Article

Progress in Human Geography
37(1) 72–92

DOI: 10.1177/0309132512443147
phg.sagepub.com

Getting off the ground: On the politics of urban verticality

Stephen Graham
Newcastle University, UK

Lucy Hewitt
University of Glasgow, UK

Abstract
This article contends that critical urban research is characterized by horizontalism. It argues that the swathe of recent urban writings have neglected the vertical qualities of contemporary urbanization. The article's introductory section elaborates this argument in detail. The paper then elucidates three areas where vertically oriented research is emerging. These encompass: the links between Google Earth and urbanism; the connections between social secession and ascension through buildings, walkways and personalized air travel; and the links between verticalized surveillance and urban burrowing.

Keywords
cities, Google Earth, politics, secession, subterranean, surveillance, verticality

I Introduction: critical urban research – an overly flat discourse

In 2002, in an influential series of articles for the web magazine *Open Democracy*, architectural writer Eyal Weizman argued that, paradoxically, the cartographic, top-down aerial gaze that had long dominated both mainstream and critical geopolitical discourses had worked to flatten their spatial imaginaries. 'Geopolitics is a flat discourse,' he wrote, 'It largely ignores the vertical dimension and tends to look across rather than to cut through the landscape. This was the cartographic imagination inherited from the military and political spatialities of the modern state' (Weizman, 2002: 3). Weizman's response – his politics of verticality project – explicitly sought to expose the complex politics of *vertical* space that characterize the Orientalist and neocolonial architectures of Israeli power in and around the West Bank. In it, he worked towards what he called the 're-visioning of existing cartographic techniques' in order to 'create … a territorial hologram in which political acts of manipulation and multiplication transform a two-dimensional surface into a three-dimensional volume' (p. 3).

In this wide-ranging and synthetical article our contention is that a similar flattening of discourses and imaginaries tends still to dominate critical urban research in the Anglophone

Corresponding author:
Lucy Hewitt, School of Social and Political Sciences, University of Glasgow, 25–29 Bute Gardens, Glasgow G12 8RS, UK.
Email: lucy.hewitt@glasgow.ac.uk

world. There are some notable exceptions; perspectives stressing the vertical and aerial aspects of critical urban geography are beginning to increase. However, we seek to demonstrate in what follows that the majority of critical urban writing emerging over recent decades has neglected the vertical qualities of contemporary processes of urbanization. In other words – and in contrast to many emerging debates within contemporary philosophy, cultural studies, and architecture – we contend that a notable *horizontalism* tends still to dominate analyses of contemporary urban space within such traditions.

The recent proliferation of 'relational' and topological theorizations of urban life (Taylor et al., 2010), for example, overwhelmingly privilege horizontally extending relational connections over vertical ones. Recent debates about 'rescaling' and the politics of urban space stress the horizontal nature of such processes. These are based explicitly on the idea of a 'flat ontology' (Collinge, 2006) of multiscaled processes, imaginaries and flows linking sites and spaces to more or less distant elsewheres. In the process, we would contend that such debates fail to address how such rescaling processes might lead to dramatic shifts in the vertical constructions or experiences of urban space, form, and social and political power. Indeed, scholars of rescaling processes, rather than addressing the actual vertical spatialities of urban life, normally posit the 'vertical' aspects of such transformations as referring to the nested hierarchies of units of territorial governance, laid out as jurisdictions across flat, cartographic space – from locality to city, region, nation, etc. – that were often reified or naturalized within more traditional approaches to urban and human geography (see, for example, Brenner, 2004; Marston et al., 2005).

In our final, illustrative example, the wide spectrum of debates about 'global cities', 'world city networks' (Taylor, 2004), 'network societies' (Castells, 2000) and the 'splintering' of urban space (Graham and Marvin, 2001) that surrounds urban neoliberalization in turn implicitly prioritize horizontal processes of network formation, spatial fragmentation, and the uneven extensibility of mobilities and connections. While traditional cartographic representations are a much less dominant means of depicting alleged transformations of cities and urban life than they once were, the 'God trick' of the top-down, bird's-eye view is still widely deployed in critical urban social science, bringing Weizman's concomitant risk of discursive flattening in its wake.

Encouragingly, a growing number of scholars and writers have begun to argue for a concerted move beyond the pervasive horizontalism of critical urban and human geographic research. It is increasingly common for critical geographic scholars, in particular, to concur with Scott's (2008: 1858) recent call for 'stronger theorizations of verticality' to counter the 'implicit horizontalism' that she diagnoses in critiques of the 'cartographic impulse' within imperialist and colonial political and cultural geographies. Her suggestion? To construct what she calls a 'postcolonial' treatment of her main area of concern – the subterranean:

> The undeniable 'horizontality' of colonial and imperial expansion should not be allowed to overshadow the dimension of verticality that, in many times and places, was equally central to colonial and imperial ventures and was manifest in practices concerned with the subterranean such as mining and the mapping of geological formations. (Scott, 2008: 1853)

Several promising examples of vertically oriented critical urban research are beginning to emerge. McNeil's (2005) review of the neglected, vertical relationalities which surround the proliferation of urban skysrapers is one. Skayannis' (2010) recent call to attend to the politics and architecture of what he calls the urban 'Z axis' – especially the rapid growth of infrastructural, luxury or securitized subterranean

complexes – is another. Klauser (2010), meanwhile, is pioneering the linkage of critical urban research with Sloterdijk's increasingly influential philosophy of 'spheres' (see Sloterdijk, 2011). Klauser (2010) urges researchers on the politics of urban security, especially, to embrace fully 'spherical' and hence volumetric and verticalized imaginations of urban space and so to move beyond contemporary approaches which are 'almost exclusively based on two-dimensional planar metaphors' (p. 326).

Urban and architectural historians, always less dominated by the flat discourses, planar metaphors and the 'cartographic impulse' than urban geographers, have also done much to excavate the ways in which vertical urban life has been imagined, normalized, built or contested (see, for example, Boyer, 2003; Morshed, 2004; Passanti, 1987; Wigoder, 2002). Within these traditions, what Bauman (2000: 4) has called the 'metaphysics of verticalism', extending from classical structures, through the city-cosmos geometries inherent in medieval city planning (Lilley, 2009), to modernist mass social housing towers and the contemporary global proliferation of massive skyscrapers and urban megastructures, has dominated debates.

Most notable here is the edited collection *City Levels* (Ireson, 2000), a project designed to address the extending verticality of contemporary cities as a proliferation of stacked horizontal surfaces and planes. Here, verticality is seen as 'an axis along which to view the city in a different way'. Although contemporary urbanists and urban thinkers may 'be well versed in the up-and-down rules of urban life', the book's editor writes (Ireson, 2000: 70), 'it is a challenge to rethink our perspective on the significance of the vertical zones they index as contexts for specific patterns of architectural design, or types of interaction between people, or people and the city itself'. The perspective in *City Levels*, although a step forward, remains ultimately static by reifying such levels without addressing the complex and dynamic relational geographies through which they are mutually constructed, inhabited and imagined.

Much, therefore, remains to be done. It is still the case that very few books or papers in Anglophone urban social science or critical urban geography explicitly problematize or analyse the vertical qualities of cities and urban life. The emerging 'aerial turn' in critical human geography (see Adey, 2010a) has thus far been dominated by geopolitical and mobility-centred debates; critical urban geographers have yet to be fully involved. As a result, despite the extraordinary vertical extension of built space both upwards and downwards within the last few decades, very few of the latest geographical theorizations of contemporary cities fully address such issues beyond passing asides. The influential formulations of Massey et al. (1999: 4) – one useful example – do emphasize that 'the number of things that can only be found in cities', as they put it, include 'skyscrapers, underground railways, street lighting (maybe), and not much else'. They also rightly stress the unique *intensity* of cities as places. However, in the three-volume 'Understanding Cities' collection that follows (Allen et al., 1998, 1999; Pile et al., 1999), the crucial contribution of verticality to the spatiality and intensity of cities is addressed only in a brief aside on Michel de Certeau's (1984: 91) famous musings from the top of the World Trade Center and of the centrality of skyscrapers to the imagery of cities (see Flusty, 1997).

In the discussion that follows, our aim is to help galvanize the emerging strands of critical urban research that address the vertical aspects of contemporary urbanization and urban life. Rather than simply arguing for some sort of vertical or aerial turn, to counterbalance the implicit horizontalism of contemporary critical urban research, however, we argue that a fully *volumetric* urbanism is required which addresses the ways in which horizontal and vertical extensions, imaginaries, materialities and lived practices intersect and mutually construct each other

within and between subterranean, surficial and suprasurface domains (see Lerup, 2006). This is especially so when contemporary urban processes involve: the radical horizontal extension of cities and urban regions *and* the engineering of unprecedented numbers of both super-high and super-deep structures; the unprecedented mass accessibility of the top-down visualities of computerized remote sensing *and* actual routine physical access to aerial and vertical spaces; and the rapid growth of horizontally distanciated networks of communication *and* growing exposure of every aspect of urban life to unblinking constellations of vertical imaging, tracking and surveillance.

Amid all this, Bauman (2000: 4) asks the pertinent question: 'what does elevation mean in an age of the horizontalization of world views?' The discussion that follows is a preliminary exploration of this question. In it, we illustrate in detail three crucial areas where vertically oriented research across the urban social sciences is fast emerging. These encompass, in turn: the complex links between Google Earth and urbanism; the connections between social secession and ascension through buildings, flyovers, walkways and personalized air travel; and connections between vertical surveillance and various forms of counter-hegemonic urban burrowing.

II Google Earth urbanism

> To truly exist every city needs its perspective. Its point of view. Its eyes. (Lerup, 2006: 242)

> Today the aerial view – the image *of* everywhere – seems to *be* everywhere. (Dorrian, 2011: 164)

The first crucial challenge for critical urban research on the politics of verticality is to confront one of the most important innovations in urban digital media in the contemporary period: Google Earth (hereafter GE). This mass media assemblage 'mashes up' global satellite imagery, geopositioning coordinates, digital cartography, geolocated data, three-dimensional GIS, architectural drawings, street-level digital imagery and other social media, data and software. These are configured together as an 'always-on', interactive datascape – a flexible and multiscaled portal through which urban life can be enacted, mediated and experienced in profoundly new and important ways (see Scott, 2010).

GE forces us to revisit, and update, a very long-standing debate about the urban cultural politics of the aerial, 'God's eye', or top-down view (see Vidler, 2000) in a world where this view has very rapidly become radically accessible, zoomable and pannable in a myriad of mobile and (near) real-time ways. A particular imperative is to consider the ways in which the uses of GE resonate with de Certeau's (1984: 92) foundational point that, from medieval perspective painters, modernist planning ideologies, scopic perspectives from skyscrapers and aerial views from aircraft, 'the desire to see the city precedes the means of satisfying it'. The anthropologically vertical and volumetric stance of humans in occupying space is of crucial importance here. For the representational and visual abstractions of verticality and the top-down gaze that continually remediate such corporeal life have deep technoscientific and cultural genealogies to which the GE assemblage adds new and subtle twists (see Bishop, 2004; Jay, 1993).

Dorrian (2011), for one, believes that mass public access to Google Earth fundamentally challenges long-standing assumptions that the view from above necessarily involves dispassionate, technocratic or privileged scopic power. Scott (2010: xii), while linking Google Earth to the Apollo images of Earth (see Cosgrove, 2003), Buckminster Fuller's mini-Earth project and Charles and Ray Earme's 1968 film, *Powers of Ten*, argues that it brings a 'significant shift ... in the capacities inscribed within the information technology and in the planetary

imagination it sponsors'. Two broad sets of issues emerge at the intersections of GE and contemporary critical urban research.

1 'Imperial infrastructure'? Resolution, temporality and surveillance in the indexical city

First, complex political and cultural economies attend both to GE's genealogy and to its highly uneven resolution and up-to-dateness. This crucially configures the degree to which GE can emerge as a new, distributed and indexed urban medium. While remarkably accessible compared to previous generations of top-down cartography and imagery, GE is, nonetheless, a product of US military technoscience, commercialized by a globe-spanning, although US-centred, internet conglomerate. This has important effects and profound urban biases. Until very recently, for example, GE automatically defaulted to a US-centred view. Indeed, the French Government have launched Geoportal (http://www.geoportal.org/web/guest/geo_home) to correct perceived US-centricity and biases within GE's representations.

While GE is 'mashable' and flexible, the dominant, de facto data sets are heavily dominated by a cluster of key transnational corporations who overlay the satellite surfaces with geolocation data geared towards exploiting this new screen interface. This is done to sustain their competitive advantages in tourism, travel, leisure services, food provision, etc., as well as to build up new geodemographic information products that GE, as a surveillance apparatus, helps generate. Meanwhile, while these restrictions are being blurred by the availability of non-US-licensed providers, certain spaces have been deliberately proscribed (Afghanistan), blurred (Dick Cheney's residence) or rendered at a deliberately low resolution (Israel) because of US or other national security interventions. Beyond this, of course, lies a burgeoning politics of urban legibility and camouflage as state, commercial and non-state actors work to appropriate the new vertical views to conflicting ends. As financial collapse hit the Greek State in 2009, for example, the Government tried to locate wealthy Athenians guilty of tax avoidance by using GE to find their swimming pools. The immediate response was to drape tarpaulins over the telltale azure rectangles. Meanwhile, many social and political movements have mobilized GE and satellite imagery in their efforts to expose war crimes and state violence in places as diverse as Darfur, Zimbabwe, Burma and Sri Lanka (see Herscher, 2010).

With GE blurring into Google Maps and other social media, it is possible to mark up and customize a myriad of personal and collective urban traces and tracks. In turn, these data tracks, analysed by specialist software, support whole complexes of lucrative corporate data mining and geodemographic profiling. Martijn de Waal writes:

> All kinds of mobile media can be used to register and track behavior, varying from spatial use (where was I last week) to consumption patterns (what did I buy, what was I reading, listening to on my iPod etc.) ... These track records can be analyzed on aggregate, or used on an individual base. (de Waal, 2008)

As well as sustaining a myriad of customized communities and surveillance assemblages, GE sustains a range of 'filtering mechanisms: only people with a certain reputation are allowed to enter a certain site: the clubhouse, the VIP Room, the sports stadium, a shopping mall' (de Waal, 2008).

It is also crucial to stress that the experience of GE is replete with dramatic variations in availability, resolution and degree of up-to-dateness based on broader unevenness in the political economies of use, markets and advertising potential. On the demand side the highly uneven geographies of broadband access across the world constrain access. On the supply side, unevenness in data resolution favours central,

high-technology and highly urbanized capitalist heartlands. Muster (2008), contrasting the rich, immersive and three-dimensional experience of zooming in and around Manhattan, recalls her parallel attempt to zoom in on towns in and around the Oklahoma-Kansas border, and the 'sorry, but we don't have imagery at this zoom level for this region' apologies. The visual experience of GE tends also to be 'strangely situated between abrupt temporal glitches and near real-time user interaction' (Muster, 2008: 1). Higher-resolution updates sometimes revert certain cities to older imagery as digital mosaics are continually remade. Liverpool City Council have complained publicly because the relatively old image of the City accessible to viewers failed to incorporate many of the projects completed through the recent wave of development activity.

More broadly, Holmes (2004) stresses the importance of conceiving of worldwide assemblages of geolocational technology surrounding GE as 'Imperial infrastructure'. GE, as with the GPS system to which it so seamlessly links, is a system with strictly military origins which has been recently liberalized to integrate broad sectors of civil society into the basic architecture. Any use of, or reliance on, GPS, for example, involves connecting to satellites, Geodetic mapping complexes and atomic clocks run by the US military. 'When you use the locating device you respond to the call: you are interpellated into Imperial ideology', writes Holmes (2004). Paradoxically, though, GE assemblages also add further potency to non-state insurgencies and terrorist organizations, who, as with the 2008 Mumbai attacks by the Lashkar-e-Taiba group, are widely embracing them to plan and coordinate their attacks on cities (Bishop, 2010).

2 Google Earth brandscapes: the terrestrial surface becomes digital medium

Second, critical urban research needs to confront how this latest development in mass vertical visuality is being exploited to construct megastructural urban brandscapes as startling extensions of the politics of urban neoliberalism. Here emerge the complex intersections between a vertical, top-down view and the horizontality of contemporary urban sprawl. For, as Lerup (2006: 243) contends, it is only from the perspective of the satellite that the 'striated, spread-out geographies' of contemporary urbanized regions and 'megalopolitan' corridors can actually be fully represented. Writing about Berger's (2006) influential mapping of the geographies of sprawl, and wasted land in urban America, Lerup points out that 'from a satellite, this neglected in-between [of drosscape or 'pure unadulterated waste'] is the real grammar of the horizontal city, requiring a new mathematics whose nature, strength and intelligence lies embedded in its apparent incoherence' (Lerup, 2006: 243).

With the satellite view of the city now normalized as a dominant field of urban representation for mass consumption, navigation, planning and, increasingly, marketing, however, it is perhaps the way in which cityscapes are increasingly engineered to be brandscapes visible from space that is the most immediate example of GE urbanism. Here, Dorrian points out that 'the terrestrial surface itself becomes manipulated as a media surface, not just virtually on the GE interface, but literally'. This democratization of verticality has important effects. 'As the audience of geospatial data is no longer made up of only cartographers, scientists, military strategists and state operatives but rather – overwhelmingly – consumers, how commodities look from the sky, and how they address it, is a new concern' (Dorrian, 2011: 169).

On the one hand, here, there is growing evidence that city boosterists increasingly work to ensure that their branded, spectacularized urban 'products' work well when viewed through GE. (The construction of corporate advertising for aerial and satellite consumption is also increasingly common.) A consultant involved in the staging of the 2012 London

Olympics remarked recently that 'it's a media event, so it will look great from the air' (cited in Dorrian, 2011: 169). It is interesting to note that vertical ascension within London, on the huge London Eye viewing device, is also being marketed now as 'the way the world sees London' in ways that resonate with the construction of earlier iconic urban view points such as the Eiffel tower (Dorrian, 2011). On other occasions – such as the demolition of a US Navy office complex that resembled a swastika on the system – built space has been reengineered because of unwanted vertical associations via GE (see Perry, 2007). More prosaically, of course, GE is being used by a wide range of tourists and travellers as a new medium for anticipating and planning journeys and checking the validity of claims by the tourism industry, and by urban planners, architects and clients in the production and design of urban development projects.

On the other hand, it is necessary to address the rapid emergence of megastructural urban landscapes which are carefully designed from the outset with their representation through GE in mind. Most notable here are the 'Palm' and 'World' developments in Dubai. These gargantuan projects are marketed as 'today's great development epic' (http://www.theworld.ae/au_overview.html; see Figure 1). Here, civil engineering, land art and landscape architecture blur together to imprint 'the hybridization of text, diagram and photograph ... to the terrestrial surface' (Dorrian, 2011: 169). The image from space is appropriated directly into the process of place marketing and mega-spectacle formation, just as the rendition of virtual imagery is actualized through the movement of millions of tonnes of concrete, rubble, sand and steel.

This combination, in turn, works to materialize what Davis and Monck (2007) have called a 'dreamworld of neoliberalism' – an elite utopia, combining the ultimate in horizontal and totally privatized urban secession with the unique marketing device of the archipelago

Figure 1. The terrestrial surface as Google Earth brandscape: view of Dubai's 'World', and one of the two 'Palm' developments, from the International Space Station.
Source: http://www.everystockphoto.com; NASA's Marshall Space Flight Center, attribution license.

facsimile of the global cartographic image visible, as digital urban interface, from space through GE. 'Opportunity that's worlds apart ... Welcome to your very own blank canvas in the azure waters of the Arabian Gulf', gushes the marketing spiel for The World, 'where orchestrating your own version of paradise ... is a much needed inoculation against the ordinary, and where you'll discover that The World really can revolve around you'.

Complex reiterations emerge here to connect the image of the 'World' in GE's 'data set patchwork of the virtual globe that serves as the gateway to the other world towards which we zoom and where we appear to find the patches reinstated at another scale, although this time resolved into real-estate parcels' (Dorrian, 2011: 168). As in London, we must also add to this mix the ways in which Dubai is also operating as a particularly extreme site of urban spectacularization through unprecedented upward extension and secession, with the largest constellation of skyscraper construction in recent history, including what, at least for now, is the highest building on earth, the 828 m Burj Khalifa (Figure 2) (see Acuto, 2010).

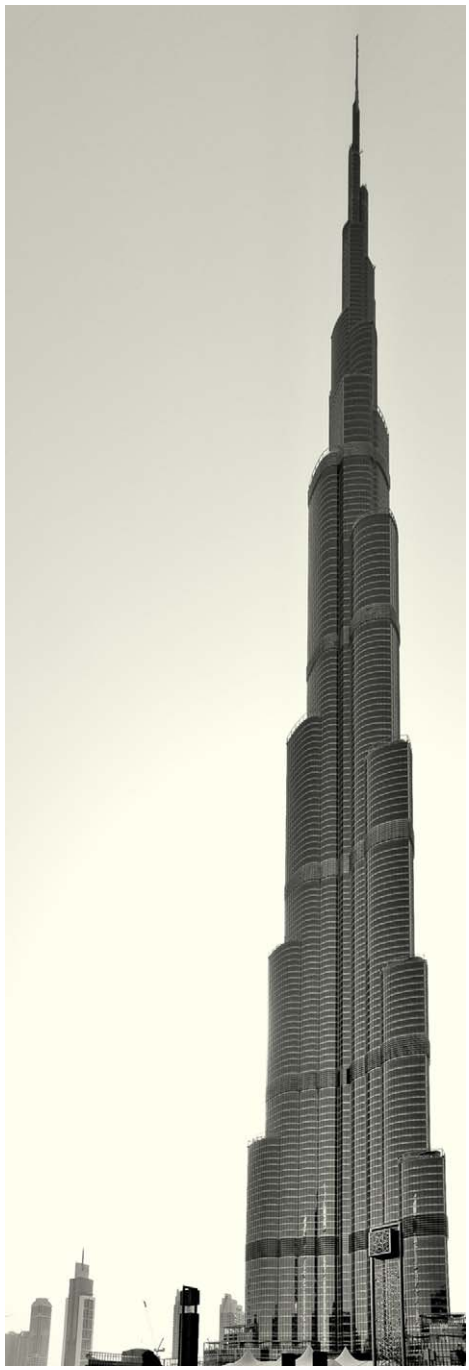

Figure 2. The 828 m Burj Khalifa: the world's tallest skyscraper.
Source: http://www.everystockphoto.com; photographer Ashraful Kadir.

III Secession by ascension: perpendicular splintering?

> There were the Street People and there were the Air People. Air people levitated like fakirs . . . access to the elevator was proof that your life had the buoyancy that was needed to stay afloat in a city where the ground was seen as the realm of failure and menace. (Raban, 1991)

The Burj Khalifa is an appropriate case on which to move to the second key agenda for vertical urbanism to address: the ways in which verticality and ascension are increasingly mobilized to sustain social secession within contemporary cities. While not completely ignored (see McNeil, 2005), the politics surrounding the vertical 'splintering' of urban structures, sites and circulations remain largely neglected, and an implicit horizontalism still dominates the overwhelmingly flat discourses surrounding social fragmentation within neoliberalizing cities.

Crucial questions emerge here. What of the *vertical* aspects of urban secession and social fragmentation within what Henri Lefebvre (1984: 337) called the growing 'independence of volumes with respect to the original land'? Might the global proliferation of iconic as well as more prosaic high-rise residential, corporate and hotel skyscrapers contribute in many cities to the emergence of a myriad of vertically stratified, gated 'communities' which residualize the surface city as powerfully as exurban gated communities residualized traditional public street systems? Does the proliferation of secessionary vertical landscapes, in turn, necessarily work to exacerbate the polarization of spatial practices that Michel de Certeau (1984: 82) famously identified in Manhattan between urban 'voyeurs', lifted up 'out of the city's grasp' to God-like positions from which they could 'see the whole' of the 'concept' city far-below, and those less privileged walking subjects down below forced to continue inhabiting the street level? What, in other words, are the

spatial politics through which socio-economic elites rise upwards into the insulated capsular heights of vertical structures? And how does their literal upward mobility set the terms of contemporary geographical imaginaries and the tensions between surface, suprasurface and subsurface urbanism? Finally, how do these contemporary architectures and infrastructures of ascension connect with ancient, modern and more recent genealogies of vertical defensive and military architecture, social stratification and cultural representation within different contexts (modernist mass social housing, Haussmanized tenements, previous rounds of 'skyscraper living' in North America, and the deep cultural traditions equating urban social class with vertical height)?

1 Processes of vertical capsularization

> Verticality quite literally means security *from* the insecurities below. (Adey, 2010b: 58)

A growing range of urban writers and activists are starting to address the social politics of vertical urban splintering and what Morshed (2004) has called the 'aesthetics of ascension' across a range of contemporary cities within a general context where projects of mass vertical social housing has been widely abandoned. Anti-gentrification social movements in San Francisco and Vancouver, for example, now actively suggest that the central landscapes of these two cities are being rapidly transformed through processes of 'vertical sprawl' erecting archipelagos of 'vertical gated communities' – solipsistic capsular spaces for elite groups – into the sky (see SFConnection, 2007; Waterhouse-Hayward, 2010).

Ayoub (2009) meanwhile, speaking about London, interprets the startling implantation of large numbers of locally novel, very tall buildings in the City since the early 1990s as the product of: a familiar concoction of global-city governance boosterism; efforts by elites to construct icons symbolizing global power, 'national arrival', innovation and centrality (see also Bunnell, 2004); the demands generated by London's centrality to transnational corporate and financial geographies; the re-regulation of global finance; and speculative property booms. However, she also underlines the ways in which residential skyscrapers are marketed as unalloyed elite spaces of social secession and aspiration for the London's growing population of überwealthy. Marketed using the iconography of traditional, street-level public space, the various 'sky lobbies', viewing 'plazas' and galleries, and rooftop restaurants in these complexes offer what she calls 'allusions to the open and free character of public space' (Ayoub, 2009: 93). But, as with horizontally connected skywalk cities built in US cities like Houston since the 1970s, Ayoub stresses that such complexes are starkly capsular spaces of social secession – 'analogous cities' (see Boddy, 1992) which are access-controlled, only partially accessible, increasingly securitized and intensively surveilled and policed (see De Cauter, 2005). In the heavily privatized and securitized spaces of London's Canary Wharf, Ayoub notes, access to the skyscraper structures since the 2005 terrorist attacks in central London entails negotiating various security checkpoints to demonstrate in advance one's legitimate reasons for access.

It is thus necessary to consider how horizontal and vertical geographies of secession are mutually constructed within complexes like London's Docklands or Houston's central skywalk system. Flusty (1997), writing about the then-new Bunker Hill downtown complex in LA, tells the story of trying to reach the complex from the streets below by foot:

> the Hill's designers are not too keen on pedestrians coming up from below (except janitors) … The entire Hill is … separated from the adjacent city by an obstacle course of open freeway trenches, a palisade of concrete parking garages and and a

Figure 3. 'The same address as God' and 'The higher you go, the cooler you get': advertisement hoardings around new residential skyscraper towers in Mumbai
Source: Photograph by Adam Cooper, reproduced with permission.

> tangle of concrete bridges linking citadel to citadel high above the streets … We could attain the summit from the south, but only by climbing a narrow, heavily patrolled stair 'plaza', studded with video cameras and clearly marked as private property. (Flusty, 1997: 53)

In Manhattan, meanwhile, Zukin (2010) also notes a palpable 'luxification of verticality' in the design, material culture and marketing of contemporary skyscraper condominiums in Manhattan. One upmarket $8 million condominium, she finds, is marketed as a 'pin-drop quiet' space of '800 square foot loft floating 28 stories above Lower Manhattan'. Similar tropes dominate marketing of elite vertical housing in Mumbai. 'Reach for it!' screams the real-estate billboard surrounding the new IB Sky tower complex in the city. 'Consider it a blessing to share the same address as God' (Figure 3) (see Harris, 2010). Another shouts 'the higher you go, the cooler you get', hinting at the dreams of private solipsism and bourgeois environmentalism that sustain the rush to ascend in such a tropical, megacity environment.

In most Global South cities, it is the complex relations between proliferating verticalized enclaves, prevailing networks of urban infrastructure and circulation and the wider, majority-city of informal settlements that currently dominates the politics of the verticality. Appadurai, speaking about Mumbai, argues that we must contrast the 'vertical city' of modernity – with its often hidden, subterranean infrastructure networks and political ecological and hydrological engineering – with the contemporary 'horizontal' condition in the city characterized by informal 'infrastructure-free' settlements where everything is 'fully available to the gaze' (quoted in Gandy, 2009: 230). Vikas Oberoi, of Oberoi constructions – developer of many vertical enclaves in Mumbai, points out that these spaces are attractive to urban elites and middle classes precisely because they bundle together a wide range of services, introduce access-control checkpoints and walls against the perceived threats of the externalized city and allow reliable, high-quality infrastructures and immediate environments to be offered to residents on a club basis. 'I would call the [developments] in Mumbai vertical gated communities', he recently said, 'because they take care of virtually all of [residents'] needs'. Dwivedi characterizes such enclaves as 'heavenly enclaves surrounded by slums' (quoted in Bharucha, 2010).

Perhaps the most extreme and notorious Mumbai example of elite, vertical secession is the recent construction of a 27-storey, 400,000 square foot tower which houses only one family – the Ambani family – of five (see Figure 4). The tower houses a six-storey vertical parking garage, three helipads, hundreds of servants and a series of airborne swimming pools.

Rao (2007: 245), in an insightful analysis of links between the neoliberalization of planning techniques and imaginations of density in Mumbai, stresses that the widespread sprouting of secessionary towers across Mumbai 'has added a three-dimensional twist to the drama of

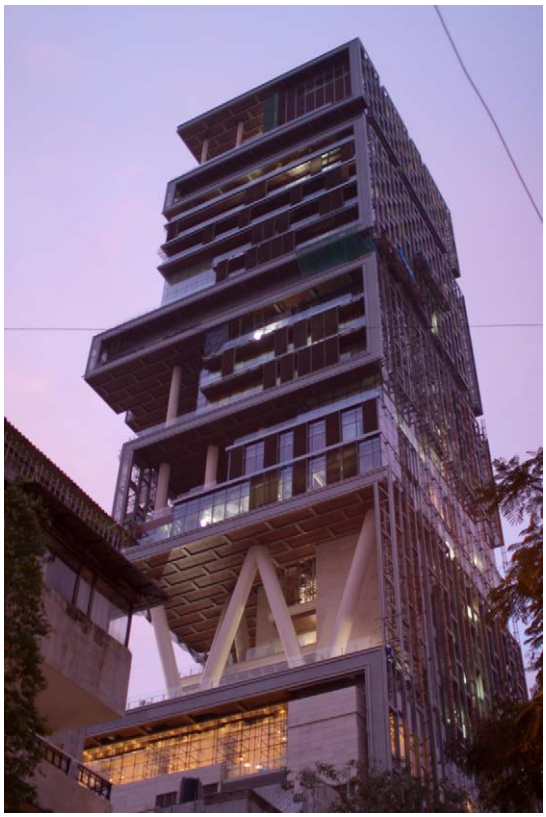

Figure 4. The 27-storey Ambani 'family tower', Mumbai
Source: http://www.everystockphoto.com; photographer Jay Hariani.

hierarchy, exclusion and dispossession' in the city. The construction of this new archipelago of towers works, she suggests, to render concrete long-standing imaginations of futurity and globality which, in turn, are woven into complex landscapes of displacement and predatory speculation against surrounding informal cities. 'This emerging vertical city', Rao (2007: 245) suggests, 'thus renders these landscapes [of surrounding, informal urbanism] obsolete by the sheer force of juxtaposition against this fabric, now perceived as one of dereliction'. Such structures, as Adey (2010b: 58) writes, 'sit uncomfortably above the violence below'.

Crucially, in Mumbai, the widespread construction of vertical 'islands within cities', marketed to middle classes and elites as solutions to perceived problems of insecurity and infrastructural and environmental degradation, are being complemented by complex assemblages of vertical *circulatory*, ascension and separation. Harris (2010) points out that Mumbai is now encircled by over 60 'flyover' raised highways and over 50 raised pedestrian-only skywalk systems. The latter evoke the earlier and rather different experience of the construction of tunnels and skywalks in the centres of North American cities since the 1960s (Boddy, 1992). It is unclear, as yet, however, whether the Mumbai skywalks are working as surveilled, securitized and access-controlled systems which work to suck urban middle classes from traditional street systems, which, consequently, become residualized and criminalized. 'Precisely because downtown streets are the last preserve of something approaching a mixing of all sectors of society', Boddy (1992: 125) wrote, 'their replacement by the sealed realm overhead and underground has enormous implications for all aspects of political life'.

At the very least, and resonating with our broader theme here, Harris (2010: 2) emphasizes that Mumbai's new highway and skywalk developments 'show ... how new three-dimensional frames of analysis are required if we are to begin to open up the social and political complexities of urban change in a megacity such as Mumbai'. What is needed, clearly, are detailed studies of the lived situated practices and experiences surrounding urban life for verticalized elites in a variety of contexts. Such work would provide fascinating contrasts to that which has so powerfully revealed the complex technoscientific and cultural politics of life in mass social housing blocks (see, for example, Jacobs et al., 2007; McGrail, 1999).

2 'Where are the fastest elevators?' The politics of vertical transportation

A crucially important dimension to the new politics of urban secession by ascension are the

configurations of the often hidden and neglected structures of vertical transportation that sustain it. Social historian of technology Ithiel de Sola Pool (1977) stressed that the history of the skyscraper is inseparable from the history of both the elevator – which allowed ingress and egress of required office workers – and of the horizontally stretched networks of electronic transportation communication – that allowed those people both to commute to work and to attempt to exercise control at a distance over dispersed sites once there. Unfortunately, however, the geographies of vertical transportation within and between built structures have been overwhelmingly ignored by critical social science. Entire disciplines and myriads of journals and professional bodies concentrate on engineering and analysing the geographies of *horizontally* distributed systems of urban mobility; the social scientific literature on lifts, elevators and vertical people movers remains both minuscule and esoteric (see Goetz, 2003).

It is noteworthy, though, that rapid advances in lift/elevator technology are as fundamental to the global proliferation of mega-skyscrapers as are innovations in materials science and civil engineering (Strakosch, 1998). Ever since Elisha Otis invented the first example in 1852, lift technology has been central to what Sayre (2011) has called 'the colonization of the up'. '"Up" has of course always existed', he writes, 'but not until the late 19th century had it become a place to work and live. Up as a habitable territory had to be made, sometimes forcefully but always without precedent'. It is equally notable that even positivist and technocratic debates within transport geography are now starting to address the vertical geographies of movement within and between the extending worlds of built, indoor environments stretched across extending cityscapes. In overcoming one prominent manifestation of the horizontalist tradition of human geography, this work is starting to move from a preoccupation with what Thill et al. (2010) call 'two-dimensional geographic space' – as represented by top-down cartography – to begin to address the complex circulatory technics and politics sustaining complexes of 'vertical sprawl': multi-use, megastructural buildings scattered across the extending three-dimensional urban spaces of fast-growing cities. 'The comprehension of the very nature and complexity of spatial and functional relationships between these spaces', Thill et al. (2010: 405–406) suggest, 'framed by the indoor and outdoor infrastructures supporting human movement (hallways, elevator shafts, walkways, and others) is enhanced once it is recognized that the city is not flat'.

In Japan, new elevator technology has been central to relatively recent moves beyond long-standing earthquake-limited height controls that have spawned a series of multi-use 'city within city' vertical complexes (for example, the Roppongi Hills; see http://www.roppongihills.com/en). These 'vascular shafts' (Sayre, 2011: 11), encompassing super-thin malls, elite condominiums, corporate HQs, expensive hotels and restaurants, are serviced by some of the world's fastest elevators. These are marketed publicly as icons of national modernity every bit as powerful as the more familiar *Shinkansen* bullet train networks that lace the country's cities horizontally. 'If you want to know where the world's hottest economies are', *Forbes* magazine gushes, 'skip the GDP reports, employment statistics and consumer spending trends. All you need to do is answer one question: Where are the fastest elevators?' (Van Riper and Malone, 2007, quoted in Sayre, 2011: 10).

As ever-more extraordinary vertical megaprojects are imagined, marketed and constructed, whether as putative responses to sustainability challenges, demographic growth, or the changing possibilities of speculation and construction technology (see Al-Kodmany, 2011), so the uneven social geographies of vertical mobility are likely to proliferate. The extreme vertical urbanism embodied in possible future projects like Dubai's projected 2.4 km high,

400-storey 'Vertical city' tower, for example, are deliberately being designed with 'internal elevator layout[s] splitting the working populations from the residents and providing high speed VIP express services to designated areas' (*Khaleej Times*, 2008). Such emergences underline the importance of Cwerner's (2006, 2009) innovative work on the normalization of personalized helicopter travel among São Paulo's elites. His is one of the first bodies of work to connect the 'aeromobilities turn' in critical social science to the material politics of ascension and vertical splintering in Global South megacities. Showing how this process resonates with long-standing imaginaries of personalized air travel within the history of modern and modernist urban planning, Cwerner elucidates the complex assemblage of technoscientific practices and political affordances that work to bring São Paulo's elites to ascend over, and residualize, the City's chronically saturated ground-level streetscapes. This occurs as they move to inhabit instead complex archipelagos of helicopter-pad accessible secessionary capsules spread across the city-region. Cwerner carefully exposes how personalized helicopter travel is marketed and imagined as a frictionless and detached form of point-to-point mobility for security-obsessed elites who have gained extraordinary wealth as intermediaries within the neoliberalization of Brazil's economy. Finally, he stresses the ways in which access to personal helicopter travel works as a powerful status symbol in ways that resonate with long-standing equation of height with power in the history of urbanism.

Cwerner's work is thus a very useful early example of analysing the social and political geographies of what he calls the 'tri-dimensional city' (Cwerner, 2006: 203). It is crucial, though, to stress that socially progressive vertical mobility systems are also possible. Brand and Dàvila (2011), for example, explore how a vertically organized mass transit system utilizing cable car technologies has worked powerfully against logics of secession and splintering in Medellin, Colombia, by radically improving the mobility opportunities of marginalized informal settlements strung out across the mountains of the City's periphery.

3 The politics of urban air

> Air matters too little in social theory ... Air is left to drift ... neither theorised nor examined, taken simply as solidity's lack. (Choy, 2010: 9–11)

Choy's detailed analysis of the politics of urban ascension, environment and air quality in Hong Kong are also especially apposite here. Ascending up the proliferating skyscrapers in this most vertically structured of 'global' cities, Choy (2010: 27) notes that 'the rich have access to good air while the poor are relegated to the dregs, to the smog and dust under flyovers or on the streets'. Choy's work demonstrates that horizontal political-economic geographies and political ecologies surrounding the exporting of bad air from global cities – as manufacturing and waste are offshored – need to be addressed along with the contested politics of urban ascension. Elite expatriates, for example, can seek refuge from bad air, noise, heat and humidity by colonizing Hong Kong's 'airy refuges' – in skyscraper penthouses located in the topographic heights of the Peak or Mid-Levels on Hong Kong Island.

Just above the teeming street, meanwhile, covered, extending, air-conditioned escalator systems snake to connect archipelagos of elite spaces of consumption, work and leisure. Choy (2010: 29) talks of a day spent in the company of an executive from the Tsing Tao beer company as he 'wends his way expertly through Wenchai, a government and nightlife district on Hong Kong island, without ever touching the ground'. Above all, in Hong Kong, as elsewhere, Choy (2010: 28) stresses that the city's 'air spaces are visibly marked by the racialized and classed bodies that live, work and play in them ...

Much of Hong Kong seems designed to get off the ground – into the air, and out of it'.

IV 'The sky kills': urbanism, vertical orientalism and the politics of burrowing

> The geography of occupation has … completed a 90-degree turn. The imaginary 'Orient' – the exotic object of colonization – was no longer beyond the horizon, but now under the vertical tyranny of Western airborne civilization that remotely managed its most sophisticated and advanced technological platforms, sensors and munitions above. (Weizman, 2009: 325)

A third key theme for a vertically sensitive critical urbanism to address surrounds the complex connections between neo-Orientalist practices of vertical urban surveillance and targeting by states and security forces, and a growing world of active, subterranean burrowing to escape vertical scrutiny. Whether it be through helicopter-borne paramilitarized policing above the favelas of Rio (Adey, 2010b), police helicopter patrols over LA (Herbert, 1996), military satellite surveillance (Harris, 2006; MacDonald, 2007), drone-based assassination raids by Israel above Gaza or the west Bank (Weizman, 2009) or the continuous use of aerial lethal force via armed drones in Pakistan or Afghanistan (Graham, 2004; Gregory, 2011), complex practices through which technophiliac, verticalized state power is launched against Orientalized renditions of surface or subsurface cities are a dominant feature of contemporary security politics (see Graham, 2010).

1 Vertical military technophilia and the city as camouflage

In a classic neo-Orientalist tradition, cities are widely projected by state, military and security elites as complex, exotic and intrinsically devious three-dimensional spaces in which adversaries of verticalized state security forces actively seek shelter, protection and anonymity as part of a pervasive 'urbanization of insurgency' (Taw and Hoffman, 2000). As Weizman (2009) argues, it is therefore imperative that critical geographers and urbanists explore attempts at verticalized domination, where the latest innovations in military technoscience, linked to imperial discourses and imaginaries, permeate three-dimensional geopolitical struggles in Gaza Strip, Pakistan, Afghanistan and elsewhere – as well as their increasing deployment above strategic global cities or mega sporting and political events within the capitalist heartlands of global city métropôles.

Davis (2006) talks of the increasingly widespread 'hornet-like helicopter gunships' above Rio, Gaza and elsewhere, which 'stalk enigmatic enemies in the narrow streets of slum districts, pouring hellfire into shanties or fleeing cars'. Adey (2010b: 52), meanwhile, suggests that helicopters and drones offer the technophiliac agencies of state military and security operatives 'machinic prosthetic view[s]' facilitating 'a perspective which may be simultaneously distant and abstract while near and vertically present'. In megacites like Rio, he argues, the helicopter, in particular, 'performs the longstanding role of making-legible amongst other devices of the state' (see also Scott, 1998). This history, of course, overlaps powerfully with the longer cultural history of the enrolment of the aerial view into cartography, modernist urban planning, authoritarian state building, colonial urbanism, urban counterinsurgency warfare, strategic urban bombing and Cold War nuclear targeting (see Dorrian and Pousin, 2012; Vidler, 2000).

By rendering complex urban places as verticalized digital imagery, sensed automatically from afar through machinic prostheses (missile heads, helicopter sensors, drone cameras, but also satellite imagery) these practices tend towards ethical thinning and distanciation from the lived socialities of the targeted places (Dorrian, 2009). Often, they dehumanize and

Other such places as they are consumed and distributed through YouTube, voyeuristic TV shows or state propaganda. 'In an aerial sleight-of-hand', suggests Adey (2010b: 62), describing the rendering of Rio's favelas into imagery by militarized state helicopter sensors, 'official portrayals of the megacity avoid any mention of its disorder or the helicopter's ambiguous and vertical visualities'. Such places – Rio's majority-city – are therefore fully obfuscated from the official place marketing and branding imagery so central to Brazil's efforts to stage the Olympics and World Cup. Within such clichéd urban imagineering, 'the horizon between land and sky, beach and water is given primacy in almost every single image, moving or otherwise' (p. 62).

A broader vertical geopolitical process is at work in the ways in which military-security complexes of states project cities as intrinsically problematic because of the ways in which they are deemed to *interrupt* the vertical surveillance and targeting processes (Graham, 2004). The US Marine Corps Intelligence Agency (1997: 11), for example, predicted that extending global urbanization, combined with the proliferation of 'asymmetric' conflicts pitching non-state fighters against state militaries, will *necessarily* mean that 'opposition forces will camouflage themselves in the background noise of the urban environment. Within the urban environment, it is not the weapon itself rather the city which maximizes or mutes an arm's effectiveness'.

Essentializing all cities, everywhere, as mere spaces working to camouflage threats secreted into quotidian urban life, is proving essential to legitimize very heavy investment in new surveillance and targeting systems in state militaries and paramilitarizing security forces: new micro-drones, swarms of half-manufactured, half-organic cyborgian insects; myriads of robotic devices spread generously through the 'urban battlespace' which use computer code linked to vast databases to automatically define

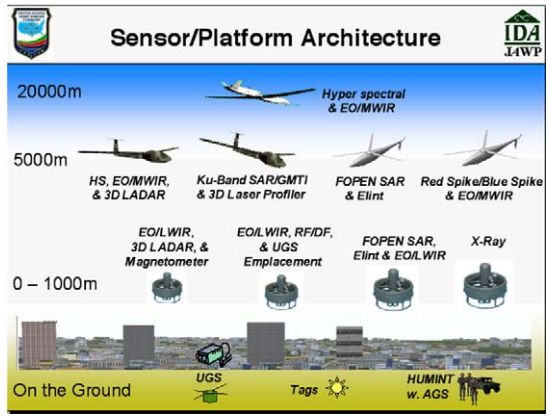

Figure 5. The range of unmanned drones predicted by the US military as part of its 2003 'Urban Resolve' exercise to be deployable above Jakarta within a hypothetical full-scale counterinsurgency operation there in 2015.
Source: Anastasiou (2006: 32) (public domain).

and even destroy 'targets'. Such emerging techno-scientific complexes – illustrated well by the suite of drones projected to loiter above the megacity of Jakarta within a US military simulation of a full-scale counterinsurgency operation there set in 2015 (Figure 5) – are being designed to permanently permeate and systematically unveil urban environments, so allowing military theorists to fantasize once more about long-standing dreams of verticalized omniscience and domination.

Crucially, with military-industrial-security complexes seeking to normalize drones, satellites and other vertical surveillance and targeting systems across the widest possible markets, what Michel Foucault (2003: 103) called 'boomerang' effects are operating between armed, counterinsurgency operations in the cities of colonial frontiers and the increasingly militarized 'urban operations' of policing and security operations within cities in capitalist heartlands. One recent advert for helicopter-based infra red sensor by the FLIR (Forward Looking Infra Red) corporation, for example, portrayed a two-sided front elevation of a

helicopter with an armed, military one on the left and the unarmed, police one on the right with the strapline 'Every Night, All Night – From Baghdad to Baton Rouge [the largely African-American capital of Louisiana] – We've Got Your Back' (Graham, 2010: 26).

2 Subterranean insurgency: the 'last symmetry' or 'final frontier'

Importantly, the demonization of cities as sites interrupting attempts at vertical domination increasingly extend below the urban surface to encompass subterranean domains. Such processes build on the long-standing rendition of the urban subterranean by social and political elites as a literal 'underworld' of criminality, filth, death, legendary occupation and internal strife (see Gandy, 1999; Pike, 2005, 2007; Stallybrass and White, 1986, on links between imaginaries of the urban subterranean and above-surface rationalization and planning of urban space). Through them, national militaries, security forces and military-industrial complexes are increasingly (re)imagining the spaces below ground as sites beyond aerial and vertical scrutiny that thus require systematic exposure, targeting and, if need be, destruction (see Graham, 2004).

Rather than in the mass, mutual urban burrowing of both strategic blocks during the Cold War, then (Vanderbilt, 2010), contemporary 'asymmetric' conflict renders the burrowing of the adversary as inherently problematic (while, of course, national security states in the USA and Israel continue to burrow). Norgard et al. (2005) of the US Air Force Academy, for example, talk of a 'proliferation of strategic subsurface sanctuaries' within both the main cities and remote hinterlands of US adversaries, geared towards the production and storage of weapons of mass destruction and the protection of leaders. The widespread argument within military and security publications is that such subterranean complexes represent one of the greatest challenges for the American military (Sepp, 2000), and the vertically organized matrix of satellites, aircraft, drones and ground sensors is built to allow them to occupy what a RAND report called the 'ultimate high ground' (Lambeth, 2003) of space-based surveillance and targeting. Kennedy (2002), discussing the construction of dedicated tunnel warfare training facilities for US special forces, laments the way in which non-state insurgencies and terrorist movements like the Taliban and Al Q'aeda now routinely burrow into 'large honeycombed complexes of natural caves and man-made tunnels, often cleverly disguised, booby trapped and filled with food, water and ammunition'.

To expose these 'deeply buried facilities' to vertical destruction, the US military is developing and deploying a whole suite of conventional and nuclear 'bunker-busting' bombs. These have startling names such as 'Deep Digger', 'Rods from God' or even the 'Robust Nuclear Earth Penetrator'. Even more startling, the Pentagon is investing in a whole new generation of sensors and imaging systems designed to detect and visualize underground structures. The 'Transparent Earth' program, for example, is being developed to send sensors down existing pipe systems to help build up a Google Earth-like 3D interface 'that would display the physical, chemical and dynamic properties of Earth down to a 5 kilometre depth' (Drummond, 2010). Smith, of the Geospatial Corporation – the company tasked with part of the analysis – reflects that the 'underground is truly the final frontier' (cited in Drummond, 2010). The hope is that, when complete, the 'Transparent Earth' program may mean that 'for enemies of America, going underground may no longer be an option' (Dillow, 2010).

More prosaically, the greatest effort and research addressing the subterranean realm among national security states is targeting the less elaborate tunnel systems now routinely constructed to allow surreptitious or

proscribed movements, migrations and economies to flourish despite intensifying surface and above-surface surveillance and targeting. Such illicit tunnel complexes are reminiscent of the Viet Cong's subterranean burrowings during the Vietnam war (Bishop, 2010). Motivations here vary – from illicit drugs smuggling, people trafficking and the 'tunnelization of migration' (Finoki, 2009) to sustaining basic economic flows or full-scale subterranean insurgencies. Nevertheless, broadly similar cartel-controlled and ever more elaborate subterranean complexes are emerging in a wide range of cases: beneath the Gaza-Egypt border (with almost 1,000 tunnels; Lerner, 2008); the US-Mexico border (especially around Tijuana and Nogales, Arizona); and even beneath the US-Canada border. The perceived strategic importance of these tunnel complexes is such that NORTHCOM, the newly installed US strategic command for North America, has set up a special Task Force to address them. Specialized tunnel warfare training facilities are now proliferating (Figure 6). In 2006 the US Congress also passed a special law to specifically criminalize transborder tunnels.

Figure 6. The US Army's newly opened Joint Tunnel Test Range (JTTR) at the Yuma proving ground, Arizona.
Source: http://www.yuma.army.mil/index.asp (public domain).

In Israel-Palestine, meanwhile, Eyal Weizman, updating his initial politics of verticality work cited at the start of this paper, now carefully links subterranean burrowing to the politics of airspace and the (attempted) territorial lock-down of the surface. 'The territorial logic of Israel's occupation is increasingly manifest along a vertical axis', he writes (Weizman, 2009: 253). 'The more efficient the destructive capacity of the Israeli air force has become [in drone operations and targeted assassinations], the deeper the resistance has had to retreat below ground.' What Weizman calls the 'last symmetry' of so-called asymmetric conflict, thus, is that between virtually total control of airspace and space domains by military security states, mirrored in 'the enemy's mastery of subterranean warfare' (p. 253) – hence the broader theme of Weizman's (2007) book *Hollow Land*.

Weizman's observations of tactics and countertactics are instructive. IDF operatives routinely use simple gravity as a weapon by pouring raw sewage into newly discovered tunnels (Weizman, 2007: 257). Tunnels beneath the now-defunct 'international airport' in Gaza demonstrate how 'tunneling has replaced flying' within a three-dimensional frame of strategic infrastructure, and the 2006 war in Lebanon ended up a major victory for Hezbollah because of a baroque complex of 40 m deep 'underground villages' prepared over a period of years with the help of Iranian engineers (p. 258). 'The

[2006] Lebanon war was waged between two spheres of extra-territorial sovereignty', Weizman contends. 'An "upper Lebanon" of Israeli-controlled airspace, and [a] "lower Lebanon" dug beneath villages, civilian neighbourhoods and open land' (p. 258). Finoki (2009), author of the excellent *Subtopia* blog on military urbanism (see http://subtopia.blogspot.com), suggests that the lesson to state security engineers is thus quite simple: 'prepare for tunnels!'.

It is certainly imperative for critical urban and political geography to link the proliferation of tunnel complexes with the extraordinary intensification of state-backed technoscientific scrutiny that has marked vertical geopolitics over the past few decades. 'Despite advances in satellite imaging, infrared and sensor technology, and a flexing global panoptic muscle', Finoki (2006) continues, 'detection methods have suffered accuracy due to the expansion of a subterranean urbanism that's become increasingly more sophisticated at deflecting aerial surveillance'. Thus, as with all the research themes highlighted in this paper, critical attention needs to fall on the mutual constitution of vertically separated levels, domains and relationalities within broader volumetric frames. By merely concentrating on surface-level borders, or the intensification of above-ground surveillance, Finoki (2006) stresses that crucial subterranean realms are obscured – complexes where, as he puts it, the 'limits of power are undone by the primordial urge to human ingenuity persistent in its crudest form, in its naked right to move freely beyond all constraints and survive, snoop, escape, evade, profit'.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

References

Acuto M (2010) High-rise Dubai urban entrepreneurialism and the technology of symbolic power. *Cities* 27(4): 272–284.

Adey P (2010a) *Aerial Life: Spaces, Mobilities, Affects*. Oxford: Wiley-Blackwell.

Adey P (2010b) Vertical security in the megacity: Legibility, mobility and aerial politics. *Theory, Culture and Society* 27(6): 51–67.

Al-Kodmany K (2011) Tall buildings, design and technology: Visions for the twenty-first century city. *Journal of Urban Technology* 18(3): 115–140.

Allen J, Massey D, and Pile S (eds) (1998) *City Worlds*. London: Routledge.

Allen J, Massey D, and Pryke M (eds) (1999) *Unsettling Cities: Movement/Settlement*. London: Routledge.

Anastasiou A (2006) *Modeling Urban Warfare: Joint Semi-Automated Forces In Urban Resolve*. Wright-Patterson Air Force Base, OH: Air University.

Ayoub L (2009) Public air space: Planning and accessing tall buildings in London. In: Naik D and Oldfield T (eds) *Critical Cities: Ideas, Knowledge and Agitation*. London: Myrdle Court Press, 88–97.

Bauman O (2000) In the age of horizontalization. In: Ireson A (ed.) *City Levels*. Basel: BirkHauser, 4–5.

Berger A (2006) *Drosscape: Wasting Land in Urban America*. New York: Princeton Architectural Press.

Bharucha NK (2010) Gated societies split city. Available at: http://therealclub.com/News/1273.

Bishop R (2004) 'The vertical order has come to an end': The insignia of the military C^3I and urbanism in global networks. In: Bishop R, Phillips J, and Yeo W (eds) *Beyond Description: Singapore Space Historicity*. London: Routledge, 60–78.

Bishop R (2010) Interview with Ryan Bishop on Megacities and Violence. *Theory, Culture and Society* December. Available at: http://theoryculturesociety.blogspot.com/2010/12/interview-with-ryan-bishop-on.html.

Boddy T (1992) Underground and overhead: Building the analogous city. In: Sorkin M (ed.) *Variations on a Theme Park: The New American City and the End of Public Space*. New York: Hill and Wang, 123–153.

Boyer MC (2003) Aviation and the aerial view: Le Corbusier's spatial transformations in the 1930s and 1940s. *Diacritics* 33: 93–116.

Brand P and Dàvila J (2011) Mobility innovation at the urban margins: Medellin's Metrocables. *City* 15(6): 647–660.

Brenner N (2004) *New State Spaces: Urban Governance and the Rescaling of Statehood*. Oxford: Oxford University Press.

Bunnell T (2004) Re-viewing the *Entrapment* controversy: Megaprojection, (mis)representation and postcolonial performance. *GeoJournal* 59(4): 297–305.

Castells M (2000) *The Rise of the Network Society*. Oxford: Blackwell.

Choy T (2010) Air's substantiations. Paper for Berkeley Environmental Politics Colloquium. Available at: http://globetrotter.berkeley.edu/bwep/colloquium/papers/ChoyAirEP.pdf.

Collinge C (2006) Flat ontology and the deconstruction of scale: A response to Marston, Jones and Woodward. *Transactions of the Institute of British Geographers* 31: 244–251.

Cosgrove D (2003) *Apollo's Eye: A Cartographic Genealogy of the Earth in the Western Imagination*. Baltimore, MD: Johns Hopkins University Press.

Cwerner S (2006) Vertical flight and urban mobilities: The promise and reality of helicopter travel. *Mobilities* 1: 191–215.

Cwerner S (2009) Helipads, heliports and urban air space: Governing the contested infrastructure of helicopter travel. In: Cwerner S, Kesselring S, and Urry J (eds) *Aeromobilities*. Abingdon: Routledge, 225–246.

Davis M (2006) Fear and money in Dubai. *New Left Review* 41: 47–68.

Davis M and Monk DB (eds) (2007) *Evil Paradises: Dreamworlds of Neoliberalism*. New York: New Press.

de Certeau M (1984) *The Practice of Everyday Life*, translated by Randall S. Berkeley, CA: University of California Press.

De Cauter L (2005) *The Capsular Civilization: On the City in the Age of Fear*. Rotterdam: Nai Publishing.

de Sola Pool (1977) *The Social Impact of the Telephone*. Cambridge, MA: The MIT Press.

de Waal M (2008) Urban computing, lifestyle management and Google Earth urbanism. Available at: http://www.themobilecity.nl/2008/01/16/99.

Dillow C (2010) On DARPA's list: A real-time, 3-D picture of the Earth beneath our feet. Available at: http://www.popsci.com/technology/article/2010-02/darpa-wants-real-time-3-d-picture-earth-beneath-our-feet.

Dorrian M (2009) The aerial image: Vertigo, transparency and miniaturization. *Parallax* 15(4): 83–93.

Dorrian M (2011) On Google Earth. *New Geographies* 4: 164–170.

Dorrian M and Pousin F (eds) (2012) *Seeing from Above: The Aerial View in Visual Culture*. London: IB Tauris, forthcoming.

Drummond K (2010) With Darpa's 'Transparent Earth', underground doesn't mean out of sight. Available at: http://www.wired.com/dangerroom/2010/02/darpas-plan-for-world-domination-map-entire-planets-underground.

Finoki B (2009) Tunnelizing migration 1: The border tunnel capital of North America. Available at: http://subtopia.blogspot.co.uk/2009/03/tunnelizing-migration-1-border-tunnel.html.

Flusty S (1997) Building paranoia. In: Elin N (ed.) *Architecture of Fear*. New York: Princeton Architectural Press, 47–59.

Foucault M (2003) *Society Must be Defended*. London: Penguin.

Gandy M (1999) The Paris sewers and the rationalization of urban space. *Transactions of the Institute of British Geographers* 24(1): 23–44.

Gandy M (2009) Water, politics and cinematic space in contemporary Mumbai. In: Naik D and Oldfield T (eds) *Critical Cities: Ideas, Knowledge and Agitation*. London: Myrdle Court Press, 227–235.

Geotz A (ed.) (2003) *Up, Down, Across: Elevators, Escalators and Moving Sidewalks*. London: Merrell.

Graham S (2004) Vertical geopolitics: Baghdad and after. *Antipode* 36(1): 12–23.

Graham S (2010) *Cities Under Siege: The New Military Urbanism*. London: Verso.

Graham S and Marvin S (2001) *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition*. London: Routledge.

Gregory D (2011) The everywhere war. *The Geographical Journal* 177(3): 238–250.

Harris A (2010) Vertical urbanism: Geographies of the Mumbai flyover. ESRC End of Award Report, RES-000-22-3127. Swindon: ESRC.

Harris C (2006) The omniscient eye: Satellite imagery, 'battlespace awareness', and the structures of the imperial gaze. *Surveillance and Society* 4: 101–122.

Herbert SK (1996) *Policing Space: Territoriality and the Los Angeles Police Department*. Minneapolis, MN: University of Minnesota Press.

Herscher A (2010) From target to witness: Architecture, satellite surveillance, human rights. In Kenzari K (ed.) *Architecture and Violence*. Actar: Barcelona, 127–148.

Holmes B (2004) Drifting through the grid: Psychogeography and imperial infrastructure. Available at: http://www.springerin.at/dyn/heft_text.php?textid=1523&lang=en.

Ireson A (ed.) (2000) *City Levels*. Basel: Birkhauser.

Jacobs J, Cairns S, and Strebel I (2007) 'A tall storey … but, a fact just the same': The red road high-rise as a black box. *Urban Studies* 44(3): 609–629.

Jay M (1993) *Downcast Eyes: The Denigration of Vision in Twentieth-Century French Thought*. Berkeley, CA: University of California Press.

Kennedy H (2002) Navy sets up new facility for tunnel-warfare training. *National Defense Magazine* November. Available at: http://www.nationaldefensemagazine.org/archive/2002/November/Pages/Navy_Sets_Up6633.aspx.

Khaleej Times (2008) Dubai: Vertical city, 2.4 km (1.5 miles) tall. Available at: http://sabbah.biz/mt/archives/2008/09/15/dubai-vertical-city-24-km-15-miles-tall.

Klauser FR (2010) Splintering spheres of security: Peter Sloterdijk and the contemporary fortress city. *Environment and Planning D: Society and Space* 28(2): 326–340.

Lambeth BS (2003) *Mastering the Ultimate High Ground: Next Steps in Military Uses of Space*. Santa Monica, CA: Rand Corporation.

Lefebvre H (1994) *The Production of Space*, translated by Nicholson-Smith D. Oxford: Blackwell.

Lerner A (2008) Almost 1,000 tunnels from Egypt to Gaza. Available at: http://www.imra.org.il/story.php3?id=41346.

Lerup L (2006) Postscript. In: Berger A *Drosscape: Wasting Land in Urban America*. New York: Princeton Architectural Press, 242–243.

Lilley K (2009) *City and Cosmos: The Medieval World in Urban Form*. London: Reaktion.

MacDonald F (2007) Anti-*Astropolitik* – outer space and the orbit of geography. *Progress in Human Geography* 31(5): 592–615.

McGrail S (1999) Communication technology and local knowledges: The case of 'peripheralized' high-rise housing estates. *Urban Geography* 20(4): 303–333.

McNeil D (2005) Skyscraper geography. *Progress in Human Geography* 29(1): 41–45.

Marine Corps Intelligence Agency (1997) *The Urban Century: Developing World Urban Trends and Possible Factors Affecting Military Operations*. Defense Intelligence Reference Document. Quantico: VA: Marine Corps Intelligence Agency.

Marston SA, Jones JP, and Woodward K (2005) Human geography without scale. *Transactions of the Institute of British Geographers* 30(4): 416–432.

Massey D, Allen J, and Pile S (eds) (1999) *City Worlds*. London: Routledge.

Morshed A (2004) The aesthetics of ascension in Norman Bel Geddes's Futurama. *Journal of the Society of Architectural Historians* 63: 74–99.

Munster A (2008) Welcome to Google Earth. In: Kroker A and Kroker M (eds) *Critical Digital Studies Reader*. Toronto: University of Toronto Press, 397–416.

Norgard JD, Wicks MC, and Musselman RL (2005) Deep ground penetrating radar (GPR) WIPD-D models of buried sub-surface radiators. Paper presented at Wireless Communication and Applied Computational Electromagnetics, 2005, IEEE/ACES International Conference.

Passanti F (1987) The skyscrapers of the Ville Contemporaine. *Assemblage* 4: 52–65.

Perry T (2007) Navy to mask barracks shaped like a swastika. *Los Angeles Times* 26 September. Available at: http://articles.latimes.com/2007/sep/26/local/me-swastika26.

Pike D (2005) *Subterranean Cities: The Worlds beneath Paris and London, 1800–1945*. Ithaca, NY: Cornell University Press.

Pike D (2007) *Metropolis on the Styx: Version 2: The Underworlds of Modern Urban Culture, 1800–2001*. Ithaca, NY: Cornell University Press.

Pile S, Brook C, and Mooney G (eds) (1999) *Unruly Cities? Order/Disorder*. London: Routledge.

Raban J (1991) *Hunting Mister Heartbreak: A Discovery of America*. London: Collins Harvill.

Rao V (2007) Proximate distances: The phenomenology of density in Mumbai. *Built Environment* 33(2): 227–248.

Sayre R (2011) The colonization of 'up': Building up and to the right in postwar Japan. Available at: http://web.mac.com/ryansayre/architokyo/colonization_of_up.html.

Scott F (2010) Foreword: 'Making data speak'. In: Wilkins G (ed.) *Distributed Urbanism: Cities After Google Earth*. Abingdon: Routledge, xi–xiv.

Scott H (2008) Colonialism, landscape and the subterranean. *Geography Compass* 2: 1853–1869.

Scott J (1998) *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*. New Haven, CT: Yale University Press.

Sepp EM (2000) Deeply buried facilities: Implications for military operations. Occasional Paper 14. Montgomery, AL: Center for Strategy and Technology, Air War College, Maxwell Air Force Base.

SFConnection (2007) The 'vertical gated communities' of San Francisco. Available at: http://thesfconnection.

wordpress.com/2007/02/12/the-vertical-gated-communities-of-san-francisco.

Skayannis P (2010) Is urban underground space luxury? From infrastructures to subterranean structures. Paper presented at the 24th AESOP Annual Conference: Association of European Schools of Planning, Helsinki.

Sloterdijk P (2011) *Bubbles. Spheres, Volume I: Microspherology*, translated by Hoban W. Cambridge, MA: The MIT Press.

Stallybrass P and White A (1986) The city: The sewer, the gaze and the contaminating touch. In: Stallybrass P and White A *The Politics and Poetics of Transgression*. London: Methuen, 125–148.

Strakosch GR (ed.) (1998) *The Vertical Transportation Handbook*. New York: Wiley.

Taw JM and Hoffman B (2000) *Urbanization of Insurgency: The Potential Challenge to US Army Operations*. Santa Monica, CA: Rand Corporation.

Taylor PJ (2004) *World City Network: A Global Urban Analysis*. London: Routledge.

Taylor PJ, Hoyler M, and Verbruggen R (2010) External urban relational process: Introducing central flow theory to complement central place theory. *Urban Studies* 47(13): 2803–2818.

Thill J-C, Dao HDD, and Zhou Y (2011) Travelling in the three-dimensional city: Applications in route planning, accessibility assessment, location analysis and beyond. *Journal of Transport Geography* 19(3): 405–421.

Vanderbilt T (2010) *Survival City: Adventures Among the Ruins of Atomic America*. Chicago, IL: Chicago University Press.

Van Riper T and Malone R (2007) The world's fastest elevators. Available at: http://www.forbes.com/2007/10/01/elevators-economics-construction-biz-logistics-cx_rm_tvr_1001elevators.html.

Vidler A (2000) Photourbanism: Planning the city from above and from below. In: Bridge G and Watson S (eds) *A Companion to the City*. Oxford: Blackwell, 35–45.

Waterhouse-Hayward A (2010) Vancouver's vertical gated communities. Available at: http://blog.alexwaterhousehayward.com/2010/01/vancouvers-vertical-gaited-communities.html.

Weizman E (2002) Introduction to the politics of verticality. Open Democracy. Available at: http://www.opendemocracy.net/ecology-politicsverticality/article_801.jsp.

Weizman E (2007) *Hollow Land: Israel's Architecture of Occupation*. London: Verso.

Weizman E (2009) *The Least of All Possible Evils*. Rome: Nottetempo.

Wigoder M (2002) The 'solar eye' of vision: Emergence of the skyscraper-viewer in the discourse on heights in New York City, 1890–1920. *Journal of the Society of Architectural Historians* 61(2): 152–169.

Zukin S (2010) The normalization of luxury: Aesthetics and authenticity in the big city. Keynote presentation at the Association of European Schools of Planning Conference, Helsinki, 7–10 July.