
Constructing Premium Network Spaces: Reflections on Infrastructure Networks and Contemporary Urban Development*

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Introduction: reproblematising networked urban infrastructure

By considering the city as an enormous artefact, the size and distribution of its streets, sidewalks, buildings, squares, parks, sewers and so on can be interpreted as remarkable physical records of the socio-technical world in which the city was developed and conceived (Aibar and Bijker, 1997: 23).

Social power cannot any longer (if it ever could) be disconnected from the power or ability to move quickly over space (Swyngedouw, 1993: 323).

As Kaika and Swyngedouw (this issue) suggest, the period from the 1930s to the 1960s witnessed the growing invisibility of the infrastructural complexes of water, power and communications, especially in the western city. With the exception of what they call the 'new urban phantasmagoria' of urban highways, infrastructure networks tended to be gradually shifted beneath the urban scene, both physically and metaphorically. The 'urban dowry' of pumping stations, telephone exchanges and electricity power plants were often closed and recycled, as cities sourced their power and water resources from further afield, and as digital fibre optic lines were threaded through the fabric of the city. The huge technological networks of ducts, pipes, conduits and wires were themselves relegated to the urban background, just as accessibility to the networks seemed to approach universality. As they put it (p. 134), '[h]igh modernity crusaded towards clarity, towards veiling what lay underneath the city'.

From the point of view of the network users, networked infrastructures were thus gradually reconstructed as apparently immanent, standardized and universal constructions which 'miraculously' entered the increasingly private spheres of the domestic house or corporate office 'as if by magic'. Networked infrastructures were, in a sense, constructed as 'territorial adapters' (Dupuy, 1995) that invisibly brought the expanding modern metropolis, indeed the modern nation and global economic system, into dynamic articulation. Power, communications, water and transport services became normalized within broader constructions of urban consumption and culture. Increasingly, they were also delivered within public or private monopolies constructed at the urban, regional or

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national scales as part of the wider elaboration of national welfare states (Graham and Marvin, 1995). Within these supply regimes basic power, water, sewerage and communications services were gradually 'rolled out' across geographical territories as public or 'quasi-public goods' using systems of standardized services, tariffs and cross-subsidies ('universal service obligations' in Anglo-Saxon nations; 'public service' regimes in France; 'services of general interest' in the rest of Europe; and so on — see Offner, this issue).

To use the parlance of social studies of technology, basic infrastructure services thus became 'black boxed' (see Winner, 1993). That is, they came to be treated by users as unproblematic and 'closed' sociotechnical artefacts that could be relied on without much thought. Once such services had been 'domesticated' and normalized within their spaces of consumption (see Rose, 1995), users tended not to worry where the electrons that power their electricity came from; how their telephone conversations (or later faxes and Internet messages) were flitted across the city or the planet; how complex technological systems sustained their journey to work; or what distant gas and water reserves they were utilizing in their homes. Users rarely considered the huge sociotechnical constructions, or complex governance arrangements, that lay beyond the power point, beyond the telephone, beyond the car ignition key, or beyond the water tap or toilet. This was especially so as new technologies and centralized practices of management and planning at regional and national scales allowed unprecedented levels of network reliability to be achieved by network operators. As David Perry (1995: 2) puts it, when infrastructure networks 'work best, they are noticed least of all'.¹

Beyond the growing specialist literature on the management and engineering of individual urban infrastructure networks, assumptions of immanent, ubiquitous and standardized infrastructure networks also filtered, usually implicitly, into many analyses of contemporary cities. Take, by way of example, Steven Pinch's (1985) book *Cities and services* on the geography of collective consumption in UK and US cities. In this, Pinch argued that network utility supplies and streets (and sometimes public transport and telecommunications networks too) were 'public local goods' which were, by definition, 'generally speaking, freely available, to all individuals at equal cost within particular local government or administrative areas' (p. 10). The implication was that, compared to other 'point-specific' collective services like education, health or retailing, libraries or other municipal services, they did not have an urban spatiality. They were, by implication, of relatively little interest to urban researchers.²

The high-modern ideal of the ubiquitously networked city thus achieved widespread currency as a rhetorical and ideological device. But we must be wary of overgeneralizing or oversimplifying its construction. Detailed experiences and policies developed within its broad rubric remained extremely diverse, both between networks and between spaces (see Lorrain and Stoker, 1997; Tarr and Dupuy, 1988). The extension and integration of networks was deeply enrolled in the construction and legitimation of nation states; the emergence of ideologies of technological progress and emancipation; the particularities of intergovernmental relations; the construction of professionalized corps of urban engineers and infrastructure operators; and the elaboration of complex technical practices of

1 The normalization and 'black boxing' of infrastructure services, of course, makes the potential or actual collapse of networked connections all the more fearful and traumatic. Catastrophic infrastructure failures fleetingly reveal the utter reliance of contemporary urban life on networked infrastructures. This applies whether through the much-feared 'Y2K'-related collapse of transport, finance, electricity or water systems, or through wars (Beirut 1978, Sarajevo 1984, Belgrade 1999), earthquakes (Kobe 1995, Los Angeles 1996, Taiwan and Turkey 1999), terrorism (City of London 1994), ice storms (Montreal 1997–8), floods (Central America 1998), or technical collapse (Auckland's electricity in 1998, Manhattan's telephone system in 1975) (see Barakat, 1998).

2 We should note, though, that significant urban research addressing the interconnections between cities and networked infrastructures has recently emerged in France (see Dupuy, 1991; Offner 1993; and the pages of the journal *Flux*) and in the UK and North America (see the *Journal of Urban Technology*).

infrastructure management. It was also bound up with the uneven emergence of welfare states and modern urban planning systems and the diverse techno-economic (re)configuration of individual territories (see Offner, this issue).

So it should be no surprise that the ubiquitously networked metropolis has never actually been achieved in practice. It was, in all cases, more a deeply symbolic construction than a tangible, achievable reality (see Kaika and Swyngedouw, this issue). In all western cities, despite the widening 'roll out' of networks, variations in the quality and degree of social and geographical access to networked infrastructures remained stark. Networks remained contested and biased. In so-called 'developing' and colonial cities, networks and urban engineering plans largely focused on the infrastructural needs of metropolitan and colonial elites (with the often unrealized, promise of later network extensions to the 'majority' population). The high-modern western ideal of a unitary, orderly city, integrated by networked infrastructure, was thus often remodelled as a system of 'spatial apartheid' (Balbo, 1993). Modern networks were laid out for the 'population'; the 'natives' remained confined to pre-modern, non-networked informal settlements beyond *cordon sanitaires* of walls and major boulevards. As Balbo argues, the partial completion of modern networked infrastructure was a very deliberate attempt to symbolize the superiority of colonial power-holders over colonized civilisations. He writes that:

the network city is the concretisation of the master planning approach to the idea of the unitarian city. Those who cannot afford to have their own WC or water tap and adopt other types of solution for their needs (oil lamps, street water vendors, foot travelling, pit latrines) are not acknowledged as citizens of the network city, even if they are the majority of the population (Balbo, 1993: 29).

I want to argue in this paper that we are now starting to see a renewed physical, social, political and discursive salience to urban networked infrastructures. In many cities and parts of cities in the 'developed', 'developing', 'newly industrializing' and 'post-communist' worlds, infrastructure networks are being reproblematised. The 'black boxes' surrounding them are being 'reopened'. Certain users are starting to look beyond the taken-for-granted point of consumption at the configuration of the whole sociotechnical artefact that supports their mobility, communications, power and water needs. In particular, in these times of 'globalization', those users demanding intense local and global connectivity are starting to pay considerable attention to how the whole of their networked urban infrastructures are configured beyond the end of pipe, the plug, the wire or the street.

In response to such scrutiny, standardized public or private infrastructure monopolies are receding as hegemonic forms of infrastructure management. We are starting to witness the uneven overlaying and retrofitting of new, high performance urban infrastructures onto the apparently immanent, universal and (usually) public monopoly networks laid down between the 1930s and 1960s. In a parallel process, the diverse political and regulatory regimes that supported the 'roll out' of power, transport, communications and water networks towards the rhetorical goal of standardized ubiquity are, in many cities and states, being 'unbundled' or even 'splintered', as a result of widespread movements towards privatization and liberalization (see Offner, this issue).

What this amounts to, this paper argues, is the uneven emergence of an array of what I call 'premium networked spaces': new or retrofitted transport, telecommunications, power or water infrastructures that are customized precisely to the needs of powerful users and spaces, whilst bypassing less powerful users and spaces.

The widespread emergence of such premium networked spaces seems to be closely bound up with widespread trends towards the physical and socioeconomic partitioning of the fabric of many contemporary cities (Badcock, 1997). In many cities the uneven global production of connectivity that stems from the widening range of premium network spaces seems to combine uneasily with 'a paradoxical tendency towards the enforcement

of local boundaries' (Ezechieli, 1998: 3; see Castells, 1996). But the relationships between the two processes remain far from clear and had yet to be explored by systematic urban research (see Graham and Marvin, 2000).

This paper seeks to develop a broad and international exploration of the construction of premium networked spaces. It also aims to begin analysing how they might be bound up within wider processes of urban change and restructuring. To this end the paper analyses, in particular, four processes of sociotechnical and political economic change that are broadly supporting the emergence of premium networked infrastructures. These are: the 'unbundling' of urban infrastructure provision; the erosion of comprehensive urban planning and the construction of new consumption spaces; the emergence of infrastructural consumerism; and the widespread shift towards extended and auto-mobilized cityscapes. In each case, examples of premium networked spaces are offered via brief case studies. Finally, a reflection is made on the limits which seem likely to inhibit the production of premium networked spaces, by way of a conclusion.

It is important to stress at the outset that the aim of this paper is not to suggest that all networked infrastructures in all places are somehow moving *en masse* from an era of standardized coherence to one of splintered fragmentation. Its brief analysis of a wide range of infrastructure networks in a wide diversity of cities does not seek to reduce complex, diverse shifts to some simple, phase-based transition model. Such an approach would clearly risk the twin dangers of crass ethnocentricism and analytical reductionism. I would also be open to accusations that my analysis simply reified infrastructure networks as agents of urban transformation in their own right. I am extremely wary that, as Wacquant (1996: 124–5) suggests, 'binary oppositions are prone to exaggerate differences, confound description and prescription, and set up overburdened dualisms that miss continuities, underplay contingency, and overstate the internal coherence of social forms'. Rather, the approach of this paper is simply to look both across different networks and across a wide range of cities in order to review a wide range of cases where premium transport, telecommunications, street, power and water networks are clearly emerging.

One final qualification is necessary: we also need to be careful not to suggest that sociotechnical secession of a premium networked space from the wider metropolis will ever be some simple, attainable process. Rather, premium network spaces are the results of the *strategies* of coalitions of interests within the contested and highly complex geopolitical and governance contexts of their respective cities. They do nothing to guarantee some easy secession from the wider metropolitan fabric, for a number of reasons. Political and social responses to attempts at secession, including social movements, protests and resistance, can lead to the dismantling of premium network spaces and the instigation of more socially and spatially equalizing regulatory and governance regimes. This occurred in late nineteenth-century London as social protests led to the removal of private street barriers and the incorporation of private streets into the monopolistic public street system (Atkins, 1993). To some extent, it is also occurring now in post-apartheid South Africa, as infrastructure regulators seek to establish basic norms for the networking of black townships (although see Bond, 1999 for a critique). Democratic resistance and social mobilization can also serve to balance the secessionary tendencies with more redistributive design, development, regulation and governance strategies. And strategies of resistance and transgression are possible through which marginalized groups can begin to assert their rights to space and network access in the city.

'Unbundling' infrastructure networks and the 'glocal scalar fix'

In the first trend supporting the construction of premium networked spaces, many nations, regions and cities across the developing, developed, newly industrializing and post-communist worlds are privatizing their incumbent infrastructure operators, opening up

monopolies to new forms of regulated competition, and allowing many types of infrastructural capital to unevenly colonize their spaces.

On the supply-side, powerful and transnational alliances and mergers between network operators in telecommunications, energy, water and transportation are growing rapidly, as newly private or entrepreneurial infrastructure firms attempt to position themselves favourably within dominant and emerging markets on an increasingly international basis. Such trends are being encouraged by the efforts of the World Trade Organization and regional trade blocs like the European Union to support a progressive liberalization of national infrastructure monopolies. Infrastructure operators are working hard to internationalize through programmes of takeovers, strategic alliances and mergers at increasingly international scales. Consolidation deals to create larger utility power companies in the electricity sector alone amounted to \$50 billion in 1998 across the world (Rider, 1999). In turn, financial markets are working harder to further penetrate infrastructure markets to benefit from floatations, privatizations and to recommodify profitable infrastructural spaces. As Poole argues, 'the world's financial markets are awash with private capital looking for economically sound infrastructure projects to invest in. Several multi-billion dollar infrastructure funds have already been assembled' (1998: 7).

In some extreme cases, such as the UK, the wholesale privatization of networked infrastructure during the past fifteen years has meant that 'in urban infrastructure and development, in part, the state has displaced its responsibility for financing and provision to the financial sector' (Clark, 1999: 242). Given the long-term and risky nature of infrastructural investment, such investors are likely to be reluctant to invest in large-scale, comprehensive and 'bundled' networks, unless there are ways to guarantee certain rates of return (Clarke, 1999). Such investors are tending to demand a project-by-project risk assessment, identifying individual revenue and profitability streams for particular infrastructural developments, within tight definitions of accounting that tend to avoid social or geographical cross-subsidies and the collective roll out of networks. In practice, this can 'mean a loss of the redistributive, social role implied by infrastructure public monopolies' (Little, 1995: 9). It can also mean that local municipalities lose or must reformulate their territorially based regulatory function, as private networks transcend their boundaries and their jurisdictions (see Offner, this issue).

The replacement of monopolistic forms of collectivized infrastructure development (that tended to support the standardized infrastructural ideal), with quasi-competitive regimes that need to attract international finance capital, may, in some cases, work to support the splintering of integrated and 'bundled' networks into a range of individually financed and managed infrastructure projects (Guy *et al.*, 1997). As Gordon Clarke (1999: 257) suggests, again from the point of view of the UK, 'one result of [financial] scrutiny has been a shift away from long term investment relationships to project-by-project assessments ruled by the law of contract'. In Brazil, Sueli-Ramos Schiffer observes that, with the privatization and vertical disintegration of state infrastructure monopolies since the 1970s, private capital has tended only to be attracted by the low-risk elements of infrastructure networks that can be 'splintered' off from the whole and directly managed for private profit:

the functional and territorial unbundling of infrastructure networks are, on the one hand, necessary to make feasible private operation of public utilities. Besides the desirable doctrinaire appeal to competition, the unbundling of complex unitary networks is a precondition for schemes of project finance based strictly on each project's risk (Ramos Schiffer, 1997: 19).

Such 'unbundling' can take many forms: the vertical disintegration of incumbent monopoly suppliers and the separation of local and national infrastructure; the erosion of standardized tariffs and the concomitant reduction of cross-subsidies between profitable and non-profitable parts of the network; public re-regulation to stimulate competition

between public or private suppliers; a growing segmentation of parts of the market; or the easing of restrictions of new market entrants and a restriction on general public investment (see Silva, this issue). Explicit privatization is a widespread (but not necessary) parallel to unbundling, as local and national states seek to draw in private capital whilst simultaneously modernizing obsolescent infrastructure. The organizational, sociotechnical and geographical dimensions of unbundling can therefore be complex and intertwined (see Lorrain and Stoker, 1997).

On the demand side, the central notion underpinning the construction of premium networked infrastructures — whether they be locally or translocally orientated — is that of ‘fiscal equivalence’ (Mallert, 1993). Within regimes of fiscal equivalence, privileged users struggle to ‘get what they pay for’ rather than cross-subsidizing lower income spaces and groups through either generalized tariffs or public taxation. The configuration of lines of connections and access nodes for networks, as well as user charges and service packages, becomes geared within ‘markets’ to the needs of particular users and spaces, rather than being driven by broader, public notions of cross subsidization and the imperative of serving entire urban territories. This, again, supports network unbundling, either through the construction of wholly new private infrastructures that completely bypass the monopolistic and relatively standardized network of the past, or through the use of the old network to deliver ‘virtual’ access to a whole new range of competitive private service providers.

Through encouraging processes of unbundling, because of their dissatisfaction with standardized and bundled collective monopolies, many powerful users are thus now seeking to develop their own transport, street, telecommunications, water and energy systems. They are doing so in partnership with private and public infrastructure firms and operators, and often with direct support from entrepreneurial planning and economic development agencies, in ways that allow them to effectively secede from the wider, public sociotechnologies that were the legacy of the standardized, integrated ideal.

Neil Brenner terms the grandiose infrastructural spaces that are emerging with the connection between these supply-side and demand-side factors ‘glocal scalar fixes’ (Brenner, 1998: 7). To him, the infrastructure projects which tend to result — globally-oriented ‘teleports’, international ‘hub’ air and water ports, ‘wired’ technology parks, high speed railways, as well as international supply connections in electricity, gas and water — differ radically from the styles of infrastructure development that characterized the latter stages of the standardized ideal. In stark contrast to the Fordist-Keynesian project of attempting to develop ‘homogenizing spatial practices on a national scale’, for example, Brenner writes that ‘a key result of these processes of state re-scaling has been to *intensify* capital’s uneven geographical development’ (Brenner, 1998: 476, my emphasis). As Susan Christopherson (1992: 284) has suggested, ‘with the withdrawal of national ‘equalizing’ investment, the privatisation of previously public investment and the concentration of public spending in some types of localities, public investment programmes have deepened trends toward uneven spatial development’. Take just a couple of examples.

‘Global’ cities and the construction of financial enclaves

Our first example of these trends comes from the telecommunications sector, where many new entrants such as WorldCom/MCI and COLT are specifically building new optic fibre grids only in the congested but highly profitable cores of ‘global’ cities and financial capitals (Graham, 1999). Increasingly, these dedicated core city networks are, in turn, being directly interconnected via transcontinental and transoceanic fibre networks, which serve further to secede the telecommunications infrastructure of the financial cores of dominant global cities from the wider networks of national and regional telephone monopolies. Thus ‘archipelagos’ of core city networks are being interconnected directly by optic fibre networks across oceans and continents, conveniently bypassing intervening

inter- and intra-urban spaces, with their less capable and more costly infrastructures, through a classic 'glocal' logic. Such glocal bypassing can involve geopolitically significant international connections to demand 'hot spots' which actually involve very small physical networks which are carefully targeted only on the areas with the very highest communications demand. For example, one network of only 125 km of fibre laid recently by the telecommunications company WorldCom in central London carries fully 20% of the whole of the UK's international telecommunications traffic (Graham, 1999). As broadband Internet connections start to become essential to many businesses in the US, many commentators are worried about the economic fortunes of spaces and firms beyond the 20 or so metropolitan cores (and associated affluent residential districts) which receive 90% of current investment in such infrastructure (Lieberman, 1999).

Newly developed financial services enclaves beyond the cores of 'global' cities, such as London's Docklands, Tokyo's Teleport Town and the Brooklyn 'MetroTech' and Jersey City riverfront developments in New York, are also being equipped with wide portfolios of carefully customized networked infrastructures. These enable them to connect seamlessly to the existing downtown, whilst direct articulations with (often low-income) surrounding residential districts can, at the same time, be carefully managed. London Docklands, for example, has a light rail network that ties it directly to the City of London, a Short Take Off and Landing (STOL) airport connecting it straight to other European Business capitals. It has a new highway and underground links to direct commuters to and from far-off affluent residential districts. It has a dedicated, private underground network of servicing tunnels. And it has a suite of world class, dedicated 'Teleport', telecommunications, power and water systems. At the same time, however, local access via roadways or footways are carefully 'filtered' through a so-called 'mini Ring of Steel' comprising 'fortress' urban design practices, cordons, access control systems, CCTV and a private police force to restrict unwanted traffic.

A few miles west in the City of London such combinations of intense global connection and managed local connection are taken to further levels. The City now has the most competitive glocal electronic connections with the rest of the planet in Europe, with six separate private optic-fibre networks and countless service providers offering unparalleled connectivity (Graham, 1999). In addition, British Airports Authority, the UK's private airport operator, is planning to extend its new Heathrow Express rail system to directly link the City direct with Heathrow, the world's largest international airport, with only two intervening stops (in place of the twenty or so stops on the current underground) and a journey time of only 20 minutes (compared to the hour and a half currently).

Simultaneously, however, efforts are being made to actively manage the City of London's local infrastructural articulations via streets and local roads with the rest of London. Surrounding the main financial district is an electronic monitoring system known as the 'Ring of Steel'. This scans the registration plates of all entering vehicles, automatically searches through links with police databases for stolen vehicles, and alerts the control room when a vehicle travels the 'wrong way' down a one-way street or fails to exit the 'Ring of Steel' zone at the end of the business day.

Glocal infrastructure and the construction of foreign direct investment enclaves

Newly constructed spaces for foreign direct investment (FDI), in both the 'North' and the 'South', show similar combinations of intense glocal infrastructural connection and attempts at the careful 'filtering' of local connections. Such spaces are increasingly equipped with their own self-sufficient assemblies of customized glocal infrastructure networks, which allow the immediate locale to be transcended. Consider a few examples. In Brazil, firstly, new auto plants are being equipped, at direct municipal and Federal expense, with their own private universe of glocal connections: private ports, canals, telecommunications networks, water, power and highway connections. At the same time,

it has been demonstrated that social provision of basic services is being undermined across cities and municipalities as a whole because of the spiralling public costs of such strategies (Rodríguez-Pose and Arbix, 1999).

Meanwhile, on the Indonesian islands of Johor and Riau, just South of Singapore — part of the transnational ‘SIJORI Growth Triangle’ — newly-constructed FDI and resort enclaves are being furnished with telephone systems which perfectly express the subtle logics of glocally configured premium network spaces. Such systems treat calls across the international border to Singapore as ‘local’; those beyond the enclave walls to the rest of Indonesia are deemed ‘international’ (Grundy-Warr *et al.*, 1999: 310). Power, water and transport systems are, similarly, tightly configured to support the glocal needs of the new enclaves.

Such a configuration is part of an effort to bypass and transcend Indonesia’s poor quality infrastructure, so overcoming barriers to manufacturing and tourist FDI. More broadly, in another excellent example of how premium network spaces can bypass traditional constraints, a ‘fast track’ immigration system is backing up Singapore’s regionalization drive in this ‘triangle’, allowing selected business people to use special electronic passes (replete with biometric hand prints) to completely bypass traditional immigration controls at airports.

Finally, it is worth mentioning the classic glocal spaces being constructed to support cheap data processing and back office constructions in the Caribbean, India and the Philippines. In these, special ‘digiports’ — high capacity, points-specific satellite infrastructures — are being combined with Export Processing Zone tax-haven status, and ultra-reliable water and power networks to support enclaves of maximum global connectivity and minimum local connectivity for transnational corporate foreign investors and information service firms (see Wilson, 1998).

The erosion of comprehensive urban planning and the construction of new consumption spaces

Such enclave construction is being further encouraged by the second set of processes which have undermined the standardized infrastructural ideal: the related erosion of notions of comprehensive urban planning first elaborated by Haussmann over a century before. The technocratic and comprehensive styles of urban planning most closely allied to the shift towards normalized and standardized infrastructure have found it difficult to survive the shift to an increasingly globalized political economy driven by liberalized flows of capital, technology and information. It has also lost much of its legitimacy in western and post-socialist nations as a result of being undermined by powerful social and cultural critiques.

As a result, urban planning now tends to centre on projects rather than comprehensive and strategic plans, on getting other agencies to deliver required urban services or infrastructures, and on pragmatic attempts to address perceived local problems rather than utopian or visionary frameworks for re-engineering metropolitan regions according to idealized blueprints of desired urban forms. This shift, along with the withdrawal through privatization and liberalization of many infrastructure networks from even the peripheral orbit of public sector planning, has significantly contributed towards the onset of splintered models of infrastructural development. Whilst planners have themselves developed a ‘growing scepticism towards large-scale infrastructure projects’ (Filion, 1996: 1640), urban planning has, in many cases, become:

fragmented, pragmatically tuned to economic and political constraints and oriented toward stability rather than being committed to change through comprehensive plans. It became increasingly geared to the needs of producers and the wants of consumers and less concerned

with overarching notions of rationality or criteria of public good. The outcome has been a disorganised approach that has led to a collage of highly differentiated spaces and settings (Knox, 1993: 12).

Most planning concepts today support, at least implicitly, the notion that 'the primary matter of importance is no longer an integral approach, but the cheerful acceptance of regions as archipelagos of enclaves' (Bosma and Hellinga, 1998: 16). As part of wider shifts towards complex urban governance regimes, many cities now have a myriad of small, special purpose zones, from cultural, heritage or leisure and sports districts, to business improvement districts, enterprise zones, technology districts, shopping malls, financial districts, affluent enclaves etc. Such spaces increasingly tend to be developed, organized and managed by property-led development bodies, urban marketing organizations and special infrastructure developers (Boyer, 1996). Strategic urban planning, where it exists, now centres on attempts to bring diverse agencies of urban and spatial governance into some degree of coordination and collaboration (Healey, 1997).

Public and private sector planners supporting the construction of the new edifices of urban development thus articulate a very different strategy and set of ideals to those which aspired to use modern plans to bring 'order' and 'coherence' to a whole city space (at least in part) through the coordinated 'roll out' of networked infrastructures. The logic tends now to be for planners and urban governance agencies to fight for the best possible networked infrastructures for their specialized district, in partnership with (often privatized) network operators, rather than striving to orchestrate how networks roll out through the city as a whole (Nunn and Schoedel, 1997). Take an example:

Business Improvement Districts (BIDs) as secessionary streetscapes

Competition between retail and consumption spaces is fuelling the unbundling of relatively homogeneous streetscapes, especially in the cities of North America (Mallert, 1993). Even where traditional streetscapes remain economically successful or are gentrified, and where the comprehensive municipal planning of street systems still exists, tendencies towards the construction of premium network spaces are in evidence, as such spaces try to compete for the custom of shoppers and tourists with proliferating enclosed malls, plazas and atria (and their own recessionary, privatized 'streetspaces').

One notable innovation, which amounts to the splintering of a carefully selected system of traditional streets from the wider metropolitan fabric, is the Business Improvement District (BID). Originating in the USA, where there were over 1200 in 1998, BIDs are also diffusing widely around the world. By 1998 they were in operation in Europe, the Caribbean, Australia and South Africa (Hannigan, 1998: 139).

A tailor-made form of local government, BIDs essentially involve the collaboration of local property capital to take control over a range of local municipal functions for their own private urban 'patch'. Such services encompass street cleaning, street lighting, public space management, garbage removal, public works, private policing, environmental improvements and marketing. BIDs have been characterized as 'cities in cities' or 'micropolises' (Valone and Berman, 1995). Even though they are unelected bodies, BID boards are able to raise property taxes, enforced by law, and use them in an excellent example of fiscal equivalence — all revenues are spent within the district. Free riders, and social or geographical cross subsidies, are thus avoided.

In a clear fragmentation of urban service provision and planning, richer BIDs like those in central Manhattan are, not surprisingly, able to undertake extensive public works, modifying street systems, public transport routes and utilities to the exact demands of BID members. Many BIDs are carefully themed, with uniform street furniture and streetscapes, signifying their secession from the wider city, whose 'inability to generalize improvement strategies' (Zukin, 1995: 36) is widely cited by BID boards as a reason for taking the initial decision to secede from the municipal street system. Similar

dissatisfaction with municipal-wide street management regimes lies behind the recent shifts towards private and quasi-private 'town centre management' strategies in the UK (equipped with their own CCTV systems) which are, in effect, informal BIDs without the tax-raising powers (Reeve, 1996).

The construction of infrastructural consumerism

The third trend supporting the construction of premium network spaces is the diversification of consumer demands and the growth of what we might term 'infrastructural consumerism'. Within this, firms and quasi-firms are eager to use consumer segregation and geodemographic targeting techniques in the construction of diverse infrastructure 'brands'.

There has been, in the last twenty years, a dramatic global assertion of 'the moral superiority of individual choice compared to the 'tyranny' of collective decision making' (Leonard, 1997: 4). The relatively standardized 'mass society' of Fordist production, distribution and consumption — which was so closely associated with the notion of standardized, immanent networked infrastructures in the high-modern city — has fractured into a growing pluralization of practices, tastes and needs (Lash and Urry, 1994). Distinctive styles of infrastructure consumption are now 'viewed increasingly as a means of asserting distinctiveness within mass society' (Knox, 1993: 20).

Thus, standardized and 'black boxed' infrastructural services — such as the standard 'black' telephone connection, the ubiquitous public electricity supplier, the mass broadcast TV signal, the public water 'board', the municipal pavement, and the standardized 'Fordist' motor car on the public street or road — have become increasingly hard to maintain in many cities, especially amongst socioeconomic elites. As in other service industries, shifts are thus occurring towards differentiated ranges of socially symbolic infrastructural services, offering wider and wider choices for tailored infrastructure services within internationalizing niche markets. Infrastructure services become less and less a basic means to sustain modern urban life and more and more a means to support and construct diverse cultural identities and symbolic identity politics.

Directly supporting this disaggregation and 'unbundling' of infrastructure networks are the practices of geodemographic targeting adopted from retailing and financial service industries (Goss, 1995; Pickles, 1995). The overall rationale tends to be to 'pinpoint concentrations of potentially high spending customers' (Winter, 1995: 14) so that the costs of building or operating profitable infrastructure are minimized whilst the return is maximized. Even when territorial monopolies remain in place, the diversification of service 'brands' is increasingly common. Even incumbent monopolies are striving to become more entrepreneurial in the face of the growing likelihood that they, too, will eventually face competition, either within their incumbent territory or in the spaces that they, themselves, are seeking to colonize through new business ventures.

The broad shift towards infrastructural consumerism is 'imposing an ethos of individual choice which belies the role of consumption in the systemic reproduction of capitalism' (Clarke and Bradford, 1998: 874). Moreover, such infrastructural 'choice' tends to be limited to certain social and spatial groups within the city. The ability to access competing providers is dependent on wealth, location, skills and how lucrative one is to serve. For infrastructure service providers, the imperative, as Golding (1998: 19) observes, is now to:

Decide how to divide up the market. Segment, then organise your business physically or virtually around that segmentation. Apply the principle right through the chain of activities surrounding a particular customer so that each channel (let us say an energy service), segment (the elderly, dual income families), or sector (utilities) receives an apparently seamless service.

Such techniques, in turn, can help support the production of highly customized infrastructure services aimed at tightly defined geodemographic target markets. Take three examples.

Liberalized competition and infrastructural consumerism in the utilities

Within newly liberalized utility markets, environmentally conscious consumers in Sweden, the UK and California can now sign up with 'green' electricity generators to offer them home supplies (Summerton, 1995). They can thus guarantee that, whilst the actual electricity they use in their home might be from nuclear or non-renewable sources, renewable energy will be inputted to the network to the amount that they use. In fact, in the UK's liberalizing energy markets, energy services can now be accessed 'virtually' from companies tied closely with trade unions or senior citizens' organizations, the green movement, Chinese communities, social housing providers, local authorities and so on. Countless other new entrants compete simply on price. Some target the special needs of high-income users, such as for swimming pool heating.

These services thus start to transcend and cross-cut the contiguous territorial monopolies of the standardized ideal; every household on any one street can now theoretically sign up to a different electricity company, gas company or telephone company. 'Virtual' competition in water is even being mooted. A whole range of competitive utility services are now offered over the singular power or gas networks due to the monitoring capabilities of information technology. More familiarly, of course, we should not forget that consumers in many nations can now also choose from dozens of 'personalized' media, mobile and fixed telecommunications, broadcast, satellite and cable TV and Internet service portfolios from a veritable blizzard of private and public sector offerings.

Secessionary gated communities and the 'bundling' of private infrastructure

The production of such customized and consumerist networks is increasingly bound up with the production of partitioned social spaces within many contemporary cities. Developers of gated communities and condominium complexes in such diverse cases as North America (Zaner, 1997), Istanbul (Sandercock, 1998), Mumbai (Bombay) (Masselos, 1995), Jakarta (Dick and Rimmer, 1998), Manila (Connell, 1999) Shanghai (Rose and Tang, 1997) and São Paulo (Caldeira, 1996) are starting to take advantage of infrastructural consumerism and liberalization by developing and 'bundling' their own customized utility, street, telecommunications and even transport services. Once again, the promise of filtering local connectivity to the wider city (through walls, gating, Closed Circuit Television and private security) is closely combined with enhanced local or glocal connectivity (through direct highway connections to airports, premium water and power connections, and enhanced telecommunications).

For the developers of gated communities and condominium complexes in the US, for example, 'enhanced telephone services, movies on demand — even Internet access — are taking their place alongside pools, fitness centres, and party rooms as standard amenities in today's multifamily [gated] communities' (Zaner, 1997: 65). These are geared towards maximizing profitability and adding value and functionality for those higher income groups who are able to live there. US gated communities, in particular, are bundling together whole suites of electronic entertainment, communications and security applications and physical infrastructures for residents. Apartment developers in New York and San Francisco are now offering trunk Internet connections to their highest price apartments which deliver speeds of between 100 and 150 times that experienced by other Internet users over the public telephone system. Gated communities across the US are also exploring special tariff and service deals with newly liberalized energy and water firms. One, in Phoenix, has even developed a fleet of electric cars for use within the 'community' which cannot even be legally driven outside its gates on public highways (Kirby, 1999).

Strikingly similar developments on the periphery of Istanbul 'are marketed as having all the amenities of 'a small and modern American village', including private utilities and services, private buses into the city, private security and surveillance systems, electronic shopping facilities connected to the supermarket, on site sports, health and entertainment facilities, and schools' (Sandercock, 1998: 176). Developers of gated condominium complexes in the Murumbi area of São Paulo are increasingly exploiting liberalization to 'supply sophisticated infrastructural services for top income groups' (Ramos Schiffer, 1997: 10). In Mumbai (Bombay), upper-income gated enclaves, developed within wider fields of informal shanty settlements, mean that 'a sense of interconnectedness between the differing sections of the city's population as a whole' is being replaced 'by a sense of interconnectedness with certain parts only of the population, not all of it' (Masselos, 1995: 210). The premium water pipes which interconnect these developments, laid on the surface to cut costs, are actually used as footways by residents of shanty towns in intervening spaces — even though they are completely unable to access the potable water flowing within. In Shanghai, finally, newly-constructed affluent enclaves on the edge of the city are, like high-class hotels, developing their own water boreholes and bottled water supplies to try and bypass the perceived inadequacies and health risks that the burgeoning suburban middle class associate with relying on the state-run water network (Alana Bolund, personal communication).

Bypassing gridlock: electronic highways as premium network spaces

Our final example of how infrastructural consumerism can lead to the construction of premium network spaces which bypass standard and public infrastructure monopolies comes from the recent commodification and growth of diversified urban highway systems in cities in North America and Australia (Graham, 1998). Here, private highway corporations have started to develop electronically priced 'smart' highways in carefully targeted high-demand urban corridors. Commuters in certain areas of Toronto (Electronic Toll Road 407), Melbourne (the Citylink system), LA (SR91) or San Diego (I-15), for example, can now choose the 'premium' roadspace of higher speed and guaranteed congestion-free highways, over the 'free', grid-locked and public highways that were the legacy of the standardized infrastructural ideal. Use of the new electronic highways is monitored in time and space via car-based electronic tags; charges are electronically debited from bank accounts. Prices per kilometre vary, like telephone tariffs, according to the time of travel.

On such 'e-highways' prices often simply rise in real time to deter more traffic in the event of congestion, so maintaining the guarantee of free flow at all times of day. Access control is strictly enforced; free riders without tags are electronically tracked down and fined by post. In the Toronto case, the Ontario State Government has even suggested the possibility of raising the speed limit on the 'e-highway' beyond that enforced on the state's own public highways (Graham, 1998).

In effect a 'diversified' market in highway space is developing in these cities out of the homogeneous, standardized and public system that was developed over the past half century. The *Toll Roads Newsletter* eventually expects private electronic highway corporations to offer many value-added services to upper-income users using its personal databases of highway users: 'road operators will be able to give you weather reports, make or change motel reservations that suit your route, and give you spoken directions to the destination of your choice' (Graham, 1998: 1).³

3 At the same time, however, social access to mobility, needless to say, is becoming more starkly polarized by income in cities with the onset of 'e-highways'. In these cases the commodified pricing mechanism is being directly enrolled as a barrier between higher income commuters and drivers (who are deemed to warrant the extra power of space that the use of the new 'smart' highways entails) and lower income groups who simply cannot afford tolls and are marginalized to the rump of the congested and public highway system.

Urban decentralization and the polynucleated urban region

The final process which is supporting the construction of premium urban infrastructure networks, I would argue, is the apparently pervasive shift towards extended and polynucleated urban regions. Roger Keil (1994: 131) asks, 'have we reached the era of the outer city, and does the real urbanism of the waning century really happen on the edge?' The landscapes of the extended, polynucleated city-region tend to transcend the possibility of rolling out singular or coherent urban infrastructures. Instead, particularly in the cities of North America, Australasia and Eastern and South-East Asia, 'packaged landscapes' of automobile-oriented developments spread through the urban periphery and 'post suburbia' (Knox, 1993). They tend to articulate a new urban experience of fragmentation and segregation which further fuels the sensibilities of splintering networks (Pope, 1996). The spectacular growth of urban peripheries also tends to geographically eclipse or even isolate the networked urban cores that were the legacies of the standardized infrastructural ideal (Dick and Rimmer, 1998).

The widespread shift to highways and automobiles as the dominant transport system of extended, polynuclear urban regions has strongly supported the broader shift towards urban physical and social fragmentation (Pope, 1996). Highways and motorization have contributed towards a coarsening, widening and stretching of the urban fabric. More broadly, automobiles and highways have tended to support a horizontal segregation of uses within the extending metropolitan region. As Calthorpe (1993: 21) suggests, 'the car is now the defining technology of our built environment. And more importantly, it allows the ultimate segregation of our culture: land uses which separate old from young, home from job, rich from poor, and owner from renter'. Consider one final example.

Malls, theme parks, resorts and the automobilized cityspace

A variety of common techniques of design, infrastructure development and access control are now widely being used by developers and operators of malls, theme parks and urban resorts to withdraw them from the wider urban fabric whilst connecting as seamlessly as possible to wider middle-class markets via dedicated automobile routes.

New, inward-looking developments are placed within a *cordon sanitaire* of car parks, highways and defensive landscape architecture, exaggerating the sense of social and spatial separation from the wider urban fabric. Malls and theme parks, in particular, whilst 'bundling' an ever greater range of retail, leisure, media, hotel, commercial and residential uses, tend to rely on a form of fortress architecture to secede from the immediate urban environment (Dick and Rimmer, 1998). At the same time, direct highway links and capacious, integrated parking garages allow a seamless flow of consumers from across the wider urban region and beyond directly into the protected 'inverted city' within (Dovey, 1999: 123). Access by foot through traditional streets or by public transit is often either virtually impossible or extremely hazardous.⁴

Once automobile-based consumers arrive at such spaces, 'through the lack of signs they stimulate consumers to traverse the space of the parking lot quickly and enter within. . . The problem with this kind of architecture is the way it ruptures the urban fabric by isolating buildings from both the surrounding landscape and the street' (Gottdeiner, 1997: 138).

Very often such developments are also 'consciously situated beyond the geographic and financial reach of minorities and the poor in the exurban fringe' (Hannigan, 1998:

4 An example of the starkness of such carefully designed local disconnections came on 14 December 1995 at the huge Walden Galleria Mall on the edge of Buffalo, USA (Gottdeiner, 1997: 132). An employee of the mall, Cynthia Wiggins, was trying to cut across a seven-lane highway from the public city bus stop when she was run down and killed by a 10-ton truck. City buses were not allowed to enter the mall, of which every aspect had been designed to attract high-spending middle and upper income consumers travelling by car.

190). Sometimes, wholly new private transit systems are developed to cater entirely to the needs of the internalized space within the complex. At Sydney's Darling Harbour, the new LA Getty museum and the Merry Hill mall in the UK, dedicated 'people mover' rail systems have been constructed as internal transportation systems, either within the boundaries of the site, or to articulate it with adjacent highways or other consumption spaces.

As with the atria and 'skywalk' complexes within some North American and Asian city cores, malls and urban entertainment complexes often therefore tend to rupture the traditional street patterns that were the legacy of the standardized infrastructural ideal. In so doing, they tend to internalize the energy, circulation patterns and financial circuits that used to be tied closely to such street patterns in new privatized and enclosed domains within which automobile access is seamlessly melded into built space. In Asia's largest hybrid mall, the Ngee Ann City in Singapore, for example, 'nightclubs are entered through Parking lots on the eighth floor' (Turnbull, 1997: 229, cited in Cartier, 1998: 172). Turnbull comments that 'as the traditional street pattern was violently displaced, folded, compressed, and replaced' by the Ngee Ann City complex, 'the heterogeneity of the street — its energy — was captured, contained and accelerated' (*ibid.*).

Concluding discussion: the limits to premium networked spaces

This paper has sought to explore a wide range of emerging examples of the construction of premium network spaces across the full range of networked infrastructures and in a highly international spread of contemporary cities. In so doing, its approach has necessarily been one of broad review rather than detailed analysis. Through this approach we have been able to maintain a very wide perspective of how a range of networked infrastructures are being carefully configured by operators, development interests and users to meet the new demands of corporate and middle and upper income users for premium infrastructure networks.

Such premium networked spaces transcend the perceived limitations of the standardized, monopolistic power, water, communications and transport networks laid out during the past half century. These processes of constructing premium infrastructure networks have been related, in particular, to changing organization and political economies of capitalist state and scale formation, to the growth of entrepreneurial and fragmented urban planning, to the emergence of infrastructural consumerism, and to the polynucleating and extending landscapes of urban regions themselves.

To begin to understand the significance of premium networked urban infrastructures, however, it is necessary to qualify the empirical review undertaken above. This is for four reasons. First, we must be wary of over-generalization. The above cases constitute a wide and diverse set of examples in an extremely broad range of urban contexts. They involve a variety of similar but distinct processes from the construction of completely new private infrastructures to the sociotechnical reconfiguration of old networks; from classic cases of wholesale privatization to public 're-regulation' and the changing practices of continuing monopolies; from the combined secession of interlinked networks and built urban spaces to the 'virtual' construction of markets. This article can do no more than begin to sketch this variation; a good deal more analysis will be required before we will be fully able to understand how infrastructural 'unbundling' is involved in the restructuring of urban areas in all the cases reviewed above.

Second, the cases explored only represent some of the most visible and 'extreme' examples of the construction of premium networked infrastructures. These are drawn primarily from UK, US and Asian cities. However, both in these and in many other spaces, the monopolies, cross subsidies and 'bundled' networks of the high-modern period, along with the associated political practices and normalized 'black boxed'

consumption practices, have not been removed wholesale. In many cases, they remain substantially intact. In a good many urban contexts, the shift from emphasizing sociospatial homogenization of networks to the 'unbundling' of different practices for different users is in fact likely to be much more subtle. It is manifest in changed practices of marketing within continuing public or private monopolies, in the adoption of geodemographic targeting techniques, rather than the spectacular emergence of wholly new or highly visible premium networked spaces (Graham, 1997).

Thirdly, as emphasized already in the introduction, we need to be wary of the dangers of implying some simple, binary transition. Whilst they are no doubt in the ascendancy at present, customized and unbundled urban infrastructure networks are far from new; users in social and economic enclaves have long sought to enrol both development interests and network operators to construct their own 'closed' infrastructures throughout urban history (witness, for example, the International Settlements of early twentieth-century Shanghai, or the closed and private Victorian streets of the West End of London). Socioeconomic enclaves have also long been supported by uneven development practices within apparently standardized infrastructural monopolies (Cox and Mair, 1988).

The history of developing cities, in particular, has also long been one of the use of constructed built form along with customized infrastructure to maintain socioeconomic enclaves. So the processes analysed above in cases like global cities, FDI complexes and gated enclaves, represent a renewal of old and established practices of distant infrastructural connection and attempts at filtering local connection, rather than something radically new. They simply do this with renewed degrees of intensity and global reach and, often, without the pretence of eventually moving towards universal access.

Finally, it is important to re-emphasize that the dream of a totally purified, hermetically-sealed world of premium urban spaces is exactly that — a dream. For even in the interlinked premium networked spaces of the contemporary cities where their construction has gone farthest, ambivalent tensions remain. The 'messy' realities of urban life creep back in. Total secession is never possible. There are limits in the degree to which full sociotechnical bypassing of public, monopolistic networks is possible. As in the cases of the City of London, FDI enclaves and malls, premium network spaces actually require continued connectivity to wider public networks in order to function. Uneasy boundary tensions thus often develop between the two regimes. Boundaries are porous. Perfect control strategies are never possible. 'Public' mixing can often still overcome strategies of separation and control. Moreover, the sheer diversity of identities, social worlds and political pressures in contemporary cities can swamp efforts to impose some simplistic notions of exclusion and order.

The complex institutional fabric of urban governance, meanwhile, often tends to resist the simple and easy secession of socioeconomic elites, and their infrastructure systems, from tax paying systems. In most cases, scope continues to exist at the level of local and national states and governance regimes to reassert leverage over the production and regulation of premium networked spaces. Local municipalities and planning agencies can renege on license agreements and bring networks back into direct connection with public network operations (as is planned with some private 'e-highways' in California). Traditional policy intervention through the construction of public duct space, public investment, leeway rights and planning instruments can do much to socialize benefits from premium networked infrastructure investments (see Offner, this issue).

Above all, we will fundamentally misunderstand contemporary cities if we believe that they can somehow be simply 'programmed' by powerful interests through the construction of new infrastructure networks or the development of new walls and barriers — even within increasingly extreme and uneven capitalist contexts. Spaces do remain in many cities which have more or less robust 'public' qualities — streets, and other networked spaces, where difference and diversity can and do still come together under relatively free conditions. 'Great cities', writes Andy Merrifield (1996):

by their very definition, have enormous diversity of ingredients and people, and they aren't mere passive pieces on a chess board that big capital can move around or exclude at whim. Invariably, new forces of disintegration can be and are used as the medium for new forms of integration and affirmation. That is how and why people survive in cities and rebuild their lives out of so much rubble, injustice and disappointment.

In the context of urbanization in developing world contexts, Grundy-Warr *et al.* (1999) offer a particularly resonant analysis of attempts, already encountered above, to develop sealed-off glocal tourist and manufacturing enclaves in the Indonesian islands within the 'SIJORI' growth triangle, just to the south of Singapore. In practice these attempted premium networked spaces have actually been overwhelmed by in-migration and the spontaneous construction of squatter settlements. All manner of attempts at boundary control in the new enclave spaces — erecting barriers, building walls, stipulating who has access and who does not, employing private security companies, customizing premium infrastructure only to the needs of those inside the enclave — have been effectively undermined and rendered useless. Infrastructure networks have been 'illegally' accessed. And 'the island's reputation as a booming economy has overwhelmed official controls. As a consequence it has not been possible to entirely separate [the enclaves] from the surrounding development of the island. These processes draw attention to the difficulty of securing growth through protected enclaves' (Grundy-Warr *et al.*, 1999: 324).

The message, then, is clear. We should direct analysis towards exploring the diverse ways in which premium networked spaces across all infrastructural sectors are being constructed, legitimized and maintained — politically, sociotechnically, legally and geographically. But perhaps the greater challenge is to understand how premium networked spaces fit more broadly into what David Harvey (1996: 260–1) termed the 'co-gredience' of contemporary metropolitan life — 'the way in which multiple processes flow together to construct a single consistent, coherent, though multi-faceted time-space system'.

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