also a control condition, which involved neither contact nor presence of an outgroup member. Each experimental pair (one naïve participant and the confederate) met briefly as students from the two rival colleges. During this phase information was exchanged, and the confederate presented herself as either typical or atypical of the outgroup by means of her dress and what she said. They then completed a set of problem-solving tasks in separate booths and compared their responses by exchanging answer sheets between the booths. The confederate's answers and comments on this task were used to manipulate the second factor, pleasant vs unpleasant contact.

Results and implications

Before analysing the main data, Wilder verified that he had successfully manipulated both typicality and pleasantness of contact. Wilder analysed two main measures. The first were evaluations of the outgroup college (attitudes) – e.g. the rated quality of education at each college (from poor to excellent). The second were beliefs about characteristics of the outgroup (stereotypes) – e.g. ratings of the other college's students as conservative–liberal and studious–frivolous.

There was evidence that evaluation of the outgroup was most positive in the 'typical' member/'pleasant' contact condition. This rating was significantly different from the control condition (see figure 18.18). There was, however, almost no evidence that the contact manipulations affected participants' stereotypes. So it seems that beliefs about the outgroup are harder to change than evaluations of the outgroup.

Wilder's results gave broad support to his main hypotheses, and were crucial in highlighting the importance of typicality in intergroup contact. But a limitation of the main study is that there was no actual contact between group members: instead, they simply passed information on answer sheets between their separate booths. In this way, interpersonal interaction was carefully controlled in the study, but perhaps participants never felt they had really 'seen' enough of the other group member to warrant changing their stereotypes.

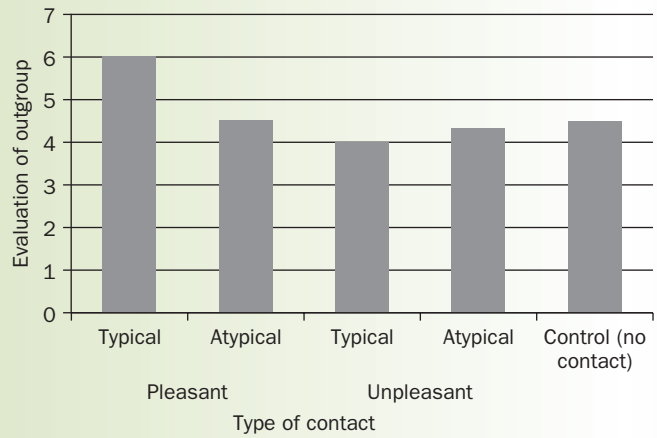

Figure 18.18

Generalization of pleasant vs. unpleasant contact with a typical outgroup member. Source: Wilder (1984).

Wilder, D.A., 1984, 'Intergroup contact: The typical member and the exception to the rule', *Journal of Experimental Social Psychology*, 20, 177–94.

prevent intergroup categorizations from coming to the fore. Recategorization may be more attainable, but it can still be difficult to get people from opposing groups with a history of antipathy and conflict to regard themselves as members of one superordinate group. (This is part of the problem in Northern Ireland, for example.) Recategorization can also pose a threat to social identity at the subgroup level, because people do not want to abandon their cherished subgroup identities for more general (and less distinctive) superordinate identities.

A more successful strategy may be a combination of a superordinate identity and distinctive subgroup identities, so that each group preserves its distinctive subgroup identity within a common, superordinate identity (Hornsey & Hogg, 2000). A nice example is the Barbarians invitation rugby team, which regularly plays matches against visiting international teams to the UK. They all wear the same famous blue-and-white hooped shirts, but they each wear the socks of their club team. So subgroup (club) identities are effectively viewed as complementary and valued roles within a larger, superordinate identity – the Barbarians.

At the societal level this notion relates to the social policy of multiculturalism or cultural pluralism, in which group differences are recognized and nurtured within a common superordinate identity that stresses cooperative interdependence and diversity. This notion has been especially cultivated in some societies and countries, especially 'immigrant countries' such as Australia, New Zealand and Canada.

FINAL THOUGHTS

Clearly, our behaviour is influenced in complex ways by other people and the groups to which they belong. Sometimes the presence of other people can improve our performance and judgement, but sometimes their presence worsens it. Sometimes other people can encourage us to intervene and help others; sometimes they inhibit us. The outcome depends on a complex weighing up of 'costs' and 'benefits' of intervening vs. not intervening. And sometimes they can make us behave in ways of which we would never have thought ourselves capable.

The social support of others can, then, be a source of physical and psychological strength. It can help us to resist pressures to conform to group norms, or give us the moral courage to disobey orders from an authority figure. But the social categorization that is a common consequence of group membership can also be a source of prejudice and conflict. The role of psychological research can here serve a very important professional and public role: by understanding the underlying processes, social psychology can contribute towards greater societal harmony by reducing prejudice and conflict.

Summary

- There is a wide range of evidence regarding the effects of other people on social behaviour.
- We have highlighted some of the key theories in interpersonal relations, group processes and intergroup relations, and we have summarized the methods and findings of some of the most important studies.
- Generally, performing a task in the presence of other people improves performance on easy tasks, but impairs performance on difficult tasks.
- People are more likely to help if they are on their own, or with friends. The presence of multiple bystanders inhibits intervention because responsibility is diffused and the costs of not helping are reduced.
- People are especially likely to obey orders from a legitimate authority figure, and when others are obedient.
- We are motivated to seek the company of others to compare ourselves with them, reduce anxiety and acquire new information from them. Social support from others provides a 'buffer' against stress.
- Close interpersonal relationships can be analysed in terms of social exchange of goods, love, information and so on. Happy close relationships are characterized by high intimacy, whereas distressed relationships tend to involve reciprocation of negative behaviour.
- We join social groups for multiple reasons, and frequently define ourselves, in part, as group members. This social identity develops over a series of stages, in which we are socialized into groups.
- Groups are typically structured into roles, of which the distinction between leader and followers is central. Group influence is affected by norms, and both majorities and minorities within groups can exert influence, albeit in different ways.
- Performance of groups is often worse than performance of individuals, because potential gains in effectiveness are offset by social loafing and poor decision making. Decisions made in groups tend to be more extreme than individual decisions, sometimes with disastrous consequences. Individuals are also less creative in groups, because their ideas are blocked by those of other group members.

- In larger groups we may find ourselves influenced by other members of a crowd, due to shared norms and a shared identity, but crowds are not necessarily irrational.
- Behaviour between members of different groups may be competitive, especially where goals are incompatible, but ingroup favouritism can be triggered by the mere existence of two groups, and the development of social identity as a group member.
- Excesses of intergroup behaviour are revealed in prejudice and discrimination, which sometimes take subtle forms in contemporary society. Prejudice and discrimination may be partly determined by personality, but have more to do with group norms, and the desire to achieve or maintain a positive social identity and dominate other groups.
- Social psychology contributes positively to society by promoting social harmony. Positive, cooperative contact between members of different groups reduces anxiety and can generalize beyond the contact situation, while ingroup–outgroup categorizations can be altered in various ways to decrease the importance of group memberships, promote shared identities, and recognize group differences in a positive way.

REVISION QUESTIONS

1. Why does the presence of other people tend to improve performance on easy, well-learned tasks, but worsen it on difficult, poorly learned tasks?
2. What processes explain bystander apathy in the presence of other people?
3. What are some of the main types of coordination losses and motivation losses in group performance, and how could they be overcome?
4. Discuss the role of norms within groups, and explain how they develop and change.
5. Are competitive goals necessary or sufficient conditions for creating intergroup conflict?
6. What kinds of intergroup contact can promote prejudice reduction, and how?

Further Reading

Baron, R.S., & Kerr, N.L. (2002). *Group Process, Group Decision, Group Action*. 2nd edn. Buckingham: Open University Press.
An excellent review of key theories and studies in the area of group performance and decision making.

Bierhoff, H-W. (2002). *Prosocial Behaviour*. Hove: Psychology Press.
Includes detailed coverage of the main theories of, and processes underlying, prosocial behaviour and their applications.

Brewer, M.B. (2003). *Intergroup Relations*. 2nd edn. Buckingham: Open University Press.
A clear account of phenomena relating to intergroup conflict and its resolution.

Brown, R.J. (1995). *Prejudice: Its Social Psychology*. Oxford: Blackwell.
Thorough and readable overview of the foundations of prejudice and how to reduce it.

Fletcher, G. (2002). *The New Science of Intimate Relationships*. Oxford: Blackwell.
An authoritative survey including major theories of relationships and the processes involved in the development of intimate relationships.

Turner, J.C. (1991). *Social Influence*. Buckingham: Open University Press.
An integrative account of majority/minority influence and group polarization from the perspective of self-categorization theory.

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Health Psychology 19

CHAPTER OUTLINE

Learning Objectives

By the end of this chapter you should appreciate that:

- health psychologists study the role of psychology in health and wellbeing;
- they examine health beliefs as possible predictors of health-related behaviours;
- health psychology also examines beliefs about illness and how people conceptualize their illness;
- a health professional's beliefs about the symptoms, the illness or the patient can have important implications;
- stress is the product of the interaction between the person and their environment – it can influence illness and the stress–illness link is influenced by coping and social support;
- beliefs and behaviours can influence whether a person becomes ill in the first place, whether they seek help and how they adjust to their illness.

INTRODUCTION

Health psychology is a relatively recent yet fast-growing sub-discipline of psychology. It is best understood by answering the following questions:

- What causes illness and who is responsible for it?
- How should illness be treated and who is responsible for treatment?
- What is the relationship between health and illness, and between the mind and body?
- What is the role of psychology in health and illness?

Human beings are complex systems and illness can be caused by a multitude of factors, not just a single factor such as a virus or bacterium. Health psychology attempts to move away from a simple linear model of health and looks at the combination of factors involved in illness – biological (e.g. a virus), psychological (e.g. behaviours, beliefs) and social (e.g. employment). This reflects the *biopsychosocial* model of health and illness that was developed by Engel (1977, 1980). Because, in this model, illness is regarded as the result of a combination of factors, the individual is no longer simply seen as a passive victim of some external force, such as a virus. Acknowledging the role of behaviours such as smoking, diet and alcohol, for example, means that the individual may be held responsible for their health and illness.

biopsychosocial the type of interaction between biological factors (e.g. a virus), psychological factors (e.g. beliefs) and social factors (e.g. class)

According to health psychology, the whole person should be treated, not just the physical changes that occur due to ill health. This can include behaviour change, encouraging changes in beliefs and coping strategies, and compliance with medical recommendations. Because the whole person is treated, the patient becomes

partly responsible for their treatment. For example, she may have a responsibility to take medication, and to change beliefs and behaviour. No longer is the patient seen as a victim.

From this perspective, health and illness exist on a continuum. Rather than being either healthy or ill, individuals progress along a continuum from healthiness to illness and back again. Health psychology also maintains that the mind and body interact. It sees psychological factors as not only possible consequences of illness (after all, being ill can be depressing), but as contributing to all the stages of health, from full healthiness to illness.

The aims of health psychology can be divided into two main aspects:

1. Understanding, explaining, developing and testing theory (for example: what is the role of behaviour in the etiology of illness? can we predict unhealthy behaviour by studying beliefs?).
2. Putting theory into practice (for example: if we understand the role of behaviour in illness, can unhealthy behaviours be targeted for intervention? if we change beliefs and behaviour, can we prevent illness onset?)

Health psychologists study the role of psychology in all areas of health and illness, including:

1. what people think about health and illness;
2. the role of beliefs and behaviours in becoming ill;
3. the experience of being ill in terms of adaption to illness;
4. contact with health professionals;
5. coping with illness;
6. compliance with a range of interventions; and
7. the role of psychology in recovery from illness, quality of life and longevity.

This chapter will provide an overview of health beliefs and behaviours, individuals' illness beliefs, the role of health professionals' beliefs, stress and chronic illness.

HEALTH BELIEFS AND BEHAVIOURS

health behaviours examples are exercise, food intake and going to the doctor

Over the last century *health behaviours* have played an increasingly important role in health and illness. This relationship has been highlighted by McKeown's book, *The Role of Medicine* (1979), which discusses the decline of infectious diseases in the nineteenth century, which forms the focus for medical sociology. It also highlights the increasing role of behaviour in illness in the twentieth century. The latter represents the focus for health psychology. The commonly held view is that the decline in illnesses such as TB, measles, smallpox and whooping cough was related to the development of medical interventions such as chemotherapy and vaccinations. For example, antibiotics are seen as responsible for the decline in illnesses such as pneumonia and TB. But McKeown showed that the decline in infectious diseases had already begun, before the development of medical interventions. He claimed that, looking back over the past three centuries, this decline is best understood in terms of social and environmental factors.

McKeown also examined health and illness throughout the twentieth century. He argued that contemporary illness is caused by an individual's own behaviours, such as whether they smoke, what they eat and how much exercise they take, and he suggested that good health was dependent on tackling these habits. McKeown's emphasis on behaviour is supported by evidence of the relationship between behaviour and mortality.

Behaviour and mortality

It has been suggested that 50 per cent of mortality from the ten leading causes of death is due to behaviour. If this is correct, then behaviour and lifestyle have a potentially major effect on longevity. For example, Doll and Peto (1981) estimated that tobacco consumption accounts for 30 per cent of all cancer deaths, alcohol 3 per cent, diet 35 per cent, and reproductive and sexual behaviour 7 per cent. Approximately 75 per cent of all deaths due to cancer are related to behaviour. More specifically, lung cancer (the most common form) accounts for 36 per cent of all cancer deaths in men and 15 per cent in women in the UK. It has been calculated that 90 per cent of all lung cancer mortality is attributable to cigarette smoking, which is also linked to other illnesses such as cancers of the bladder, pancreas, mouth, larynx and oesophagus, and to coronary heart disease. And bowel cancer, which accounts for 11 per cent of all cancer deaths in men and 14 per cent in women, appears to be linked to diets high in total fat, high in meat and low in fibre.

As health behaviours seem to be important in predicting mortality and longevity, health psychologists have attempted to increase our understanding of health-related behaviours. In particular, based on the premise that people behave in line with the

Figure 19.1

Behaviour can have a major effect on longevity: for example, around 90 per cent of deaths from lung cancer are attributable to cigarette smoking.

health beliefs examples are perceptions of risk or beliefs about the severity of an illness

way they think, health psychologists have turned to the study of *health beliefs* as potential predictors of behaviour.

THE ROLE OF HEALTH BELIEFS

Attribution theory

The origins of attribution theory lie in the work of Heider (1944, 1958), who argued that individuals are motivated to understand the causes of events as a means to make the world seem more predictable and controllable (see chapter 17).

Attribution theory has been applied to the study of health and health behaviour. For example, Bradley (1985) examined patients' attributions of responsibility for their diabetes and found that perceived control over their illness (is the diabetes controllable by me or a powerful other?) influenced their choice of treatment. Patients could either choose an insulin pump (a small mechanical device attached to the skin that provides a continuous flow of insulin), intense conventional treatment or a continuation of daily injections. The results indicated that the patients who chose an insulin pump showed decreased control over their diabetes and increased control attributed to doctors. In other words, an individual who attributed their illness externally and felt that they personally were not responsible for it was more likely to choose the insulin pump and to hand over responsibility to doctors.

A further study by King (1982) examined the relationship between attributions for an illness and attendance at a screening clinic for hypertension. The results demonstrated that if the hypertension was seen as external but controllable, the individual was more likely to attend the screening clinic ('I am not responsible for my hypertension but I can control it').

Health locus of control

health locus of control where the cause of health is seen to be located – either internal ('due to me') or external ('due to others')

The issue of controllability emphasized in attribution theory has been specifically applied to health in terms of the *health locus of control*. Individuals differ in their tendency to regard events as controllable by them (an internal locus of control) or uncontrollable by them (an external locus of control).

Wallston and Wallston (1982) developed a measure to evaluate whether an individual regards their health as:

- controllable by them (e.g. 'I am directly responsible for my health');
- not controllable by them and in the hands of fate (e.g. 'Whether I am well or not is a matter of luck'); or
- under the control of powerful others (e.g. 'I can only do what my doctor tells me to do').

It has been suggested that health locus of control relates to whether we change our behaviour (by giving up smoking or changing our diet, for instance), and also to our *adherence* to recommendations by a health professional. For example, if a doctor encourages someone who generally has an external locus of control to change his or her lifestyle, that person is unlikely to comply if she does not deem herself to be responsible for her health.

adherence (or **compliance**) the extent to which a patient does as suggested (e.g. taking medicine or changing behaviour)

However, although some studies support the link between health locus of control and behaviour (e.g. Rosen & Shipley, 1983), several other studies either show no relationship or indicate the reverse of what is expected (e.g. Norman, 1990; 1995).

Unrealistic optimism

Weinstein (1983, 1984) suggested that one of the reasons we continue to practice unhealthy behaviours is our inaccurate perceptions of risk and susceptibility. He gave participants a list of health problems to examine and then asked: 'Compared to other people of your age and sex, are your chances of getting [the problem] greater than, about the same as, or less than theirs?' Most participants believed that they were less likely to experience the health problem. Clearly, this would not be true of everyone, so Weinstein called this phenomenon unrealistic optimism.

Weinstein (1987) described four cognitive factors that contribute to unrealistic optimism:

1. lack of personal experience with the problem;
2. the belief that the problem is preventable by individual action;
3. the belief that if the problem has not yet appeared, it will not appear in the future; and
4. the belief that the problem is infrequent.

Research close-up 1

Stages of smoking cessation

The research issue

Traditionally, addictive behaviours have been viewed as 'either/or' behaviours. Therefore, smokers were considered either 'smokers' or 'non-smokers'. But DiClemente and Prochaska (1982) developed a trans-theoretical model to examine the stages of change in addictive behaviours. This model is now widely used in health psychology to both predict and understand behaviour, and it is central to many interventions designed to change behaviour. In particular, individuals are assessed at the beginning of any intervention to identify which stage they are at. The content of the intervention can then be tailored to match the needs of each person.

The stages of change model describes the following stages:

1. precontemplation (not seriously considering quitting in the next six months)
2. contemplation (considering quitting in the next six months)
3. action (making behavioural changes)
4. maintenance (maintaining these changes)
5. relapse (return to old behaviour)

The model is described as dynamic, not linear, with individuals moving backwards and forwards across the stages.

For the present study, the authors sub-categorized those in the contemplation stage (stage 2) as either contemplators (i.e. not considering quitting in the next 30 days) or in the preparation stage (i.e. planning to quit in the next 30 days).

Design and procedure

The authors recruited 1466 participants for a minimum intervention smoking cessation programme from Texas and Rhode Island. The majority were white, female, started smoking at about 16 years of age, and smoked on average 29 cigarettes a day. The participants completed the following set of measures at baseline and were followed up at one month and at six months. The participants were classified into three groups according to their stage of change: precontemplators, contemplators and those in the preparation stage.

1. Smoking abstinence self efficacy (DiClemente et al., 1985), which measures the smoker's confidence that they would not smoke in 20 challenging situations.
2. Perceived stress scale (Cohen et al., 1983), which measures how much perceived stress the individual has experienced in the last month.
3. Fagerstrom Tolerance Questionnaire (Fagerstrom, 1978), which measures physical tolerance to nicotine.
4. Smoking decisional balance scale (Velicer et al., 1985), which measures the perceived pros and cons of smoking.
5. Smoking processes of change scale (DiClemente & Prochaska, 1985), which measures the individual's stage of change. According to this scale, participants were defined as precontemplators (n = 166), contemplators (n = 794) and those in the preparation stage (n = 506).
6. Demographic data, including age, gender, education and smoking history.

Results and implications

The results were first analysed to examine baseline difference between the three participant groups. The results showed that those in the preparation stage smoked less, were less addicted, had higher self efficacy, rated the pros of smoking as less positive and the costs of smoking as more negative, and had made more prior quitting attempts than the other two groups.

The results were then analysed to examine the relationship between stage of change and smoking cessation. At both one and six months, the participants in the preparation stage had made more quit attempts and were less likely to be smoking.

The results provide support for the stages of change model of smoking cessation, and suggest that it is a useful tool for predicting the outcome of an intervention.

DiClemente, C.C., & Prochaska, J.O., 1982, 'Self-change and therapy change of smoking behaviour: A comparison of processes of change in cessation and maintenance', *Addictive Behaviours*, 7, 133–42.

These factors suggest that our perception of our own risk is not a rational process.

In an attempt to explain why individuals' assessment of their risk may go wrong, and why people are unrealistically optimistic, Weinstein (1983) argued that individuals show selective focus. He claimed that we ignore our own risk-increasing behaviour ('I may not always practise safe sex, but that's not important') and focus primarily on our risk-reducing behaviour ('At least I don't inject drugs'). He also argued that this selectivity is compounded by egocentrism – individuals tend to ignore others' risk-decreasing behaviour ('My friends all practise safe sex, but that's irrelevant') and focus on the risk-increasing behaviour of those around them ('My friends sometimes drive too fast').

The stages of change model

The stages of change model (also known as the transtheoretical model of behaviour) was originally developed by Prochaska and DiClemente (1982) as a synthesis of 18 therapies describing the processes involved in behavioural change. These researchers suggested a new model of change which has been applied to several health-related behaviours, such as smoking, alcohol use, exercise and personal screening behaviour such as going for a cervical smear or attending for a mammograph (e.g. DiClemente et al., 1991; Marcus, Rakowski & Rossi, 1992).

If applied to giving up cigarettes, the model would suggest the following stages:

1. Precontemplation: I am happy being a smoker and intend to continue smoking.
2. Contemplation: I have been coughing a lot recently; perhaps I should think about stopping smoking.
3. Preparation: I will stop going to the pub and will buy lower tar cigarettes.
4. Action: I have stopped smoking.
5. Maintenance: I have stopped smoking for four months now.

The model describes behaviour change as dynamic, rather than being 'all or nothing', so the five stages do not always occur in a linear fashion. For example, an individual may move to the preparation stage and then back to the contemplation stage several times before progressing to the action stage. Even when an individual has reached the maintenance stage, they may slip back to the contemplation stage over time.

The model also examines how we weigh up the costs and benefits of a particular behaviour. In particular, individuals at different stages of change will differentially focus on either the costs of a behaviour ('Giving up smoking will make me anxious in company') or the benefits ('Giving up smoking will improve my health').

INTEGRATED MODELS

Attribution theory and the health locus of control model emphasize attributions for causality and control, unrealistic optimism focuses on perceptions of susceptibility and risk, and the stages of change model stresses the dynamic nature of beliefs, time, and costs and benefits. These different perspectives on health beliefs have been integrated into structured models.

The health belief model

The health belief model (figure 19.2) was developed initially by Rosenstock in 1966 and further by Becker and colleagues throughout the 1970s and 1980s (e.g. Becker et al., 1977). Their aim was to predict preventative health behaviours and the behavioural response to treatment in acutely and chronically ill patients. Over recent years, the model has been used to predict many other health-related behaviours.

According to the health belief model, behaviour is a product of a set of core beliefs that have been redefined over the years. The original core beliefs are the individual's perception of:

- *susceptibility* to illness – 'My chances of getting lung cancer are high';
- the *severity* of the illness – 'Lung cancer is a serious illness';
- the *costs* involved in carrying out the behaviour – 'Stopping smoking will make me irritable';
- the *benefits* involved in carrying out the behaviour – 'Stopping smoking will save me money'; and
- *cues to action*, which may be internal (e.g. the symptom of breathlessness) or external (e.g. information in the form of health education leaflets).

The health belief model suggests that these core beliefs are used to predict the likelihood that a behaviour will occur.

In response to criticisms, the model was revised to add the construct health motivation to reflect readiness to be concerned about health matters ('I am concerned that smoking might damage my health'). More recently, Becker and Rosenstock (1987)

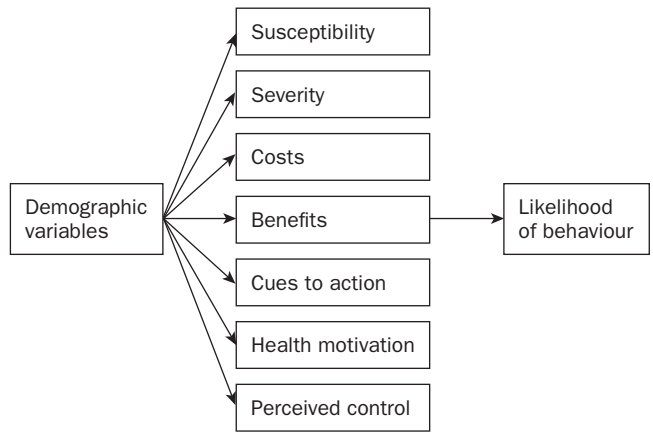

Figure 19.2

The health belief model. Source: Ogden (2000), after Becker et al. (1977).

suggested that perceived control ('I am confident that I can stop smoking') should also be added to the model (see chapter 17).

When applied to a health-related behaviour such as screening for cervical cancer, the health belief model predicts that someone is likely to have regular screening if she perceives that:

- she is highly susceptible to cancer of the cervix;
- cervical cancer is a severe health threat;
- the benefits of regular screening are high; and
- the costs of such action are comparatively low.

There will also most likely be relevant cues to action – either external (such as a leaflet in the doctor's waiting room) or internal (such as pain or irritation, which she perceives to be related to cervical cancer).

The new, amended model would also predict that a woman is more likely to attend for screening if she is confident that she can do so, and she is motivated to maintain her health.

The protection motivation theory

Rogers (1975, 1983, 1985) developed the protection motivation theory (figure 19.3), which expanded the health belief model to include additional factors.

The original protection motivation theory claimed that health-related behaviours are a product of, and therefore predicted by, five components:

severity – 'Bowel cancer is a serious illness';
susceptibility – 'My chances of getting bowel cancer are high';
response effectiveness – 'Changing my diet would improve my health';
self efficacy – 'I am confident that I can change my diet'; and
fear – 'Information about the links between smoking and lung cancer makes me feel quite frightened'.

The protection motivation theory describes severity, susceptibility and fear as relating to 'threat appraisal' (i.e. appraising an outside threat), and response effectiveness and self efficacy as relating to 'coping appraisal' (i.e. appraising the individual themselves). According to the theory, there are two types of information source: environmental (e.g. verbal persuasion, observational learning) and intrapersonal (e.g. prior experience). This information influences the five components listed above, which then elicit either an adaptive coping response (a behavioural intention) or a maladaptive coping response (such as avoidance or denial).

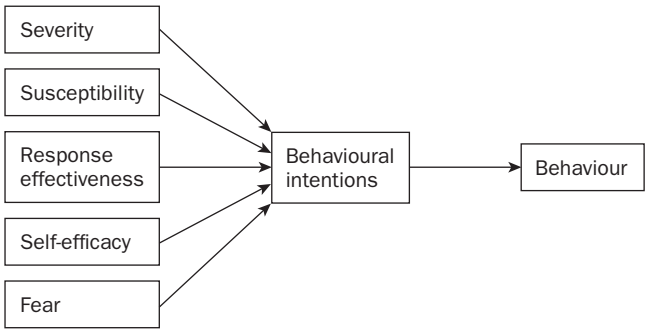

Figure 19.3

The protection motivation theory. Source: Ogden (2000), after Rogers (1985).

If applied to dietary change, the protection motivation theory would make the following predictions. Information about the role of a high fat diet in coronary heart disease would increase fear, increase the individual's perception of how serious coronary heart disease was (perceived severity) and increase their belief that they were likely to have a heart attack (perceived susceptibility). If the individual also felt confident that they could change their diet (self efficacy) and that this change would have beneficial consequences (response effectiveness), they would report high intentions to change their behaviour (behavioural intentions). This would be regarded as an adaptive coping response to the presented information.

The theory of planned behaviour

The theory of planned behaviour (figure 19.4) was developed by Ajzen and colleagues (Ajzen, 1985; 1988; Ajzen & Madden, 1986). It emphasizes behavioural intentions as the outcome of a combination of several beliefs (see chapter 17).

The theory proposes that intentions should be conceptualized as 'plans of action in pursuit of behavioural goals' (Ajzen & Madden, 1986), and that these are a result of the following composite beliefs:

Attitude towards a behaviour – composed of a positive or negative evaluation of a particular behaviour, and beliefs about the outcome of the behaviour ('Exercising is fun and will improve my health').
Subjective norm – this represents the beliefs of important others about the behaviour, and the individual's motivation to comply with such beliefs ('People who are important to me will approve if I lose weight, and I want their approval').
Perceived behavioural control – comprising a belief that the individual can carry out a particular behaviour based on a consideration of internal control factors (e.g. skills, abilities, information) and external control factors (e.g. obstacles, opportunities) – both of which are related to past behaviour.

These three factors predict behavioural intentions, which are then linked to behaviour. (The theory of planned behaviour also states that perceived behavioural control can have a direct effect on behaviour without the mediating effect of behavioural intentions.)

Applied to alcohol consumption, the theory would predict that someone will have high intentions to reduce alcohol intake (behaviour intentions) if he believes that:

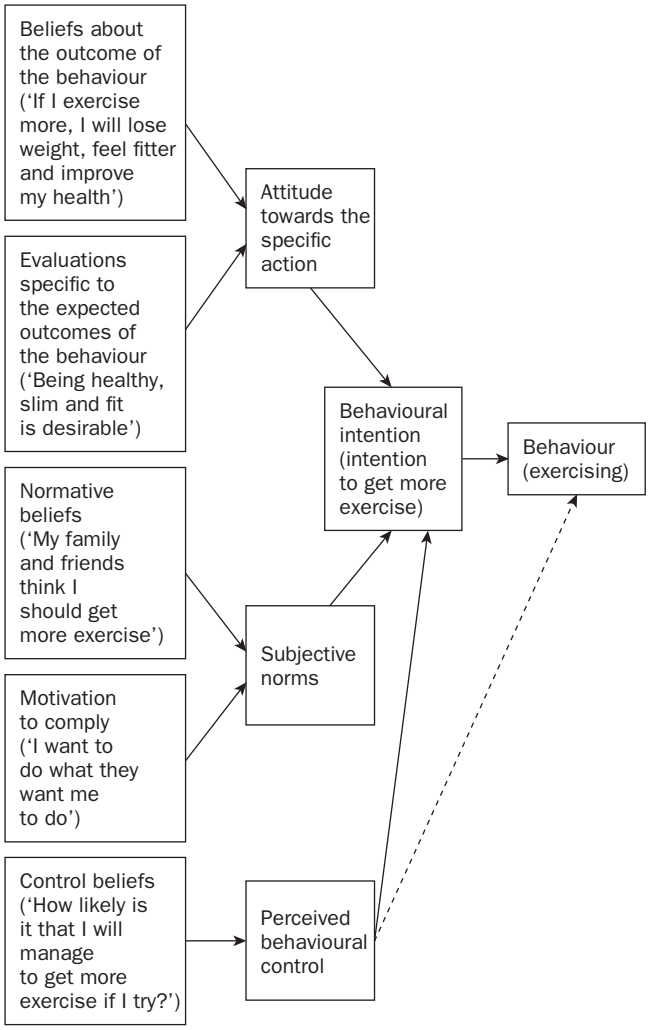

Figure 19.4

The theory of planned behaviour applied to the intention to engage in physical exercise. Source: Ogden (2000), after Ajzen (1985) and Stroebe (2000).

- reducing his alcohol intake will make his life more productive and be beneficial to his health (attitude to the behaviour);
- the important people in his life want him to cut down (subjective norm); and
- he is capable of drinking less alcohol due to his past behaviour and evaluation of internal and external control factors (high behavioural control).

The model also predicts that perceived behavioural control can predict behaviour without the influence of intentions. For example, a belief that the individual would not be able to exercise because they are physically incapable of doing so might well be a better predictor of their exercising behaviour than their high intentions.

Pioneer

Howard Leventhal (1931–) is Professor of Psychology at the State University of New Jersey at Rutgers. He has carried out extensive research into the experience of being ill, which has informed much work on illness perceptions, and he developed the self-regulatory model of illness behaviour. He places emphasis on the role of symptom perception in triggering illness behaviour and the links between emotion and health.

ILLNESS BELIEFS

illness beliefs examples are how long the illness will last and what impact it will have on the patient's life

Leventhal and colleagues (Leventhal, Meyer & Nerenz, 1980; Leventhal & Nerenz, 1985) defined *illness beliefs* as a patient's own implicit, commonsense beliefs about his or her illness. They proposed that these beliefs provide a framework, or schema, for coping with and understanding an illness, and for telling us what to look out for if we believe that we are becoming ill.

THE DIMENSIONS OF ILLNESS BELIEFS

Using interviews with patients suffering from a variety of illnesses, Leventhal et al. identified five dimensions of illness beliefs:

1. *Identity* refers to the label given to the illness (the medical diagnosis) and the symptoms experienced; for example, 'I have a cold . . .' (the diagnosis) '. . . with a runny nose' (the symptoms).
2. The *perceived cause of the illness* – this may be biological (e.g. a virus, in the case of a cold, or an injury or lesion, in the case of another type of illness) or psychosocial (e.g. stress or health-related behaviour). Patients may also hold representations of illness that reflect a variety of different causal models; for example, 'My cold was caused by a virus' versus 'My cold was caused by being run-down'.
3. *Time line* refers to beliefs about how long an illness will last, whether it is acute (i.e. short term) or chronic (i.e. long term); for example 'My cold will be over in a few days'.
4. *Consequences* refers to the patient's perceptions of the possible effects of the illness on his or her life. These may be physical (e.g. pain, lack of mobility), emotional (e.g. loss of social contact, loneliness) or a combination of factors; for example, 'My cold will prevent me from playing football, which will prevent me from seeing my friends'.
5. *Curability and controllability* refers to the patient's beliefs about whether their illness can be treated and cured, and the extent to which its outcome is controllable (either by

themselves or by others): for example, 'If I rest, my cold will go away', 'If I get medicine from my doctor, my cold will go away'.

Evidence for the dimensions

qualitative research uses methods such as open-ended interviews, focus groups or observation, where the data are analysed without resorting to number

quantitative research uses methods such as questionnaires, experiments and structured interviews, where the data are analysed using numbers

The extent to which beliefs about illness comprise these different dimensions has been studied using both *qualitative* and *quantitative research*.

Leventhal and colleagues carried out interviews with individuals who were chronically ill (having been recently diagnosed with cancer) and healthy adults. Participants' descriptions of their illness indeed suggested underlying beliefs made up of the above dimensions. Other studies have provided support for these dimensions using more artificial and controlled methodologies. Lau, Bernard and Hartman (1989) asked 20 people to sort 65 statements into piles that 'made sense to them'. These statements had been previously made in response to descriptions of 'your most recent illness'. The researchers reported that the piles of categories that people produced reflected the dimensions of identity of the illness (diagnosis/symptoms), its consequences (the possible effects), the time line (how long it would last), the cause (what caused the illness) and cure/control (how and whether it could be treated).

A series of experimental studies by Bishop and colleagues provided further support for this framework. For example, Bishop and Converse (1986) presented participants with brief descriptions of patients who were experiencing six symptoms. The participants were randomly allocated to one of two sets of descriptions – a 'high prototype', in which all six symptoms had been previously rated as associated with a given disease, and a 'low prototype', in which only two of the six symptoms had been previously rated as being associated with the same disease. It was found that those individuals in the high prototype condition labelled the disease more easily and accurately than did those in the low prototype condition. The authors argued that this provides support for the role of the identity dimension (i.e. diagnosis and symptoms) of illness representations, and that this also suggested that there is some consistency in people's concept of the identity of illnesses.

Participants were also asked to describe in their own words what else they thought may be associated with each patient's situation. Bishop and Converse reported that 91 per cent of the associations fell within the aforementioned dimensions of illness beliefs. Within these, the dimensions of 'consequences' (the possible effects) and 'time line' (how long it will last) were the least frequently mentioned dimensions.

There is also some evidence for a similar structure of illness representations in other non-Western cultures (Lau, 1995; Weller, 1984).

Measuring illness beliefs

In order to delve further into beliefs about illness, researchers in New Zealand and the UK have developed the 'Illness Perception Questionnaire' (IPQ). This asks people to rate a series of statements about their illness. These statements reflect the dimensions of identity (e.g. symptoms such as pain, tiredness), consequences (e.g. 'My illness has had major consequences on my life'), time line (e.g. 'My illness will last a short time'), cause (e.g. 'Stress was a major factor in causing my illness') and cure/control (e.g. 'There is a lot I can do to control my symptoms').

A MODEL OF ILLNESS BEHAVIOUR

Leventhal incorporated illness beliefs into a self-regulatory model of illness behaviour (figure 19.5) to examine the relationship between someone's cognitive representation of his or her illness and their subsequent coping behaviour.

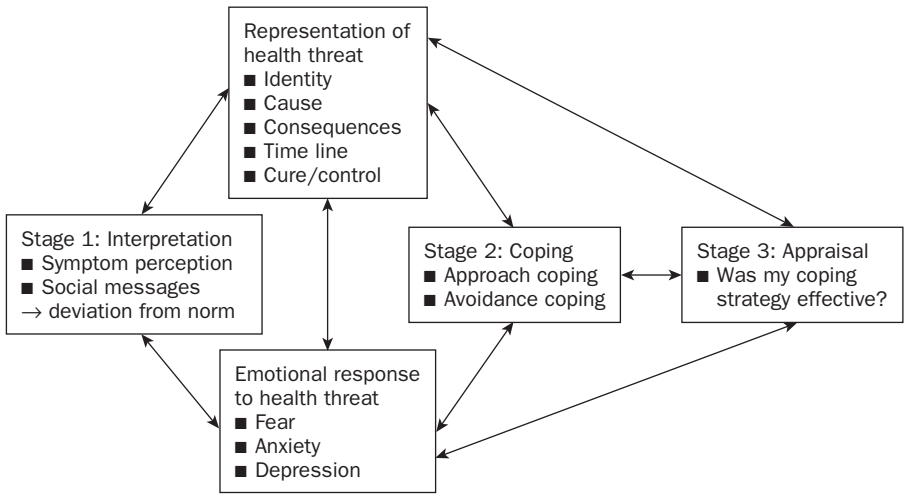

Figure 19.5

The self-regulatory model. Source: Ogden (2000), based on Leventhal et al. (1980).

The model is based on problem solving and suggests that we deal with illnesses and their symptoms in the same way as we deal with other problems. The assumption is that, given a problem or a change in the status quo, an individual will be motivated to solve the problem and re-establish his state of 'normality'. In terms of health and illness, if healthiness is your normal state, then you will interpret any onset of illness as a problem, and you will be motivated to re-establish your state of health.

Traditional models describe problem solving in three stages:

interpretation – making sense of the problem;
coping – dealing with the problem in order to regain a state of equilibrium; and
appraisal – assessing how successful the coping stage has been.

These three stages are said to continue until the coping strategies are deemed to be successful and a state of equilibrium has been attained.

This process is regarded as self-regulatory because the three components of the model interrelate, in an ongoing and dynamic fashion, in order to maintain the status quo. In other words, they regulate the self.

The three stages of Leventhal's model can be applied to health as follows:

Stage 1 – Interpretation

symptom perception how an individual experiences and makes sense of their symptoms

social messages input from a range of sources such as friends, family and media regarding the nature of symptoms

An individual may be confronted with the problem of a potential illness through two channels – *symptom perception* and *social messages*.

Symptom perception ('I have a pain in my chest') influences how an individual interprets the problem of illness. This is not a straightforward process, perception being in turn influenced by individual differences, mood and cognitions.

The factors contributing to symptom perception are illustrated by a condition known as 'medical students' disease', described by Mechanic (1962). A large component of the medical curriculum involves learning about the symptoms associated with a multitude of illnesses. More than two thirds of medical students incorrectly report at some time that they have the symptoms they are learning about. This phenomenon might be explained in terms of mood (i.e. medical students becoming quite anxious due to their work load), cognition (the students are thinking about symptoms as part of their course) and social context (once one student starts to perceive symptoms, others may model themselves on this behaviour).

Information about illness also comes from other people, perhaps as a formal diagnosis from a health professional or a positive test result from a routine health check. But we also often access such information via our 'lay referral system' (i.e. seeking information and advice from multiple sources, such as colleagues, friends or family). For example, coughing in front of one friend may result in the advice to speak to another friend who had a similar cough, or a suggestion to take a favoured home remedy. Or it may result in a lay diagnosis or a suggestion to seek professional help from a doctor. Social messages like this will influence how we interpret the 'problem' of illness.

Once we have received information about the possibility of illness through these channels we become aware that something has deviated from the norm and that there has been a change in our health status. According to this framework we are then motivated to return to a state of 'problem free' normality. This involves assigning meaning to the problem. According to Leventhal, we may do this by accessing our illness beliefs. So the notion is that the symptoms and social messages contribute towards the development of illness beliefs, which will be constructed according to the five dimensions mentioned earlier. These cognitive representations of the problem will give the problem meaning and enable us to develop and consider suitable coping strategies.

According to Leventhal, the identification of the problem of illness will result in changes in emotional state as well as in our cognitive representation. For example, perceiving a) the symptom of pain and receiving b) the social message that this pain may be related to coronary heart disease may result in deviation from the norm, and resultant anxiety. So any coping strategies have to relate to both our illness beliefs and our emotional state.

Stage 2 – Coping

Coping can take many forms, but two broad categories have been defined – approach coping (e.g. taking pills, going to the doctor, resting, talking to friends about emotions) and avoidance coping (e.g. denial, wishful thinking). When faced with the problem of illness, we develop coping strategies in an attempt to return to a state of healthy normality.

In an alternative model of coping, Taylor and colleagues (e.g. Taylor, 1983; Taylor, Lichtman & Wood, 1984) looked at how we adjust to threatening events. In a series of interviews with rape victims and cardiac and cancer patients, they found that coping with threatening events (including illness) consists of three processes:

- a search for meaning – 'Why did it happen to me?'
- a search for mastery – 'How can I prevent it from happening again?'
- a process of self enhancement – 'I am better off than a lot of people.'

Taylor and colleagues argued that these three processes are central to developing and maintaining 'illusions', and that these illusions constitute a process of cognitive adaptation.

Stage 3 – Appraisal

Appraisal is the final stage in Leventhal's model. At this point people evaluate their coping strategy as either effective or ineffective. If it is appraised as effective then they will continue with it and

the same set of coping strategies will be pursued. If the coping strategies are appraised as ineffective then people are motivated to think of alternatives which will then be put into place. The appraisal stage clearly illustrates the self-regulatory nature of the model as the process of interpretation, coping and appraisal is not a linear pathway but dynamic and ongoing. Accordingly, the individual self-regulates by a constant ongoing process of appraisal, which assesses whether coping is effective and whether the individual is successfully managing to achieve a renewed sense of equilibrium.

HEALTH PROFESSIONALS' BELIEFS

Early research regarded health professionals as experts and assumed that doctors with similar levels of knowledge and training would act in similar ways. But there is, in fact, considerable variability in different aspects of medical practice.

For example, Anderson et al. (1983) reported that doctors differ in their diagnosis of asthma. Mapes (1980) suggested that they also vary considerably in terms of their prescribing behaviour, some doctors giving drugs to only 15 per cent of their patients and others offering prescriptions for up to 90 per cent. Bucknall, Morris and Mitchell (1986) reported significant variation in doctors' measurement of blood pressure, and Marteau and Baum (1984) reported that doctors differ significantly in their treatment of diabetes.

It is now generally accepted that health professionals may behave not just according to their education and training, but also according to their own 'lay beliefs'. This means that any evaluation of the interaction between health professionals and patients should not only focus on the personal beliefs of the patient and the knowledge base of the professional, but also on the personal belief system of the professional.

Figure 19.6

Interaction between patient and doctor can be influenced by the health professional's beliefs about the patient and the disease, as well as by their knowledge.

Beliefs that influence practice

Research indicates that the following beliefs influence the development of a health professional's original diagnosis.

The nature of clinical problems If a health professional believes that illness is determined by biomedical factors (e.g. lesions, bacteria, viruses), they will develop a diagnosis that reflects this perspective. But a professional who places the emphasis on psychosocial factors may develop a different diagnosis. For example, if a patient reports feeling tired all the time, the first professional might point to anaemia as the cause, and the second to stress.

The probability of the disease Health professionals also have different beliefs about how common a health problem is. For example, some doctors may regard childhood asthma as a common complaint and hypothesize that a child presenting with a cough has asthma. Another doctor who believes that childhood asthma is rare might not consider this diagnosis.

The seriousness of the disease Health professionals are motivated to consider the 'pay-off' in reaching a correct diagnosis, which is related to their beliefs about the seriousness and treatability of an illness. For example, if a child presents with abdominal pain, the professional may diagnose appendicitis, as this is a serious but treatable condition. In this case, the benefits of arriving at the correct diagnosis for this condition far outweigh the costs involved (such as time wasting) if the diagnosis is actually wrong.

The patient The original diagnosis will also be influenced by the health professional's existing knowledge of the patient, including medical history, degree of support at home, psychological state, and beliefs about why the patient came to see the doctor.

Similar patients We know that stereotypes can confound a decision-making process (see chapter 17). Yet without them, consultations between health professionals and patients would be extremely time consuming. Stereotypes reflect the process of 'cognitive economy'. They play a central role in developing and testing a hypothesis and reaching a management decision. So a health professional will typically base their decision partly on factors such as how the patient looks/talks/walks, and whether they are reminiscent of previous patients.

Communicating beliefs to patients

Health professionals' own health-related beliefs may be communicated to patients. A study by McNeil et al. (1982) examined the effects of health professionals' own language on patients' choice of treatment. They found that patients are more likely to choose surgery if they are told it will 'increase the probability of survival' rather than 'decrease the probability of death'. The phrasing of a question like this tends very much to reflect the beliefs of the individual doctor. So the results indicate that the subjective views of health professionals may be communicated to the patient, and subsequently influence the patient's choice of treatment.

THE STRESS–ILLNESS LINK

stress negative emotional experience resulting from a mismatch between the individual's appraisal that the stressor is stressful and their ability to cope with and therefore reduce their response to it

The term '*stress*' means many different things to many people. A lay person may define stress in terms of pressure, tension, unpleasant external forces or an emotional response. Psychologists define stress in a variety of different ways. Contemporary definitions of stress regard the external environment as a potential stressor (e.g. problems at work), the response to the stressor as stress or distress (e.g. the feeling of tension), and the concept of stress as something that involves biochemical, physiological, behavioural and psychological changes. Researchers have also differentiated between stress that is harmful and damaging ('distress') and stress that is positive and beneficial ('eustress').

The most common definition of stress was developed by Lazarus and Launier (1978), who regarded it as a transaction between people and the environment. Within this definition,

Figure 19.7

On the stock exchange floor, it is easy to see how stress arises from a transaction between people and their environment.

stress involves an interaction between the stressor ('My job is difficult') and distress ('I feel stressed by it'). So a stressful response might be the feeling of stress that results from a mismatch between a) a situation that is appraised as stressful and b) the individual's self-perceived ability to cope and therefore reduce the stress.

Stress models

Throughout the twentieth century, stress models have varied in terms of their definition of 'stress', their emphasis on physiological and psychological factors, and their description of the relationship between the individual and their environment.

Cannon's 'fight or flight' model

One of the earliest models of stress was developed by Cannon (1932). The 'fight or flight' model suggested that external threats elicit the 'fight or flight' response, increasing activity rate and arousal. These physiological changes enable the individual either to escape from the source of stress or fight. Cannon defined 'stress' as a response to external stressors that is predominantly seen as physiological (see chapters 5 and 6).

Selye's general adaptation syndrome

Developed in 1956, Selye's general adaptation syndrome describes three stages in the stress process:

- 'alarm', which describes an increase in activity and occurs immediately the individual is exposed to a stressful situation;
- 'resistance', which involves coping and attempts to reverse the effects of the alarm stage; and
- 'exhaustion', which is reached when the individual has been repeatedly exposed to the stressful situation and is incapable of showing further resistance.

Life events theory

In an attempt to depart from models that emphasize physiological changes, the life events theory examines stress and stress-related changes as a response to life change. Research has shown links between life events and health status, in terms of both the onset of illness and its progression (Yoshiuchi et al., 1998).

These results were obtained using Holmes and Rahe's (1967) 'Schedule of Recent Experiences' (SRE) – an extensive list of possible life changes or life events. These range in supposed objective severity from serious events, such as 'death of a close family member' and 'jail term', through more moderate events, such as 'son or daughter leaving home' and 'pregnancy', to minor events, such as 'vacation' and 'change in eating habits'.

Each event has a predetermined point score to reflect its impact, with the combined score reflecting the adjudged stress rating of the assessed individual. For example, 'death of spouse' would result in more changes to an individual's life schedule than 'trouble with boss', and is therefore allocated a higher point score. The difficulty with this significance weighting is that it was devised by psychologists, not the research participants. For example, whilst a divorce may be very stressful for one person, it might be liberating for another.

The model of appraisal and transaction

Both Cannon's and Selye's early models of stress presented it as an automatic response to an external stressor – a perspective that is also reflected in life events theory, with its use of expert rather than individual rating schemes. By contrast, more recent models allow for active interaction between the individual and external stressors, rather than passive response. This approach provides a role for psychological state. It is epitomized by Lazarus's transactional model of stress and his theory of *appraisal*.

appraisal an individual's assessment of both the outside world and their ability to cope with this world

In the 1970s, Lazarus introduced the psychological dimension into our understanding of the stress response (1975; Lazarus & Cohen, 1973, 1977). He argued that stress involves a transaction between an individual and his or her external world, and that a stress response is elicited if the individual appraises an event as stressful. Lazarus defined two forms of appraisal:

1. Primary appraisal: the individual initially appraises the event in three ways – as (a) irrelevant, (b) benign and positive or (c) harmful and negative.
2. Secondary appraisal – the individual evaluates the pros and cons of his or her different coping strategies.

So primary appraisal is essentially an appraisal of the outside world and secondary appraisal is an appraisal by the individual of himself (figure 19.9).

Does stress cause illness?

The relationship between stress and illness is not straightforward, and there is a lot of evidence to suggest that several factors mediate the stress–illness link, including exercise, coping styles, life events, personality type, social support and actual or perceived control.

Stress can affect health through a behavioural pathway or through a physiological pathway. Behaviours that may change as a result of stress include sleep, food intake and alcohol consumption. Stress can also induce changes in the body's biochemicals, such as catecholamines and corticosteroids, and changes in activity, such as heart rate.

Stress and behaviour

Recent research has examined the effect of stress on specific health-related behaviours, such as exercise, smoking, diet and alcohol consumption, in terms of initiation, maintenance and relapse. It has also highlighted the impact of stress on general

Pioneer

Figure 19.8

Richard Lazarus developed the role of psychological factors and appraisal in the study and treatment of stress.

Richard Lazarus (1922–2002) was Professor of Psychology at the University of California, Berkeley. His original work explored theories of emotion, which led him to focus on stress and coping. In particular, he introduced and developed the role of psychological factors in stress and emphasized the importance of appraisal. He established the UC Berkeley Stress and Coping Project, in which he extended his ideas on the importance of appraisal to explain exactly what stress is and what coping involves. This project culminated in the publication in 1984 of *Stress, Appraisal, and Coping*, one of the most widely cited and read books in psychophysiology and health psychology.

behavioural change. For example, research suggests that individuals who experience high levels of stress show a greater tendency to perform behaviours that increase their chances of becoming ill or injured (Wiebe & McCallum, 1986) and of having accidents at home, work and in the car (Johnson, 1986). For example, when under stress a person may smoke more, sleep less, drive faster and be less able to focus on the task in hand, which, in turn, may result in heart disease, cancer or accidents.

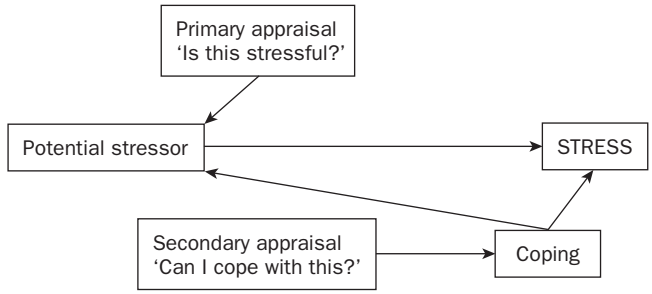

Figure 19.9

The role of appraisal in stress. Source: Ogden (2000), based on Lazarus (1975).

Stress and physiology

The physiological consequences of stress have been studied extensively, mostly in the laboratory using the acute stress paradigm. This involves bringing participants into a controlled environment, putting them into a stressful situation (such as counting backwards, completing an intelligence task or giving an unprepared speech) and then recording any changes. This research has highlighted two main groups of physiological effects:

1 Sympathetic activation When an event is appraised as stressful, it triggers responses in the sympathetic nervous system. This results in the production of catecholamines (adrenalin and noradrenalin), which causes changes in factors such as blood pressure, heart rate, sweating and pupil dilation. These changes are experienced subjectively as a feeling of increased arousal. This process is similar to the 'fight or flight' response described by Cannon. Sympathetic activation and prolonged production of adrenalin can result in:

- blood clot formation
- increased blood pressure
- increased heart rate
- irregular heart beats
- fat deposits
- plaque formation
- immuno-suppression

These changes may increase the chances of heart disease and kidney disease, and leave the body open to infection.

2 Hypothalamic-pituitary-adrenocortical (HPA) activation Stress also triggers changes in the HPA system. This results in increased levels of corticosteroids (cortisol), leading to more diffuse changes, such as the increased use of carbohydrate stores and a greater chance of inflammation. These changes constitute the background effect of stress, and cannot be detected by the individual. They are similar to the alarm, resistance and exhaustion stages of stress described by Selye as they show how chronic ongoing stress can be damaging to the body in the longer term. HPA activation and prolonged production of cortisol can result in:

- decreased immune function
- damage to neurons in the hippocampus

These changes may increase the chances of infection, psychiatric problems and losses in memory and concentration.

The role of hormones

Kiecolt-Glaser and Glaser (1986) argued that stress causes a decrease in the hormones produced to fight carcinogens (factors that cause cancer) and repair DNA. In particular, cortisol decreases the number of active T cells, which can increase the rate of tumour development. This suggests that experiencing stress whilst ill could exacerbate the illness through physiological changes. So if the illness itself is appraised as being stressful, this itself may be damaging to the chances of recovery.

Psychoneuroimmunology (PNI)

This relatively new area of research is based on the prediction that psychological state can influence the immune system via the nervous system. This perspective provides a scientific basis for the 'mind over matter', 'think yourself well' and 'positive thinking, positive health' approaches to life. It suggests that not only can psychological state influence health via behaviour, but beliefs may influence health directly. In particular, research has focused on the capacity of psychological factors (such as mood, thought suppression and stress) to modify immune functioning.

Positive mood is associated with better immune functioning, whereas negative mood is associated with poorer immune functioning (Stone et al., 1987). Humour appears to be particularly beneficial (Dillon, Minchoff & Baker, 1985). Certain coping styles (such as suppression and denial) may relate to illness onset and progression (e.g. Kune et al., 1991), while thought expression through writing or disclosure groups may improve immune functioning (Pennebaker et al., 1988; Petrie, Booth & Pennebaker, 1998; see also chapter 6).

Everyday Psychology

Life and stress

Most of us would like to be better at managing stress, especially if we cope through potentially damaging habits such as smoking or drinking.

Robert Sapolsky is one of the foremost authorities in the field of stress. In his book, *Why Zebras Don't Get Ulcers*, Sapolsky argues that we evolved for a very different stress environment than that which faces us today. He argues that in our evolutionary past we regularly faced serious, life-threatening situations (such as a predator attack or hostility with a neighbouring tribe over an important resource). Today our lives are much safer and our stressors much milder, but there are many of them – continual, recurring and irritating. We may find it hard to 'escape' from these stressors and their effects may build up over time. Sapolsky explores the role of stress in heart disease, diabetes, growth retardation, memory loss and auto-immune diseases such as multiple sclerosis.

In attempting to decide why zebras do not get ulcers (or heart disease, diabetes and other chronic diseases), Sapolsky suggests that people develop such diseases partly because our bodies are not designed for the constant stresses of a modern-day life (like sitting in traffic jams or dealing with multiple conflicting demands). Instead, we seem better equipped to deal with the kind of short-term stress faced by a zebra, such as outrunning a lion!

So why do we adapt to some stressful emergencies, while others make us sick? And why are some of us especially vulnerable to stress-related diseases? Is this related to features of our personalities? If so, are these features learned or innate?

Humans today live long enough and are intelligent enough to engage with and even generate all sorts of stressful events. Sapolsky suggests that stress-related disease emerges, predominantly, from our chronic activation of a physiological system that has evolved to respond to acute physical emergencies. We seem able to turn on the stress response not only in response to physical or psychological insults, but also by just thinking about potential stressors.

Stress may be characterized by non-constructive fretting and agonizing, and may generalize into more serious free-floating anxiety and panic attacks, which can interfere with daily living.

Sapolsky highlights studies that suggest we do have some control over stress-related ailments. One strategy is 'containment'. Simply set aside about 10–20 minutes each day for worrying! It is then easier to dispatch concerns from your mind for the remainder of your waking hours. Another technique is to put some constructive thought into how to better deal with problems during this 'worry period' rather than fretting in an unfocused manner. Another idea is to focus on living life in the present. According to this principle (related to Zen philosophy), we should strive constantly to enjoy each moment to its fullest. If you cannot live 'in the moment', there will always be other concerns on your mind.

Finally, our overall attitude or 'mindset' can influence our responses to stressful situations. Realistically, life is never as bad as it seems during our darkest and most depressed moments, nor as wonderful as it seems during our happiest, most ecstatic moments. It is somewhere in between. A sage piece of advice might be: instead of worrying about relatively trivial matters, save your emotional energy for the really big problems in your life, because it is likely that there will be more than enough of those.

Sapolsky, R., 2003, 'Taming stress', *Scientific American*, 289 (3), 86–95.

Pioneer

Figure 19.10

Jamie Pennebaker found that writing and talking can reduce time spent visiting the GP and improve work performance.

Jamie Pennebaker (1950–) is Professor of Psychology at the University of Texas at Austin and has been involved in exploring the role of psychological factors in symptom perception. He has also promoted research into the impact of psychological factors on the immune system, and he has a particular interest in the links between traumatic experiences, language, and physical and mental health. His studies find that time spent in simple writing and/or talking (including self-disclosure) can reduce time spent being seen by a physician, medical costs and alcohol use, and can increase work performance.

CHRONIC ILLNESS

Chronic illnesses, such as asthma, AIDS, cancer, coronary heart disease and multiple sclerosis, are another important focus for health psychologists. This section uses coronary heart disease (one of the leading causes of death in the present day) to illustrate the role of psychology at every stage, from predicting risk factors through to rehabilitation.

PROFILE OF AN ILLNESS

Coronary heart disease (CHD) is caused by hardening of the arteries (atherosclerosis), which are narrowed by fatty deposits. This can result in angina (pain) or a heart attack (myocardial infarction). CHD is responsible for 33 per cent of deaths in men under 65 and 28 per cent of all deaths. It is the leading cause of death in the UK, killing 4300 men and 2721 women per million in 1992. It has been estimated that CHD cost the National Health Service in the UK about £390 million in 1985/86. The highest death rates from CHD are found in men and women with a manual occupation and men and women of Asian origin. In middle age, the death rate is up to five times higher for men than women, but this evens out in old age, when CHD is the leading cause of death for everyone, regardless of gender.

Many risk factors for CHD have been identified, some less modifiable (e.g. educational status, social mobility, social class, age, gender, family history and race) than others (e.g. smoking behaviour, obesity, sedentary lifestyle, perceived work stress and type A behaviour).

PSYCHOLOGY'S ROLE

Psychology has a role to play at all stages of CHD (figure 19.11):

1. Psychological factors influence the onset of CHD. Our beliefs about both behaviour and illness can influence

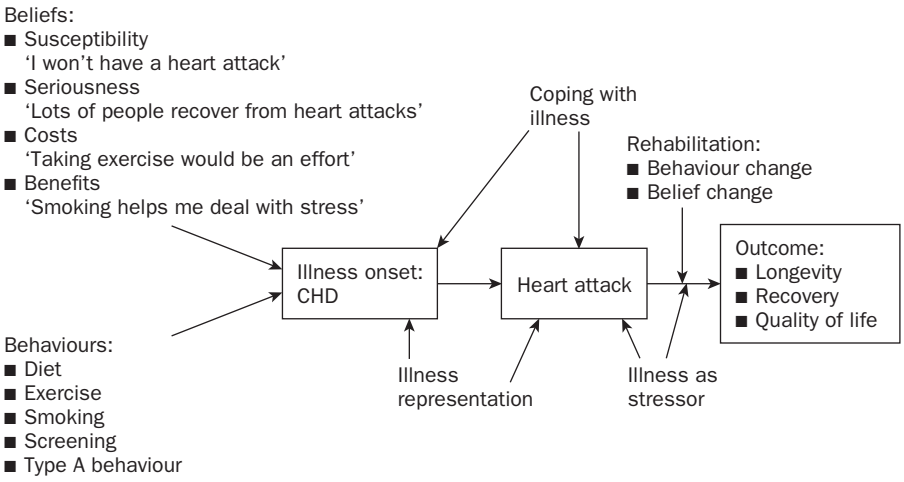

Figure 19.11

The role of psychology in coronary heart disease. Source: Ogden (2000).

whether we become ill or stay healthy. For example, someone who believes that 'lots of people recover from heart attacks' may lead an inactive and sedentary lifestyle; and a belief that 'smoking helps me deal with stress' is hardly likely to help someone give up smoking. Beliefs such as these therefore result in unhealthy behaviours that can lead to CHD.

2. Once ill, people also hold beliefs about their illness and will cope in different ways. Psychology therefore continues to play a role as the disease progresses. For example, if someone believes 'my heart attack was caused by my genetic makeup', they may cope by thinking 'there is nothing I can do about my health; I am the victim of my genes'. Beliefs like this are likely to influence the progression of the illness either by affecting behaviour or by having an impact on the immune system.
3. Psychology also has a role to play in the outcome of CHD. For example, believing that a heart attack is due to a genetic weakness rather than a product of lifestyle may mean that a person is less likely to attend a rehabilitation class and be less likely to try and change the way they behave. People also differ in other ways regarding their

Research close-up 2

Patient expectations and the placebo effect

The research issue

For a long time, medicine has regarded adherence to (i.e. compliance with) medical recommendations as important for patient recovery. This might be expressed in simplified forms such as: 'Take these drugs and you will get better.' Implicit within this assumption is the belief that an 'active drug' is better than a placebo. This is why trials to explore the effectiveness of a drug should compare it with a placebo. But it is possible that simply taking medication (whether active or inert) may also be beneficial if the patient expects to get better. This perspective is in line with the focus on beliefs found within health psychology, and the prediction that positive expectations may result in improvements in health.

This paper (Horwitz et al., 1990) presents a reanalysis of the data from a drug trial that explored the effectiveness of beta blockers following a heart attack. The paper asks whether simply adhering to medical recommendations to take pills was beneficial to recovery following a heart attack, regardless of whether the pills taken were active pills or placebo pills.

Design and procedure

The original study included 3837 men and women aged 30 to 69 who were reassessed every three months for an average of 25 months. For this paper, data were analysed from 1082 men in the experimental condition (who had received the beta blocker) and 1094 men in the placebo condition. Follow-up data were analysed for 12 months. Measures were taken of psychosocial factors, adherence and clinical characteristics.

Results and implications

- Compared to patients with good adherence, those with poor adherence were twice as likely to have died at one year follow-up. This was true for both the experimental group and the control group.
- Even taking into account psychosocial factors (e.g. stress, depression, smoking, alcohol use, exercise) and clinical factors (e.g. severity of heart attack), this finding was the same.
- So, regardless of whether the drug was a beta blocker or a placebo, taking it as recommended halved the participants' chances of dying over a 12-month period.

These results indicate a strong link between adherence to medical recommendations and mortality, regardless of the type of pill taken. This effect does not appear to be due to psychosocial or clinical factors (for example, the non-adherers did not simply smoke more than the adherers). So doing as the doctor suggests appears to be beneficial to health, but not necessarily because 'the drugs are good for you'. Instead, the findings indicate that simply by taking (what is believed to be) medication, the patient expects to get better.

The authors concluded that 'perhaps the most provocative explanation for the good effect of good adherence on health is the one most perplexing to clinicians: the role of patient expectancies or self-efficacy'. The researchers suggest that 'patients who expect treatment to be effective engage in other health practices that lead to improved clinical outcomes' (Horwitz & Horwitz, 1993). The authors also propose that the power of adherence may not be limited to taking drugs; it may occur with other forms of health intervention such as recommendations for behaviour change.

Horwitz, R.I., Viscoli, C.M., Berkman, L. et al., 1990, 'Treatment adherence and risk of death after a myocardial infarction', *Lancet*, 336 (8714), 542–5.

experiences of illness and their ability to adjust to such a crisis in their lives. For example, whilst some people cope by taking definite action and making plans about how to prevent the illness getting worse, others go into a state of denial or cope by indulging in unhealthy behaviours, making the situation worse. Such factors can impact upon their quality of life, possibly even influencing how long they live.

Behavioural risk factors

The risk factors for CHD can be understood and predicted by examining an individual's health beliefs. Psychology's role is to both understand and attempt to change these behavioural risk factors.

- *Smoking* is estimated to be the cause of one in four deaths from CHD. Smoking more than 20 cigarettes a day increases the risk of CHD in middle-age threefold. Giving up smoking can halve the risk of another heart attack in those who have already had one.
- *Diet and exercise* (especially cholesterol levels) have also been implicated in CHD. It has been suggested that the 20 per cent of a population with the highest cholesterol levels are three times more likely to die of heart disease than the 20 per cent with the lowest levels. We can reduce cholesterol by cutting down total fats and saturated fats in our diet, and increasing polyunsaturated fats and dietary fibre. Other risk factors include excess coffee and alcohol and lack of exercise.
- *High blood pressure* is another risk factor – the higher the blood pressure, the greater the risk. Even a small decrease in the average blood pressure of a population could reduce the mortality from CHD by 30 per cent. Blood pressure appears to be related to a multitude of factors, such as genetics, obesity, alcohol intake and salt consumption.
- *Type A behaviour* is probably the most extensively studied risk factor for CHD. Friedman and Rosenman (1959) initially defined type A behaviour as excessive competitiveness, impatience, hostility and vigorous speech. In 1978, using a semi-structured interview, they identified two types of type A behaviour. Type A1 is characterized by vigour, energy, alertness, confidence, loud speaking, rapid speaking, tense clipped speech, impatience, hostility, interrupting, frequent use of the word 'never' and frequent use of the word 'absolutely'. Type A2 was defined as being similar to type A1, but not as extreme, and Type B behaviour was regarded as relaxed (for example, showing no interruptions of others' speech) and quieter.
- *Stress* has also been extensively studied as a predictor of CHD. In the 1980s Karasek developed a job demand/job control model of stress. He proposed the 'job demand control hypothesis', which includes the concept of job strain (see chapter 20). According to Karasek and colleagues (e.g. Karasek & Theorell, 1990), there are two aspects of job strain: i) job demands (which reflect conditions that affect performance) and ii) job autonomy (which reflects the person's control over the speed or the nature of decisions made within the job). Karasek's hypothesis suggests that high job demands and low job autonomy predict CHD. More recently, Karasek developed the hypothesis further to include the concept of social support. This is deemed to be beneficial for CHD, and is defined in terms of emotional support (i.e. trust between co-workers and social cohesion) and instrumental social support (i.e. the provision of extra resources and assistance).

Figure 19.12

The risk of heart disease can be reduced by cutting down on saturated fats and increasing polyunsaturated fats and fibre in our diet.

Rehabilitation programmes

Modifying exercise – Most rehabilitation programmes emphasize exercise as the best route to physical recovery, on the assumption that this will in turn promote psychological and social recovery, too. But whether, more generally, these programmes influence risk factors other than exercise (such as smoking, diet and Type A behaviour) is questionable.

Modifying type A behaviour – The recurrent coronary prevention project was developed by Friedman et al. (1986) in an attempt to modify type A behaviour. It is based on the following questions: 'Can type A behaviour be modified?' and 'Could such modification reduce the chances of a recurrence?' The study involved a five-year intervention and

1000 participants who had all suffered a heart attack. They were allocated to one of three groups: (i) cardiology counselling, (ii) type A behaviour modification, or (iii) no treatment. Type A behaviour modification involved: discussions of beliefs, values and ways to reduce work demands and increase relaxation, and education about changing the individual's cognitive framework. At five years, the type A modification group showed a reduced recurrence of heart attacks, suggesting that such intervention programmes may reduce the probability of reinfarction in 'at risk' individuals.

Modifying general lifestyle factors Other rehabilitation programmes have focused on modifying risk factors such as smoking and diet. For example, van Elderen, Maes and van den Broek (1994) developed a health education and counselling programme for patients with cardiovascular disease after discharge from hospital, with weekly follow-ups by telephone. Although this study involved only a small number of patients, the results seemed to provide some support for including health education in CHD rehabilitation programmes.

FINAL THOUGHTS

Doctors often express surprise at the behaviour of their patients. They ask, 'why do they continue to smoke even when they know the risks?', 'why do patients come to see me when nothing is really wrong?', 'why do patients not come to see me when something is seriously wrong?' and 'why are people so different in the ways they manage the stress in their lives and respond to illness?'

Health psychology addresses these questions and highlights the role of psychological factors in understanding the issue at their core, namely variability. This chapter has explored the beliefs people have about health behaviours and illness, the beliefs that might influence health professionals and the impact of stress upon our lives. In addition, it has illustrated how psychological factors have a role to play at all stages of a chronic illness. Central to all this is the study of variability. Health psychology provides a means to understand this variability and helps to explain why people differ both from each other and from how other people would sometimes like them to be.

Summary

- Health psychologists study the role of psychology in health and wellbeing. They highlight the importance of both a) developing and testing psychological theory and b) relating theory to health practice.
- Health psychology examines health beliefs as possible predictors of health-related behaviours, such as: a) the costs and benefits of a behaviour, b) susceptibility and severity of an illness, c) self efficacy in changing behaviour, d) a person's past behaviour and e) the beliefs of important others.
- Health psychology also examines beliefs about illness and suggests that individuals conceptualize their illness in terms of its time line, its symptoms, the causes and consequences of the problem, and whether it can be controlled or cured.
- The self-regulatory model of illness behaviour highlights how symptoms are a perception, how people are motivated to make sense of their illness, how they cope with illness in different ways, and how these factors can influence how they behave in relation to their illness.
- A health professional's beliefs about the symptoms, the illness or the patient may influence their diagnosis, how patients are treated and the effectiveness of any communication between patient and professional.
- Stress is seen as an interaction between the person and their environment. It can influence illness, either through changing health-related behaviours such as smoking and exercise or via a physiological pathway, and it is mediated by coping and social support.
- Beliefs and behaviours can influence whether a person becomes ill in the first place, whether they seek help and how they adjust to their illness.

REVISION QUESTIONS

1. Medicine suggests that people become ill because they catch bacteria or viruses or develop something wrong with their bodies. What other factors might influence whether someone becomes ill?
2. Medicine takes responsibility for making people well again. What can the person themselves do about their own health?
3. Most people know that smoking is bad for them but many continue to smoke. Why might this be?
4. Even after being asked by their doctor, many women do not attend for their regular cervical smear. What factors might influence their decision not to attend?
5. When ill, some people take to their bed, take time off work and need looking after. For others, illness simply gets in the way and they try to carry on as usual. Why do people differ in this way?
6. If you took the same symptoms to five different doctors, you might get five different diagnoses and five different treatments. Why do you think this is?
7. Stress has been linked with a range of health problems. How do you think that stress influences illness?
8. Some people die from heart attacks, whilst other people recover and have long and happy lives. Once someone has had a heart attack, what do you think they could do to prevent another one?

Further Reading

Bennett, P. (2000). *An Introduction to Clinical Health Psychology*. Buckingham: Open University Press.
A useful introduction to how the theories and research of health psychology can be put into practice.

Bowling, A. (1995). *Measuring Disease*. Buckingham: Open University Press.
An overview of the theory behind measuring quality of life and a clear review of the existing scales for assessing health status.

Connor, M., & Norman, P. (eds) (1995). *Predicting Health Behaviours*. Buckingham: Open University Press.
A thorough description of social cognition models and the extent to which they predict health-related behaviour.

Ogden J. (2004). *Health Psychology: A Textbook*. 3rd edn. Buckingham: Open University Press.
This book has formed the basis for this chapter and provides a grounding in health psychology at a more advanced level.

Penny, G., Bennett, P., & Herbert, M. (1994). *Health Psychology: A Lifespan Perspective*. Amsterdam: Harwood.
An examination of health psychology with a focus on the lifespan, and an assessment of childhood, adolescence, adulthood, mid life and the elderly.

Stroebe, W. (2000). *Social Psychology and Health*. 2nd edn. Buckingham: Open University Press.
Recently updated edition of this authoritative and clear text applying social-psychological principles to topics such as modification of health behaviour, stress and health, and health promotion.

Taylor, S. (1999). *Health Psychology*. 4th edn. Boston: McGraw-Hill.
A thorough overview of health psychology with an emphasis on health care delivery and work from the US.

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Organizational Psychology

20

CHAPTER OUTLINE

LEARNING OBJECTIVES

INTRODUCTION

INDIVIDUALS AT WORK

- Matching the person to the job
- Fitting into the organization
- Training – does it work?
- Leadership styles
- Job satisfaction
- Stress at work

GROUPS AT WORK

- More than the sum of the parts
- Group decision making

ORGANIZATIONS AT WORK

- Organizational design
- Organizational culture
- Power and politics

REDUNDANCY AND UNEMPLOYMENT

- Redundancy – a kind of bereavement
- Psychological effects of unemployment

FINAL THOUGHTS

SUMMARY

REVISION QUESTIONS

FURTHER READING

Learning Objectives

By the end of this chapter you should appreciate that:

- organizations use a variety of techniques to ensure a 'fit' between employees and the organization – some are more effective than others;
- designed appropriately, training that managers provide for employees can influence how those employees perform their jobs;
- stress and employee attitudes are important in influencing performance in the workplace;
- several person and situational factors impact on team effectiveness and group decision making;
- organizational culture is important for workplace performance, and can be measured across several different dimensions;
- power is an important construct in the workplace and can be defined and measured in several different ways;
- there is evidence for discrimination against women at work;
- unemployment can have serious psychological effects.

INTRODUCTION

Within three years of reading this text, you are very likely to enter and begin work in an organization that is quite new to you. This will represent a major change in your life, associated with new patterns of behaviour, attitudes, new knowledge and skills.

In this chapter, we discover what psychologists know about the experience of working in an organization, from starting to leaving. This journey through the levels of work organizations and over the lifespan of an individual's experience can cover only a relatively few topics, but in the process it should provide an insight into a rich and increasingly important sub-discipline.

Almost all studies in this area are conducted in the organizations themselves, from three perspectives:

1. individual – selection, socialization, training, leadership, job satisfaction and organizational commitment, and the causes and consequences of stress;
2. group – work group effectiveness and decision making; and
3. organizational – design and culture of the organization, the exercise of power and the experience of women at work.

We end by analysing the powerful effects of redundancy and unemployment.

But the first step is recruitment. How do organizations achieve a fit between an individual, the job and the organization?

INDIVIDUALS AT WORK

When we consider some of the major factors affecting individuals at work, how they are selected, socialized, developed through training and affected by the behaviour of their bosses and peers, we begin to see how pervasive the effects of our work experience can be in our lives.

The jobs we do shape us by offering us a sense of growth, commitment and satisfaction, or they can alienate us, creating chronic feelings of anxiety and directly affecting our health and wellbeing. The influence of work in colouring every aspect of our lives is profound.

MATCHING THE PERSON TO THE JOB

Selection is based on the premise that there are stable individual differences between people, which can be identified (see chapters 13 and 14), and that these differences have an impact on how effective people are in a particular job (Robertson, 1995).

Not surprisingly, psychologists have been at the forefront of developing and using personnel selection methods. One of the aims of selection is to ensure a fit, i.e. a good match, between the person and the organization. Failure to achieve this can not only result in poor job performance, but the well being of the employee also suffers, and ultimately the employment relationship is likely to end.

Common selection procedures

job analysis procedures for describing jobs, including the nature of the work and the relationships of the job-holder with other people

The typical process for designing a selection system begins with a *job analysis* to identify the essential requirements. This information is used to create a job description, which forms the basis of a person specification. This specification translates the demands of the job into human terms and lists criteria that an applicant must satisfy if they are to perform the job successfully (Arnold, Robertson & Cooper, 1991). Selection methods determine whether the applicant's skills, knowledge and abilities meet these criteria. For example, if the person specification states that good verbal reasoning skills are required, a psychological test of verbal reasoning may well be used in the selection procedure. Common selection procedures (from Arnold, Robertson & Cooper 1991) are:

Interviews – often involving more than one interviewer. At a panel interview, the applicant will be questioned by several interviewers. The most important features of a job interview are the extent to which a pre-planned structure is followed, and the proportion of questions that are directly related to the job.

Psychometric tests – including tests of cognitive ability (e.g. general intelligence, verbal ability, numerical ability) and self-report measures which are designed to evaluate personality.

References – usually obtained from current or previous employers, often in the final stages of the selection process. The information requested may be specific or general and open-minded.

biodata life history information about job candidates

Biodata – biographical information about the candidate's life history. Some biodata inventories contain several questions, including objective questions (such as professional qualifications held) and more subjective ones (such as preferences for different job features).

work-sample tests personnel assessment techniques which require the applicant to perform tasks that are examples of the task demands of the job in question

Work-sample tests – using samples of the job (e.g. the contents of an in-tray for an executive position, or specific kinds of typing for a secretarial post). The applicant is given instructions and a specific amount of time to complete the tasks.

Handwriting analysis – making inferences about the candidate's characteristics by examining specific features of his/her handwriting, such as slant and letter shapes.

assessment centres series of assessment exercises (e.g. interviews, work-sample tests, group discussions) used to assess a person's potential for a job

Assessment centres – a combination of some of the above techniques. Candidates are usually processed in groups, and some of the techniques require them to interact (e.g. simulated group decision-making exercises).

psychometric tests assess cognitive and personality dimensions

Although the usefulness of *psychometric tests* in selection has been hotly debated by psychologists, their validity has been found to be relatively good (Robertson & Kinder, 1993). The drawback from the perspective of employers is that training is required for those who wish to administer and interpret these tests. Even though the financial costs of ineffective selection are potentially large, organizations still rely on techniques such as personal references, graphology (handwriting analysis) and even astrology. These techniques are demonstrably and largely invalid as selection devices (Rafaeli & Klimoski, 1983).

Selection methods need to have good *criterion validity*. This is the relationship between scores on the selection method and scores on the ultimate performance measures, such as number of sales made, commission earned or other types of outcomes required by the organization (Landy & Farr, 1980).

criterion validity the relationship between a person's scores in a selection method (e.g. job interview or intelligence test) and his/her scores on subsequent performance measures (e.g. supervisor's rating of the person's job performance)

Figure 20.1

Despite the fact that psychological tests show good criterion validity, the most frequently used selection method for many jobs is the unstructured interview.

Psychological tests show good criterion validity. For example, one of the best predictors of job performance (for all but very simple jobs) is general intelligence (Hunter & Hunter, 1984; see also chapter 13). And yet the most frequently used selection method for many jobs is the unstructured interview, which has poor criterion validity. Here, interviewers ask a wide variety of questions, but without planning what questions will elicit the information that best predicts job performance.

structured interviews in which the questions are standardized across interviewees

Structured interviews, involving two or more interviewers asking standard job-related questions of all candidates, are much better selection methods, but they are rarely used (Huffcutt & Arthur, 1994; Wiesner & Cronshaw, 1988). These interviewers are likely to ask targeted questions, such as: 'Have you ever been in a situation at work where a customer was very angry about a service you had provided? Describe the situation and how you handled it.' This kind of question will usually elicit clearer information about the likely future performance of the candidate, because one thing we know for sure is that one of the best predictors of future behaviour is past behaviour (see chapter 17).

Personality tests (used for assessing traits such as conscientiousness, confidence and sociability) are increasingly popular tools in employee selection (see chapter 14). Tests that assess specific personality traits relevant to a particular job are reasonably valid predictors of job performance (Hogan & Roberts, 1996), whereas general-purpose personality tests have lower validity (Salgado, 1997).

Fitting into the organization

Once you have started work for an organization, it will seek to shape you to fit in and to contribute to achieving its goals. This is done through socialization and training.

The stages of socialization

Socialization is the process by which members of a society (be it a country, organization or even a family) are taught how to behave and feel by influential members of that society. In the past, theory and research has concentrated on the development of children and adolescents. But more recently it has become clear that we are socialized and resocialized throughout our lives (Wanous, Reichers & Malik, 1984).

When employees start work, they learn about their new jobs, the work environment and how they are required to behave – attending meetings on time, dressing according to certain standards, using particular styles of speech. They learn to align their work values with those of the organization. For example, army recruits are socialized, or indoctrinated, into the 'army way', learning not only the rules and regulations but also the values and behaviours that match the army's distinctive culture. Many commercial organizations emphasize customer service as vital, and require employees to adopt the values, attitudes and behaviours that support such a service strategy.

Socialization has all or some of the following stages (Wanous, 1992):

- confronting and accepting organizational reality – Wanous (1978) suggested that organizations can make this 'reality shock' stage smoother by providing applicants with a realistic job preview describing negative as well as positive aspects of the job;

Figure 20.2

Like many new employees, army recruits learn to align their work values with those of the organization, absorbing not only the rules and regulations but also the values and behaviours that match the army's distinctive culture.

- achieving role clarity by discovering what is expected in terms of job requirements and performance;
- becoming situated within the organizational context – settling in and getting used to how things are done; and
- detecting signposts of successful socialization – e.g. feeling accepted by colleagues, confidence in completing the job successfully, understanding the formal and informal aspects of the job, and knowing the criteria used to assess job performance.

This process of 'learning the ropes' has at least three elements (Van Maanen & Schein, 1979, pp. 226–7):

- acquiring the knowledge required for both job performance and general functioning in the organization (e.g. how to make a grievance, what quality standards need to be met);
- acquiring a strategic base, i.e. a set of decision rules for solving problems and making decisions (e.g. building good relationships with colleagues in your and other departments, knowing whether it is acceptable to question a senior manager's decision); and
- learning the organization's purpose, which may be different from what is publicly stated (e.g. employee welfare may, in practice, be rated much lower than maximizing profits).

How your job can change you

There is evidence that, over the longer term, an individual's personality, values and cognitive functioning are changed by their job. Kohn and Schooler (1983) found that jobs high in complexity can enhance intellectual functioning. Von Rosenstiel (1989) showed that people who started without a strong career orientation and who were supportive of environmental protection become less 'green' and more career-orientated when they took a company job. Mortimer, Lorence and Kumka (1986) found that people tend to value more, over time, things like money or challenge that are characteristic of their particular type of work, and to devalue things that are not, such as unconventional dress or antipathy to rules (although they may start their career valuing these latter characteristics more).

Not surprisingly, a problem with strong socialization tactics is that they tend to create conformists with little inclination to innovate (see chapter 18). Van Maanen and Schein (1979) proposed six dimensions to socialization tactics:

1. *collective vs. individual* – the degree to which the organization processes recruits in batches (where everyone has the same learning experiences) or individually;
2. *formal vs. informal* – the degree to which the process is formalized (as in set training programmes), or is handled informally (such as via individual supervision by the immediate supervisor, and through learning on the job);
3. *divestiture vs. investiture* – the degree to which the process destroys aspects of the self and replaces them (as in an army training camp), or enhances aspects of the self (as in some forms of professional development);
4. *serial vs. disjunctive* – the degree to which role models are provided (as in apprenticeship or mentoring programmes), or are deliberately withheld (as in sink-or-swim initiations, in which the recruit is expected to figure out her own solutions and is not told what to do);
5. *sequential vs. random* – the degree to which the process consists of guiding the recruit through a series of discrete steps and roles, as opposed to being open-ended (where training is based on the needs of the individual, and there is no set sequence in his/her progression); and
6. *fixed vs. variable* – the degree to which stages of the training process have fixed timetables or are open-ended (such as in some promotional systems, where the employee is not advanced to the next stage until she is deemed ready).

Van Maanen and Schein argued that the more a newcomer's experiences are like the first half of each pair given in the listing above (e.g. collective, formal, sequential, etc.), the more likely the recruit is to conform; individual perspectives and attitudes will be stripped away and replaced by standardized behaviours. Socialization into the army relies on strong socialization tactics. New recruits are trained together, segregated from experienced soldiers, and socialization tends to suppress individual aspects of the self (which are then replaced by conformity to army norms).

Pioneer

Edgar H. Schein (1928–) is the Sloans Fellows Professor of Management (Emeritus) and Senior Lecturer at the MIT Sloan School of Management. He has contributed to the discipline of organizational psychology in the areas of organization development, career development and organizational culture. In *Career Survival: Strategic Job and Role Planning*, he presented concepts and activities for managers based on research he first reported in *Career Dynamics: Matching Individual and Organizational Needs* (1978). He is the author of *Organizational Culture and Leadership* (1992), and is considered the leading international expert on organizational culture.

Training – does it work?

Training is a learning process structured in a systematic fashion and designed to raise the performance level of an employee (Goldstein, 1993; Tannenbaum & Yukl, 1992). With the marked change in work environments over the last quarter of the twentieth century (such as new ways of working, cutbacks at managerial level and the devolution of responsibility and accountability to individual staff) has come an urgent need to develop and maintain staff skills through continuous training. Furthermore, with the expanded use of new technology (and information technology in particular) most people at work need continual training

to update their skills (Ashton & Felstead, 1995; Pfeffer, 1998; Tharenou & Burke, 2002). Yet the approach to training in many organizations is often haphazard and reactive.

Psychologists have much to offer organizations in relation to how training can best be used to achieve a fit between the individual and his job. Organizations must undertake a *training needs assessment* in order to identify who needs to develop more knowledge and skills to successfully complete their present and future tasks. This is usually done through observation, interview, group discussion and work samples. Training methods include on-the-job training (coaching), lectures, simulations (e.g. cockpit simulation), case studies and programmed instruction (via computers).

training needs assessment identification of learning requirements, to facilitate successful completion of present and future roles

A critical question (given the huge costs involved) is whether training transfers to job performance. Three factors influence the *transfer of training*:

transfer of training application of what was learned in job training to the job itself

- the similarity of training to work tasks – the more similar the better;
- the employee's motivation to use newly learned skills or knowledge on the job; and
- organizational support for the transfer of training, such as supervisory support for the implementation of new ideas.

Ideally, training should be evaluated to determine whether it is achieving its desired ends. This can range from whether the individual enjoyed the training and applies it, to whether it affects job performance, customer satisfaction or even organizational productivity and profitability.

Does training work in practice? Research shows that training improves individual and organizational performance in a variety of ways, including increased organizational productivity, better product quality and improved customer service. In a review of training research, Tharenou and Burke (2002) report that training is related to:

- the acquisition and retention of essential employees;
- employee satisfaction;
- employee turnover rate (i.e. the percentage of employees quitting their jobs each year);
- work productivity (e.g. sales per employee);
- product quality; and
- customer ratings of service and product quality.

Leadership styles

Organizational psychologists have struggled with the concept of leadership since the mid twentieth century, changing their focus from personality ('leaders are born, not made') to environmental factors ('circumstances determine who emerges as the leader') and back to personality again (Bass, 1990; Fiedler, 1967; House, 1977; see also chapter 18).

Today, there is a lot of interest in charismatic or *transformational leadership*. This represents a leadership style that enables the leader to exercise diffuse and intense influence over the beliefs, values, behaviour and performance of others (House, Spangler & Woycke, 1991). Such leaders tend to be dominant and self-confident with a need to influence others while believing strongly in their own values. They communicate their goals and visions clearly, and have high expectations of their followers' performance.

transformational leadership a style used by leaders who tend to be dominant and self-confident, need to influence others, while believing strongly in their own values, communicate their goals and visions clearly, and have high expectations of their followers' performance

The fascination with this kind of leadership is evidenced by the number of books by or about charismatic leaders. Some studies suggest that these leaders inspire effort and satisfaction amongst their employees, resulting in higher productivity. But Howell and House (1995) caution against this type of leadership style because, they argue, it can also have negative consequences. Think of charismatic historical figures who have initiated destruction in their societies (e.g. Adolf Hitler); or particular characters such as the People's Temple cult leader, Reverend Jim Jones, who persuaded his followers to feed a poison-laced drink to their children and then drink it themselves. Nearly 1000 people died in this incident (Osherow, 1981).

Howell and House distinguish between socialized and personalized charismatic leadership. 'Socialized leaders' emphasize egalitarianism, serving collective interests rather than self-interest, and developing and empowering others. They are altruistic, self-controlled, follower-oriented (rather than narcissistic), and work

Figure 20.3

The negative influence of transformational leadership: the People's Temple cult leader, Reverend Jim Jones, persuaded his followers to feed a poison-laced drink to their children and then drink it themselves. Nearly 1000 people died.

Research close-up 1

Transformational and transactional leadership

The research issue

Bass's (1985) theory of transformational leadership distinguishes between transactional leaders and transformational leaders. Transactional leaders base their relationships with their followers on a series of exchanges or bargains. They reward followers for accomplishing agreed objectives by giving recognition, bonuses, merit awards or particularly stimulating projects. They also 'transact' with followers by focusing on their mistakes, and delaying decisions or avoiding intervening until something has gone wrong. Transformational leadership, in contrast, is characterized by behaviour that helps followers to develop their knowledge and skills, stimulating them intellectually and inspiring them to go beyond self-interests to achieve or pursue a higher vision, mission or purpose. Transactional leadership focuses on short-term corrective or reward-based transactions, whereas transformational leaders employ charisma and give more consideration to each individual's needs. Transformational leaders focus on longer-term goals and place emphasis on developing a vision that inspires their followers.

Of course, all leaders are likely to display elements of both styles of leadership, but, according to this framework, it is proposed that there will be considerable variation between leaders in the extent to which they employ predominantly one or other style. Howell and Avolio (1993) decided to investigate the extent to which transactional and transformational leadership behaviours predicted business performance.

Design and procedure

The researchers worked with 78 managers in a large Canadian financial institution, which was one of the oldest and most successful in the country. They measured leadership behaviour by administering the Multifactor Leadership Questionnaire (MLQ) to (on average) four of the followers of each of the 78 managers. The MLQ measures transformational leader behaviour by items such as 'uses symbols and images to get his or her ideas across', 'provides reasons to change my way of thinking about problems' and 'spends time coaching me'. Transactional leadership is measured by items such as 'points out what I will receive if I do what needs to be done', 'is alert for failure to meet standards' and 'things have to go wrong for him or her to take action'.

One year later, the researchers gathered data on the performance of the business units for which each of the managers was responsible. These data included productivity improvement, size of operating expense budget, conformity of salaries to budget and total project costs.

Results and implications

The managers who displayed less transactional leadership behaviours and more consideration for individuals, intellectual stimulation of followers and charisma had better business unit performance one year later. Transactional leadership behaviours were also negatively related to unit performance.

The results suggest that managers need to develop a transformational leadership style in order to be more effective and to contribute to the performance of their business units or organizations. But the authors point out that their results are not entirely consistent with previous studies. Although previous studies reveal positive relationships between transformational leadership styles and performance, they also showed positive relationships between transactional behaviours and performance.

Transactional leadership behaviours may lead to poorer performance in an environment, such as the financial services industry, where there is much change and turbulence. Employees may need to develop a longer-term vision of their work to cope with long-term change, which transactional styles (focused as they are on meeting short-term goals) do not encourage. Interviews with senior managers in the organization revealed a concern that some managers had become too transactional and spent too much time on meeting immediate goals and achieving short-term results rather than motivating, empowering and inspiring employees. The researchers suspected that the negative relationships between transactional styles and performance might have been a consequence of employees feeling that rewards were being used to control their behaviour rather than reward performance.

The positive impact of transformational leadership on performance could be due to followers internalizing the charismatic leader's vision or values and consequently working hard to achieve that vision, regardless of the short-term consequences for them. Such effects are more likely to be powerful (according to theory) in organizations that are coping with considerable change, where a focus on the long-term future helps to distract employees from the short-term stresses of additional workloads or major change in their work.

The researchers speculate that transformational leadership may have a direct effect on the commitment levels of followers and their preparedness to be good organizational 'citizens' who contribute beyond what they are required to, and that this, in turn, affects business unit performance. The investigators call for more research to help us understand not just whether, but how, transformational leadership behaviours influence job performance.

Howell, J.M., & Avolio, B.J., 1993, 'Transformational leadership, transactional leadership, locus of control, and support for innovation: Key predictors of consolidated-business-unit performance', *Journal of Applied Psychology*, 78, 891–902.

through legitimate authority and established systems. 'Personalized leaders' are more self-interested and manipulative and can engender pathological relationships with their followers, leading to unhappy work outcomes such as poor performance, conflict-ridden relationships and poor individual wellbeing.

JOB SATISFACTION

Selection, socialization and training are all ways in which the organization acts upon the individual at work. But how might individuals react to these processes and to the experience of work in general?

job satisfaction a person's attitude (favourable or unfavourable) towards their job

Job satisfaction is a judgement we make about how favourable our work environment is (Motowildo, 1996) and can be reflected in our thoughts and feelings (Brief, 1998). It is the most researched construct in organizational psychology and the subject of literally thousands of studies.

There are two approaches to assessing job satisfaction. The first sees it as a single, global affective experience. So people are asked to give an overall assessment: 'In general, how satisfied are you with your job?' The second, and more widely adopted, approach is to view job satisfaction as a cluster of attitudes towards different aspects of the job, such as pay, supervisory support, autonomy, variety, working conditions and promotion prospects. A mean score is calculated to represent a composite measure of job satisfaction. Table 20.1 is a typical example of this composite approach.

What makes a job satisfying?

Hackman and Oldham's (1976) influential job characteristics theory identifies five characteristics as contributors to job satisfaction:

- task identity – the extent to which the job represents a whole piece of work (e.g. running a restaurant compared with just washing the dishes);
- task significance – how important the task is for society in general, and for the goals of the organization;
- autonomy – the amount of freedom the person has to decide on how best to do their job;
- feedback – receiving information about job performance (imagine writing essays and never receiving feedback on how well they were written); and
- variety – varied tasks are important (compare the work of an organizational psychologist with that of a supermarket check-out worker), but too much variety can create conflicting and therefore stressful demands.

Table 20.1 Job satisfaction. Across samples of several thousand, 70 per cent of people score an average of between 3.5 and 5.5. If you rate your satisfaction in this range, you are similar to most others at work but scores to the top end of this range clearly indicate a healthier person–job fit. If your average satisfaction rating is higher than 5.5, you are in an unusually satisfying job. If your average rating is below 3.5, you should consider changing those aspects of your job that are least satisfying, or even finding a new and more fulfilling role altogether.

		Extremely dissatisfied	*Very dissatisfied*	*Moderately dissatisfied*	*Not sure*	*Moderately satisfied*	*Very satisfied*	*Extremely satisfied*
1	The physical working conditions.	1	2	3	4	5	6	7
2	The freedom to choose your own method of working.	1	2	3	4	5	6	7
3	Your fellow team members.	1	2	3	4	5	6	7
4	The recognition you get for good work.	1	2	3	4	5	6	7
5	Your immediate boss.	1	2	3	4	5	6	7
6	The amount of responsibility you are given.	1	2	3	4	5	6	7
7	Your rate of pay.	1	2	3	4	5	6	7
8	The opportunity to use your ability.	1	2	3	4	5	6	7
9	Relationships between management and workers in the organization.	1	2	3	4	5	6	7
10	Your chance of promotion or progression within the company.	1	2	3	4	5	6	7
11	The way your firm is managed.	1	2	3	4	5	6	7
12	The attention paid to suggestions you make.	1	2	3	4	5	6	7
13	Your hours of work.	1	2	3	4	5	6	7
14	The amount of variety in your job.	1	2	3	4	5	6	7
15	Your job security.	1	2	3	4	5	6	7
16	The amount of training you receive.	1	2	3	4	5	6	7

Source: Warr, Cook and Wall (1979).

Pioneer

J. Richard Hackman (1940–) pioneered the Job Characteristics Model in order to help specify the content and methods of jobs. This model has influenced generations of researchers since the 1970s (Hackman & Oldham, 1976). The job characteristics model effectively linked the design of jobs with motivation theory, in what has proved to be a powerful theoretical framework. His work on groups, developed in the 1980s and 1990s, has also had a major influence (Hackman, 1990), particularly because of his championing of qualitative methods for the study of workgroups. Hackman is Cahners-Rabb Professor of Social and Organizational Psychology at Harvard University in the USA.

Many studies (e.g. Fried & Ferris, 1987) have found significant relationships between job characteristics and job satisfaction. There is strong evidence that simple and monotonous jobs (e.g. repeatedly undertaking a simple task on a factory production line) are associated with job dissatisfaction (Melamed et al., 1995). On the other hand, some people do not respond favourably to more challenging and complex jobs (Spector, 1997), so personality factors may well also be relevant here.

Other environmental factors that show significant relationships with job satisfaction include supportive supervisors and coworkers (Arvey, Carter & Buerkley, 1991) and equitable rewards (Sweeney & McFarlin, 1997). In the case of rewards, it is the extent to which employees view these as distributed fairly that affects satisfaction, rather than actual pay levels.

Job satisfaction has also been found to be related to IQ, mental health and personality variables (e.g. O'Brien, 1983; Staw, Bell & Clausen, 1986). It has even been argued that there is a genetic component to job satisfaction. For example, in a survey of groups of identical twins who were reared separately, Arvey, Bouchard, Segal and Abraham (1989) found a significant association between their levels of job satisfaction. It appears from this research that our genes influence our affective reactions to life, which can in turn affect our job experiences.

Figure 20.4

It is probably unsurprising that simple and monotonous jobs are thought to be associated with job dissatisfaction.

Consequences of job satisfaction

Does high job satisfaction lead to better job performance, or does high performance result in high job satisfaction (due, perhaps, to pride or rewards associated with high performance)?

Whatever the causal direction, past research in this area indicates that if a relationship does exist, it is a weak one (Iaffaldano & Muchinsky, 1992). But more recent research provides renewed support for the view that 'a happy worker is a productive worker'. Two studies have related the average level of job satisfaction in an organization to measures of company performance, such as profitability. They found that organizations with more satisfied employees tend to perform better than those whose employees are less satisfied (Ostroff, 1992; Patterson & West, 1998). These organizational relationships are stronger than the association between individual job satisfaction and individual job performance, because individual measures of productivity do not take into account coordination and cooperation between employees. So when people are generally satisfied and well treated at work, they seem more likely to be good organizational 'citizens', cooperating with people from other departments, taking on tasks outside their formal job descriptions and encouraging others to perform effectively.

At the individual level, perhaps not surprisingly, low job satisfaction significantly increases the likelihood that the employee will leave the organization (e.g. Crampton & Wagner, 1994).

Stress at work

Although it is difficult to estimate the cost of work-related stress, many studies report that it has enormous impact in terms of both economic costs and human suffering. For example, recent survey research estimated that about half a million people in the UK believe they are suffering from work-related stress, depression or anxiety (Jones et al., 2003) and that, in 2001, 13.4 million working days were lost in the UK due to stress, depression and anxiety. Another survey estimated that five million people in the UK feel 'very' or 'extremely' stressed by their work (Smith et al., 2000).

Based on 1995/96 prices, the Health and Safety Executive estimated that the financial cost of work-related stress to employers was about £353 to £381 million and to society about £3.7 to £3.8 billion per year. Since these calculations were made, the estimated number of working days lost due to stress has more than doubled (Jones et al., 2003).

The costs of stress stem not only from absenteeism and lost productivity, but also from compensation claims, health insurance and medical expenses. In the USA, annual mental stress

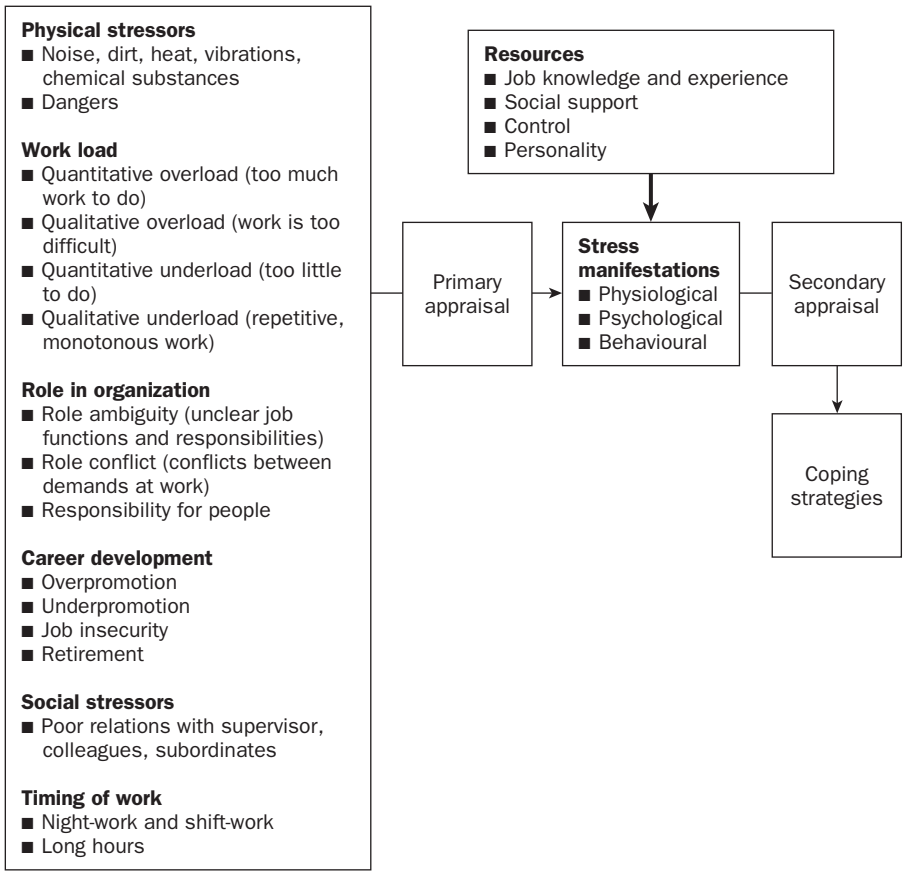

Figure 20.5

A framework of stress. Source: Based on Kahn and Byosiere (1992).

insurance claims in the California workers' compensation system have been estimated to be approximately $383 million (Beehr, 1995). Figure 20.5 presents a framework for thinking about work-place stress.

Kinds of stress

The word 'stress' is used in a number of ways (see also chapter 19). For example, 'I've got such a headache. It must be the stress over this big project'; 'I feel stressed when my boss is around'; 'I feel tense and my concentration goes when I am under stress'.

There are numerous stressors in the work environment that can result in distinctive physiological, psychological and behavioural responses.

- *Physical stressors* can lead to both physical and mental health problems. They might include the noise in a heavy construction manufacturing site or at an aluminium smelting plant, or the dirty and hot physical environment of a coal mine or steel plant. Dangers in the work environment also cause stress – think of the jobs of police officers or nurses in accident and emergency departments of hospitals; both of these sets of workers are often subject to violent attacks.
- *Work load* can be quantitative (too much work to do) and qualitative, where work is too difficult for the individual (French & Caplan, 1972). Work underload can also act as a stressor (Cox, 1980) – again this can be quantitative (not enough work to do) and/or qualitative (repetitive, routine, under-stimulating).
- The person's *role in the organization* can also lead to pressures in the form of *role conflict* and ambiguity (Kahn et al., 1964). Role conflict occurs when we have to deal with conflicting job demands. It is not unusual for an individual to be caught between two groups of people expecting different behaviours. This might occur when a non-management employee is promoted to a supervisory role and then has to balance the expectations of previous colleagues with the new demands of management. *Role ambiguity* occurs when we are unsure about our work requirements, responsibilities and co-workers' expectations.

role conflict when demands placed on an employee conflict with one another

role ambiguity employee uncertainty about their job functions and responsibilities

- Stress can also arise from *career development issues*, such as fear of redundancy, failure to achieve promotion, or promotion into a role we are not prepared for.
- *Social stressors* include poor relationships with supervisors, peers and subordinates (characterized by, for example, low trust and supportiveness).
- Finally, many studies have shown that the *timing of work* (such as long hours or shift work) affects stress levels.

Figure 20.6
Shift work can affect stress levels.

Reactions to stress

Although you and I may be subject to similar work stressors, our responses and the amount of strain each of us feels can be very different, depending on how we appraise the situation and what coping strategies we use (Lazarus & Folkman, 1984; Lazarus & Launier, 1978; see also chapters 6, 14 and 19). So the outcome of stress is a function of the interaction of the individual and the environment.

The resources that we bring to a work situation can also affect the way each of us responds to stress. Job knowledge and experience, social support, control over our work, and personality characteristics are the kinds of resources that determine whether someone finds a situation stressful. Some of the most relevant factors are:

Knowledge – People who have considerable job knowledge and experience are more likely to be able to cope with stressful situations. This is because they are less likely to experience quantitative or qualitative work overload, and they are likely to have more control over a situation than someone with little experience or knowledge (see below).

Social support – Whilst poor relationships at work can be a major source of stress, social support from colleagues and supervisors can buffer the impact of stress, mitigating the negative effects (e.g. Cummins, 1990; Manning, Jackson & Fusilier, 1996). Social support may also come from outside the job, from family and from friends.

Control – There is a widely held misperception that managers have more stressful jobs than others. While they do tend to have heavy workloads, deadlines, responsibility for complex decisions, and many relationships to manage, stress-related diseases are much less common in managers than in blue-collar workers (Fletcher, 1988; Karasek & Theorell, 1990). One important reason for this appears to be that managers have greater control (autonomy) over their work. Karasek (1979) showed that the most damaging jobs have a combination of high demands (volume and pace of work) with low control.

Personality characteristics – Neurotic people are more likely to see stimuli as threatening than are hardy characters. Hardiness encompasses three personality traits: (i) commitment, (ii) an internal locus of control (believing that you have control over your own life) and (iii) a sense of welcoming challenge (Maddi & Kobasa, 1984; see also chapters 14 and 19). Those who are high in hardiness tend to view events as less stressful than do others, and they are less likely to be overwhelmed by challenging situations.

Prevention of stress

Stress management programmes have multiplied since the 1970s (Payne, 1995). Many of these programmes help participants to perceive a situation as challenging rather than stressful. They teach coping strategies and advise on diet, exercise, alcohol and substance abuse. Some programmes use techniques such as self-help groups, relaxation and meditation. Unfortunately, systematic evaluations of stress management programmes have shown them to be of limited effectiveness (Briner & Reynolds, 1999).

Employers will sometimes try to reduce stress through changes in the workplace, such as *job redesign*, or to increase individuals' resources through social support or increased control (by increasing job responsibilities and/or participation in decision making). And, of course, stressors can also be tackled directly, for example by reducing noise or working hours.

job redesign techniques to increase the variety, autonomy and completeness of a job

GROUPS AT WORK

More than the sum of the parts

Work groups, or teams, are increasingly common in organizations. Formal groups are those designated as work groups by the organization. The members of these groups usually have shared task objectives. Examples of these formal groups include health care teams, management groups, mining crews and research and development project groups. Informal work groups are not defined by the organization as functional units, but nevertheless have an impact on organizational behaviour. Examples include friendship and pressure groups.

work groups collectives of individuals within organizations – formal groups are designated as work groups by the organization, and informal groups are not defined by the organization as functional units, but nevertheless have an impact upon organizational behaviour

Group influences on work behaviour

Early studies of organizational behaviour show that work groups profoundly influence individual behaviour. In the 1920s and 1930s, several studies were carried out at Western Electric's Hawthorne Works in Chicago, USA, to examine the effects of illumination levels on workers' performance in assembling and inspecting relays used in telephone equipment. The researchers varied the level of illumination and studied the effects on workers' performance.

The results showed that any variation in the level of illumination (down to a level almost the equivalent of moonlight) led to improvements in performance. This effect was explained in terms of the workers' appreciation of the attention and interest shown in their work by researchers and managers, which manifested itself in better work performance. This effect has come to be known as the *Hawthorne effect*, and field studies that test methods of intervention in organizations have to demonstrate that positive results are not simply due to this effect (this is somewhat analogous to the 'placebo effect' discussed in chapters 16 and 19).

Hawthorne effect when workers appreciate the attention and interest shown in their work by researchers and managers, and show this appreciation through better work performance

Further studies in the Hawthorne Works examined the effects of several other factors (such as number and length of rest periods, and hours of work) on the performance of a small group of female workers (see *Everyday Psychology* for more detail on this

Everyday Psychology

The Hawthorne Effect

The scientific management approach dominated thinking about human performance in organizations in the early part of the twentieth century. It assumed that there was one best way to manage, and that productivity could be maximized by careful study of job content, combined with ergonomic studies, standardized methods of job performance and appropriate selection and training in the precise components required for the job. This approach informed the continued development of assembly line methods in the early twentieth century, best typified in the Ford Motor Company's approach to vehicle production.

Roethlisberger and Dixon (1939) were inspired by the scientific management approach to investigate the effects of (among other things) illumination levels on workers' performance in Western Electric's Hawthorne Works, near Chicago. Their aim was to discover how to optimize the workplace by manipulating factors such as levels of lighting and hours of work, in order to achieve maximum productivity.

Two groups of female employees took part in the first element of the investigation, which took place in a relay assembly department. The control group worked without any changes in the level of illumination in their workroom. In the experimental group the lighting was systematically varied (being sometimes brighter and sometimes dimmer than the standard level of illumination for the control group), and the productivity of the workers was continually monitored. Subsequent investigations examined the effects on productivity of variables such as length of rest pauses, length of the working day and week, and a free lunch.

The findings were quite baffling. Both the control group and the experimental group increased their productivity during the study. Regardless of whether illumination levels were increased or decreased, the productivity of the experimental group went up. Even when the illumination was turned so low that the women could barely see what they were doing, productivity went up! The introduction of changed lengths of working hours, weeks and rest pauses had a similar impact. Even the introduction of a free lunch led to improved performance.

The results suggested that productivity rose because the women responded favourably to the 'special attention' they felt they were getting from the investigators. Knowing they were being studied apparently made them feel important and valued, and they were motivated to do their best, regardless of what changes were introduced.

In a second component of the investigation, conducted in the bank wiring room, members of work groups (this time all men) were observed during their work and interviewed at length at the end of the working day or week. There was no intervention here, since the aim was simply to observe the work process and discover how it could be done more efficiently and productively.

The men did not improve their productivity. Quite the contrary – they stopped work before the end of the working day and later told the investigators that they were capable of being much more productive. It appeared that the men feared the study would lead the company to raise the level of productivity required for the same rate of pay. So they deliberately kept productivity low to ensure they were not required in the future to achieve unreasonable levels of performance. The men had agreed informal rules between themselves about the level of productivity they would achieve, and they maintained this through their cooperation and shared goals.

In contrast to the assumptions of the scientific management approach (i.e. that technological and ergonomic factors are the predominant influences on workplace productivity), these investigations reveal the importance of social factors in work performance. In both cases, interpersonal processes played the major role in determining productivity.

These findings mark the birth of the 'human relations' movement, which drew attention to the importance of workers' needs, attitudes, social relationships and group memberships in the workplace. It is an orientation that continues to have a major influence on managerial practice today, most notably in the domain of human resource management.

Roethlisberger, F.J., & Dickson, W.J., 1939, *Management and the Worker*, Cambridge, MA: Harvard University Press.

phenomenon). The results suggest that the characteristics of the social setting or group are at least as important as the technical aspects of the work in explaining performance (Roethlisberger & Dixon, 1939).

Types of group and what makes them effective

Sundstrom, De Meuse and Futrell (1990) distinguish four main types of formal work teams:

- *advice/involvement teams* – e.g. committees, review panels, boards, quality circles, employee involvement groups, advisory councils;
- *production/service groups* – e.g. assembly teams, manufacturing crews;
- *project/development groups* – e.g. research groups, planning teams, specialist functional teams, development teams, task forces; and
- *action/negotiation groups* – e.g. entertainment groups, expeditions, negotiating teams, surgery teams, cockpit crews.

In some organizations, groups as a whole may be hired, fired, trained, rewarded and promoted. This trend has developed as organizations have grown and become increasingly complex, demanding that shared experiences and complementary skills are constantly utilized in decision-making processes. Another reason for the dominance of the work team is the belief that the combined efforts of individuals may be better than the aggregate of individual contributions – the principle of synergy.

A good deal of effort is now directed toward understanding the factors that promote group effectiveness and this has led to the development of models for understanding teams. A typical model combines inputs, processes and outputs. Inputs include (for example) organizational context and group composition; processes include decision-making leadership. Outputs refer to group performance and team member well-being (see also chapter 18). A model of these factors is shown in figure 20.8.

Figure 20.7

The surgery team: a typical action/negotiation group.

This work suggests that, ideally:

- teams should have intrinsically interesting tasks to perform (Guzzo & Shea, 1992);
- each individual's role should be essential and unique (Guzzo & Shea, 1992);
- each individual should be subject to evaluation and receive clear performance feedback (Pritchard et al., 1988);
- the team as a whole should have clear objectives, be subject to evaluation, and receive performance feedback (Poulton & West, 1999); and
- the team should frequently reflect on their task objectives, strategies and processes, modifying these as appropriate (West, 1996).

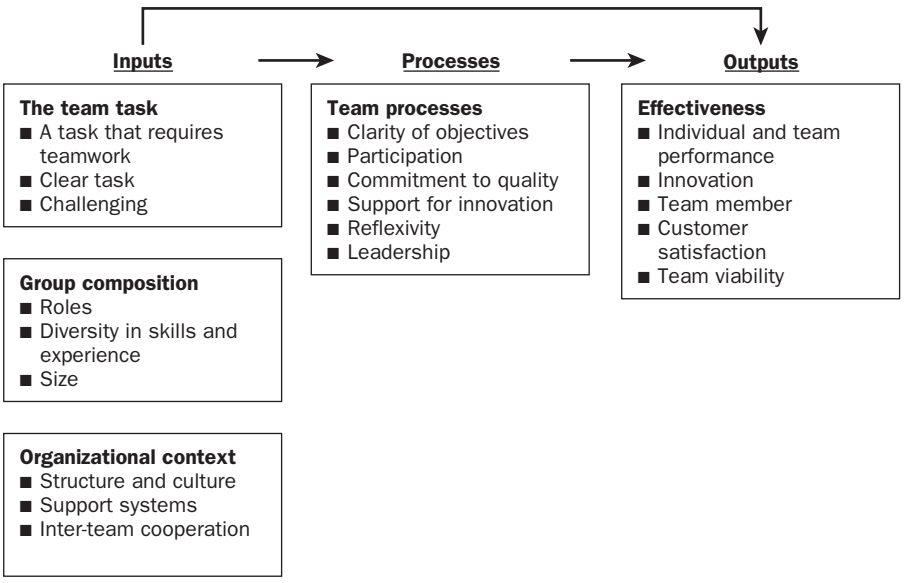

Figure 20.8

An input–process–output model of team performance. Source: West & Markiewicz, 2003.

Research close-up 2

Psychological safety in work teams

The research issue

In recent years, there has been a wave of research into teams at work. In particular, researchers seek to understand how the climate in work teams affects their performance. In a study of hospital patient care teams (Edmondson, 1996), there were clear differences between members' beliefs about the social consequences or the safety of reporting medication errors (giving the wrong drug to a patient, or giving too little or too much of the right drug). In some teams, nurses openly reported and discussed errors. In other teams, they kept information about errors to themselves. A nurse in one team said, 'Mistakes are serious, because of the toxicity of the drugs [we use] – so you're never afraid to tell the Nurse Manager.' In contrast, a nurse in another team reported, 'You get put on trial! People get blamed for mistakes . . . you don't want to have made one.'

In a subsequent study of 51 work teams in a manufacturing company, Edmondson (1999) examined whether psychological safety was evident, and whether it predicted learning in the team (e.g. about how to do the work better and meet customer requirements).

Design and procedure

Edmondson studied teams in Office Design Incorporated, an innovative manufacturer of office furniture with some 5000 employees. There were four types of team in the organization: (i) functional teams, including sales, management and manufacturing teams; (ii) self-managed teams in sales and manufacturing; (iii) time-limited cross-functional product development teams; and (iv) time-limited cross-functional project teams.

There were three phases of data collection. The first phase involved preliminary qualitative research, in which Edmondson observed eight team meetings, each of which lasted one to three hours. She also conducted 17 interviews (lasting for about an hour each) with members or observers of these eight teams. The second phase involved a questionnaire survey of 496 members of 53 teams, and two or three managers identified as observers of each team. The survey measured learning behaviour in the team ('we regularly take time out to figure out ways to improve our team's work process') and team feedback (e.g. team goals, job satisfaction, team task design, internal motivation). Phase 3 involved follow-up qualitative research with the six teams with the lowest level of learning behaviour, and the six with the highest level of learning behaviour.

The objective was to study these teams in more depth and explore differences between high- and low-learning teams. Edmondson reviewed field notes and tapes to construct short case studies describing each team, which were then used to reveal which factors were most closely related to team learning. Customers' and managers' ratings of all the teams in the study were used to provide measures of team performance and learning.

Results and implications

The study revealed considerable support for the relationship between team psychological safety and team learning behaviour. Team psychological safety was conceptualized as a shared belief among members of a team that it is safe to take interpersonal risks and that team members will not embarrass, reject or punish someone for speaking up (a confidence that stems from mutual respect and trust among team members). Edmondson found that psychological safety predicted team learning and that this, in turn, predicted team performance, as rated by managers outside the teams. For example, team members' own descriptions illustrated how a climate of safety and supportiveness enabled them to embrace error and make changes in product design as a result of seeking customer feedback. A lack of team safety contributed to reluctance to ask for help, and unwillingness to question team goals for fear of sanctions being imposed by managers. Quantitative analyses provided consistent support for the study's hypotheses: learning behaviour appeared to mediate the relationship between team psychological safety and team performance (i.e. team safety predicted performance because safety led to learning, which, in turn, led to improved performance).

The findings from Edmondson's research indicate how team design and leadership enable effective team performance. By producing a climate of psychological safety, they enable team members to explore errors and difficulties and learn from them. Members then make improvements in their work (i.e. products or services), and this, in turn, leads to improved performance. The theoretical and practical implications of this work point to the importance of team psychological safety as a central concept in understanding team composition, processes and outcomes (such as member mental health, and team performance). At the same time, the results have practical implications for how we can make teams more effective and innovative in the workplace.

Edmondson, A.C., 1996, 'Learning from mistakes is easier said than done: Group and organizational influences on the detection and correction of human error', *Journal of Applied Behavioral Science*, 32 (1), 5–28.

Group decision making

Factors in poor decision making

A principal assumption behind formal work groups is that a group will make better decisions than members working alone. And yet a good deal of research shows that social processes can undermine the effectiveness of group decision-making. While group decisions are better than the average of the decisions made individually by group members, experimental groups consistently fall short of the quality of decisions made by the best individual member (see chapter 18).

The implications of this for board and top management teams are serious. Organizational and social psychologists have therefore devoted considerable effort to identifying the processes that lead to poor group decision making:

- *Personality factors* can affect social behaviour: for example, individual members may be too shy to offer their opinions and knowledge assertively, therefore failing to contribute fully to the group's store of knowledge (Guzzo & Shea, 1992).
- *Social conformity effects* can cause group members to withhold opinions and information contrary to the majority view, especially an organizationally dominant view (Hackman, 1992; Schlenker, 1980).
- *Communication skills* vary, and some members may be unable to present their views and knowledge successfully, while someone who has mastered 'impression management' may disproportionately influence group decisions, even in the absence of expertise (Leery & Kowalski, 1990).
- *Domination* by particular individuals can mean they claim a disproportionate amount of 'air time' and argue so vigorously that their own views generally prevail. Interestingly, 'air time' and expertise are uncorrelated in groups that perform poorly (Rogelberg, Barnes-Farrell & Lowe, 1992).
- *Egocentricity* might take some individuals to senior positions, but people with this trait tend to be unwilling to consider opinions and knowledge contrary to their own, making for poor communication within the group (Winter, 1973).
- *Status and hierarchy* effects can cause some members' contributions to be valued and attended to disproportionately. So, when a senior executive is present in a meeting, her views are likely to have an undue influence on the outcome (Hollander, 1958).
- *Group polarization* is the tendency of work groups to make decisions that are more extreme than the average of individual members' decisions (Myers & Lamm, 1976).
- *Groupthink* – a phenomenon identified by Janis (1982) in his study of policy decisions and fiascos – is when a tightly knit group makes a poor decision because it is more concerned with achieving agreement than with the quality of its decision making. This effect can be especially strong when different departments see themselves as competing with one another or when teams have very strong leaders.
- *Satisficing* – or making minimally acceptable decisions – is another group tendency, and is related to this last point. Observations of group decision-making processes repeatedly show that, rather than generating a range of alternative solutions before selecting the most suitable one, groups tend to identify the first minimally acceptable solution and then search for reasons to accept that decision and reject other possible options (March & Simon, 1958; see chapter 12).
- *Social loafing* is the tendency of individuals to put less effort into achieving quality decisions in meetings than they do when individual contributions can be identified and evaluated, their perception being that their contribution is hidden in overall group performance (Latané, Williams & Harkins, 1979).
- *Diffusion of responsibility* can inhibit individuals from taking responsibility for their actions when they are in a group (e.g. Yinon et al., 1982). In this situation, people seem to assume that the group will shoulder responsibility. For example, if there is a crisis involving the functioning of expensive technology, individuals may hold back from tackling the issue on the assumption that others in their team will take responsibility for making the necessary decisions. This can threaten the overall quality of group decisions.
- *Production-blocking* is when individuals are inhibited from both thinking of new ideas and offering them aloud to the group by the competing verbalizations of others (Diehl & Stroebe, 1987). This effect has been shown in the study of brainstorming groups: quantity and often quality of ideas produced by individuals working separately consistently exceeded those produced by a group working together.
- *The hidden profile* is the powerful but unconscious tendency of team members to focus on information all or most team members already share and ignoring information that only one or two team members have (even though it may be brought to the attention of the group during decision making and may be crucial) (Stasser, Vaughan & Stewart, 2000).

This catalogue of deficiencies indicates that group decision-making within organizations is more complex than is commonly appreciated or understood.

Some useful techniques

Recently researchers have begun to identify ways of overcoming some of these deficiencies. For example, research on groupthink has revealed that the phenomenon is most likely to occur in groups where a supervisor is particularly dominant, and cohesiveness per se is not the crucial factor. Supervisors can therefore be trained to be facilitative, seeking the contributions of individual members before offering their own perceptions (see West, 1996).

Rogelberg, Barnes-Farrell and Lowe (1992) have offered a structured solution called the 'stepladder technique'. Each group member has thinking time before proposing any decisions, and then pairs of group members present their ideas to each other and discuss their respective opinions before making any decisions. The next step involves pairs of pairs presenting their views to

Figure 20.9

Groupthink is more likely to occur when there is a dominant supervisor.

each other. The process continues, with each sub-group's presentation being followed by time for the group as a whole to discuss the problem and ideas proposed. A final decision is put off until the entire group has presented.

Initial evidence suggests that the quality of group decisions made using procedures like this is at least as good as that of decisions made by their best individual members. This is consistent with the finding that fostering disagreement in a vigorous but cooperative way in organizations leads to better decisions (Tjosvold, 1998).

Teams can avoid the hidden profile problem by ensuring that members have clearly defined roles so that each is seen as a source of potentially unique and important information, by ensuring that members listen carefully to colleagues' contributions in decision making, and by ensuring that leaders alert the team to information that is uniquely held by only one or two members.

Finally, there is some evidence that work groups that take time out to reflect on and appropriately modify their decision-making processes are more effective than those that do not (Maier, 1970; West, 1996, 2004).

While organizational psychologists have contributed a great deal to our understanding of how individual performance can be improved, it should be apparent from the issues considered in this section that research on techniques for optimizing group decision making is still in its infancy.

Researchers and practitioners in organizational psychology are increasingly exploring how to structure and manage organizations that ensure that team working fulfils its potential (West & Markiewicz, 2003). This requires that organizations devolve decision making to teams, that the various teams work cooperatively across team boundaries, that teams are well led, and that people management processes (sometimes called Human Resource Management systems or HRM) support team working. The challenge is to discover how to transform traditional organizations into team-based organizations (see table 20.2).

Table 20.2 Characteristics of traditional vs. team-based organizations.

Individual command structures	*Collective decision-making structures*
Manager controls	Team monitors its performance
Vertical hierarchy	Horizontal integration across teams
Stability and uniformity	Change and innovation
One best way to organize	Team tailors its own ways of working
Managers manage	Self-managing teams

ORGANIZATIONS AT WORK

Most of the research on work groups has been carried out by psychologists. But the study of organizations has attracted attention from the full range of social and economic sciences. In recent years, psychology has begun to play a relatively larger role, particularly in collaboration with other disciplines.

ORGANIZATIONAL DESIGN

The choice of structures and associated managerial processes that enable an organization to operate effectively are described as organizational design. These structures and processes will largely determine how we experience an organization (Pugh, 1998a, b, c).

An army is large, highly structured, very formalized and hierarchical, with clear status and rankings that determine authority structures. Army rules and regulations provide strict decision-making guidelines as well as restrictions on activities. On the other hand, a small firm of consultants, which offers advice to companies on how to select people for job openings, may have an entirely different form. All consultants may have equal say in how the business is run; they may operate as independent practitioners; and there may be few rules and regulations determining their behaviour.

There are five interrelated concepts within the overarching theme of organizational design: (i) organization, (ii) how they design themselves, (iii) structure, (iv) effectiveness and (v) choice.

1. Organization The concept of organization can refer to a range of types, including businesses, governmental organizations, hospitals, universities, schools, not-for-profit organizations, churches and so on.

2. Design Design as a concept implies a deliberate effort to find an appropriate and effective organizational form (Daft, 1992). Having the army run like a small consultancy business, with few rules, no hierarchy and lots of independent action, would render it ineffective in a crisis, unable to orchestrate appropriate action. So design also implies a managerial authority to put organizational structure into effect, i.e. to ensure that particular groups of people work together on tasks specified by management.

Pioneer

Derek Pugh (1930–) inaugurated and led the Aston Research programme, a major series of studies on the structure, functioning and performance of organizations, and the effects on the attitudes and behaviour of groups and individuals within them (Pugh, 1998a, b, c). This programme began at the University of Aston and later continued at the London Business School and other centres throughout the world. Pugh contributed to the development of the new discipline of Organizational Behaviour in business schools, and he was appointed the first British Professor of the subject at the London Business School in 1970.

formalization written rules and regulations governing activities in an organization

centralization the degree to which decisions can only be taken by senior management, as against being devolved to people throughout the organization

3. Structure An organization's structure consists in its rules and regulations (degree of *formalization*) and the organizational elements that determine procedures for making decisions (degree of *centralization*).

The military and government departments are examples of highly centralized organizations, whereas decentralized organizations include voluntary organizations and partnerships (Hall, 1992). The trend today is to decentralize decisions as much as possible (though in practice this turns out to be very difficult to achieve), in order to 'empower' employees and derive maximum benefit from their knowledge, skills and abilities (Spreitzer, 1995).

Structure also includes the degree of specialization – that is, how particular and unique each person's job is. In some organizations, there is a low degree of specialization and one person may be expected to fill many roles. In a small rural health care team, for example, a nurse may act as receptionist, record keeper, telephonist, computer operator, diagnostician, treatment provider, counsellor and even cleaner. In another organization, people might have highly specialized roles, such as the telesales manager for one specific product line for one particular geographical area.

4. Effectiveness Organizations are designed to be effective, but defining 'effectiveness' is not easy (Cameron, 1986). For a car manufacturer, being effective might mean maximizing productivity and profitability. But there may be other dimensions of effectiveness that serve these ends, too, such as a high level of innovation and creativity in product design, a satisfied workforce strongly committed to learning new skills, reducing waste to improve operating efficiency, and ensuring high quality standards for the product or service that is offered.

Figure 20.10 shows a model for analysing effectiveness based on two core but complementary dimensions – (i) internal vs. external orientation and (ii) flexibility vs. control.

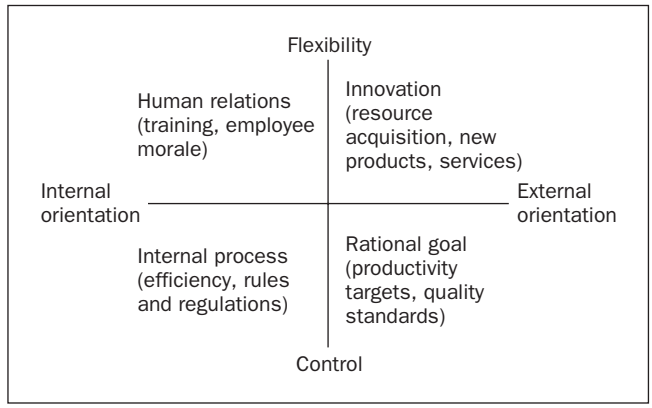

Figure 20.10

What is organizational effectiveness? In the competing values model, the effective organization combines emphases across all four domains, but there are constant tensions between the values of internal control, external flexibility and internal flexibility and external control. Managing these tensions is part of the function of management. Source: Adapted from Quinn and Rohrbaugh (1983).

To be effective, organizations must focus on the internal environment (safety, rules and regulations) as well as on the external environment (customers, the actions of competitors, government regulations), but they will do so with different degrees of relative emphasis.

Organizations will also tend to be predominantly either controlling or flexible in relation to the internal and external environment. Internal control means bureaucracy and rules and regulations. Internal flexibility means developing staff and giving them autonomy to work their own way. External control involves focusing on meeting customer requirements and productivity goals. External flexibility implies a concern with innovation, and adapting the organization to the outside world.

The model, developed by Quinn and Rohrbaugh (1983), suggests that organizational effectiveness must be achieved in four domains:

- human relations (internal flexibility)
- goals (external control)
- internal processes (internal control)
- innovation (external flexibility)

Yet these four domains represent underlying conflict (Woodman & Pasmore, 1991) between internal and external orientations of organizational activity, and between control and flexibility (e.g. tightly defining employees' roles as against encouraging them to develop or 'grow' their jobs).

How organizations resolve these dilemmas determines both organizational strategies and effectiveness. It is an interesting exercise to apply the analysis to organizations you are personally familiar with, and to then decide whether you consider that the predominant orientation of the organization is external or internal, and whether the emphasis is on flexibility or control.

5. Choice Finally, there is the concept of choice. Structures and processes do not simply evolve. They are a consequence of managerial choices, external factors (e.g. safety issues, or government legislation on equal opportunities) and stakeholder pressures (such as shareholders demanding bigger returns on their investments, or employees pressuring for better working conditions).

The downsizing trend

A critical element of organization design is size, or number of employees (Hall, 1977). The experience of working in large organizations (for example a major oil company such as BP) is very different from working in a smaller organization (such as a research institute which employs about 40 people).

Until the 1980s, the general trend was for organizations to grow, but now reductions in size are more common. This is partly because the spread of information technology, the development of networked computers and the evolution of the personal computer have all enabled networks of smaller organizations to collaborate. So nowadays call centres are replacing bank tellers and airlines reservation staff.

Organizations are also creating flatter, team-based and less centralized structures with fewer levels of management. And there is a trend towards outsourcing (or contracting out) certain core organizational services, such as catering, cleaning or computer maintenance, thereby reducing the need for a large labour force within an organization.

ORGANIZATIONAL CULTURE

As organization designs change, psychologists have investigated new ways to analyse those organizations. One approach that has caught the attention of many social scientists is to view organizations as 'cultures'.

Manifestations of culture

Imagine describing to your friends the experience of visiting a distant foreign country. You might talk about the dress, laws, religious beliefs, cultural values and traditions, physical environment, social attitudes, buildings, night life, recreational activities, language, humour, food, values and rituals of that country.

Organizations can also be described in terms of their cultures, including their values, attitudes and beliefs. Manifestations of culture include:

Hierarchy – e.g. the number of levels of command or management, from the head of the organization to the lowest level employee.

Pay levels – high or low, whether there is performance-related pay, and what the differentials are between people at different grades.

Job descriptions – how detailed or restrictive they are, and what aspects they emphasize (e.g. safety, productivity, cost saving or quality).

Informal practices – e.g. norms such as management and non-management employees sitting at separate tables in the canteen; strictly formal dress, uniforms or casual dress.

Espoused values and rituals – e.g. an emphasis on cooperation and support vs. cut-and-thrust competition between teams; cards, gifts and parties for those leaving the organization; celebrations at certain times of the calendar or financial year.

Stories, jokes and jargon – e.g. commonly told stories about a particular personal success or the failings of management; jokes about the sales department; jargon or acronyms (most government departments have a lexicon of acronyms and jargon, which is often impenetrable to outsiders).

Physical environment – office space, canteens, rest rooms. Are all spaces clean, tidy and comfortable or only the areas on public display? Are there decorations, such as plants and paintings, and adequate employee facilities, such as water fountains?

The meanings of all these aspects of the organization taken together tell us about its underlying culture (Schein, 1992). There has been particular interest in how to 'manage' *organizational culture*, and considerable resources have been spent trying to create 'a service culture' or 'an open culture' or 'a people culture', to name but three examples.

organizational culture the shared meanings, values, attitudes and beliefs held by organizational members

Understanding culture

Organizational psychologists have adopted three approaches to understanding culture (Martin, 1992): integration, differentiation and fragmentation. These differing dimensions suggest that organizational culture is complex and that we can best understand it by adopting a multidimensional perspective.

1. The integration perspective Those who adopt this view believe that a 'strong culture' will lead to more effective organizational performance. A strong culture is consistent throughout the organization, and there is organization-wide consensus and clarity. Senior management set the values and develop a mission statement. When this is effectively communicated and implemented via managerial practices, organization-wide consensus is shaped. So employees know what they are supposed to do and agree on the value of doing it.

McDonald (1991) described such a culture in the Los Angeles Olympic Organizing Committee. The employees wore attractive uniforms, developed elaborate rituals, introduced brightly coloured stadium decorations, adopted an intense working pace and told many stories about their charismatic leader, which all reinforced an organization-wide commitment around a shared set of values.

However, organizational psychologists now believe that culture is more complicated than the integration perspective alone implies.

2. The differentiation perspective This view recognizes that employees or members have differing interests, task responsibilities, backgrounds, experiences and expertise, which means that work attitudes and values, as well as pay and working conditions, will vary throughout the organization. Add the differing social identities due to gender, class and ethnic background, and, according to this perspective, the concept of a unifying culture seems inappropriate. Instead, it is proposed that within the organization there are overlapping and nested sub-cultures, which co-exist in relationships of harmony, conflict or indifference.

Van Maanen (1991) found just this differentiation even in the 'strong culture' of Disneyland. Food vendors and street cleaners were at the bottom of the status rankings whereas, among ride operators, those responsible for 'yellow submarines' and 'jungle boats' had high status. Some tension was noted between operators, supervisors and even customers as the different groups interacted. At the same time, supervisors were engaged in an endless struggle to catch operators breaking the rules.

According to Van Maanen, the conflict or differentiation perspective offers a more realistic account of organizational culture than the integration perspective.

3. The fragmentation perspective Ambiguity is a defining feature of many organizations. According to the fragmentation perspective, this ambiguity occurs because there simply is no consensus about meanings, attitudes and values of the organization.

Meyerson (1991) demonstrated this approach in a study of a social work organization. Where goals were unclear, there was no consensus about appropriate ways to achieve them, and success was hard to define and to assess. In this organization, ambiguity was the salient feature of working life. As one social worker reported: 'It just seems to me like social workers are always a little bit on the fringe; they're part of the institution, but they're not. You know they have to be part of the institution in order to really get what they need for their clients, but basically they're usually at odds with the institution' (p. 140).

There is considerable debate about the types of cultures that are associated with organizational effectiveness but some researchers have gathered data from the employees of successful companies on which characteristics they associate with their companies' success. These include emphases on customer service, quality of goods and services, involvement of employees in decision making, training for employees, teamwork and employee satisfaction (see figure 20.11).

Customer service
Strong emphasis on customer service
Company provides quality service
Customer problems corrected quickly
Delivers products/services in a timely fashion

Quality
Senior management committed to quality service
Senior management demonstrates quality is a top priority
Supervisors provide service guidance
Supervisors set good examples in relation to quality
Work group quality is rated
Continuous improvement
Clear service standards are set
Quality is a priority vs. meeting deadlines
Quality is a priority vs. cost containment

Involvement
Front line staff have the authority necessary to meet customers' needs
Encouragement to be innovative
Encouragement to participate in decisions
Sufficient effort to get opinions of staff
Management use employees' good ideas

Training
Plans for training and development
Opportunities for staff to attend training
Staff given opportunities to improve skills
Staff are satisfied with training opportunities
Staff have the right training to help them improve
New employees get necessary training

Information/Knowledge
Management gives clear vision/direction
Staff have a clear understanding of goals
Staff are informed about issues
Departments keep each other informed
Enough warning about changes
Satisfaction with organizational information

Teamwork/Cooperation
Cooperation to get the job done
Management encourages teamwork
Workload divided fairly
Enough people to do the work
Problems in teams corrected quickly

Overall satisfaction
High job satisfaction
Jobs use skills and abilities
Work gives a feeling of accomplishment
Satisfaction with organization
Rate the organization as a place to work
Proud to work for the organization
Would recommend working at the organization
High job security
Not seriously considering leaving the organization

Figure 20.11
Key dimensions of climate/culture linked to high-performing organizations. Source: Adapted from Wiley and Brooks (2000).

Power and politics

Why do people get up out of their warm beds to get to work on time on a cold winter morning? Why do they conform to the office dress code? Why do they allow the boss to talk to them in a way they would not permit from others? The explanation goes beyond the simple need for pay – it relates to issues of *power* and control.

power the probability of carrying out one's own will in an organization, despite resistance from other organizational members

The pursuit of power

'Power' can be defined as the probability of someone carrying out their own will, despite resistance (Weber, 1947). It is not usually wielded nakedly in organizations because it creates resentment and resistance. Instead, those in power tend to use influence and

Figure 20.12

The pursuit of power for its own ends can be very destructive, as the history books show.

persuasion, which is generally effective because we know that they have the power to achieve their ends ultimately.

The pursuit of power for its own ends can be very destructive. McClelland (1975) conducted an analysis of people's needs for power and showed how those with a strong power motive may present themselves well at interview but be a disaster at work, alienating others and reducing the capacity of the organization to achieve cooperative, collaborative, concerted action. This is because they tend to interpret most situations in power terms and act in Machiavellian or manipulative ways to assert or gain power.

Power, according to French and Raven (1959), derives from five sources:

- Legitimate power comes from position in the hierarchy and is imposed by authority.
- Expert power results from access to knowledge and information, so the computer wizard often gains considerable power in an organization.
- Reward power is illustrated by the person who allocates offices, parking spaces, pay rises, equipment or stationery – such people may have considerable power without being in a senior position in the hierarchy.
- Coercive power is the power to force others into action or inaction by the threat of punishment, such as delaying the payment of expenses claims.
- Referent power is wielded by someone whose persuasiveness, popularity or charisma lead others to accede to his/her wishes or suggestions.

A pluralist view

The power and politics perspective (Pfeffer, 1981) examines the way individuals and groups within organizations compete for resources and other desired ends (e.g. office space, visibility, recognition, promotion).

This 'pluralist' view regards organizations as made up of a variety of interests and beliefs that should all be heard. It contrasts with the notion that organizations can (with appropriate management) be one 'happy family' with everyone in the organization believing in the same ideals as the strong leader. This latter perspective is the 'unitarist' view (Burrell & Morgan, 1979).

The pluralist perspective is particularly relevant as businesses become more global and our societies become more multi-ethnic. Organizations must reflect their societies if they are to be sensitive to the needs and desires of their customers, quite apart from the moral issues of equal opportunities. Organizational psychologists are therefore becoming increasingly concerned with managing a workforce that is diverse in terms of ethnicity, disability, age, culture and gender.

Women at work

A major area of research on power in organizations examines the experiences of women at work. The list of potentially relevant themes (some of which also apply to men) is long, including: bias in selection, placement, performance appraisal and promotion; sexual harassment; obstacles to achievement and advancement; conflict between work and family responsibilities. Other concerns relate to being in a non-traditional (i.e. 'male') job and being in the minority (worse still, a 'token') as a female manager (Gutek, 1993).

A significant problem is stereotyping. The effects reach deep into adult employment, where 52 per cent of employed women work in occupational groups in which more than 60 per cent of their co-workers are women, such as clerical and secretarial work, service work and sales. Similarly, 54 per cent of men work in occupational groups where more than 60 per cent of their co-workers are men, including occupational groups such as managers and administrators, craft and related occupations, plant and machine operatives (Equal Opportunities Commission, 1998). Women are also vastly over-represented in part-time work and pregnancy is still (illegally) treated by some employers as a cause for dismissal. In 1998, the UK Equal Opportunities Commission reported that 34 per cent of complainants had been dismissed or threatened with dismissal when they first announced their pregnancy; 28 per cent were told so before going on maternity leave, 18 per cent while on leave, and 3 per cent on their return to the workplace (Equal Opportunities Commission, 1998).

Perhaps most revealing of the pervasive discrimination against women in the workplace is the data on pay. The gender gap in average hourly pay of full-time employees, excluding overtime, narrowed between 1998 and 2003 to its lowest value since records began. However, women's average hourly pay was still only 82 per cent of men's. Average gross hourly earnings, excluding overtime, of full-time women were 82 per cent of the equivalent average for men.

Although women have increased their representation somewhat in the ranks of executives (from 8.9 per cent in 1991 to 18 per cent in 1998), they still account for less than 5 per cent of company directors (Equal Opportunities Commission, 2004) in the UK. In the US in 2004, only 8 of the top 500 companies were headed by a woman.

One issue, which is much debated, is whether women have different managerial or leadership styles from men. The bulk of the

Figure 20.13

The experiences of women at work are subject to major research, which considers, for example, the 'token woman' in the workplace.

research suggests there are large differences within genders as well as between them, but that women adopt a consistently more democratic and participative style of management than men do (Eagly & Johnson, 1990; Powell, 1993). Some researchers argue that women also have a more 'transformational' style, inspiring and encouraging their employees, whereas men tend to use a 'transactional' style, punishing and rewarding selectively to achieve the desired task-related behaviours (e.g. Rosener, 1990).

REDUNDANCY AND UNEMPLOYMENT

The fierce competition of globalization has led organizations to outsource parts of their operations that other companies can do less expensively. This has led to more insecurity within organizations, and to waves of *downsizing* as organizations cut jobs that seem to add cost but little value. Our concern here is with the effects of redundancy and unemployment on those who experience these events.

downsizing when organizations reduce their workforce to save on labour costs

REDUNDANCY – A KIND OF BEREAVEMENT

While the beginning of an individual's experience in an organization is a process of learning new behaviours, the end may be a process of letting go as a result of redundancy. Redundancy can come about because of downsizing. It can also be a result of skills obsolescence, as when e-mail networks reduce the need for an internal post system and the traditional mail coordinator is no longer required. Or it can be a result of outsourcing. For example, school meal services may be contracted out to private catering firms, making 'dinner assistants' redundant.

Some employees volunteer for redundancy, and are happy to leave the organization with some financial package as compensation. Often, though, redundancy is perceived in terms of loss – loss of income, prestige, status and social identity. Those who are left behind in the organization often experience guilt, and, although they may be willing to work harder, they generally feel more insecure having witnessed the dismissal of colleagues (Daniel, 1972; Hartley et al., 1991). Redundancy has even been compared to bereavement, with associated psychological stages of shock, denial, disbelief and, later, acceptance.

PSYCHOLOGICAL EFFECTS OF UNEMPLOYMENT

Unemployment usually has very negative psychological consequences. Research from the 1930s to the present day has consistently shown that the unemployed have poorer mental health than comparable groups of employed people. Figure 20.14 shows that only 18 per cent of the employed population are so severely stressed that they would benefit from professional help, whereas this figure lies at 30 per cent for the unemployed. Unemployed people have worse profiles on measures of anxiety, depression, life dissatisfaction, experienced stress, negative self-esteem and hopelessness about the future. They are also more likely to report social isolation and low levels of daily activity. Their physical health is poorer, and they are more likely to attempt and commit suicide (Fryer, 1992; Warr, 1987).

The average psychological wellbeing of school leavers who become unemployed diverges from those who get satisfactory jobs, even when their wellbeing before leaving school is similar. And people who move out of unemployment into satisfactory jobs show sharp improvements in mental health. These findings are striking in their consistency. The same picture emerges across studies, samples, different research groups, countries and over time.

Striking, too, is the fact that the psychological effects of unemployment extend to the whole family. In a classic study of a whole village affected by unemployment, the effects were shown to spread across the whole community, lowering its spirit and functioning (Jahoda, Lazarsfeld & Zeisel, 1972).

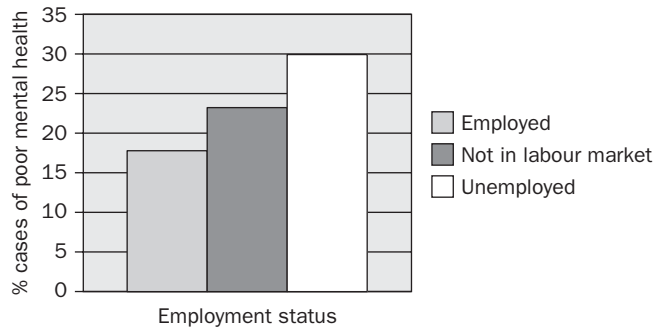

Figure 20.14

Percentage of cases of poor mental health by employment status. Source: Based on British Household Panel Survey, 3rd wave data (1993–94).

FINAL THOUGHTS

Work is a part of everyone's life, whether it is domestic work, voluntary work, assisting in a shoe shop, or nursing in or managing a large hospital. Our work contributes to the meaning we create about ourselves as we build a sense of identity. Our experience of work also determines our psychological and physical health. But more than this, work organizations have a profound effect on society and on the sense of community created within it. Our experience of work spills over into family life – those whose work is rewarding and fulfilling take the benefits back into their families and communities. Moreover, organizations can be productive and enhancing players in society or can behave in exploitative and unethical ways. So understanding work and organizations is of huge importance in human society. To give just one example, one study has shown a strong link between the management of staff in hospitals and patient mortality (West et al., 2002).

The challenge is to create work organizations that enhance human well-being, learning and creativity, contribute to society and its development, and provide models of communities based on justice, ethics, innovation and economic effectiveness. There is much still to discover, but psychological theory and research are proving to offer the most profound insights into the world of work as our understanding of this field develops.

Summary

- Organizational psychology is an important and vibrant field of inquiry which has been enjoying considerable growth in recent decades throughout the industrialized world.
- It provides valuable insights that help us understand people's actions, thoughts and feelings in relation to work, and consequently how to improve the management of people at work.
- Organizational psychology has made significant contributions to improving many areas of people management, including personnel selection, training, employee morale and motivation, working conditions, and organizational design and development.
- Although many companies continue to seek success through, for example, technology or cost reduction, rather than through effectively managing their workforce, there is increasing evidence that people management is a crucial source of organizational success.
- As a result, those individuals responsible for commercial organizations, as well as policy makers in government, are looking to psychologists and other organizational scientists to help create organizations that are effective and efficient but are also experienced as nurturing and supportive environments by the people who work within them.
- Recent research has demonstrated strong relationships between employee job satisfaction and organizational performance.

REVISION QUESTIONS

1. What are the main devices organizations use to ensure a 'fit' between employees and the organization?
2. What methods of selecting people for jobs are most effective?
3. How can managers ensure that the training they provide for employees influences how they perform in their jobs?
4. Is there a link between employees' attitudes and their performance at work?
5. Why should we be concerned about whether people are 'stressed' by their work and how can we make work less stressful for people?
6. What factors hinder and help team effectiveness at work?
7. How can decision making by groups be made more effective?
8. Why is feeling 'safe' in a work team important for team performance?
9. What is organizational culture, and what dimensions could you use to describe the culture of organizations that you have experienced (e.g. voluntary work, school, paid work)?
10. What are the main sources of power that people have at work – and what do we mean by 'power' in organizations?
11. To what extent is discrimination against women at work a thing of the past?
12. What are the psychological effects of becoming unemployed?

Further Reading

Brief, A.P. (1998). *Attitudes in and around Organizations*. London: Sage.
A critical overview of research on organizational attitudes.

Daft, R.L. (1998). *Organizational Theory and Design*. 6th edn. Cincinnati: South-Western.
Easily readable introduction to organizational design and effectiveness, drawing together many themes.

Goldstein, I.L. (1993). *Training in Organizations: Needs Assessment, Development, and Evaluation*. 3rd edn. Pacific Grove, CA: Brooks/Cole.
A good overview of practical and theoretical issues in the training field.

Hackman, J.R. (ed.) (1990). *Groups that Work (and Those that Don't): Creating Conditions for Effective Teamwork*. San Francisco: Jossey-Bass.
Insights into how work groups function, and the factors and conditions that enhance their effectiveness.

Morgan, G. (1997). *Images of Organization*. 2nd edn. London: Sage.
One of the most original and stimulating frameworks for understanding the nature of organizational life.

Schein, E.H. (1992). *Organizational Culture and Leadership*. 2nd edn. San Francisco: Jossey-Bass.
An influential account of the nature, causes and effects of organizational culture.

Smith, M., & Robertson, I.T. (1993). *Systematic Personnel Selection*. London: Macmillan.
A comprehensive text on personnel selection issues.

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An introduction to the relevant research and the practice of teamwork.

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Forensic Psychology

21

CHAPTER OUTLINE

Learning Objectives

By the end of this chapter you should appreciate that:

- forensic psychology is informed by research in many other areas;
- research has identified the major influences on the accuracy of eyewitness memory;
- there are major differences between voluntary and coerced confessions;
- interviewers use a variety of techniques to enhance memory retrieval in witnesses;
- it is not straightforward to detect lies and deceit;
- there are factors present during childhood that can predict adult offending, and important influences over the lifespan that help to explain and characterize violent conduct;
- there is a variety of treatments used when working with offenders;
- forensic psychologists work in a similar way to other psychologists.

INTRODUCTION

Crime is part of our everyday lives. Switch on the television and there will be documentaries about crime, films about crime and crime stories in the news. Pick up a newspaper and there will be coverage of local crimes, and articles about crimes of national and international significance. Browse in a bookshop and you will probably find a crime section with novels about crime, true crime stories, books about criminals and books written by criminals. Listen to a conversation on the bus or in the pub and there is a good chance that you will hear someone talk about a burglary in their street, or their car being broken into, or a friend's credit cards being stolen.

From the time that Cain killed Abel, crime has been in the news. For centuries before psychology appeared on the scene, philosophers struggled to understand evil and antisocial acts, while students of jurisprudence wrestled with issues of criminal law and punishment. It was not until the turn of the 1900s that psychology was first applied to understanding criminal behaviour, and forensic psychology did not really emerge as a speciality until the middle of the twentieth century.

But forensic psychology has quickly grown in popularity, aided and abetted by several well-known television series. University postgraduate courses have expanded to include forensic psychology, and there is now a range of professional opportunities for those with the appropriate qualifications.

PSYCHOLOGY AND THE LAW

THE MEANING OF 'FORENSIC'

According to *The Concise Oxford English Dictionary*, 'forensic' means 'Of, used in, courts of law'. So, strictly speaking, forensic psychology is the application of psychology to matters concerning the court of law.

Wrightsman's *Forensic Psychology* takes just this approach in proposing that 'Forensic psychology is reflected by any application of psychological knowledge or methods to the task facing the legal system' (2001, p. 2). This correct usage of the term 'forensic' is similarly reflected in other texts given specifically to forensic psychology (Gudjonsson & Haward, 1998) or more generally to psychology and law (Bartol & Bartol, 1994; Kapardis, 1997; Stephenson, 1992).

But 'forensic psychology' has also come to be used in a much broader sense – when psychology is associated with any topic even remotely related to crime, such as the development of antisocial behaviour, the study of different types of offender, and crime prevention. This improper use of the term 'forensic' has, rightly, met with disapproval (Blackburn, 1996), but its use has become widespread.

In considering the topic of forensic psychology in the broad sense it is helpful to distinguish between *legal psychology* – which can be thought of in terms of Wrightman's definition – and *criminological psychology* – the application of psychological knowledge and methods to the study of crime and criminal behaviour.

legal psychology the application of psychology to matters of concern in a court of law.

criminological psychology the application of psychology to enrich our understanding of crime and criminal behaviour

THE ORIGINS OF LEGAL PSYCHOLOGY

The application of psychology to the legal arena took place even as psychology first developed as a university-based academic discipline. In their history of forensic psychology, Bartol and Bartol (1999) note that several eminent figures, such as J. McKeen Cattell (1895), Alfred Binet (1905) and William Stern (1910), conducted studies of the accuracy of memory, drawing parallels with the precision of real-life eyewitness testimony. Even Sigmund Freud showed an interest in legal psychology, publishing in 1906 a paper titled 'Psychoanalysis and the ascertaining of truth in courts of law'.

But there is little doubt that the most influential figure of the time was the American-based German psychologist Hugo Münsterberg (1863–1916). A doctoral student of Willhelm Wundt in Leipzig, Münsterberg met William James at Harvard in 1889, eventually taking a post there in 1897 (Spillmann & Spillmann, 1993). While writing on many areas of psychology, often in a controversial manner (Hale, 1980), Münsterberg's major contribution to the fledgling discipline of forensic psychology is to be found in his book, published in 1908, *On the Witness Stand*. He advanced the view that psychology could usefully be applied to enhance understanding of courtroom issues and procedures.

In particular, Münsterberg drew attention to the psychologist's understanding of perception and memory, claiming that psychological knowledge provided insight into the reliability of witness testimony (thereby making the case for the psychologist as expert witness). At the time, Münsterberg's claims for the practical benefits of psychology in the courtroom drew fierce attack from the legal profession (Wigmore, 1909). But his writings have stood the test of time in anticipating important areas of research, such as the study of the reliability of evidence, as seen in investigations of eyewitness memory and confessional evidence.

Pioneer

L. R. C. Haward (1920–98) can rightly be acclaimed as the first major figure in British forensic psychology. A clinical psychologist by training, Lionel Haward saw the potential for psychology to inform legal proceedings. He published on the topic of forensic psychology in the 1950s – well before The British Psychological Society formed the Division of Criminological and Legal Psychology (now the Division of Forensic Psychology) – and in 1981 he wrote the classic text *Forensic Psychology*. Alongside his academic work, he appeared as an expert witness in many cases, including the infamous 1960s trial of the underground magazine *Oz*.

Pioneer

Hugo Münsterberg (1863–1916) is often referred to as the founding father of forensic psychology. A German psychologist, Münsterberg was invited to America in 1892 by William James to set up a psychological laboratory at Harvard University. Münsterberg's insistence that psychology could be applied to education, industry, and law was variously applauded as inspired by his supporters, or derided as opportunistic by his critics. During the First World War his political views (as seen in his pro-German sympathies, and a critical stance that he adopted to American involvement in the war) led to his becoming a social and academic outcast.

EYEWITNESS MEMORY

AN EARLY MODEL OF MEMORY

The capacity and fallibility of human memory was one of the first areas of investigation in psychological research (see chapter 11). Through careful experimental work, several distinguished scholars, including Hermann Ebbinghaus (1850–1909), began to unravel

Everyday Psychology

The role of the expert witness

As professional chartered or registered psychologists, forensic psychologists are often called upon to provide reports on particular individuals for court hearings. For example, in a legal context, a forensic evaluation may subsequently be used to assist the court in making an appropriate decision regarding family, civil or criminal matters. A forensic psychologist might be called to give expert evidence in the accuracy of eyewitness memory, or the likelihood of a false confession, or the reliability of children as witnesses when subjected to certain questioning procedures.

Figure 21.1

Forensic psychologists are often called upon to provide reports on particular individuals for court hearings.

The evaluation of the client provided by the forensic psychologist will often involve characterizing the relationship between psychological factors and relevant legal issues. For example, what is the forensic psychologist's best opinion regarding the possible precipitating factors preceding the crime or civil offence? Findings should be clearly communicated and reflect standard psychological practice, including nationally and internationally accepted psychological instruments and norms. Relevant empirical research that is consistent with the psychologist's conclusions should be noted. Any recommendations that are made (for example, with respect to rehabilitation) must be legally sound, practical and involve services that are widely available in the individual's local community.

Forensic psychologists should be able to defend their conclusions logically. It is especially important that the psychologist uses explanations that can be understood by non-psychologists, such as the judge, barristers and, of course, members of the jury. The relevant issues should therefore be presented clearly and simply, but without 'dumbing down'. This takes great skill on the part of the forensic psychologist.

The conclusions and recommendations of the forensic psychologist should assist the relevant person or agency in reaching a decision, and should not add unnecessary confusion to that process. In addition to having a relevant training and education background, it is therefore critical for psychologists who undertake forensic evaluations to possess excellent assessment and communication skills. They must also have experience and/or a thorough training in completing psychological evaluations in a legal setting so that they will not be 'fazed' by the process. Lawyers engaged in cross-examination can be hostile and seek to undermine the credibility of the psychologists' professional opinions.

'Wherever possible, stick to the facts' is a piece of advice frequently offered to individuals who are presenting in court. Psychologists offering a professional opinion in court are protected by the court and therefore cannot be sued for defamation. Nevertheless, they should evaluate the core facts of the case in order to reach a professionally informed opinion regarding the psychological issues only. As with any professional, psychologists should not offer opinions outside their area of expertise. For example, they should not speculate on whether a defective mechanism in the workplace may have contributed to the event they have identified; this would be the province of another forensic professional.

Egeth, H.E., & McCloskey, M., 1984, 'Expert testimony about eyewitness behaviour: Is it safe and effective?' in G.L. Wells & E.F. Loftus (eds), *Eyewitness Testimony: Psychological Perspectives*, Cambridge: Cambridge University Press.

some of the fundamental properties of memory functioning (Ebbinghaus, 1885/1994). One model that emerged from this early work described the three memory stages of (i) acquisition (when memories are formed), (ii) retention (holding them in storage) and (iii) retrieval (fetching them from storage).

eyewitness testimony the evidence given by witnesses to a crime, typically in the form of a verbal account or person identification

While memory theory has moved on from this basic model, it is still useful in a discussion of eyewitness memory. Research into the accuracy of *eyewitness testimony* has focused on initial observation of the incident (acquisition), the period between seeing and recalling (retention) and, finally, giving testimony (retrieval). Researchers have engaged with a wide range of relevant variables over a long period (Goodman et al., 1999; Ross, Read & Toglia, 1994; Sporer, Malpass & Koehnken, 1996), including:

- social variables, such as the status of the interrogator;
- situational variables, such as the type of crime;
- individual variables, such as witness age; and
- interrogational variables, such as the type of questioning.

Acquisition

Research has also considered the effect of particular types of crime. For example, can witnesses to a violent crime be as accurate as witnesses to a non-violent crime? Controlled experimental studies, typically during which witnesses see videotaped crimes of varying degrees of violence, suggest that violence results in poorer witness accuracy (Clifford & Hollin, 1981). But strangely, field studies of real-life witnesses suggest that those who are exposed to highly violent events can give very accurate testimony (Yuille & Cutshall, 1986). Indeed, adult victims of rape usually give a reasonably accurate account of this extreme personal experience of violence (Koss, Tromp & Tharan, 1995).

One possible explanation for this apparent contradiction is that, in a stressful situation such as a violent crime, a witness's attention may narrow to the central (rather than the peripheral) details of the incident. The theory is that the deployment of attention narrows to central details of the event, such as the criminal's actions, thereby producing less reliable memory for peripheral detail, such as what colour shirt the criminal was wearing (Clifford & Scott, 1978). When the central detail is a life-threatening weapon, witnesses may pay much more attention to the weapon, to the exclusion of other details. This phenomenon is known as 'weapon focus' (Loftus, Loftus & Messo, 1987).

It is vital to understand the impact on witness memory of factors such as the type of crime. What is encoded during acquisition is critical because it forms the basis for what is stored in memory and eventually retrieved when giving testimony.

Retention

During the retention stage, witness memory may be subject to various influences, such as discussion with other witnesses and exposure to media accounts of the crime, not to mention the fact that memory becomes less accurate over time. So the time interval between acquisition and retrieval is an obvious consideration.

Several studies have compared the accuracy of eyewitness face identification over short and long time intervals. Malpass and Devine (1981), for example, chose short (three-day) and long (five-month) intervals. They found, not surprisingly, that after three days there were no false identifications, but after five months the rate of false identifications had risen (table 21.1). Conversely, the rate of correct identifications was initially high but fell significantly at five months.

Krafka and Penrod (1985) reported a similar finding with the much shorter time intervals of two hours and 24 hours. The force of the evidence suggests that identification accuracy does decrease with time, although the rates for false and correct identifications may be different.

Table 21.1 The effect of delay on face recognition.

	Short delay	*Long delay*
Correct IDs	83%	36%
False IDs	0%	35%

Source: Based on Malpass and Devine (1981).

Table 21.2 Speed estimates of collision in response to different forms of question wording.

Question, with different words used in place of the blank	*Average speed estimates (miles per hour)*
'About how fast were the cars going when they – each other?'	
contacted	31
hit	34
bumped	38
collided	39
smashed	41

Source: Based on Loftus and Palmer (1974).

Retrieval

Finally, during the retrieval stage, factors that potentially influence the accuracy of eyewitness testimony include interview style and the use of aids to recall, such as the photofit and identity parades (see also chapter 11).

Studies of the impact of *leading questions* show that even subtle changes in question wording can influence testimony. For example, Loftus and Palmer (1974) asked witnesses to a filmed traffic accident to estimate the speed of the cars when 'they – into each other': for different groups of witnesses the blank read 'contacted', 'hit', 'bumped', 'collided' or 'smashed'. The witnesses' estimates of the speed increased according to the level of force implied by the verb contained in the question (table 21.2).

leading questions contain information (either intentionally or unintentionally) that can bias the respondent's reply

In later questioning, those witnesses who had been asked about the car 'smash' were more likely to say – mistakenly – that they had seen broken glass. Additional studies have established that misleading information presented to witnesses is more likely to have an influence on peripheral details than central events (Read & Bruce, 1984). Furthermore, it seems that the effects of leading questions such as those used by Loftus and Palmer (1974) are a direct product of the demands of the questioning procedures, rather than the questions leading to permanent changes in memory (Zaragoza, McCloskey & Jarvis, 1987). This last point emphasizes that witnesses can give incorrect replies to questions even though the memory trace ('retention') itself has apparently not been distorted.

The strength and validity of the evidence

Narby, Cutler and Penrod (1996) have created three categories of witness-related evidence based on reliability and magnitude of effect:

1. reliable and strong factors that show consistent effects on eyewitness memory (e.g. there are differences in memory performance between adult and child witnesses; if a person is wearing a disguise, such as a hat, this influences accuracy of memory; and the length of time, termed 'exposure duration', that the witness has to observe an incident);
2. reliable and moderate factors that show effects in some studies but not in others (e.g. the match between the level of confidence a witness has in their memory and how accurate it really is; weapon focus; and crime seriousness); and
3. weak or non-influential factors that have little or no effect on witness accuracy (e.g. witness gender; the personality of the witness; and (within limits) the witness's level of intelligence).

An issue that is broader than the strength of the evidence concerns its validity when applied to the real world. Do the findings from psychological studies parallel what happens to real crime witnesses? Should research findings be made available to the court to influence real trials? In other words, can psychological studies of eyewitness memory be generalized to real life?

Critics such as Konecni and Ebbesen (1986) and Yuille and Cutshall (1986) note the lack of realism in many experimental studies, such as the use of filmed crimes, and the participants' awareness of the research aims. The matter boils down to one of control – laboratory studies allow a high degree of control at the expense of realism, while field research is more realistic and 'ecologically valid' but prey to a host of influences that reduce control over the variables being measured. This is a problem

Research close-up 1

Measuring crime

The research issue

A great deal of research in forensic psychology relies on a measure of crime as key outcome measure. For example, the evaluation of crime prevention initiatives, innovative police procedures or offender treatment strategies all rely on measuring their impact on crime in order to estimate their effectiveness and make decisions regarding their continued funding. There are several ways of measuring crime (for example, conducting victim surveys to gain knowledge of local or national estimates of levels of crime, asking known criminals to give self-reports about their offending, or looking to official reconviction records). We know that there will be differences across measurement of crime according to the use of victim reports, self-reports or official figures. But what can we say about variation within a type of measurement? For example, can it be taken for granted that there will be consistency in official records of crime?

A study by Friendship, Thornton, Erikson and Beech (2001) looked at the two main sources of criminal history information held in England and Wales. It is from these sources that researchers take official reconviction figures.

Design and procedure

The research was concerned with two sources of criminal history data:

1. The Offenders Index (OI) is a computerized database containing criminal histories, based on court appearances, of all those convicted of standard offences in England and Wales since 1963.
2. The National Identification System (NIS) is based on police records held both on microfiche and a computer database.

In order to compare these data sources, the researchers took a sample of 134 sexual offenders and compared the data for offence history and reconvictions for this group as recorded on the OI and the NIS.

Results and implications

There were variations between the two data sources in their recording of criminal history variables of the sexual offenders. This variation, in turn, indicated that the reconviction rates derived from the two data sources differed. Based on the OI, the reconviction rate for the sample was 22 per cent reconviction for general offences and 10 per cent for further sexual offences, but for the NIS, the comparable rates were 25 per cent and 12 per cent, respectively. Also, when a composite measure of reconviction was derived by combining OI and NIS data to give the 'best' estimate, the reconviction rates, again for general and sexual offences, were 32 and 13 per cent respectively.

Friendship et al. are correct in stating that their findings will be of great benefit to researchers. The use of composite measures of reconviction, based on both the OI and NIS data sources, gives a more complete indication of reconviction than either source used alone. This is essential information, based on empirical study, for researchers whose work may inform both policy-makers and practitioners.

Friendship, C., Thornton, D., Erikson, M., & Beech, A., 2001, 'Reconviction: A critique and comparison of two main data sources in England and Wales', *Legal and Criminological Psychology*, 6, 121–9.

which has bedevilled many areas of psychological research but its influence is arguably no more profound than in the field of forensic psychology.

The strongest conclusions that can be validly drawn will most likely be derived from a variety of studies (including laboratory studies, case studies, field studies and archival studies) which employ a broad range of different experimental designs and methodologies (see chapter 2 on 'triangulation').

THE PSYCHOLOGY OF CONFESSION

In law, a confession is exceptionally powerful evidence – an irrefutable admission of guilt. But while most confessions are true, some people have been known to 'confess' to a crime they did not commit. Gudjonsson (2003) offers a catalogue of cases in which people have been imprisoned for long periods, or even executed, on the basis of a false confession. In the UK these infamous cases include those of the 'Guildford Four' and 'Birmingham Six', two court cases from the mid 1970s, in which four and six innocent people respectively received long prison sentences based on evidence that included false confessions. How often such cases arise is impossible to know – matters of guilt and innocence are not always clear-cut, and the discovery of a mistake in sentencing can take years to come to light. Undoubtedly, some such errors never do.

Why people make false confessions, another issue raised by Münsterberg (1908), is a very 'psychological' question. A distinction has been drawn between two types of false confession – *voluntary* and *coerced*. Coerced false confession can be broken down further into two sub-types – coerced–compliant and coerced–internalized false confessions.

Figure 21.2

The famous 'Birmingham Six': their case in the UK is one of a catalogue of cases in which people have been imprisoned for long periods, or even executed, on the basis of a false confession.

VOLUNTARY FALSE CONFESSIONS

voluntary confession formal admission of guilt given freely, which can be true or false, usually made to the police

A voluntary false confession occurs when, in the absence of any obvious external pressure, an individual presents himself to the police and admits to a crime he did not commit. Kassin and Wrightsman (1985) suggest several possible reasons for this behaviour:

1. the desire for notoriety – it is a feature of many high-profile crimes that substantial numbers of people come forward to confess;
2. the individual may feel guilty about a previous event in his life, and believe he deserves to be punished;
3. inability to distinguish between fact and imagination, so internal thoughts of committing a crime become 'real' (this type of behaviour is often associated with major mental disorders such as schizophrenia);
4. the desire to protect someone else, such as a child or partner (this type of false confession can be coerced as well as voluntary).

Gudjonsson (2003) notes revenge as another motive that can lead to a false confession. In one case, a man made a false confession deliberately to waste police time as revenge for what he perceived as his previous wrongful treatment by the police.

In contrast to voluntary false confessions, the essential element of a coerced confession is that the individual is persuaded to confess. As Kassin (1997) suggests, to understand coercion within the context of a false confession it is necessary to begin with the process of police interrogation.

coerced confession formal admission of guilt made under duress, which can be true or false, usually made to the police

INTERROGATIONAL TACTICS

The laws relating to the conduct of police interrogation of suspects vary from country to country. But there are some psychological principles that can be applied whenever one person is seeking information from another, irrespective of location.

Suspects may spend time isolated in police cells before and during interrogation, an experience that can be frightening and stressful (Irving, 1986). For some, this situation may create psychological distress or exacerbate existing psychological and emotional conditions. Police interrogation manuals from both Britain (Walkley, 1987) and America (Inbau, Reid, & Buckley, 1986) tell us that, from a police perspective, the interrogator must overcome the suspect's natural resistance to tell the truth, and so must be skilled in the use of strategies to persuade the suspect to confess. These interrogational tactics, based on the social psychology of conformity, obedience and persuasion (see chapter 18), increase the pressure on suspects so that they will fall into line with the

interrogator's view of events. The interrogator will do this by suggesting that they have the power to determine what charge will be brought, whether the suspect will receive bail or be remanded in custody, and whether to involve other people known to the suspect. The interrogator might also use persuasive tactics designed to encourage the suspect to confess, suggesting, for example, that there is evidence proving the case against the suspect, or that accomplices have confessed, or even, as Gudjonsson and MacKeith (1982) noted, by producing dummy files of evidence.

More recently, there have been various legal changes in the rules governing the conduct of interrogations to eliminate dubious practice (Gudjonsson, 2003). There is guarded optimism that the changes are having the desired effect. But in such a highly charged and complex arena, where there are often pressures on the police to solve a high-profile crime, it can be difficult to be certain of how the minutiae of social exchanges during interrogation influence the final outcome.

Coerced false confessions

Gudjonsson and Clark (1986) suggested that a suspect will come to an interrogation with a general cognitive 'set' that may be hostile, suspicious or cooperative. This cognitive set (itself related to factors such as intelligence, level of stress and degree of previous experience of police questioning) will influence the suspect's appraisal of the situation, and so affect the suspect's strategy for coping with the interrogation.

Gudjonsson and Clark describe two styles of initial coping response:

1. a logical, realistic approach, which seeks actively to deal with the situation and may lead to active resistance (which may weaken as the interrogation progresses) to the interrogator's persuasion to confess; and
2. a passive, helpless stance, which avoids confrontation with the interrogator, and so reduces stress but may lead to increased susceptibility to the interrogator's persuasive tactics.

During questioning, the suspect has to recall information, but she must also make some difficult decisions. She has to decide how confident she is in her memories, what answer to give the interrogator (which may not be the same as the suspect's private knowledge of events) and whether she trusts the interrogator. Resistant suspects are likely to hold onto their own version of the truth, rebutting persuasive attempts to bring them to confess. Coerced suspects may change their version of the truth so as to agree with the interrogator.

Where a false confession ensues, this process of coerced agreement can be seen in two distinct ways:

1. The suspect remains aware that her confession and her private, internal knowledge of the event disagree, but the suspect nevertheless comes to agree with the interrogator. This is called a coerced–compliant false confession.
2. In some circumstances, the suspect's internal account of events actually changes to fall into line with the interrogator, so that, both publicly and privately, the suspect comes to agree with the interrogator's version of events. This is called a coerced–internalized false confession.

Coerced compliance

The notion of compliance has a long history in psychological research (Asch, 1956; Milgram, 1974; see also chapter 18). The compliant suspect copes with the pressures of interrogation by coming to agree with the interrogator (even while knowing that the agreement is incorrect, in the case of the coerced–compliant false confession). This might happen for several reasons: the suspect might wish to please the interrogator, avoid further detention and interrogation, avoid physical harm (real or imagined) or strike a deal with the interrogator that brings some reward for making a confession (Vennard, 1984).

Coerced internalization

The essential element in a coerced–internalized confession is the suspect's coming to believe that their own memory for events is incorrect and that the police version must therefore be true. Kassin (1997) has drawn the analogy between this type of confession and the phenomenon of false memories (see chapter 11). There are perhaps also parallels with the notion of cognitive dissonance, discussed in chapter 17 (whereby a person comes to change their attitudes to make them more consistent with their behaviour) and the kind of obedience which occurs towards authority figures (discussed in chapters 1 and 18) may well also be relevant here.

Drawing on the psychology of suggestibility (Gheorghiu et al., 1989), Gudjonsson (1987) developed the notion of *interrogative suggestibility* – the extent to which, during intense questioning, people accept information communicated by the questioner and so change their responses. The powerful combination of situational stress, individual factors such as self-perception, intelligence and memory ability, and current psychological state may trigger suggestibility to misleading information on the part of the suspect, and so produce a false confession.

interrogative suggestibility the degree to which individuals are inclined to accept as true the type of information that is communicated by the questioner during interrogation

THE PSYCHOLOGY OF INVESTIGATION

The cognitive interview

Interviews are one of the most common ways of gathering information across a range of settings for a variety of reasons (Memon & Bull, 1999). In the context of crime investigation,

Figure 21.3

Interviews are one of the most common ways of gathering information.

there will be interviews with witnesses, suspects and victims, all conducted with various aims, including gathering evidence, cross-checking information and eliciting confessions (Milne & Bull, 1999). Interviewing children has become something of a speciality in its own right (Lamb et al., 1999).

The less salubrious aspects of police interviewing have been highlighted by investigators of false confessions, but there are other, more constructive, aspects of the interview process to consider. A technique known as the *cognitive interview* illustrates the application of psychology to facilitate investigative interviewing. A great deal of the research on eyewitness testimony points to the frailties of memory and questions the reliability of eyewitness evidence. The cognitive interview is an attempt to find a constructive solution to these problems and improve the accuracy of eyewitness recall.

cognitive interview method of questioning witnesses, devised for use by the police, based on principles taken from memory research

Fisher, McCauley and Geiselman (1994) describe how the original cognitive interview protocol, used by police officers, incorporated four techniques to enhance memory retrieval:

1. *Context reinstatement* – the witness is encouraged to recollect aspects of the situational context (such as sights and sounds at the time of the event and relevant personal factors, such as how they felt and what they were thinking at the time of the incident).
2. *Report everything* – the witness engages in perfectly free recall, unconstrained by focused (and potentially leading) questioning, or self-censoring of what is reported. The theory underpinning these two techniques lies in the contextual similarity between encoding and retrieval (see discussion of the encoding specificity principle in chapter 11). So if the process of retrieval from memory can take place in a similar psychological context to that in which the information was encoded, the witness should have facilitated access to stored memories, improving the accuracy and completeness of recall (Fisher et al., 1994).
3. *Reverse order* – the witness is encouraged to begin their description of an event from different starting points (such as a mid-point), or to start at the end and work backwards to the beginning.
4. *Change perspective* – witnesses are encouraged try to give an account of the event from the point of view of another person, such as another witness or the victim.

Techniques 3 and 4 are intended to encourage witnesses to try to use many different paths to retrieve information from memory. If memories are stored as networks of associations, increasing the number of retrieval points should lead to more complete recall of the original event (Fisher at al., 1994).

As the research and practice base developed, so the protocols for the cognitive interview expanded to include, for example, a broader range of specific questioning techniques and the use of guided imagery (Fisher & Geiselman, 1992).

A body of evaluation studies, conducted in both laboratory and field settings, has accumulated since 1984. According to Milne and Bull (1999), the weight of evidence shows that the cognitive interview elicits more correct (that is, truthful) information than other types of interview. While there are some reservations, the technique is generally well received by police officers and has become widely used. Furthermore, recent research suggests that it is a reliable and helpful technique with child witnesses (Milne & Bull, 2003).

Detecting lies and deceit

How easy is it to tell when someone is telling lies and seeking to deceive? (See also chapter 6.) Kassin (1997) cites several examples taken from police training manuals that suggest suspects' verbal and nonverbal cues can be read to determine if they are lying. For example, it has been suggested that guilty suspects do not make eye contact, while innocent suspects give clear, concise answers.

It is possible that these general rules are useful, but the empirical evidence suggests that even skilled questioners are not good at detecting deceit simply on the basis of a suspect's verbal and non-verbal cues (Ekman & O'Sullivan, 1991). Vrij (2000) suggested that most liars are caught because it becomes too difficult to continue to lie, and they have not made sufficient preparation to avoid detection. Vrij lists seven qualities that make a good liar:

1. having a well prepared story;
2. being original in what is said;
3. thinking quickly when the need arises;
4. eloquence in storytelling;
5. having a good memory for what has been said previously;
6. not experiencing emotions such as fear or guilt while lying (see chapter 6); and
7. good acting ability.

Statement Validity Assessment (SVA) method for the formal analysis of witness statements in order to gauge their reliability

If verbal and non-verbal cues are hard to read, how does an investigator catch out an individual who possesses all the attributes listed above? One approach is a highly structured analysis of verbal content, known as *Statement Validity Assessment (SVA)*.

Originally developed as a clinical tool for analysing children's statements in cases of sexual abuse (Undeutsch, 1982), SVA consists of three elements:

1. A statement is taken in a structured interview.
2. The content of the statement is judged by the forensic psychologist in a criterion-based content analysis (CBCA). These content criteria are concerned with the general characteristics of the statement (such as whether it has a logical structure), the specific contents of the statement (such as descriptions of events and people), motivation-related content (such as admission of a lack of memory) and offence-specific elements (concerning the fine details of the offence).
3. The CBCA is necessarily subjective, and needs to be evaluated against a standard set of questions set in the 'validity checklist' (Raskin & Esplin, 1991). This checklist raises questions about the conclusions drawn from the analysis. In other words, the content analysis itself is put to the test by systematic consideration of interviewee characteristics. The interviewee's psychological and motivational characteristics, the characteristics of the interview and a 'reality check' against other forensic evidence are all examined.

It is clear that SVA represents an attempt to bring order and rigour to the essentially subjective matter of judging the veracity and reliability of an interviewee's statement. However, in a review of the substantial evaluative literature with regard to SVA, Vrij (2000) has expressed several reservations about the technique and highlighted areas where questions remain. He concludes that 'SVA evaluators appear to be able to detect truths and lies more accurately than would be expected by chance' (p. 153). In other words, while not a perfect technique, SVA does help improve accuracy beyond guesswork and inaccurate beliefs about how to judge accuracy.

OFFENDER PROFILING

offender profiling constructing a picture of an offender's characteristics from their modus operandi together with the clues left at the crime scene

If ever a topic generated a great deal of heat and rather less light, *offender profiling* would be high on the list of most forensic psychologists. But as our knowledge base increases, it is likely that the technique will become increasingly sophisticated (Ainsworth, 2001; Jackson & Bekerian, 1997).

Wrightsman (2001) distinguishes between profiling historical and political figures, profiling likely criminals from crime scene characteristics, and profiling the common characteristics of known offenders. Turvey (2000) draws the distinction between inductive and deductive methods of profiling. Inductive methods rely on the expert skills and knowledge of the profiler – a method often referred to as 'clinical' in style. By contrast, deductive methods rely on forensic evidence, such as crime scene characteristics and offence-related empirical data – an approach often referred to as 'statistical'.

Profiling historical and political figures

Attempts have been made to construct psychological profiles of historical figures (from Jack the Ripper to Adolf Hitler) by systematically gathering and organizing information in an effort to understand their motives and behaviour. Experts will undoubtedly have constructed psychological profiles of Saddam Hussain in order to try to predict his behaviour during the 2003 conflict in Iraq. These types of profile typically rely on specialist knowledge (e.g. military, historical).

Profiling criminals from the crime scene

Way back in the late 1880s, forensic pathologists were trying to link series of crimes by the similarity of crime scene characteristics, such as the nature of a victim's wounds. More recently, the American Federal Bureau of Investigation (FBI) pioneered an investigative system based on central features (such as the details of a crime scene and forensic evidence) in order to construct a profile of the psychological and behavioural characteristics of the criminal (Douglas et al., 1986).

While forensic evidence can yield many clues, the starting point for the FBI was to use the crime scene to construct a picture of the type of person who committed the offence. This approach yielded various classifications of types of offender associated with their psychological characteristics.

For example, a much used distinction (mainly concerned with serious offenders such as murderers or rapists), incorporated within the FBI framework, is that between 'organized' and 'disorganized' offenders (Ressler, Burgess & Douglas, 1988). An organized offender will plan the offence, be careful not to leave evidence, and target the victim. The disorganized offender will seemingly offend at random, use a weapon that is discarded near to the scene of the crime, and make few attempts to hide evidence or potential clues. In terms of psychological characteristics, the organized offender is seen as intelligent and socially adjusted, although this apparent normality can mask a psychopathic personality. According to this framework, the disorganized offender is said to be less intelligent and socially isolated, may have mental health problems, and is likely to offend when in a state of panic. The obvious criticisms of such distinctions (and the FBI approach more generally) is that they are inductive, highly subjective and lacking in robust empirical validation.

Profiling common characteristics of known offenders

The third approach to profiling is to look to empirical data, rather than an expert's opinion, to construct profiles. This approach

emphasizes the rigorous gathering of data about the crime from multiple sources (such as geographical location and victim statements), the application of complex statistical analyses to databases of crime scene details (and other forensic evidence), and attempts to build a profile of the offender with theoretical integrity. Adopting this approach, Canter and Heritage (1990) analysed data from over 60 cases of sexual assault and were able to identify over 30 offence characteristics, such as level of violence, use of a weapon, type of assault and use of threats. Statistical analyses were used to search for relationships and patterns between the factors, and to build up characteristic profiles of types of sexual assault. This and other similar studies provide preliminary support for the central premises of offender profiling based on the common characteristics of known offenders.

Figure 21.4

Most young offenders 'grow out of' crime by the age of 18, but others continue to offend into adulthood.

CRIMINOLOGICAL PSYCHOLOGY

The academic relationship between criminology and psychology has not always been harmonious (Hollin, 2002a). Studies of the first criminologists, in the late 1800s, focused on the individual offender, and it was hard to distinguish between criminologists and psychologists. In the 1930s, the focus in mainstream criminology shifted from the individual to society, and psychological theories of criminal behaviour held little sway compared to sociological theories. But since the 1990s, there has been an increasing dialogue between the disciplines as the study of the individual once again becomes a concern in criminology (Lilly, Cullen & Ball, 2001).

The Cambridge Study

Predicting delinquency

longitudinal research type of research design in which data are collected from a group of people, termed a cohort, over a long period of time (typically decades)

One of the main findings from *longitudinal research* is that most juvenile crime is 'adolescence limited'. In other words, most young offenders 'grow out' of crime by the time they are 18 (Moffitt, 1993). But some juveniles (called 'life-course persistent' offenders) will continue offending into adulthood (Moffitt, 1993). Developmental criminology attempts to identify the factors that predict longer-term offending, in turn contributing to preventative efforts.

Cambridge Study in Delinquent Development longitudinal study, based at the University of Cambridge, concerned with the development of delinquency and later adult crime

The Cambridge Study in Delinquent Development is an extensive longitudinal study conducted in Great Britain that has generated a wealth of data (Farrington, 2002). It began in 1961 with a cohort of 411 boys aged eight and nine, and it is still in progress, with over 90 per cent of the sample still alive. The methodology used in the Cambridge Study has involved not only access to official records, but also repeated testing and interviewing of the participants, as well as their parents, peers and schoolteachers.

Approximately 20 per cent of the young men involved in the survey were convicted as juveniles, a figure that grew to 40 per cent convicted (excluding minor crimes) by 40 years of age. The official convictions matched reasonably well with self-reported delinquency. By comparing the worst offenders with the remainder of the cohort, *predictive factors* began to emerge. These are factors evident during childhood and adolescence that have predictive value with respect to behaviour in later life. The Cambridge Study strongly suggests that the intensity and severity of certain adverse features in early life predict the onset of antisocial behaviour and later criminal behaviour.

predictive factors characteristics of an individual or their environment that have some utility in predicting the likelihood of their future offending

Farrington (2002) lists these predictive factors as follows:

1. antisocial behaviour, including troublesomeness in school, dishonesty and aggressiveness;
2. hyperactivity–impulsivity–attention deficit, including poor concentration, restlessness and risk-taking;
3. low intelligence and poor school attainment;
4. family criminality as seen in parents and older siblings;
5. family poverty in terms of low family income, poor housing and large family size; and
6. harsh parenting style, lack of parental supervision, parental conflict and separation from parents.

Other studies have found similar predictors for aggression and violent conduct (Kingston & Prior, 1995). It is also evident that

Pioneer

David P. Farrington (1944–) is currently Professor of Psychological Criminology at the Institute of Criminology at the University of Cambridge. A prolific researcher, he is widely cited for his work (initially with Donald West) on the Cambridge Study in Delinquent Development. He has also published on a range of other topics, including shoplifting, bullying, crime prevention, and methodologies for evaluating criminological interventions. He has the distinction of being the first non-American President of the American Society of Criminology. He is a former chair of The British Psychological Society's Division of Criminological and Legal Psychology.

childhood antisocial behaviour and adolescent delinquency are related to other developmental problems. Stattin and Magnusson (1995) found clear relationships between the onset of official delinquency and other educational, behavioural and interpersonal problems. Farrington, Barnes and Lambert (1996) showed that these developmental problems are frequently concentrated in specific families. In their sample of 397 families, half the total convictions in the whole sample were accounted for by 23 families!

The force of the Cambridge Study and other similar research is to suggest that we need prevention strategies to reduce child and adolescent antisocial behaviour (Farrington, 2002). Such strategies might include improving young people's school achievement and interpersonal skills, improving child-rearing practice and reducing poverty and social exclusion.

Adult criminals

A longitudinal study allows us to compare adult offenders and non-offenders to discover even more about the pathways to crime. When the cohort in the Cambridge Study reached the age of 18, the chronic offenders had a lifestyle characterized by heavy drinking, sexual promiscuity, drug use and minor crimes (mostly car theft, group violence and vandalism). They were highly unlikely to have any formal qualifications, they held unskilled manual jobs, and had had frequent periods of unemployment.

By 32 years of age, the chronic offenders were unlikely to be home-owners, had low-paid jobs, were likely to have physically assaulted their partner, and used a wide range of drugs. As you might expect, they had an extensive history of fines, probation orders and prison sentences. It was clear from their life histories and current circumstances that these men were leading a bleak and socially dysfunctional existence.

The data also point to protective factors. These are factors that appear to balance the negative predictors, so that at times when you would expect offending to occur, it does not. When males show all the predictive signs for a criminal career and yet do not commit offences, Farrington and West (1990) label them 'good boys from bad backgrounds'. These men were generally shy during adolescence and socially withdrawn as adults. While not involved in crime, they did experience relationship problems with their parents or partners. Forming close relationships in early adulthood also seems to be related to a decrease in offending. In particular, those offenders who married showed a decrease in offending – providing that their partner was not a convicted offender (Farrington & West, 1995).

It would be a mistake to try to construct an exact model of a criminal career from all these data. There are too many unanswered questions for us to be overly confident in predicting the outcome, and simply describing the predictive factors is not the same as explaining how they bring about delinquent behaviour. Thus far, there is no grand theory to explain how the interaction between a young person and his or her environmental circumstances culminates in criminality. However, there are enough positive developments in the extant literature to indicate that this might be feasible in the future, at least with respect to certain probabilities and confidence limits.

VIOLENT OFFENDERS

Criminal behaviour takes many forms, but there is little doubt that violent acts are a source of great public concern. A recent World Health Report (Krug et al., 2002) referred to violence as 'a global public health problem'. Contemporary psychological theory characterizes violence in this context in terms of an interaction between the qualities of the individual and characteristics of their environment.

The development of violent behaviour

As with delinquency, the development of violent behaviour can be studied over the lifespan, leading to the formulation of complex models of violent conduct. Nietzel, Hasemann and Lynam (1999) developed a model based on four sequential stages across the lifespan (table 21.3). This is an excellent example of an attempt to integrate social, environmental and individual factors to characterize the key factors underlying violence.

At the first stage, there are distal antecedents to violence. These are divided into biological precursors (including genetic transmission and lability of the autonomic nervous system – see chapter 3), psychological predispositions (including impulsivity and deficient problem solving) and environmental factors (such as family functioning and the social fabric of the neighbourhood).

At the second stage, there are early indicators of violence as the child develops, such as conduct disorder and poor emotional regulation. Third, as the child matures the developmental processes associated with the intensification of violent behaviour come into effect, including school failure, association with delinquent peers, and substance abuse.

Finally, as the adolescent moves into adulthood there is a stage at which *maintenance variables* come into force, including continued reinforcement for violent conduct, association with criminal peers, and social conditions that provide opportunities for crime.

Notice how this approach draws on much of what you have studied in earlier chapters of this book (e.g. chapters 3, 4, 10 and 15).

Table 21.3 Suggested developmental sequence in the aetiology of violent behaviour.

Distal antecedents	*Early indicators*	*Developmental processes*	*Maintenance variables*
Biological factors (e.g. brain dysfunction) Psychological factors (e.g. impulsiveness) Environmental factors (e.g. high crime neighbourhood)	Conduct disorder Poor parenting Early aggression	School failure Cognitive style (e.g. hostile attributions) Substance abuse	Peers Opportunities Socioenconomic deprivation

Source: Adapted from Nietzel, Hasemann and Lynam (1999).

A psychological profile of violence

social information processing theoretical model of how we perceive and understand the words and actions of other people

Research has also begun to uncover some of the psychological processes characteristic of the violent person. For example, the influential work of Dodge and colleagues has drawn on *social information processing* (i.e. how we perceive and understand and the words and actions of other people) to seek to understand the psychology of violence.

Crick and Dodge (1994; Dodge 1997) suggested that we follow a sequence of steps when we process social information (see chapter 17):

- encoding social cues
- making sense of these cues
- a cognitive search for the appropriate response
- deciding on the best option for making a response
- making a response

Dodge proposed that violent behaviour may result from deficits and biases at any of these stages.

Beginning with social perception, there is evidence that aggressive young people search for and encode fewer social cues than their non-aggressive peers (Dodge & Newman, 1981) and pay more attention to cues at the end of an interaction (Crick & Dodge, 1994). This misperception may in turn lead to misattribution of intent, so that the actions of other people are mistakenly seen as hostile or threatening (Akhtar & Bradley, 1991; Crick & Dodge, 1996).

Working out how best to respond to a situation is a cognitive ability often referred to as social problem solving. It involves generating feasible courses of action, considering potential alternatives and their likely consequences, and making plans for achieving the desired outcome (Spivack, Platt & Shure, 1976). Studies suggest that violent people show restricted problem-solving ability and consider fewer consequences than non-violent people (Slaby & Guerra, 1988). This sequence of cognitive events culminates in violent behaviour, which the violent person may view as an acceptable, legitimate form of conduct (Slaby & Guerra, 1988).

The role of anger

Cognitions interact with emotions (see chapter 6), and anger (particularly dysfunctional anger) is the emotional state most frequently associated with violent behaviour (Blackburn, 1993). Anger may be said to be dysfunctional when it has significantly negative consequences for the individual or for other people (Swaffer & Hollin, 2001). It would be wrong to say that anger is the principal cause of violence, or that all violent offenders are angry, but clearly it is a consideration in understanding violence.

Currently, the most influential theory of anger is Novaco's (1975). According to Novaco, for someone to become angry, an environmental event must first trigger distinctive patterns of physiological and cognitive arousal. This trigger usually lies in the individual's perception of the words and actions of another person.

When we become angry, physiological and cognitive processes are kicked into action. Increased autonomic nervous system activity includes a rise in body temperature, perspiration, muscular tension and increased cardiovascular activity. The relevant

Figure 21.5

Anger is the emotional state most often associated with violent behaviour.

Research close-up 2

The effectiveness of rehabilitation

The research issue

Historically, there is a longstanding struggle between liberal proponents of rehabilitation of offenders and conservative advocates of punishment for those who commit crimes. While this debate operates on many levels, engaging both moral and philosophical issues, there is an important role for empirical research: do efforts to rehabilitate offenders demonstrably lead to a reduction in offending?

The issue for researchers therefore seems plain: do attempts at rehabilitation work? Arriving at an answer to this question is not so straightforward. How is it possible to make sense of the outcome evidence from studies using different types of treatment, conducted with different offender populations, and carried out in a range of settings?

In the late 1960s, a research team was commissioned in New York state specifically to address the issue of the effectiveness of rehabilitation with offenders. The research team was given the task of conducting a comprehensive review of the effectiveness of rehabilitative efforts in prisons.

Design and procedure

The researchers set about their survey in the traditional way. They conducted a search of the literature, identifying a total of 231 relevant treatment outcome studies appearing between 1945 and 1967. Following traditional review procedures, they then set their criteria for successful and unsuccessful studies and categorized each study according to these criteria. This procedure is sometimes referred to as 'vote counting'.

Results and implications

The dissemination of the findings of government-sponsored applied research is not always straightforward. The researchers presented a 1400-page manuscript to the state committee in the early 1970s, and eventually a book was published giving details of the research (Lipton, Martinson & Wilks, 1975). But the research findings presented in the book were not what created the study's major impact.

In 1974 one member of the research group, Robert Martinson, individually published an article in a general interest journal, pre-empting the book (Martinson, 1974). His general stance is that there is very little evidence that treatment has any significant effect on offending. Martinson's paper begins by asking 'What works?' and concludes with a section 'Does nothing work?' (to which he finds the answer, with some caveats, to be affirmative).

The notion that 'nothing works' took hold in many quarters, including academic researchers, policy-makers in the criminal justice system and the public at large. The impact of the message was significant, as funding was withdrawn from projects aimed at rehabilitation, prisons espoused a custodial rather than rehabilitative role, and theory and practice shifted to punishment, deterrence and 'just desserts' for offenders.

Lipton, D.S., Martinson, R., & Wilks, J., 1975, *The Effectiveness of Correctional Treatment*, New York: Praeger.

Martinson, R., 1974, 'What works? Questions and answers about prison reform', *Public Interest*, 35, 22–54.

cognitive processes (Novaco & Welsh, 1989) involve various types of information-processing biases concerned with the encoding of interpretation and triggering cues. For example, attentional cueing is the tendency to see hostility and provocation in the words and actions of other people, while an attribution error occurs when the individual believes that his or her own behaviour is determined by the situation, but that the behaviour of other people is explained by their personality (see chapter 17).

The progression from anger to violence is associated with the disinhibition of internal control, which can result from factors such as high levels of physiological arousal, the perception that there is little chance of being apprehended or punished, and the perpetrator's use of drugs or alcohol.

Moral reasoning

There is a long history of research into the relationship between moral reasoning and offending (Palmer, 2003). Gibbs has examined the specific association between moral reasoning and violent behaviour, focusing on the bridge between theories of social information processing and moral development. Gibbs and colleagues suggest that this bridge takes the form of cognitive distortions (Gibbs, 1993; Goldstein, Glick & Gibbs, 1998) by which we rationalize or mislabel our own behaviour.

For example, if I perceive someone else's actions as having hostile intent, leading me to assault them, my distorted rationalization might be that 'he was asking for it'. Cognitive distortion

is also seen in my biased interpretation of the consequences of my behaviour. So I might say that my victim 'could have had it worse' or 'wasn't too badly hurt' or that 'no real damage was done' (Gibbs, 1996). These powerful types of distorted thinking are often socially supported and reinforced by the offender's peer group.

Working with offenders

Approaches to working with offenders have inevitably changed as our understanding of antisocial and criminal behaviour has developed, moving from psychodynamic psychotherapy, through group therapy, to behaviour modification. Yet there are those who see little merit in using treatment to reduce offending. (Hollin, 2001, has documented the struggle between proponents of treatment and advocates of punishment.)

But since the mid 1990s there has been a renewed interest in the treatment approach, stimulated by a clutch of studies using meta-analysis.

Using meta-analysis to inform treatment programmes

Meta-analysis allows inspection of the aggregated findings from a group of studies around a common theme. Its use in studies into the effects of offender treatment has had a profound effect on recent practice.

Offender treatment meta-analyses draw the critical distinction between clinical and criminogenic outcome variables. In this context, 'clinical outcomes' refers to changes in some dimension of personal functioning, such as psychological adjustment, attitudes or social competence. On the other hand, 'criminogenic outcomes' refers specifically to measures concerned with crime, such as self-reported delinquency, official reconvictions and type of offence.

As a broad generalization, treatment of offenders (as with other populations) tends to produce beneficial clinical outcomes (Lipsey & Wilson, 1993). But a significant contribution of the meta-analyses has been to highlight influences on criminogenic outcomes (in other words, those characteristics of treatment interventions that produce a reduction in offending).

Several meta-analytic studies have sought to identify the practical recommendations that can be taken from this empirical research (see McGuire, 2002, for an overview). The first major conclusion is that there is an overall reduction in reoffending after treatment – in the region of 10 per cent (Lipsey, 1992; Lösel, 1996). The second conclusion is that some interventions have a significantly greater effect than others – the most effective producing more than 20 per cent reduction in reoffending (Lipsey, 1992).

As the evidence accumulates, a broad consensus has been reached regarding the characteristics of treatments that impact on offending:

1. Indiscriminate targeting of treatment programmes is counter-productive in reducing recidivism. Medium- to high-risk offenders should be selected and programmes should focus on criminogenic targets: that is, treatments should be concerned with those aspects of the offender's thinking and behaviour that can be shown to be directly related to their offending.
2. The type of treatment programme is important, with stronger evidence for structured behavioural and multimodal approaches than for less focused approaches. (The term 'multimodal' means using a variety of treatment techniques to address a range of targets for change, as discussed below with reference to Aggression Replacement Training.)
3. The most successful studies, while behavioural in nature, include a cognitive component, i.e. they encourage the offender to focus on their attitudes and beliefs.
4. Treatment programmes should be designed to engage high levels of offender responsivity: that is, the style of treatment should engage the offender to make him or her responsive to treatment and, at the same time, be responsive to the needs of different offenders such as juvenile or adult offenders or male and female offenders.
5. Treatment programmes conducted in the community have a stronger effect than residential programmes. While residential programmes can be effective, they should be linked structurally with community-based interventions.
6. The most effective programmes have high treatment integrity, in that they are carried out by trained staff, and treatment initiators are involved in all the operational phases of the treatment programmes.

What Works generic name given to a recent approach to offender treatment, which is based on findings from meta-analyses of the offender treatment literature

The translation into practice of these principles derived from meta-analysis has become known as the *What Works* form of treatment programmes (McGuire, 1995). The possibilities raised by the What Works principles have been recognized in the UK at a government policy level (Vennard, Sugg & Hedderman, 1997) and have significantly influenced work with offenders in prison and on probation. The development of national programmes for working with offenders has become a major initiative, seeking to capitalize on the possibilities raised by What Works (Lipton et al., 2000).

Offending behaviour programmes – an example

Aggression Replacement Training (ART) is an excellent example of a programme approach to working with offenders. ART was developed in the USA during the 1980s as a means of working with violent offenders. This training programme has proved to be an effective way

Aggression Replacement Training (ART) research-based programme for working with violent offenders

Figure 21.6

Offender treatment programmes conducted in the community have a stronger effect than residential programmes.

of reducing aggressive behaviour (Goldstein & Glick, 1987; 1996). ART has continued to be developed as the evidence base grows and practice techniques become more refined (Goldstein, Glick & Gibbs, 1998).

ART consists of three components, delivered sequentially, and so would qualify as a multimodal programme:

1. Skillstreaming involves the teaching of skills to replace out-of-control, destructive behaviours with constructive, prosocial behaviours. Social skills are taught in terms of step-by-step instructions for managing critical social situations. For example, offenders might be taught conflict negotiation skills for use in situations where previously they would have used aggression.
2. Anger control training first establishes the individual-specific triggers for anger, then uses the anger management techniques of (i) enhancing awareness of internal anger cues, (ii) teaching coping strategies, (iii) skills training, (iv) self-instruction and (v) social problem solving. Thus, offenders are taught to recognise their own feelings of anger and then helped to develop strategies, using new skills and enhanced self-control, to control anger and hence reduce aggression.
3. Moral reasoning training is concerned with enhancing moral reasoning skills and widening social perspective-taking. This is achieved through self-instruction training, social problem solving and skills training. The focus here is on increasing the offenders' understanding of the effects of their actions on others people, thereby enhancing the values that young people have for the rights and feelings of others.

Pioneer

Don A. Andrews (1941–) is Professor of Psychology at Carleton University, Ottawa. He is arguably the most influential psychologist currently working in the field of offender rehabilitation. At a time when the practice of offender rehabilitation was vigorously challenged, Andrews was one of its staunchest defenders. He is a fierce critic of those criminologists who have questioned the place of psychology in understanding crime and criminal behaviour. A strong advocate of evidence-based practice and theoretical integrity, he developed a risk assessment instrument (the Level of Service Inventory) which is widely used by practitioners in the criminal justice systems of several different countries. His book, with James Bonta, *The Psychology of Criminal Conduct*, is a fine example of both his forthright style and the outstanding quality of his work.

Research close-up 3

The effectiveness of rehabilitation revisited

The research issue

Not surprisingly, there was significant opposition to the notion that 'nothing works' in offender rehabilitation. The literature included in the original review was re-examined by several researchers, who all reached different conclusions. Other researchers assembled different sets of relevant studies, which showed (they claimed) that treatment was effective. But still the broadly accepted position in government policy and community practice was that nothing works, and policies for managing offenders become increasingly punitive. (Even Martinson's later article published in 1979, recanting much of his earlier views, failed to have any impact.)

The complex task of making sense of a large body of literature using a narrative review is always liable to lead to disagreement. The development and refinement in the mid 1980s of the technique of meta-analysis presented a more systematic and objective alternative to the narrative review as a means of making sense of the findings of a large body of literature.

The largest and most influential meta-analysis of the offender treatment literature to date was conducted by Lipsey (1992).

Design and procedure

The first step in Lipsey's work was to establish the eligibility criteria for studies to be included in the meta-analysis. There were six criteria used in making decisions about inclusion, ranging from the nature of the outcome variables to the type of research design.

The next step was to gather the research studies together using searches of bibliographic databases. Lipsey noted that these searches produced 'more than 8000 citations' (p. 89) of potential relevance to the study. Once the individual studies had been collected and passed through the eligibility criteria, they were coded for analysis.

For the 443 studies included in the meta-analysis, Lipsey used a 154-item coding scheme, incorporating study characteristics such as type of treatment, research design, length of treatment, type of outcome measure, and so on. Once coded, the data represented the characteristics and findings of the 443 individual studies to be statistically analysed using meta-analytic procedures.

Results and implications

In meta-analysis a key outcome is effect size, which can be calculated in several ways but represents the outcome of the comparison between treatment and no treatment. It is also possible to calculate whether an effect size is statistically significant.

So with regard to recidivism, a positive effect size would indicate that treatment reduced offending, while a negative effect size would indicate that treatment increased offending. The magnitude of the effect size indicates the numerical difference in recidivism between treated and untreated offenders. A meta-analysis allows comparisons of the effect size of, say, different treatment types or treatment effects in different settings.

Lipsey reported an overall small positive effect size (a statistical measure of the impact of the treatment), so while it would not be true to say that 'nothing works', neither could an overwhelmingly strong case be made for treatment.

Importantly, meta-analysis also allows researchers to identify the characteristics of 'high effect' treatments (those treatments that produce a significantly high reduction in recidivism compared to no treatment). For example, Lipsey's analysis strongly indicated that structured treatments, generally using cognitive–behavioural methods of treatment, gave greater positive effects in reducing recidivism than treatments based on non-directive counselling.

The impact of Lipsey's work, taken in conjunction with other meta-analyses, can be seen in a large-scale resurgence in methods of offender treatment. This renewed interest has attracted significant government funding under the banner of 'What Works', with renewed endeavours in both research and practice.

Lipsey, M.W., 1992, 'Juvenile delinquency treatment: A meta-analytic inquiry into the variability of effects' in T.D. Cook, H. Cooper, D.S. Cordray et al. (eds), *Meta-analysis for Explanation: A Casebook*, New York: Russell Sage Foundation.

Martinson, R., 1979, 'New findings, new views: A note of caution regarding sentencing reforms', *Hosfra Law Review*, 7, 242–58.

FINAL THOUGHTS

It is appropriate to end with a cautionary note. The study of crime is not the province of any one discipline, and forensic psychology must guard against becoming isolated from a much wider multidisciplinary context. Of course, forensic psychologists must be aware of advances in their own discipline, but the real challenge is also to be aware of other highly related and mutually informative disciplines, such as criminology, law, psychiatry and sociology.

Having said this, it is an inescapable truism that crimes are committed by people, and if forensic psychologists cannot contribute meaningfully to understanding people's behaviour then something has gone seriously awry! Therefore, as much as psychologists should acknowledge the informative perspectives of researchers and practitioners from related disciplines, they and others should also acknowledge the unique perspective that psychologists themselves can offer in tackling illegal behaviour and dealing proactively with its perpetrators.

Summary

- Forensic psychology covers a great deal of ground, stretching into many areas including (but not limited to): cognitive psychology, as seen in the studies of eyewitness testimony, interview techniques, and social information processing accounts of violence; developmental psychology (which is critical for our understanding of delinquent development); and social psychology (which plays an important role in theories of criminal behaviour).
- There are a number of factors that can influence the accuracy of eyewitness memory, and research into the accuracy of eyewitness testimony focuses on three areas: acquisition, retention and retrieval. Research has also been put to good use in assisting police in structuring witness interviews appropriately.
- Sometimes people confess to crimes they did not commit, but there are important differences between voluntary and coerced confessions – in the case of coerced confessions, the suspect may even come to believe that their own memory for events is false.
- During crime investigations, interviewers use a variety of techniques to enhance memory retrieval in witnesses. Some of these enable the process of retrieval from memory to take place in a similar psychological context to that in which the information was first recorded, while others encourage the witness to try to use many different paths to retrieve the information.
- Even skilled questioners find it difficult to detect lies and deceit simply on the basis of a suspect's verbal and non-verbal cues, so more advanced approaches are often needed.
- Thanks to studies such as *The Cambridge Study in Delinquent Development*, we now know that there are factors present during childhood that can predict adult offending, and important influences over the lifespan that help to explain and characterize violent conduct.
- Approaches to working with offenders have changed as our understanding of antisocial and criminal behaviour has developed, moving from psychodynamic psychotherapy, through group therapy, to behaviour modification, and a broad consensus has been reached regarding the characteristics of treatments that impact on offending.
- Like all good psychologists (and perhaps unlike their depiction in the popular media), forensic psychologists are concerned with evidence (in terms of methodologies for gathering robust data and appropriate methods of analysis) upon which to base appropriate theories and practice.

REVISION QUESTIONS

1. Are research findings from psychology sufficiently robust and reliable to be applied to real world problems such as crime?
2. 'There is nothing so practical as a good theory.' Is this true in forensic psychology?
3. A great deal of psychological research points to the shortcomings in the reliability of eyewitness and confessional evidence. How might psychologists tackle this problem?
4. Is it *really* possible to understand the psychological characteristics of a criminal from crime scene evidence?
6. With reference to the findings from longitudinal studies, is it true that the causes of delinquency are to be found at the level of the individual?
7. Discuss the view that spending money to treat criminals is 'morally wrong and a waste of public money'; instead, it has been suggested that criminals should be punished for their crimes . . .

Further Reading

Andrews, D., & Bonta, J. (2003). *The Psychology of Criminal Conduct*. 3rd edn. Cincinnati, OH: Anderson.
An assertive view of the role of psychology in explaining crime, particularly good on risk assessment and intervention.

Blackburn, R. (1993). *The Psychology of Criminal Conduct: Theory, Research and Practice*. Chichester: John Wiley & Sons.
A closely argued text that reaches a more advanced readership.

Hollin, C.R. (1989). *Psychology and Crime: An Introduction to Criminological Psychology*. London: Routledge.
This book and its 1992 companion (see below) are broad-based texts primarily for undergraduate courses.

Hollin, C.R. (1992). *Criminal Behaviour: A Psychological Approach to Explanation and Prevention*. London: Taylor & Francis.
See above.

Kapardis, A. (1997). *Psychology and Law: A Critical Introduction*. Cambridge: Cambridge University Press.
A comprehensive overview of legal psychology.

Wrightsman, L.S. (2001). *Forensic Psychology*. Belmont, CA: Wadsworth
A detailed text with a clear focus on crime investigation and courtroom processes.

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Glossary

absolutist reasoning that assumes there is always a single, clear answer to a given problem (cf. **dialectical**; **relativist**)

abstinence violation effect a more severe relapse resulting from a minor violation of substance use abstinence (e.g. one forbidden drink leading to more)

acoustic nerve conveys information from the cochlea to the auditory cortex

action potential the all-or-nothing electrical output of a neuron

acuity the finest detail that the visual (or other) system can distinguish

adaptation decline in the response of a sensory or perceptual system that occurs if the stimulus remains constant

adherence (or **compliance**) the extent to which a patient does as suggested (e.g. taking medicine or changing behaviour)

adipsia lack of drinking

after-effect change in the perception of a sensory quality (e.g. colour, loudness, warmth) following a period of stimulation, indicating that selective adaptation has occurred

Aggression Replacement Training (ART) research-based programme for working with violent offenders

agonist neurotransmitter agonists mimic or enhance the effect of a neurotransmitter

agoraphobia fear of situations in which escape would be difficult or help is not available should panic or anxiety occur

akinesia lack of voluntary movement

amnesia a clinical problem, often with underlying neurological damage, involving chronic and serious memory problems

amplitude the difference between the peaks and troughs of a waveform

amygdala a group of nuclei in the brain, important in emotional processing, whose shape was thought to resemble an almond (*amygdala* means 'almond' in Latin)

analytical psychology the theory of personality developed by Carl Jung, in which people are viewed as striving towards self-actualization

antagonist neurotransmitter antagonists prevent or reduce the normal effect of a neurotransmitter

antipsychotics drugs used to treat the symptoms of schizophrenia

anxiolytics drugs that produce sedation and reduce anxiety, popularly known as tranquillizers

aphagia lack of eating

aphasia loss of speech ability

apoptosis genetically programmed self-destruction of a neuron

appraisal an individual's assessment of both the outside world and their ability to cope with this world

arousal the fluctuating state of physiological activation of the nervous system

arousal theory developed by Eysenck, this theory provides an account of the physiological systems underlying introversion–extraversion.

articulatory suppression a research technique in which participants repeat aloud a simple sound or word, preventing the phonological loop from retaining any further information

assessment centres series of assessment exercises (e.g. interviews, work-sample tests, group discussions) used to assess a person's potential for a job

association a link between two events or entities that permits one to activate the other (such as when a characteristic odour elicits an image of the place where it was once experienced)

attachment the close links formed between a human infant and caregiver, or the intimate bond that can form between adults

attitude function the psychological needs that an attitude fulfils

attitude object the thing (e.g. idea, person, behaviour) that is accorded a favourable or unfavourable attitude

attribution an individual's belief about causality

attributional style the characteristic patterns of explanation people use to make sense of life-events

auditory cortex a region of the cortex devoted to processing information from the ears

authoritarian personality a particular type of personality (originating in childhood and oversubmissive to authority figures) that predisposes individuals to be prejudiced

autism early onset, biologically caused disorder of communication and social interaction, usually accompanied by obsessive and stereotyped behaviour and intellectual disability

autobiographical memory the recall of events from our earlier life – a type of episodic memory

autokinetic effect optical illusion in which a stationary point of light shining in complete darkness appears to move about

automatic processing the processing of information that is beyond conscious awareness and extremely fast – in experimental studies, within 240 ms of stimulus presentation

automatic thoughts used in cognitive therapy to refer to spontaneously generated thoughts associated with specific moods or situations

autonomic nervous system part of the peripheral nervous system, with sympathetic and parasympathetic components that control functions like heart rate and blood pressure

autoreceptor a neurotransmitter receptor located on a neuron so as to be activated by that neuron's own release of neurotransmitter

autoshaping classical conditioning used with pigeons which results in pecking at an illuminated response key that has been regularly presented before the delivery of food, even though the delivery of the food does not depend on the pecking behaviour

availability relies on the possibility that a solution (from heuristic reasoning) that readily or quickly comes to mind may be the correct one

aversion therapy a problem behaviour is paired with an aversive stimulus in an attempt to establish an aversive response to the behaviour (e.g. fear, disgust)

avoidance instrumental training procedure in which performing a given response brings about the omission of an aversive event that is otherwise scheduled to occur

axon the neuronal outgrowth through which the output is transmitted

behavioural inhibition shyness, quietness, fearfulness, social avoidance, and high levels of physiological arousal and stress reactivity in young children

behavioural intentions intentions to perform or not to perform a specific behaviour

behaviourism a totally objective psychology, whose subject matter is observable behaviour

between-subjects design a research study involving a systematic manipulation of an independent variable with different participants being exposed to different levels of that variable (cf. **within-subjects design**)

Big Five see **five factor model of personality**

biochemical imbalance complex neurotransmitter dysregulation process involving the various neurotransmitters in the brain

biodata life history information about job candidates

biopsychosocial the type of interaction between biological factors (e.g. a virus), psychological factors (e.g. beliefs) and social factors (e.g. class)

bivariate the relationship or association between two variables ('variate' is another word for variable)

blocking training an organism with one stimulus as a signal for an unconditioned stimulus to prevent the organism from learning about a second stimulus when both stimuli are subsequently presented together as signals for the same unconditioned stimulus

body language expressions, gestures, movements, postures and para-linguistic aspects of speech that form the basis of nonverbal communication

book-keeping model suggests that stereotypes and schemas are constantly fine-tuned with each new piece of information

bounded rationality being rational by making a rational judgement, but based on only part of the evidence

brain stem a grouping of brain structures generally taken to include the medulla, pons, midbrain, hypothalamus and thalamus

brainstorming technique of uninhibited generation of as many ideas as possible in a group (concerning a specific topic) to enhance group creativity

bystander intervention occurs when an individual breaks out of the role as a bystander and helps another person in an emergency

Cambridge Study in Delinquent Development longitudinal study, based at the University of Cambridge, concerned with the development of delinquency and later adult crime

cartesian dualism a framework offered by Descartes, which asserts a relationship of mutual interaction (see **dualism**)

case study method research method that involves a single participant or small group of participants who are typically studied quite intensively

castration anxiety a male's fear of losing his genitals, which Freud believed was related to the Oedipus complex

category-based processing information processing that is fast, non-strategic, efficient, can be automatic and beyond conscious awareness, and is more likely to occur when the data are unambiguous and relatively unimportant

central executive the component of Baddeley's working memory model that controls attention and coordinates the slave systems

central nervous system collectively, the brain and the spinal cord

central processes Fodor's term for the kinds of proposed information processing carried out in thought as distinct from those carried out by mental 'modules'

central tendency measures of the 'average' (most commonly the mean, median and mode), which tell us what constitutes a typical value

centralization the degree to which decisions can only be taken by senior management, as against being devolved to people throughout the organization

centration when a preoperational child focuses on only one aspect of a problem at a time

cerebellum the brain region important in skilled movement (in Latin, *cerebellum* means 'small brain')

channel transmits a restricted range of sensory information (e.g., in the case of colour, information about a restricted range of wavelengths, but no information about the movement or orientation of the stimulus)

chemosensors receptors for chemical signals such as glucose concentration

chromatic opponency a system of encoding colour information originating in retinal ganglion cells into red–green, yellow–blue and luminance signals; so, for example, a red–green neuron will increase its firing rate if stimulated by a red light, and decrease it if stimulated by a green light.

cingulotomy surgical procedure in which neurosurgeons make lesions in the cingulate gyrus, a section of the brain connecting the prefrontal cortex to the limbic system

classical conditioning learning procedure in which two stimuli are paired – one (the conditioned stimulus) usually presented shortly before the other (the unconditioned stimulus) to produce a conditioned response to the first stimulus (learning)

clinical psychology focuses on the causes and treatment of psychological disorders and adjustment problems such as depression and phobias

cochlea coiled structure in the inner ear responsible for transforming mechanical vibration (sound energy) into action potentials in the acoustic nerve

coerced confession formal admission of guilt made under duress, which can be true or false, usually made to the police

cognitive–affective units in the personality system a model of categories through which personality can be examined within a social cognitive framework

cognitive appraisal determines reactions to stressful events, according to Lazarus

cognitive components basic information-processing routines (e.g. encoding, response selection) which underpin task performance

cognitive dissonance theory describes how people may feel an aversive tension when their behaviour is inconsistent with their attitude, and in order to reduce their discomfort, will change their behaviour to be consistent with their attitude

cognitive distortions dysfunctional ways of thinking about the self, the world, other people and the future that can make people vulnerable to depression and other negative emotions

cognitive interview method of questioning witnesses, devised for use by the police, based on principles taken from memory research

cognitive map postulated internalized representation of the lay-out of the environment in which information about the relative spatial relationships of various features is preserved

cognitive miser someone who minimizes effort and energy when processing information, making 'top of the head' judgements, evaluations and inferences, with little thought or considered deliberation

cognitive psychology examines fundamental mental processes such as perception, thinking, memory, language

cognitive scripts see **event schemas**

collaborative empiricism cognitive therapy procedure in which the therapist formulates a hypothesis and then helps the client test the validity of the hypothesis

column a volume of cells stretching the entire depth of the cerebral cortex, which all have some physiological property in common (e.g. the preferred orientation of the bar or edge stimulus to which they respond, in the case of a column in the primary visual cortex)

compliance see **adherence**

compulsions ritualistic, repetitive behaviours that a person feels compelled to engage in

concordance rates the extent to which people show the same disorders

concrete operations period the third major phase of cognitive development, according to Piaget, lasting from approximately seven to 11 years, when the child's problem solving is more logical but his/her reasoning is largely dependent on application to immediate physical entities and tasks

condition a situation in a research study in which participants are all treated the same way

conditioned emotional response result of the superimposition of the pairing of a conditioned and an unconditioned stimulus on a baseline of operant or instrumental behaviour

conditioned response (**CR**) evoked by a conditioned stimulus as a result of classical conditioning

conditioned stimulus (**CS**) evokes a conditioned response as a result of classical conditioning

conditions of worth conditions under which affection is given

cones cells in the retina that transform light energy into action potentials, different kinds responding preferentially to different wavelengths

conformity social influence resulting from exposure to the opinions of a majority of group members and/or to an authority figure – typically superficial and short-lived

confound an unintended or accidental manipulation of an independent variable that threatens the validity of an experiment

conjunction search visual search for a unique conjunction of two (or more) visual features such as colour and orientation (e.g. a red tilted line) from within an array of distractors, each of which manifests one of these features alone (e.g. red vertical lines and green tilted lines)

connectionist approach also known as a 'neural network' approach, it is informed by a view of how the nervous system might compute different mental operations

conservation ability to recognize that an object or amount remains the same despite superficial changes in appearance

constructivist theorist who attributes the acquisition of knowledge to the active processes of the learner, building on increasingly complex representations of reality

contact hypothesis the idea that contact between members of different groups, under specified conditions, reduces prejudice and hostility

contingency theory Fiedler's interactionist theory, specifying that the effectiveness of particular leadership styles depends on situational and task factors

control group participants in an experiment who are not subjected to the treatment of interest (as distinct from the experimental group)

control theory of human functioning a metaphorical thermostat system used to model the ways in which people set standards for their own behaviour and how they monitor this behaviour

controlled processing the processing of information that is deliberate, conscious, and strategic; in experimental studies, this occurs after 2000 ms of the presentation of a stimulus

conversion a change in covert (private) opinion after exposure to others' opinions (who often represent a minority within the group)

conversion model predicts dramatic and sudden change in schema and stereotypes in the face of salient contradictions

coping processes ways of dealing with stressors – usually a mixture of being problem-focused and emotion-focused

corpus callosum massive fibre system of axons connecting the two hemispheres

correlation the extent to which two variables, such as weight and height, are related; a correlation of +1 indicates a perfect positive association, and −1 a perfect negative association

correlation coefficient a measure of the degree of correspondence or association between two variables that are being studied

cortex structure made of a layer of cell bodies, especially neocortex, the multi-layered outside of the brain (*cortex* means 'bark' in Latin)

counter-attitudinal advocacy presenting an attitude or opinion, within a role-play context, which opposes the person's initial attitude

covert sensitization a form of aversion therapy in which the client imagines a problem behaviour followed by an aversive stimulus

criminological psychology the application of psychology to enrich our understanding of crime and criminal behaviour

criterion validity the relationship between a person's scores in a selection method (e.g. job interview or intelligence test) and his/her scores on subsequent performance measures (e.g. supervisor's rating of the person's job performance)

crystallized intelligence (***Gc***) diverse skills and knowledge acquired across the lifespan

cue information that initiates and/or aids recall

cue overload principle as more information is tied to each cue, a smaller proportion of that information will be recalled

cued recall recall in response to directive cues

data-based processing information processing that is slow, deliberate, and requires conscious effort and attention, used where the need for accuracy is high

deindividuation a psychological state in which rational control and adherence to norms is weakened, leading to greater readiness to respond in an extreme manner and to violate social norms

dendrites the input system of a neuron, so called because of its branching structure

dependent variable the variable on which a researcher is interested in monitoring effects or outcomes

descriptive statistics numerical statements about the properties of data, such as the mean or standard deviation

developmental psychology the study of age-related changes across the lifespan

developmental psychopathology a perspective suggesting that risk for psychopathology depends on success at negotiating and mastering important developmental tasks

dialectical reasoning in which competing positions are integrated and synthesis achieved (cf. **absolutist**; **relativist**)

diathesis–stress model suggests that some people possess an enduring vulnerability factor (diathesis), which, when coupled with a proximal stressor, results in psychological symptoms

directional sensitivity similar to acuity

discourse a set of sentences that bear a sensible relationship to one another and so form a message

discriminative stimulus signals whether or not a given response is likely to produce a particular outcome

dishabituation restoration of a habituated response by presentation of a strong extraneous stimulus

dispersion measures of dispersion (most commonly range, standard deviation and variance) describe the distance of separate records or data points from each other

double-blind procedure in order to evaluate treatment efficacy, the patient and all staff having contact with the patient remain uninformed (blind) as to the true nature of the treatment

double recessive the two copies of a gene in an animal are both recessive (i.e. non-dominant), as opposed to one copy being dominant (in which case the phenotype, or body characteristic, will be that of the dominant gene)

downsizing when organizations reduce their workforce to save on labour costs

Dream Levinson's term for an individual's vision of his life goals, formed around 17 to 22 years of age and contributing to the motivation for subsequent personal development

dualism the view that the body and the mind (or soul or spirit) are fundamentally different in nature

dyslexia impaired reading due to trauma or developmental factors

eardrum a membrane between the outer and middle ear that vibrates when sound waves reach it

echoic memory auditory sensory memory

ecological validity the extent to which a task is typical of tasks that people have to solve in everyday life

egocentrism inability of the preoperational child to distinguish between his/her own perspective on a situation and the perspectives of others

elaborative rehearsal considering the meaning of information (cf. **maintenance rehearsal**)

electroconvulsive therapy (**ECT**) a treatment for severe depression in which two electrodes are placed on the scalp and a moderately intense electric current is passed between them for about half a second

emotional intelligence the capacity to be sensitive to and regulate our own emotional state, and that of other people

emotionality the extent to which we react emotionally – akin to a personality trait, and thought to be partly inherited.

empiricism the belief that knowledge comes from observation and experience, and sensory experience is the source of all knowledge

encoding specificity principle states that what is remembered later depends on the similarity of the retrieval situation to the original encoding conditions

episodic buffer the component in Baddeley's working memory model that integrates and manipulates material in working memory

episodic memory memory for personally experienced events

equity theory assumes that satisfaction in a relationship is highest when the ratio of one's own outcomes to inputs is equal to that of a referenced other (individuals will try to restore equity when they find themselves in an inequitable situation)

Eros the desire for life, love and sex within psychoanalytic theory

event schemas cognitive structures that describe behavioural and event sequences in everyday activities such as eating at a restaurant, attending a lecture or shopping at a supermarket

evolutionary cognition cognitive processes that are established by evolution

experimental analysis of behaviour a term used by Skinner and his associates to describe the investigation of operant behaviour (those behaviours that are not prompted by any observable stimulus)

experimental control the method of ensuring that the groups being studied are the same except for the manipulation or treatment under investigation

experimental group participants in an experiment who are exposed to a particular level of a relevant manipulation or treatment (as distinct from a control group)

experimental method a research method in which one or more independent variables are systematically manipulated and all other potentially influential variables are controlled (i.e. kept constant), in order to assess the impact of manipulated (independent) variables on relevant outcome (dependent) variables

explicit memory memory with conscious awareness of the original information or the situation in which the learning occurred

expressed emotion (**EE**) specific set of feelings and behaviours directed at people with schizophrenia by their family members

external memories memories of events that really occurred

external validity the extent to which a research finding can be generalized to other situations

extraversion the tendency to seek and engage with the company of others (cf. **introversion**)

eyewitness testimony the evidence given by witnesses to a crime, typically in the form of a verbal account or person identification

facial feedback hypothesis the view that our experience of emotion is determined by physiological feedback from facial expressions

factor analysis a data reduction technique where relationships between a large number of variables can be reduced to a relationship among fewer hypothetical (i.e. latent) factors

familial transmission genetic transmission of disorders

feature detector a mechanism sensitive to only one aspect of a stimulus, such as red (for the colour dimension) or leftwards (for direction of motion) and unaffected by the presence or value of any other dimension of the stimulus

feature integration theory different features of an object (e.g. colour, orientation, direction of motion) are thought to be analysed separately (and in parallel) by several distinct mechanisms, and the role of attention is to 'glue together' these separate features to form a coherent representation

feature search visual search for a unique feature such as a particular colour or orientation (e.g. a red spot) in an array of distractors defined by different features along the same visual dimension (e.g. green spots)

five factor model of personality a model developed using factor analysis to try to determine the key traits in human personality

flavour aversion learning classical conditioning procedure in which animals are allowed to consume a substance with a novel flavour and are then given some treatment that induces nausea, resulting in the flavour being subsequently rejected

flooding a technique used in behaviour therapy that involves exposing the patient to highly threatening events for a prolonged period of time

fluid intelligence (*Gf*) Horn and Cattell's *Gf* is something akin to Spearman's *g*, namely an overarching processing capacity that in turn contributes to *Gc* (see **crystallized intelligence**)

formalization written rules and regulations governing activities in an organization

fovea the central five degrees or so of human vision, particularly the central, high-acuity part of this area (about one degree in diameter)

free recall recall in response to non-specific cues

frequency the rate at which a periodic signal repeats, often measured in cycles per second or Hertz (Hz); the higher the frequency, the higher the perceived pitch

frequency selectivity the degree to which a system (e.g. a neuron) responds more to one frequency than another

frustration effect an increase in the vigour of responding, following the absence of reward, in a place where reward was experienced previously

functional neuro-imaging methods for observing which brain regions are active

functionalism addresses the very practical question of what functions the mind, or mental processes, accomplish

ganglion a cluster of neuronal cell bodies, especially in the spinal cord

gap junction extremely close contact between two neurons allowing direct flow of electrical current between them

generalization related to the concept of external validity, this is the process of making statements about the general population on the basis of research

generativity the feeling in mid-life that one has made or is making a contribution to the next generation (cf. **stagnation**)

genetic epistemology the study of the origin of knowledge in child development, as practised by Jean Piaget

genetic predisposition likelihood of showing condition or characteristic carried by genetic material

genotype our genetic complement, coded in DNA, that we inherit from our parents

Gestalt psychologists a group of German psychologists (and their followers) whose support for a constructionist view of perception has been enshrined in several important principles, such as 'the whole (in German, *Gestalt*) is more than the sum of the parts'

glial cells non-neuronal cells in the brain that provide 'support' for the neurons

glucostasis constancy of glucose availability (e.g. reflected in the glucose concentration in the plasma)

grasping reflex response in human infants to a stimulus (such as a finger) placed in the open palm

grey matter parts of the brain that consist mostly of neuronal cell bodies rather than axons

group polarization tendency for group discussion to produce more extreme group decisions (in the same direction as the mean of the group) than would be indicated by the mean of members' pre-discussion opinions

groupthink a mode of thinking in highly cohesive groups in which the desire to reach unanimous agreement overrides the motivation to adopt appropriate, rational decision-making procedures

gustatory pathways taste pathways through the brain

gyrus outgoing fold in the wrinkled cortical surface

habituation waning of the unconditioned response with repeated presentation of the eliciting stimulus

hair cells long, thin cells in the cochlea and the vestibular system, which, when bent, produce an action potential

Hawthorne effect when workers appreciate the attention and interest shown in their work by researchers and managers, and show this appreciation through better work performance

health behaviours examples are exercise, food intake and going to the doctor

health beliefs examples are perceptions of risk or beliefs about the severity of an illness

health locus of control where the cause of health is seen to be located – either internal ('due to me') or external ('due to others')

hemi-neglect a neuropsychological condition leading the patient to ignore one side of the world, including one side of their own body

heuristic reasoning solving a problem by using a method that is likely to give the right answer, although there is no guarantee

hindsight bias falsely overestimating the probability with which we would have predicted an outcome after we know it has already occurred

hippocampus brain structure important in memory processing, whose shape was thought to resemble a seahorse (*hippocampus* means 'seahorse' in Greek)

human information-processing approach derived from ideas in information theory, a branch of communications sciences that provides an abstract way of analysing the processing of knowledge

humanistic a branch of personality theory that emphasizes the capacity for personal growth

hyperphagia pathological overeating

hyperpolarization increasing neuronal membrane potential to more than its usual resting potential (making it harder to induce the cell to produce an action potential)

hypothalamus brain structure important in motivation and homeostatic regulation, located beneath the thalamus

hypothesis a statement about the causal relationship between particular phenomena (i.e. A causes B), usually derived from a particular theoretical framework, which is designed to be tested via research investigation

iconic memory visual sensory memory

idiographic an approach to personality that proposes each individual is unique and cannot be compared with another (see **nomothetic**)

idiosyncrasy credits Hollander's transactional theory proposes that followers reward leaders for achieving group goals by allowing them to be relatively idiosyncratic in their behaviour and opinions

illness beliefs examples are how long the illness will last and what impact it will have on the patient's life

illusory conjunctions perceptual phenomena which may occur when several different stimuli are presented simultaneously to an observer whose attention has been diverted (e.g. the perception of a red cross and a green circle when a red circle and a green cross are presented)

impairment extent to which a behaviour or set of behaviours gets in the way of successful functioning in an important domain of the individual's life

implicit memory influence on behaviour, affect or thought as a result of prior experience but without conscious recollection of the original events

imprinting the development of filial responses by newly hatched birds to an object (usually the mother) experienced early in life, or more generally the early formation of social attachments in animals

independent variable the treatment variable manipulated in an experiment, or the causal variable believed to be responsible for particular effects or outcomes

indirect agonists substances increasing neurotransmitter effects, typically by inducing additional neurotransmitter release

inferential statistics numerical techniques used to estimate the probability that purely random sampling from an experimental population of interest can yield a sample such as the one obtained in the research study

information-processing approach understanding how something works by finding out the kinds of information involved and the steps through which it goes in order to accomplish a task

informational influence social influence based on acquiring new information from other group members, which is accepted as evidence about reality

informed consent the ethical principle that research participants should be told enough about a piece of research to be able to decide whether they wish to participate

inhibitory neurotransmitters neurotransmitters that make their target cell less excitable, so it becomes harder to induce an action potential

insight an individual's understanding of the unconscious reasons for his or her maladaptive behaviour – central to psychoanalysis

inspection time (**IT**) the time taken to process a single bit of information: the stimulus is seen (inspected) for a very short time before disappearing (cf. **reaction time**)

instrumental learning the likelihood of a response is changed because the response yields a certain outcome (a reward or punishment) (also called operant conditioning)

inter-ocular transfer the adaptation or learning that occurs when a training stimulus is inspected with one eye and a test stimulus is subsequently inspected with the other eye

interactive view two processes are interactive when the processing occurring in one of them depends on the processing occurring in the other

internal validity the extent to which the effect of an independent (manipulated) variable on a dependent (outcome) variable is interpreted correctly

internal working model a set of basic assumptions (a schema) about the nature of relationships

interneurons neurons whose output projection targets are all local

interrogative suggestibility the degree to which individuals are inclined to accept as true the type of information that is communicated by the questioner during interrogation

introspection literally, looking inward, this is an observational method used to describe the elements of experience (colours, tones, tastes and so on)

introversion the tendency to avoid the company of others and to withdraw from social situations (cf. **extraversion**)

investment model a theory that proposes that commitment to a relationship is based upon high satisfaction, and/or a low quality of alternatives, and/or a high level of investment

ion channel specialized opening in the neuron's outer membrane, which lets electrically charged ions flow through, so changing neuronal potentials

job analysis procedures for describing jobs, including the nature of the work and the relationships of the job-holder with other people

job redesign techniques to increase the variety, autonomy and completeness of a job

job satisfaction a person's attitude (favourable or unfavourable) towards their job

just noticeable difference (JND) the smallest difference between two stimuli that can be discriminated

law of effect Thorndike's proposal that reward will strengthen the connection between the response that preceded it and any stimuli present when it is delivered, or more generally, the principle that the consequence (effect) of behaviour will determine how likely it is to recur

law of large numbers the idea that the average outcomes of random processes are more stable and predictable with large samples than with small samples

leading questions contain information (either intentionally or unintentionally) that can bias the respondent's reply

legal psychology the application of psychology to matters of concern in a court of law

levels of processing – the theory that there are superficial, intermediate and deeper levels of processing new information that will influence what can later be remembered

lexical criterion of importance Cattell's proposal that an aspect of personality described by many words in the vernacular is likely to be more important than one described by just a few

lobotomy (or leucotomy) surgical operation in which white nerve fibres connecting the frontal lobes with other parts of the brain are severed

logical reasoning reasoning about issues whose conclusions necessarily follow from what is given

long-term depression (LTD) a long-lasting reduction in a target neuron's response to a given level of activity of its input neurons

long-term memory store holds information relatively permanently

long-term potentiation (LTP) a long-lasting increase in a target neuron's response to a given level of activity of its input neurons

longitudinal research type of research design in which data are collected from a group of people, termed a cohort, over a long period of time (typically decades)

luminance the intensity of light corrected for the degree to which the visual system responds to different wavelengths

magno (M) cell a large cell in the visual system (particularly, the retina and lateral geniculate nucleus) that responds particularly well to rapid and transient visual stimulation.

maintenance rehearsal repeating items over and over, maintaining them in short-term memory but not increasing their long term recall

manipulation the process of systematically varying an independent variable across different experimental conditions (sometimes referred to as the experimental treatment or intervention)

manipulation check a procedure that checks the manipulation of the independent variable has been successful in changing the causal variable the experimenter wants to manipulate

materialism the view that all things, including mental phenomena, can be described in physical terms and understood in terms of matter and energy

mean the sum of all the scores divided by the total number of scores

median the middle score of a ranked array – equal to the $((N + 1)/2)$th value, where N is the number of scores in the data set

medulla the nearest part of the brain stem to the spinal cord, where some vital control systems influencing heart rate and respiration are located

memory span the number of words that you can hear and then repeat back without error

menopause the time in a woman's life when menstruation becomes less regular and then ceases

mesencephalon the mid-brain

meta-analysis a quantitative method for combining results across a number of studies by first converting the findings of each study into a metric for comparison

metamemory someone's understanding about how their memory works

method of loci a mnemonic technique used to improve memory by creating images that link the items to be remembered with a series of familiar locations

minimal cognitive architecture Anderson's model of intelligence outlining two main contributors to the gaining of knowledge: speed of information processing and modular development

minimal group paradigm an experimental procedure designed to investigate the isolated effect of social categorization on intergroup behaviour

misinformation effect recall of misleading information presented after an eyewitness experience

mnemonics techniques for improving memory

mode the most commonly occurring score in a set of data

modular view two processes are said to be modular when they occur independently of one another and do not interfere with one another

modules dedicated information-processing systems that provide information about the environment (e.g. complex information conveyed by people's faces) which cannot be provided by central processes of thought in an ecologically useful time frame

monogamous having only one sexual partner

Moro reflex reaction in human infants to sudden loss of support to the neck and head (thrusting out the arms and legs)

morphology the shape or form of a neuron

motivated tactician someone who deploys flexible information-processing strategies that are consistent with their motivations, goals and situational requirements

multiple-act criterion assessment of many behaviours that are relevant to the attitude being measured

multiple intelligences Gardner's theory that there are many autonomous intelligences including linguistic, musical, logical–mathematical, spatial, bodily–kinaesthetic, personal, naturalist and spiritualist

naming explosion a period, usually in the second half of the second year after birth, when children's early vocabulary development accelerates rapidly

negative symptoms in schizophrenia, symptoms that indicate the absence of something normal, such as good social skills, appropriate affect, motivation and life skills

neurocrine classical neurochemical action of transmitters that are released at the axon terminal to affect specialized receptor sites across the synaptic cleft

neuroleptics antipsychotic drugs

neuromodulators neurochemicals that indirectly affect neuronal activity, usually by modifying response to other chemical neurotransmitters

neuron a nerve cell

neuroticism the tendency to be worried and anxious

neurotransmitters chemical messengers used for communication between neurons, released from specialized sites at the axon terminal and affecting specialized receptor sites across the synaptic cleft

nigrostriatal the pathway from the substantia nigra to the striatum, which degenerates in Parkinson's disease

NMDA receptor a subtype of glutamate receptor

nomothetic an approach to personality that emphasizes comparisons between individuals and proposes that people are all governed by the same basic behavioural principles (see **idiographic**)

normal distribution the symmetrical, bell-shaped spread of scores obtained when scores on a variable are randomly distributed around a mean

normative influence social influence based on the need to be accepted and approved of by other group members

norms attitudes and behaviours that group members are expected to show uniformly; these define group membership and differentiate between groups

nucleus a cluster of cell bodies in the brain (as opposed to a cortical layer)

null hypothesis the hypothesis that the research reveals no effect

object permanence understanding that an object continues to exist even when it cannot be seen or touched

obsessions unwanted, persistent, intrusive, repetitive thoughts

obsessive-compulsive disorder (OCD) characterized by intrusive unwelcome thoughts (obsessions) and the need repeatedly to perform certain patterns of behaviour (compulsions), such as hand-washing

Oedipus complex a description used by Freud of boys' tendency in the phallic stage to be attracted to their mothers and to resent their fathers

offender profiling constructing a picture of an offender's characteristics from their modus operandi together with the clues left at the crime scene

olfactory pathways smell pathways through the brain

operant conditioning see **instrumental learning**

operant response (or instrumental response) an arbitrary response or behaviour performed in order to obtain a reward or escape from or avoid a punishment

optic nerve conveys information from the retina to the visual cortex

orbitofrontal cortex above the orbits of the eyes, part of the prefrontal cortex, which is the part of the frontal lobes in front of the motor cortex and the premotor cortex

organizational culture the shared meanings, values, attitudes and beliefs held by organizational members

oropharyngeal the oral cavity and pharynx

orosensory the sensory systems concerned with the oral cavity, including taste, smell and the texture of what is in the mouth

osmosensors receptors for osmotic signals

panic attack sudden and apparently inexplicable experience of terror characterized by extreme physiological reactions, such as heart palpitations and feelings of impending doom

paracrine non-classical effects of neurotransmitters that may not be released at the synapse, and/or whose receptors are not located at the synapse

parallel processing perceptual processing in which it is assumed that different aspects of perception occur simultaneously and independently (e.g. the processing of colour by one set of neural mechanisms at the same time as luminance is being processed by another set)

parallel search a visual search task in which the time to find the target is independent of the number of items in the stimulus array because the items are all processed at the same time (in parallel)

paranoid delusions elaborate set of beliefs, commonly experienced by schizophrenics, characterized by significant distrust of others and feelings of persecution

parasympathetic nervous system one of the components of the autonomic nervous system, essentially calming in its effects

partial reinforcement the delivery of a reinforcer in operant conditioning is scheduled to occur after only a proportion of the responses rather than after all of them (continuous reinforcement)

partial report procedure technique for inferring the capacity of a memory store, even when the memories do not last long enough to inform a complete report

parvo (P) cell a small cell in the visual system (particularly, the retina and lateral geniculate nucleus) that responds particularly well to slow, sustained and coloured stimuli

Pearson's *r* the commonly used name for Pearson's product-moment correlation coefficient

pegword mnemonics method for remembering items by imagining them interacting with a learned set of peg items

perceptual learning exposure to events, increasing subsequent ability to discriminate between them

period of formal operations the last of Piaget's stages of intellectual development, when thought is no longer dependent on concrete operations tied to immediately present objects and actions, but is based on reasoning about abstract propositions and the evaluation of alternative possible outcomes

peripheral nervous system the autonomic nerves and the somatic nerves that branch out beyond the spinal cord itself (as opposed to the central nervous system)

person schemas a configuration of personality traits used to categorize people and to make inferences about their behaviour – also referred to as person prototypes

personal construct a mental representation used to interpret events

phenotype the expression of our genes in behavioural traits that we can measure

phobias intense and seemingly irrational fears

phonemes basic building blocks of speech: English contains around 40 different phonemes

phonological loop the part of Baddeley's working memory model that contains a phonological store and an articulatory control process – responsible for 'inner speech'

photoreceptor a cell (rod or cone) in the retina that transforms light energy into action potentials

physiological psychology investigates the association between the brain and behaviour

pinna the structure made of skin and cartilage on the outer part of the ear.

pitch auditory sensation associated with changes in frequency of the sound wave

pituitary gland an endocrine gland, located just outside and below the brain

placebo effect phenomenon whereby patients show some form of real improvement after being treated with an inert substance (a placebo) such as a sugar pill

polygamous having many sexual partners

pons located just above the medulla, the pons has a role in arousal, autonomic function and sensory relays between the cerebrum and cerebellum

positive manifold the fact that the correlations between ability tests are all positive

positive symptoms in schizophrenia, symptoms that indicate the presence of something unusual, such as hallucinations, delusions, odd speech and inappropriate affect

positivism a term coined by Comte to describe a way of thinking that recognizes only positive facts and observable phenomena, as practised in the physical sciences

postformal reasoning a level of thought beyond Piaget's period of formal operations, characterized by the understanding that there may be multiple perspectives on a problem and that solutions may be context-dependent

power the probability of carrying out one's own will in an organization, despite resistance from other organizational members

pragmatics the significance given to a sentence or utterance by relating its semantics to everyday knowledge of situations

predictive factors characteristics of an individual or their environment that have some utility in predicting the likelihood of their future offending

preoperational period the second major phase of cognitive development, according to Piaget, extending from approximately two to six years, when the child begins to represent the world symbolically but remains intuitive and egocentric

preparedness tendency of certain combinations of events to form associations more readily than others

primary visual cortex a region at the back of the visual cortex to which the optic nerves project, and which carries out an initial analysis of the information conveyed by the optic nerves

priming the effect of a previous encounter with a stimulus

principle of contiguity the proposal that events must be experienced close together in time and space for an association to be formed between them

principle of similarity suggestion that association formation occurs particularly readily when the events are similar to one another

projection neurons neurons with connections that are not just local (i.e. they connect to other areas)

prosopagnosia a neurological condition in which the capacity to recognize individuals by their faces is lost, although other visual discriminations are unimpaired

psyche psychoanalytic term meaning 'mind'

psychoanalysis Freud's 'talking cure', which aimed to bring pathological memories into conscious awareness and was used by Freud as the foundation for developing a theory of personality

psychogenetic model of development Freud's model of personality development

psychometric tests assess cognitive and personality dimensions

psychometrics the theory and measurement of psychological variables such as IQ (intelligence quotient)

psychophysics the systematic attempt to relate changes in the physical world to differences in our psychological perceptions

psychosis a break with reality, characteristic of schizophrenia

psychosocial factors psychological, environmental and social factors that may play a role in psychopathology

psychoticism the tendency to be cold, aggressive and antisocial

psychotropic drugs a loosely defined grouping of drugs that have effects on psychological function

punisher something an animal will work to escape or avoid

punishment an aversive event as the consequence of a response to reduce the probability of the response

pyloric sphincter controls the release of food from the stomach to the duodenum

qualitative research uses methods such as open-ended interviews, focus groups or observation, where the data are analysed without resorting to number

quantitative research uses methods such as questionnaires, experiments and structured interviews, where the data are analysed using numbers

quasi-experimental method embodies the same features as the experimental method but does not involve the random assignment of participants to experimental conditions

random assignment the process of assigning participants to study conditions on a strictly unsystematic basis

random sample a sample of participants in which each has the same chance of being included, ensured by using random participant selection methods (e.g. drawing lots)

randomized clinical trial (**RCT**) random assignment of patients to treatment conditions in order to evaluate the efficacy of a treatment

reaction time (**RT**) the time taken to process a single bit of information: the stimulus is seen until a decision is made and response is completed (cf. **inspection time**)

realistic conflict theory Sherif's theory of intergroup conflict, which proposes that goal relations (e.g. competition vs. cooperation) determine the nature of intergroup relations (e.g. conflict vs. harmony)

recency effect the better recall of the last few items of information encountered

receptive field a region of the visual world where a change in the intensity of light results in changes in production of action potentials in a neuron

receptor the specialized site of action at which neurotransmitters have their effects (e.g. by controlling a membrane ion channel)

reciprocal inhibition loosening of the ability of stimuli to evoke anxiety when a response antagonistic to anxiety (e.g. relaxation) is made to occur in the presence of the stimuli

recurrent processing occurs when the later stages of sensory processing influence the earlier stages (top-down), as the output of a processing operation is fed back into the processing mechanism itself to alter how that mechanism subsequently processes its next input

reflectance the relative proportion of each wavelength reflected by a surface: the higher the reflectance, the lighter the object will look

refractory period a brief period following the generation of an action potential, during which a neuron is hard to re-excite

reinforcer an event that, when made contingent on a response, increases the probability of that response; also another term for the unconditioned stimulus in classical conditioning

relativist reasoning in which the individual has become aware that there are often different perspectives on any given issue, and that the 'correct' answer may depend on the context

reliability the extent to which a given finding will be consistently reproduced on other occasions

representativeness used in heuristic reasoning to decide whether something is likely because it corresponds to an idea of what is typical in that situation

respondent conditioning alternative name for classical conditioning

response patterns particular patterns of physiological responses, in this case linked to various emotions

resting potential the potential difference across the neuron's membrane when it is neither activated nor inhibited (roughly 70 millivolts)

retrieval-induced forgetting when some parts of a set of information are practised (i.e. repeatedly tested and retrieved), the parts that are not practised become temporarily more difficult to recall

reward something for which an animal will work

rods cells in the retina that transform light energy into action potentials and are only active at low light levels (e.g. at night)

role ambiguity employee uncertainty about their job functions and responsibilities

role conflict when demands placed on an employee conflict with one another

role schemas knowledge structures of the behavioural norms and expected characteristics of specific role positions in society based on people's age, gender, race, occupation, etc.

roles patterns of behaviour that distinguish between different activities within a group, and that help to give the group an efficient structure

rooting reflex tendency in human infants to orient the head and mouth towards an object touching the face

rostral towards the head or front end of an animal, as opposed to caudal (towards the tail)

saccades rapid eye movements in which the fovea is directed at a new point in the visual world

satiety reduction of appetite

satisficing making a judgement based on bounded rationality

schedules of reinforcement rules that determine which responses will be followed by a reinforcer in operant conditioning (see **partial reinforcement**)

schemata (**schemas**) knowledge structures that help us make sense of familiar situations, guiding our expectations and providing a framework within which new information is processed and organized

scientific method a procedure for acquiring and evaluating knowledge through systematic observation or experimentation

search space a space of possible reasoning, within which we search for a path linking the problem with the solution

self-actualization the tendency to grow in ways that maintain or enhance the self

self-consciousness the tendency to direct attention towards the self

self-efficacy the extent to which people believe that they can bring about outcomes

self-perception theory indicates that people may guess their own attitude from their behaviour towards the attitude object, particularly when they can see no external reasons for the behaviour

self schemas cognitive representations of the self that organize and process all information that is related to the self

semantic-differential scales these measure attitudes by using a dimension that depicts a strongly negative attitude at one end to a strongly positive attitude at the other

semantic memory abstract knowledge that is retained irrespective of the circumstances under which it was acquired (e.g. 'the world's largest ocean is the Pacific')

semantics the meaning of words and how they combine to give the meanings of sentences

sensorimotor stage the first stage of cognitive development, according to Piaget, extending from birth to approximately two years, when the child constructs an elementary understanding of the world and thought is tied closely to physical or sensory activity

sensory memory hypothetical large capacity memory store holding incoming sensory information for a brief period of time

sensory preconditioning pairing of two neutral stimuli prior to one of them being used as the conditioned stimulus in a standard classical conditioning procedure, leading to the other stimulus acquiring the power to evoke the conditioned response

serial model the assumption that perception takes place in a series of discrete stages, and that information passes from one stage to the next in one direction only

serial search a visual search task in which time to find the target increases with the number of items in the stimulus display, suggesting that the observer must be processing items serially, or sequentially

short-term store hypothetical memory store holding information for a few seconds

significance testing the process of deciding whether research findings are more plausibly due to chance (H_0) or due to real effects (H_1)

single-blind procedure in order to evaluate the effect of a therapy, the patient is kept uninformed (blind) as to the true nature of the treatment

social comparison the act of comparing oneself, usually with similar others, to assess one's attitudes, abilities, behaviours and emotions; these comparisons are most likely to occur when people are uncertain about themselves

social decision schemes explicit or implicit decision rules specifying the processes by which individual inputs are combined into a group decision

social exchange theory a general theoretical model that views relationships in terms of rewards and costs to participants; expected outcomes are based on personal standards, prior experience, partner's outcomes, and the outcomes of comparable others

social facilitation an increase in dominant responses in the presence of others of the same species, leading to improved performance on well-learned/easy tasks and deterioration in performance on poorly-learned/difficult tasks

social identity theory theory of group membership and intergroup relations which explains much intergroup behaviour in terms of the desire to belong to groups which are valued positively compared to other non-membership groups

social information processing theoretical model of how we perceive and understand the words and actions of other people

social intelligence competencies and skills used in social behaviour

social loafing a reduction in individual effort when working on a collective task (in which one's outputs are pooled with those of other group members), compared with when one is working alone

social messages input from a range of sources such as friends, family and media regarding the nature of symptoms

social support the feeling of being supported by others, whether in one's broader social network (which impacts positively on

health and stress) or within a small group (which helps one to resist pressures to comply with an outside majority or obey an immoral authority)

somatic nervous system the part of the peripheral nervous system that includes the sensory and motor nerves, but excludes the autonomic nervous system

speak-aloud protocols a description of our own processes of thinking during a problem solving task

spectrogram a way of plotting the amplitude and frequency of a speech sound-wave as we speak individual phonemes

speed of information processing the speed with which an individual can take in information from their environment; the speed of perceptual encoding.

split brain occurs when the corpus callosum has been cut (e.g. in order to prevent the spread of epileptic seizures)

stagnation the feeling experienced by some individuals in mid-life that they have achieved relatively little and have little to offer to the next generation (cf. **generativity**)

standard deviation the square root of the sum of the squares of all the differences (deviations) between each score and the mean, divided by the number of scores (or the number of scores minus 1 for a population estimate)

Statement Validity Assessment (**SVA**) method for the formal analysis of witness statements in order to gauge their reliability

stepping reflex the attempts of the human infant to take 'steps' if held upright with their feet touching a physical surface

stereopsis the ability to see objects three-dimensionally based on having two eyes that give us two slightly different views of those objects and their relative locations in space

stereotype mental representations of social groups and their members that include behavioural and trait characteristics that are widely shared in society

stimulus substitution when the conditioned stimulus comes to acquire the same response-eliciting properties as the unconditioned stimulus

stress negative emotional experience resulting from a mismatch between the individual's appraisal that the stressor is stressful and their ability to cope with and therefore reduce their response to it

structural model of the psyche Freud's model of how the mind works

structuralism a theory derived from the use of psychophysical methods, so called because it focuses on the structure of the mind

structured interviews in which the questions are standardized across interviewees

substantia nigra part of the brain containing the cell bodies for the dopamine-containing projection to the striatum, which degenerates in Parkinson's disease (the Latin name means 'black substance')

subtyping model predicts that disconfirming instances of a stereotype are relegated to subcategories or subtypes, which accommodate exceptions to the stereotype but by and large leave the overall stereotype intact

sucking reflex tendency in human infants to suck on objects placed in the mouth

sulcus the inward folds in the wrinkled cortical surface

superordinate goals a goal desired by two or more groups, but which can only be achieved by the groups acting together, not by any single group acting on its own

supertraits Eysenck's three key traits, which he also referred to as types

survey method the systematic collection of information about different variables in order to investigate the relationship between them

sympathetic nervous system part of the autonomic nervous system that prepares the body for emergency action

symptom perception how an individual experiences and makes sense of their symptoms

symptom substitution the emergence of new symptoms after treating the symptoms of a disorder (as opposed to its 'root' cause)

synapse the highly specialized area at which neurotransmission occurs between neurons; transmitter is released at the pre-synaptic axon terminal and binds to specialized receptors in the membrane of the post-synaptic target neuron

synaptic cleft the gap in the synapse between two adjacent neurons

syntax rules that govern the admissible orderings of letters within words, and words within the sentences of a language

tabula rasa the empiricist Locke argued that each infant is born with a mind like a blank slate, a tabula rasa, upon which experience is written

tardive dyskinesia a serious movement disorder, characterized by involuntary movements, that can arise as a side-effect of taking antipsychotic drugs

template an internally stored representation of an object or event in the outside world, which must be matched with the pattern of stimulation of the sensory systems before identification, recognition or naming of that object or event can occur

tension-reduction hypothesis the notion that people use substances in order to reduce tension and negative affect

Thanatos the drive for aggression and death in Freudian psychoanalysis (see **Eros**)

theory a coherent framework used to make sense of, and integrate, a number of empirical findings

three-component model states that beliefs, feelings and behaviour towards an object can influence attitudes towards it, and that these attitudes can reciprocally influence the beliefs, feelings and behaviours

threshold potential the voltage at which depolarization of a cell leads to generation of an action potential

timbre the complexity of a sound wave, especially one emitted by a musical instrument, allowing us to distinguish the same note played on, say, a piano and a guitar

tolerance the need for increased amounts of a substance in order to achieve the desired effect, or a diminished effect with same amount that used to produce the desired effect

topographic model of the psyche Freud's model of the structure of the mind

tracers substances used in neuroanatomy that are taken up by neurons (e.g. at the axon terminals) and transported along them (e.g. to the cell body), allowing the neurons' connections to be identified

training needs assessment identification of learning requirements, to facilitate successful completion of present and future roles

traits labels given to consistent and enduring aspect of personality, viewed as continuous dimensions

transduction the process of transforming one type of energy (e.g. sound waves, which are mechanical in nature) into another kind of energy – usually the electrical energy of neurons

transfer appropriate processing for the best recall, the type of memory encoding needs to be appropriately matched to the type of cueing information that will be available at recall

transfer of training application of what was learned in job training to the job itself

transference projection by a client onto the therapist of characteristics that are unconsciously associated with parents and other important figures

transformational leader a leader seen by followers as being endowed with exceptional personal qualities, and who works to change or transform followers' needs and redirect their thinking

transformational leadership a style used by leaders who tend to be dominant and self-confident, need to influence others, while believing strongly in their own values, communicate their goals and visions clearly, and have high expectations of their followers' performance

treatment the experimental manipulation of the independent variable

treatment–etiology fallacy a logical error in which treatment mode (e.g. psychopharmacology) is assumed to imply the cause of the disorder (e.g. biological)

two-process theory emphasizes the interaction of instrumental and classical conditioning processes in producing many types of behaviour

types a term used by early personality theorists, who divided people into different categories, or types

unconditioned response (**UR**) evoked by a stimulus before an animal has received any explicit training with that stimulus

unconditioned stimulus (**US**) evokes an unconditioned response

unconscious mental processes processes in the mind that people are not normally aware of

univariate relating to a single variable

validity the extent to which a given study investigates what it purports to investigate

variance the mean of the sum of squared differences between a set of scores and the mean of that set of scores; the square of the standard deviation (see above)

vernier acuity the ability to see very small differences in the alignment of two objects, which becomes particularly obvious when the objects are close to one another

vesicle subcompartment of a neuron in which neurotransmitter is stored prior to release

vestibular system located in the inner ear, this responds to acceleration and allows us to maintain body posture

visual search a type of experiment in which the observer typically has to report whether or not a target is present among a large array of other items (distractors)

visuo-spatial sketch pad the part of Baddeley's working memory model that is responsible for setting up and manipulating mental images

voluntary confession formal admission of guilt given freely, which can be true or false, usually made to the police

What Works generic name given to a recent approach to offender treatment, which is based on findings from meta-analyses of the offender treatment literature

white matter those parts of brain consisting mostly of axons rather than cell bodies; the axons' myelin sheaths are very white

withdrawal the experience of physical symptoms when a substance is stopped, or the use of another substance to relieve or avoid those symptoms

within-subjects design a research design in which the same participants are exposed to different levels of the independent variable (cf. **between-subjects design**)

work groups collectives of individuals within organizations – formal groups are designated as work groups by the organization, and informal groups are not defined by the organization as functional units, but nevertheless have an impact upon organizational behaviour

work-sample tests personnel assessment techniques which require the applicant to perform tasks that are examples of the task demands of the job in question

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Subject Index

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