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The end of geography or the explosion of place? Conceptualizing space, place and information technology

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Abstract: This article critically explores how the relations between information technologies and space and place are being conceptualized in a broad swathe of recent writings and discourses on the geographies of 'cyberspace' and information technologies. After analysing the powerful role of spatial and territorial metaphors in anchoring current discourses about information technologies and society, the article goes on to identify three broad, dominating perspectives. These I label the perspective of 'substitution and transcendence' (dominated by technological Utopianists), the 'co-evolution' perspective (drawing from political economy and cultural studies) and the 'recombination' perspective (derived from recent work in actor-network theory). The discussion turns to each in turn, extracting the geographical dimensions and implications of each. The article concludes by considering the implications of the discussion for spatial treatments of society–technology relations and for broader debates about the nature of space and place.

I Introduction: cyberspace, spatial metaphors, space and place

It is now widely argued that the 'convergence' of computers with digital telecommunications and media technologies is creating 'cyberspace' – a multi-media skein of digital networks which is infusing rapidly into social, cultural and economic life. Cyberspace is variously defined as a 'consensual hallucination, a graphic representation of data abstracted from the banks of every computer in the human system' (Gibson, 1984: 51); a 'parallel universe' (Benedikt, 1991: 15); or a 'new kind of space, invisible to our direct senses, a space which might become more important than physical space itself [and which is] layered on top of, within and between the fabric of traditional geographical space' (Batty, 1993: 615–16).

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Interestingly from the view point of geographers, the recent growth of discourses on 'cyberspace' and new communications technologies, even the very word 'cyberspace' itself, have been dominated by spatial and territorial metaphors (Stefik, 1996). 'Cyberspace', suggests Steve Pile (1994: 1817), 'is a plurality of clashing, resonating and shocking metaphors'. The expanding lexicon of the Internet – the most well-known vehicle of cyberspace – is not only replete with, but actually *constituted* by, the use of geographical metaphors. Debates about the Internet use spatial metaphors to help visualize what are, effectively, no more than abstract flows of electronic signals, coded as information, representation and exchange. Thus, an Internet point-of-presence becomes a web *site*. The ultimate convergent, broadband descendant of the Internet is labelled the information super*highway*. A satellite node becomes a tele*port*. A bulletin board system becomes a virtual *community* or an electronic *neighbourhood*. Web sites run by municipalities become virtual *cities* (see Graham and Aurigi, 1997). The whole society-wide process of technological innovation becomes a wild-west-like electronic *frontier* awaiting colonization. Those 'exploring' this frontier become Web *surfers*, virtual *travellers*, or, to Bill Mitchell (1995: 7), electronic *flâneurs* who 'hang out on the network'. The Internet as a whole is variously considered to be an electronic *library*, a medium for electronic *mail* or a digital market*place* (Stefik, 1996). And Microsoft seductively ask '*Where* do you want to go today?' And so the list goes on and on.

Such spatial metaphors help make tangible the enormously complex and arcane technological systems which underpin the Internet, and other networks, and the growing range of transactions, social and cultural interactions, and exchanges of labour power, data, services, money and finance that flow over them. While many allege that networks like the Internet tend to 'negate geometry,' to be 'anti-spatial' or to be 'incorporeal' (Mitchell, 1995: 8–10), the cumulative effect of spatial metaphors means that they become visualizable and imageably reconstructed as giant, apparently territorial systems. These can, by implication, somehow be imagined similarly to the material and social spaces and places of daily life. In fact, such spatial metaphors are commonly related, usually through simple binary oppositions, to the 'real', material spaces and places within which daily life is confined, lived and constructed.

Some argue that the strategy of developing spatial metaphors is 'perhaps the only conceptual tool we have for understanding the development of a new technology' (Sawhney, 1996: 293). Metaphor-making 'points to the process of learning and discovery – to those analogical leaps from the familiar to the unfamiliar which rally the imagination and emotion as well as the intellect' (Buttimer, 1982: 90, quoted in Kirsch, 1995: 543). As with the glamourous, futuristic technological visions, or dark, dystopian portraits within which they are so often wrapped, these technological metaphors 'always reflect the experience of the moment as well as memories of the past. They are imaginative constructs that have more to say about the times in which they were made than about the real future' (Corn, 1986: 219).

But the metaphors that become associated with information technologies are, like those representations surrounding the material production of space and territory (Lefebvre, 1984), active, ideological constructs. Concepts like the 'information society' and the 'information superhighway' have important roles in shaping the ways in which technologies are socially constructed, the uses to which they are put, and the effects and power relations surrounding their development. Metaphors also encapsulate normative concepts of how technologies do or should relate to society and social change, as the use of 'shock' and 'wave' metaphors in the writings of Alvin Toffler shows (see Toffler, 1970;

1980). They can even be used to represent the very nature of society itself, as the widespread use of 'information society' and 'information age' labels currently testifies. Here technologies are seen to embody metaphorically the very essence of contemporary cultural, economic, geographical and societal change. This brings with it, of course, the attendant dangers of relying on simple technological determinism in thinking about how new technologies are related to social, and spatial, change. As Nigel Thrift (1996a: 1471) contends, 'in this form of [technological] determinism, the new technological order provides the narrative mill. The new machines become both the model for society and its most conspicuous sign'.

Too often, then, the pervasive reliance on spatial and technological metaphors actually serves to obfuscate the complex relations between new communications and information technologies and space, place and society. In the simple, binary allegations that new technologies help us to access a new 'electronic space' or 'place', which somehow parallels the lived material spaces of human territoriality, little conscious thought is put to thinking conceptually about how new information technologies actually relate to the spaces and places bound up with human territorial life. Without a thorough and critical consideration of space and place, and how new information technologies relate to, and are embedded in them, reflections on cyberspace, and the economic, social and cultural dynamics of the shift to growing 'telemediation', seem likely to be reductionist, deterministic, oversimplistic and stale.

In this article I aim to explore some of the emerging conceptual treatments of the relationships between information technology systems and space and place. Building on my recent work with Simon Marvin on the relationships between telecommunications and contemporary cities (Graham and Marvin, 1996), and on conceptualizing telecommunications-based urban change (Graham, 1996; 1997a), I identify three broad, dominating perspectives and explore them in turn. First, there is the perspective of *substitution* and *transcendence* – the idea that human territoriality, and the space and place-based dynamics of human life, can somehow be replaced using new technologies. Secondly, there is the *co-evolution* perspective which argues that both the electronic 'spaces' and territorial spaces are necessarily produced *together*, as part of the ongoing restructuring of the capitalist political-economic system. Finally, there is the *recombination* perspective, which draws on recent work in actor-network theory. Here the argument is that a fully *relational* view of the links between technology, time, space and social life is necessary. Such a perspective reveals how new technologies become enrolled into complex, contingent and subtle blendings of human actors and technical artifacts, to form actor-networks (which are sociotechnical 'hybrids'). Through these, social and spatial life become subtly and continuously recombined in complex combinations of new sets of spaces and times, which are always contingent and impossible to generalize.

II Substitution and transcendence: technological determinism, generalized interactivity and the end of geography

Both the dominant popular and academic debates about space, place and information technologies adopt the central metaphor of 'impact'. In this 'mainstream' of social research on technology (Mansell, 1994), and in the bulk of popular and media debates about the Internet and 'information superhighway', new telecommunications technologies are assumed directly to cause social and spatial change, in some simple, linear and

deterministic way. Such technological determinism accords with the dominant cultural assumptions of the West, where the pervasive experience of 'technology is one of apparent inevitability' (Hill, 1988: 23). Here technology is cast as an essential and independent agent of change that is separated from the social world and 'impacts' it, through some predictable, universal, revolutionary wave of change. Thus, that central purveyor of cyberspace rhetoric, *Wired* magazine, proclaimed in their 1996 (pp. 43–44) 'Manifesto for the digital society' that:

> the Digital Revolution that is sweeping across society is actually a communications revolution which is transforming society. When used by people who understand it, digital technology allows information to be transmitted and transmuted in fundamentally limitless ways. This ability is the basis of economic success around the world. But it offers more than that. It offers the priceless intangibles of friendship, community and understanding. It offers a new democracy dominated neither by vested interests of political parties nor the mob's baying howl. It can narrow the gap that separates capital from labour; it can deepen the bonds between people and planet.

In terms of the 'spatial impacts' of current advances in communications technologies, two broad and related discourses have emerged from the loosely linked group of technological forecasters, cyberspace commentators and critics who found their commentaries on simple technological determinism (that is, extrapolating the 'logic' of the spatial impacts of telecommunications from the intrinsic qualities of the technologies themselves). First, there are widespread predictions that concentrated urban areas will loose their spatial 'glue' in some wholesale shift towards reliance on broadband, multimedia communications grids. Advanced capitalist societies are thus liberated from spatial and temporal constraints and are seen to decentralize towards spatial and areal uniformity. Secondly, there are debates about the development of essentially immersive virtual environments, which, effectively, allow the immersive qualities of geographical place to be transmitted remotely.

1 Areal uniformity, urban dissolution and generalized interactivity

The geographical effects on space and place of the supposedly wholesale 'technological revolution' based on new information and communications technologies become fairly easy to establish, if one follows an essentialist, cause-and-effect and deterministic logic through. As technologies of media, computing and telecommunications converge and integrate; as equipment and transmission costs plummet to become virtually distance independent; and as broadband integrated networks start to mediate all forms of entertainment, social interaction, cultural experience, economic transaction and the labour process, distance effectively *dies* as a constraint on social, economic and cultural life (*The Economist*, 1995). Human life becomes 'liberated' from the constraints of space and frictional effects of distance. Anything becomes possible anywhere and at any time (see Graham and Marvin, 1996). All information becomes accessible everywhere and anywhere. The 'logic' of telecommunications and electronic mediation is therefore interpreted as inevitably supporting geographical dispersal from large metropolitan regions, or even the effective dissolution of the city itself (Gillespie, 1992; Graham, 1997a).

Most common here is the assumption that networks of large metropolitan cities will gradually emerge to be some technological anachronism, as propinquity, concentration, place-based relations and transportation flows are gradually substituted by some universalized, interactive, broadband communications medium (the ultimate 'Information Superhighway'). To Baldwin and colleagues (1996), for example, this all-mediating

network, this technological Holy Grail of fully converged telephony, TV, media and data flow, embellished with virtual shopping and interactive video communications, is already in sight, with the trials of so-called full-service networks (FSNs) in cities like Orlando, Florida. 'We now have', they write (1996: 1),

> a vision of an ideal broadband communication system that would integrate voice, video and data with storage of huge libraries of material available on demand, with the option of interaction as appropriate. The telephone, cable, broadcast, and computer industries, relatively independent in the past, are converging to create these integrated broadband systems.

Linked to virtual reality (VR) technologies, such networks, it is argued, will provide, on-line and instantaneously, all the richness and subtlety of the immersive communications once available only through place-based interactions in urban areas. 'In urban terms', writes Pawley (1995), 'once time has become instantaneous, space becomes unnecessary. In a ''spaceless city'', the whole population might require no more than the 30 atom diameter light beam of an optical computer system.'

Such substitutionist arguments, in fact, have a long lineage. Assumptions that advances in telecommunication will 'dissolve' the city have a history as long as electronic communication itself. Caroline Marvin (1988), in her book *When old technologies were new*, recounts the many assumptions in the late nineteenth century that the seemingly fantastical technologies of the telegraph, wireless and telephone would annihilate space constraints through minimizing time constraints. Social, cultural and geographical differences were to be obliterated in the world-wide shift to ubiquitous, universally accessible telecommunication. According to Edward Bellamy, writing in 1897 (pp. 347–48), 'wherever the electric connection is carried … it is possible in slippers and dressing gown for the dweller to take his choice of the public entertainment given that day in every city of the earth'.

Three quarters of a century later, Marshall McLuhan argued that the emergence of his 'global village' meant that the city 'as a form of major dimensions must inevitably dissolve like a fading shot in a movie' (McLuhan, 1964: p. 366, quoted in Gold, 1990: p. 23). In 1968, Melvin Webber famously predicted that 'for the first time in history, it might be possible to locate on a mountain top and to maintain intimate, real-time and realistic contact with business and other societies. All persons tapped into the global communications network would have ties approximating those used in a given metropolitan region' (Webber, 1968: 1096). And the futurists Naisbitt and Aburdene, riding a wave of excited speculation in the late 1980s and early 1990s about the future 'information society', saw 'a new electronic heartland of linked small towns and cities as laying the groundwork for the decline of cities' (Naisbitt and Aburdene, 1991: 329). Anthony Pascal (1987: 602) extrapolated this logic, arguing that:

> the era of the computer and the communication satellite is inhospitable to the high density city. What once had to happen in the city can now take place anywhere. With the passage of time [will come] spatial regularity; the urban system converges on, even if never quite attains, complete areal uniformity. The newly emerging technologies will soon begin to provide excellent substitutes for face-to-face contact, the chief remaining *raison d'être* of the traditional city.

Such technologically determinist predictions also resonate surprisingly strongly with some of the more critical recent perspectives of the relationships between space, place and technological change. For example, Paul Virilio (1993), a French urban theorist and philosopher, recently suggested that a culture of 'generalized interactivity' is emerging, based on pervasive, ubiquitous and multipurpose telematics grids, through which 'everything arrives so quickly that departure becomes unnecessary' (Virilio, 1993: 8).

Such a transition, suggests Virilio, will amount to nothing less that a 'crisis in the notion of physical dimension' (1993: 9) of space, place, the region and the city. 'The archaic ''tyranny of distances'' between people who have been geographically scattered', he writes, increasingly gives way to the 'tyranny of real time ... The city of the past slowly becomes a paradoxical agglomeration in which relations of immediate proximity give way to interrelationships over distance' (Virilio, 1993: 10). Physical movement through transportation also evaporates in this schema, leaving a growing inertia, a sedentary and secluded dystopian urban landscape where

> the shift is ultimately felt in the body of every city dweller, as a *terminal citizen* who will soon be equipped with interactive prostheses whose pathological model is the 'motorized handicapped' equipped so that he or she can control the domestic environment without undergoing any physical displacement (Virilio, 1993: 11, emphasis in original).

2 'Mirror worlds', the transmission of place and world transcendence

Virilio's predictions of the evaporation of the material, physical dynamics of space and place find support in the more optimistic perspectives of 'cyber-gurus' like Nicholas Negroponte (1995) and Bill Gates (1995). Again, the substitution ethos dominates here, with the assumption that sophisticated VR technologies, switched over broadband global grids, will allow immersive, 3D environments to become so life-like that 'real' places will easily become substitutable. David Gelerntner (1991) imagined that such technological trends will lead to the construction of 'mirror worlds', immersive electronic simulations tied into real-time monitoring apparatus which would allow us to 'look into a computer screen and see reality. Some part of your world – the town you live in, the company you work for, your school system, the city hospital – will hang there in a sharp colour image' (Gelerntner, 1991: 1; see also Graham, 1998). More recently Nicholas Negroponte (1995: 165), Director of MIT Media Lab, asserts that:

> digital living will include less and less dependence upon being in a specific place at a specific time, and the transmission of place itself will start to become possible. If I could really look out the electronic window of my living room in Boston and see the Alps, hear the cowbells, and smell the (digital) manure in summer, in a way I am very much in Switzerland.

Such technologically evangelistic debates about 'digital living' therefore suggest that we are on the verge of accessing a technological infrastructure which will do little less than provide some single, immersive system to mediate all aspects of human life. The implication is that the very concepts of material space, place and time, and the body, will be rendered problematic, even obsolete. We will shed, as Benedikt (1991) put it, the 'ballast of our materiality', escaping the physical, corporeal domains of the body, the territorial earth, and space and time in the process (Slouka, 1995: 25). Human societies, cultures and economies are seen simply to *migrate* into the electronic ether, where identities will be flexibly constructed, any services might be accessed, endless fantasy worlds experienced and any task performed, from any location and at any time, by human agents acting *inside* the limitless domains of constructed electronic environments.

Presumably, as human life becomes more and more dominated by what Thu Nguyen and Alexander (1996: 117) call 'participation in the illusion of an eternal and immaterial electronic world', the material world of space and place would become gradually eviscerated. Pascal's shift towards 'complete areal uniformity', of homes and buildings providing equally-spaced entry points into the pure and liberating cyberspace realm, would be underway. Many cyberspace enthusiasts do, indeed, proclaim the need for

what Schroeder (1994) has termed 'world rejection'. Here cyberspace is seen to offer an *alternative* territoriality, an infinitely replenishable and extendible realm of spatial opportunity that counters the finitudes and problems of the increasingly crowded and problematic material spaces on earth. Don Mapes, for example, urges us 'to do away with our territoriality'. To him, 'the good news is: cyberspace is big. It's basically infinite. Earth is limited, it's finite. In cyberspace, if you don't like it, you can move onto the next frontier. There's always another continent in cyberspace' (Mapes, 1994, in Channel 4, 1994).

Of course, the foundations for such technological Utopianism, and determinism, are woven deeply into the very cultural roots of modern capitalist society (Marvin, 1988; Smith and Marx, 1995). Discourses of modernity and 'progress' have been widely constituted through technological promises of brave new worlds with universal, beneficent, totalizing shifts and secular technological Utopias variously promulgated by pulp science fiction, comic books, futurists, architects and 'city of the future' visionaries, advertisers and technology firms (Corn and Horrigan, 1984). The context of global environmental and social crises, as Hayles points out, merely accentuates the long-standing existential temptations to construct and believe in simple technological panaceas and escapes. 'In a world despoiled by overdevelopment, overpopulation, and time-release environmental poisons', she writes, 'it is comforting to think that physical forms can recover their pristine purity by being reconstituted as informational patterns in a multidimensional computer space. A cyberspace body, like a cyberspace landscape, is immune to blight and corruption' (Hayles, 1993: 81, cited in Robins, 1995: 138).

III Co-evolution: the parallel social production of geographical space and electronic space

The strong leaning of contemporary technological discourse towards substitution and transcendence perspectives, I would argue, tends to perpetuate little but dangerous myth and fallacy. In proffering new technologies as some complete and simple *substitutes* for the material body, the social world, and for space and place, its proponents do little to advance understanding of the complex *co-evolutionary* processes linking new information technologies and space, place and human territoriality. In allocating technologies almost magical transformative powers, in implying the easy emergence of universal social and spatial access to computer networks, and in radically overestimating the degree to which such networks can simply substitute for, and transcend, place-based, face-to-face interaction, Kevin Robins (1995: 139) has argued that they say more about their own (usually masculine) 'omnipotence fantasies' than about how complex combinations of place-based and telemediated interactions co-evolve. As he suggests, such perspectives rest on a

> common vision of a future that will be different from the present, of a space or a reality that is more desirable than the mundane one that presently surrounds and contains us … All this is driven by a feverish belief in transcendence; a faith that, this time around, a new technology will finally and truly deliver us from the limitations and frustrations of this imperfect world' (Robins, 1995: 135).

Fortunately, however, a much more sophisticated understanding has been developed recently through our second broad perspective which explores how the social production of electronic networks and 'spaces' *co-evolves* with the production of material spaces and places, within the same broad societal trends and social processes (see Mosco, 1996:

173–211). Three strands of work have emerged here: analysing the articulation between place-based and telemediated relationships; addressing the linkages between telecommunications and the city; and theoretically analysing the broader roles that new telecommunications and information technologies play in supporting the production of new types of spatial arrangements.

1 Articulations between place-based and telemediated relationships

Rather than assuming some simple substitutional relationship, our second perspective suggests that complex *articulations* are emerging between interactions in geographical space and place, and the electronic realms accessible through new technologies. The argument here is that, because cyber-evangelists are naively obsessed with the abstract *transmissional* capabilities of information technologies, technologically determinist debates usually neglect the richness and embeddedness of human life within space and place. Sawhney (1996: 309) criticizes the 'very transmission-oriented view of human communication [in cyberspace debates]. The purpose of human communication is reduced to transfer of information and the coordination of human activity. The ritual or the communal aspect of human communication is almost totally neglected'.

Technologically determinist commentators are accused of failing to appreciate the social, cultural and economic dynamics of place and space that cannot be simply telemediated no matter how broadband, 3D or immersive the substitutes. Quite the reverse, in fact, because the human construction of space and place is seen actually to ground and contextualize applications and uses of new technologies. 'The urban world networked by [Bill] Gates' technologies ''strung out on the wire'', argues Denis Cosgrove (1996: 1495), 'is not disconnected, abstract, inhuman; it is bound in the places and times of actual lives, into human existences that are as connected, sensuous and personal as they ever have been'. Kevin Robins (1995: 153) believes that 'through the development of new technologies, we are, indeed, more and more open to experiences of de-realization and de-localization. But we continue to have physical and localized existences. We must consider our state of suspension between these two conditions'.

2 Telecommunications and the city

This 'state of suspension' or articulation between place-based and electronically mediated realms is especially evident in the contemporary metropolis, which, despite some trends towards the decentralization of routine service functions (OTA, 1995), shows no sign of simple, wholesale evisceration. Globally, urbanization trends are unmatched in history in their intensity; the global urban system continues to dominate the planet economically, politically, socially and culturally; transportation flows and demands are spiralling at every scale; and even the large industrial cities in the UK and USA that recently were shedding population are showing some signs of an (albeit patchy) economic and cultural renaissance, and demographic turn round. In short, new communications technologies are not simply substituting for the experience of, or reliance on, metropolitan places. Rather, a complex co-evolution, articulation and synergy between place-based and telemediated exchange seem to be emerging. Ron Abler (1995: 3) rebels 'instinctively ... against the notion that a digitally-created version of real place constitutes an acceptable substitute for the real thing'. Equally possible, he feels, is the emergence of *place virtuality* where urban residents are able to 'tap into the

digitally-available resources of the world to enrich reality in real places. By its very nature, virtual reality implies the possibility if not the probability of real virtuality' (Abler, 1995: 3).

Drawing on McLuhan, Castells (1996: 373) similarly posits that the new, integrated media systems will bring with it what he calls a 'culture of real virtuality' drawing diverse participants and fragmented communities into new symbolic environments in which 'reality itself (that is, people's material/symbolic existence) is entirely captured, fully immersed in a virtual image setting, in the world of make believe, in which appearances are not just seen on the screen through which experience is communicated, but they become the experience'. While increasingly encompassing, however, such exchanges do not simply substitute for place-based material social worlds. Rather, they embody complex global–local articulations between the 'space of places' and the 'space of flows' (Castells, 1996: 423–28).

After all, as with television, radio and printing technologies, any cursory examination of the Internet and World Wide Web shows that much of the traffic actually *represents and articulates* real places and spaces, supporting and generating physical mobility, tourism, transport and trips for the highly mobile, élite groups that currently use it in the process. Fast-growing so-called 'virtual cities', for example, help to ground and integrate the Web activities within a particular metropolitan area. This adds coherence and legibility to the otherwise chaotic interplay between the Internet and urban space, allowing electronic spaces to be articulated to feed back positively on to the development dynamics of particular cities (see Graham and Aurigi, 1997).

As I show with Simon Marvin in a recent book (Graham and Marvin, 1996), cyberspace is, in fact, a predominantly metropolitan phenomenon which is developing *out of* the old cities. In terms of hard infrastructural investment, demand for services and rates of innovation, the largest, globally orientated metropolitan areas are clearly maintaining their dominance. Thus, while New York has around 7% of the USA population, 35% of all outgoing USA international calls start there. While London has 17% of the UK population, 30% of all UK mobile phone calls are made there. And while Paris has 16% of the French population, it commands 80% of all investment in telecommunications infrastructure in France (Graham and Marvin, 1996: 133).

The work of Jean Gottmann (1982) has clearly demonstrated that the incorporation of computer networks into the economic, administrative and sociocultural dynamics of the city merely intensifies and adds further capability to the older functions of the post, the telegraph and the telephone. The maintenance of control over ever-more complex urban and regional systems, straddling ever-larger distances, and spread over larger and larger metropolitan corridors and regions, becomes possible. Rather than simply substituting or revolutionizing the city, and flows of people and material goods, the evidence suggests that new technologies actually diffuse into the older urban fabric offering potential for doing old things in new ways. Urban transportation and infrastructure systems can be managed and controlled more precisely, improving capacity. Telecommunications co-evolve with transportation and physical flows, sometimes replacing (telebanking for branch networks, email for post), sometimes generating (travel TV programmes and conference and retail adverts), and sometimes enhancing transport capability (automatic route guidance) (see Graham and Marvin, 1996). The extending and intensifying grids of travel, trade and tourism actually rely on the enhanced control and co-ordination capacities of IT at every stage and scale. For example, 50 000 electronic exchanges of all sorts are estimated to lead up to one flight of a Boeing 747. And within cities, new

technologies allow the time and space limits surrounding consumption, work, entertainment, social networks and travel to be managed more flexibly. Thus, the spaces of the city may be constructed within a broader, and more complex, urban field networked together by more sophisticated, integrative technological networks (Boyer, 1996).

New information technologies, in short, actually resonate with, and are bound up in, the active construction of space and place, rather than making it somehow redundant. William Mitchell's notion of 'recombinant architecture' is especially relevant here, because it demonstrates how constructed and produced material spaces are now being infused with cyberspace 'entry points' of all kinds (Mitchell, 1995). Material space and electronic space are increasingly being produced together. The power to function economically and link socially increasingly relies on constructed, place-based, material spaces intimately woven into complex telematics infrastructures linking them to other places and spaces. 'Today's institutions', argues Mitchell (1995: 126), 'are supported not only by buildings but by telecommunications and computer software.' Thus the articulation between widely stretched telematics systems, and produced material spaces and places, becomes the norm and is a defining feature of contemporary urbanism. 'Constructed spaces', he suggests,

> will increasingly be seen as electronically-serviced sites where bits meet the body – where digital information is translated into visual, auditory, tactile or otherwise sensorily perceptible form, and vice versa. Displays and sensors for presenting and capturing information will be as essential as doors (Mitchell, 1994).

Bookstores, libraries, universities, schools, banks, theatres, museums and galleries, hospitals, manufacturing firms, trading floors and service providers increasingly become embodied through their presence in both material spaces and electronic spaces. While some substitution is evident – for example, with the closure of banking branches paralleling the growth of telebanking – much of the traditional, nonroutine face-to-face activity within constructed spaces, and the transportation that supports it, seems extremely resilient to simple substitution. In other words, the contemporary city, while housing vast arrays of telematic 'entry points' into the burgeoning worlds of electronic spaces, is a cauldron of emotional and personal worlds and attachments, an engine of reflexivity, trust and reciprocity (Amin and Graham, 1998).

The usefulness of the co-evolution perspective is that it underlines the fact that materially constructed urban places and telecommunications networks stand in a state of *recursive interaction*, shaping *each other* in complex ways that have a history running back to the days of the origin of the telegraph and telephone (and as the continued urban dominance of telecommunications investment and use makes clear; see Thrift, 1996a). Major urban places support dense webs of face-to-face 'co-presence' that cannot – and will not – be simply mediated by telecommunications (Boden and Molotch, 1994). This is because they are vital supports to high-level business activities in a risky and volatile global economy (Storper, 1996); because the new urban culture relies on them; and because face-to-face social life derives from them.

The complex articulations between the local and global dynamics of both material places and electronic spaces have recently been explored by Staple (1993). He believes that the Internet and other communications technologies, far from simply collapsing spatial barriers, actually have a dialectic effect, helping to compress time and space barriers while, concurrently, supporting a localizing, fragmenting logic of 'tribalization'. Far from unifying all within a single cyberspace, the Internet, he argues, may actually enhance the commitment of different social and cultural interest groups to particular material places and electronic spaces, thus constituting a 'geographical explosion of

place' (Staple, 1993: 52). This 'new tribalism', exemplified by the use of the Internet to support complex diasporas across the globe, and to draw together multiple, fragmentary special interest groups on a planetary basis, 'folds' localities, cities and regions into 'the new electronic terrain' (Staple, 1993: 52).

But it is important to stress that the ways in which places become enmeshed into globally stretched networks like the Internet will be a diverse, contingent process. A wide diversity of relations seems likely to exist between the urban structures and systems, and indeed the particularities of culture, of different spaces and the growth of telemediated interaction. Bolter (1995: 2) speculates on the diversity of the diverse configurations linking urban form with cyberspace:

> Perhaps the Japanese will construct cyberspace as an extension of their dense urban corridors. On the other hand, people can live in the suburbs and participate in cyberspace from their homes, as many Americans do now. Or, as Americans do, they can commute between one cyberspace location in the workplace (a corporate communications system) and another in their homes (American Online). Thus cyberspace can be a reflection of the American suburbs and exurbs, the Japanese megacities, or the European combination of large and medium-sized cities. Cyberspace need not be the uniform entity suggested by the current metaphor popular in the United States the 'information superhighway.

3 Telecommunications, 'spatial fixes' and the production of space

Theoretical perspectives drawing on critical political economy serve to exemplify further the ways in which new telecommunications systems are materially bound up with the production of complex new social and economic geographies. Reacting against the all-encompassing and overgeneralized concepts of the 'global village' and 'time-space compression', Scott Kirsch (1995: 544, emphasis in original) argues that 'by resorting to the rather cartoonish shrinking world metaphor, we lose sight of the complex relations ... between capital, *technology*, and space, through which space is not ''shrinking'' but rather must be perpetually recast'.

While new information and telecommunications technologies support more flexibility in the way production interests, services and media firms, tourists and investors treat space, they do not herald some simple shift to a world of pure, absolute mobility. Rather, time and space barriers become reconstituted and reformed within global geometries of flow, incorporation and exclusion. 'The mobility of commerce, organisations, information and people does not make time and space irrelevant, rather, it highlights the extent to which these areas of experience have become more, not less, multi-layered, interrelated, and complex' (Ferguson, 1992: 79). Places become increasingly shaped and constructed through their incorporation into powerful, corporate networks of flows and exchange. Far from leading to some areal homogeneity, as in some substitutionist visions, such a logic accords asymmetric power to global transnational corporations (TNCs) to scrutinize and exploit the exact locational attributes of places, as they strive to piece together seamlessly integrated, and ever more fine-grained international divisions of labour (Castells, 1989).

Perhaps the clearest exploration of how telecommunications become woven in to the production of new geographical landscapes of production, consumption and distribution at all spatial scales comes from Eric Swyngedouw (1993: 305). Building on the work of Harvey (1985), he argues that every social and economic activity is necessarily geographical. It is '*inscribed in space and takes place*' (emphasis in original). Human societies 'cannot escape place in the structuring of the practices of everyday life' (p. 305). Within an internationalizing economy, capitalist firms and governments must continually

struggle to develop new solutions to the tensions and crisis tendencies inherent within capitalism, between what David Harvey calls 'fixity' and the need for 'motion', mobility and the global circulation of information, money, capital, services, labour and commodities (Harvey, 1985). Currently, such tensions and crises arise because increasingly widely dispersed areas of production, consumption and exchange, befitting of the internationalizing economy, need to be integrated and co-ordinated into coherent economic systems. Space thus needs to be 'commanded' and controlled, on an increasingly international scale.

To do this, relatively immobile and embedded fixed transport and telecommunications infrastructures must be produced, linking production sites, distribution facilities and consumption spaces that are tied together across space with the transport and communications infrastructure necessary to ensure that a spatial 'fix' exists that will maintain and support profitability. Without the elaboration of ever more sophisticated and globally stretched transport and communications infrastructures, Harvey (1993: 7) argues that 'the tension between fixity and mobility erupts into generalized crises, when the landscape shaped in relation to a certain phase of development ... becomes a barrier to further [capital] accumulation'. Thus, new telecommunications networks 'have to be immobilised in space, in order to facilitate greater movement for the remainder' (Harvey, 1985: 149). Swyngedouw (1993: 306) elaborates:

> A communications line ... liberates actions from place and reduces the friction associated with distance and other space-sensitive barriers. However, such transportation and communications organisations can only liberate activities from their embeddedness in space by producing new territorial configurations, by harnessing the social process in a new geography of places and connecting flows ... In short, liberation from spatial barriers can only take place through the creation of new communications networks, which in turn, necessitates the construction of new (relatively) fixed and confining structures.

Crucially, then, the political economic perspective underlines that the development of new telecommunications infrastructures is not some value-neutral, technologically pure process, but an asymmetric social struggle to gain and maintain social power, the power to control space and social processes over distance. As any investigation of, say, the growth of global financial centres, or the extending global coverage of corporate telematics networks will soon discover, power over space and power over telecommunications networks go hand in hand. For example, Graham Murdock draws the striking parallel between the 'fortress effect' generated by many postmodern office buildings, and the development of vast, private 'dataspaces' on corporately controlled networks. He argues (1993: 534) that 'here, as in territorial space, continuous battle is being waged between claims for public access and use, and corporate efforts to extend property rights to wider and wider areas of information and symbolization'.

By demystifying, and unpacking, the social and power relations surrounding telecommunications and the production of space, the political economic perspective does much to debunk the substitutionist myths of technological determinism discussed above. It allows us to reveal the socially contingent effects of new technologies, the way they are enrolled into complex social and spatial power relations and struggles, and the ways in which some groups, areas and interests may benefit from the effects of new technologies, while others actually lose out. Thus, 'the increased liberation and freedom from place as a result of new mobility modes for some may lead to the disempowerment and relative exclusion for others' (Swyngedouw, 1993: 322).

An excellent example of this is the current transformation of utility markets, under pressures of competition and liberalization, and the experiences of consumers at different

ends of the market (Graham, 1997b). On the one hand, affluent consumers will have 'smart meters' which use telematics to allow them to access supplies for many, distant, competitors in a 'virtual market' for energy, from the comfort of their own homes. On the other, over 4 million poorer UK electricity consumers have already had their electro-mechanical utility meters turned into electronic 'prepayment' meters. These lock consumers into one supplier and need to be 'topped up' electronically before use, necessitating a physical journey to the post office – a major problem for many with already poor mobility, health problems, and poor physical services.

Building on Giddens' (1990) work on time-space distanciation, Paul Adams (1995) uses the concept of 'personal extensability' to capture how a subject's (telemediated and physical) access to distant spaces, services and places may allow him or her to extend his or her domination over excluded groups and so support the production of divided spaces and cities. 'One person's (or group's) time-space compression', he writes, 'may depend on another person's (or group's) persistent inability to access distant places.' As Adams states, 'the variation of extensability according to race, class, age, gender, and other socially-significant categories binds micro-scale biographies to certain macro-level societal processes' (Adams, 1995: 268; see Massey, 1993: 66).

Thus, within cities, forms of 'telematics super-inclusion' (Thrift, 1996b) emerge for élite groups, who may help shape cocooned, fortified, urban (often now walled) enclosures, from which their intense access to personal and corporate transport and telematics networks allows them global extensability. Meanwhile, however, a short distance away, in the interstitial urban zones, there are 'off-line' spaces (Graham and Aurigi, 1997), or 'lag-time places' (Boyer, 1996: 20). In these, often-forgotten places, time and space remain profoundly real, perhaps *increasing*, constraints on social life, because of welfare and labour market restructuring and the withdrawal of banking and public transport services. It is easy, in short, to overemphasize the mobility of people and things in simple, all-encompassing assumptions about place-transcendence (Thrift, 1996c: 304), which conveniently ignore the splintering and fragmenting reality of urban space.

To Christine Boyer (1996: 20), the highly uneven geography of contemporary cities, and the growing severing of the 'well designed nodes' of the city from the 'blank, in-between places of nobody's concern', allows fortunate groups to 'deny their complicity' in the production of these new, highly uneven, material urban landscapes. But perhaps the most extreme example of the complex interweaving of new technologies, power relations, and the production of space and place comes with the small, élite group who run the global financial exchanges in world cities. Here, we find that 'the extensible relations of a tiny minority in New York, London, and Tokyo, serve to control vast domains of the world through international networks of information retrieval and command' (Adams, 1995: 277).

IV Recombination: actor-network theory and relational time-spaces

Our third and final perspective takes such *relational* views of the social construction of technology further. Anchored around the actor-network theories of Michel Callon (1986; 1991) and Bruno Latour (1993), and drawing on recent theorizations of Donna Haraway on the emergence of blended human-technological 'cyborgs' (or 'cybernetic organisms' – see Haraway, 1991), a range of researchers from the sociology of science, science, technology and society, cultural anthropology and, increasingly, geography have recently

been arguing for a highly contingent, relational perspective of the linkage between technology and social worlds. Actor-network theory emphasizes how particular social situations and human actors 'enrol' pieces of technology, machines, as well as documents, texts and money, into 'actor-networks'.

The perspective is fully relational in that it is 'concerned with how all sorts of bits and pieces; bodies, machines, and buildings, as well as texts, are associated together in attempts to build order' (Bingham, 1996: 32). Absolute spaces and times are meaningless here. Agency is a purely relational process. Technologies only have contingent, and diverse, effects through the ways they become linked into specific social contexts by linked human and technological agency. What Pile and Thrift (1996: 37) call a 'vivid, moving, contingent and open-ended cosmology' emerges. The boundaries between humans and machines become ever more blurred, permeable and cyborgian. And 'nothing *means* outside of its relations: it makes no sense to talk of a ''machine'' in general than it does to talk of a ''human'' in general' (Bingham, 1996: 17). Nigel Thrift (1996a: 1468) summarizes the approach:

> no technology is ever found working in splendid isolation as though it is the central node in the social universe. It is linked – by the social purposes to which it is put – to humans and other technologies of different kinds. It is linked to a chain of different activities involving other technologies. And it is heavily contextualised. Thus the telephone, say, at someone's place of work had (and has) different meanings from the telephone in, say, their bedroom, and is often used in quite different ways.

This linkage of heterogeneous technological elements and actors, strung across distance, is thus seen as a difficult process requiring continuing efforts to sustain relations which are 'necessarily *both* social and technical' (Akrich, 1992: 206). The growing *capabilities* of telecommunications, for supporting action at a distance and remote control, do not therefore negate the need for the human actors which use them to struggle to enrol passive technological agents into their efforts to attain real, meaningful remote control. 'Stories of remote control tend to tell of the sheer amount of work that needs to be performed before any sort of ordering through space becomes possible' (Bingham, 1996: 27). Such 'heterogeneous work involving programmers, silicon chips, international transmission protocols, users, telephones, institutions, computer languages, modems, lawyers, fibre-optic cables, and governments to name but a few, has had to be done to create envelopes stable enough to carry [electronic information]' (Bingham, 1996: 31).

Thus there is not one single, unified cyberspace; rather, there are multiple, heterogeneous networks, within which telecommunications and information technologies become closely enrolled with human actors, and with other technologies, into systems of sociotechnical relations across space. As Bingham (1996: 32) again argues, 'the real illusion is that cyberspace as a singular exists at all', rather than as an enormously varied 'skein of networks' (Latour, 1993: 120) straddling, linking and weaving through different spaces. Thus, we need to consider the diverse, and interlinked, physical infrastructures of information technologies (cable, public switched telephone networks, satellite, mobile, microwave, Internet grids, transoceanic optic fibres, etc.), and how they support the vast panoply of contingent actor-networks.

'Cyberspace' therefore needs to be considered as a fragmented, divided and contested multiplicity of heterogeneous infrastructures and actor-networks. For example, there are tens of thousands of specialized corporate networks and intranets. The Internet provides the basis for countless Usenet groups, Listservers, corporate advertising sites, specialized Web sites, multi-user dungeons (MUDs), corporate intranets, virtual communities and increasingly sophisticated flows of media and video. Public switched telephone networks

(PSTNs) and the many competing telecoms infrastructures support global systems of private automatic teller machine (ATM) networks, credit card and electronic clearing systems, as well as blossoming applications for CCTV, tele-health, teleshopping and telebanking, global logistics, remote monitoring, back office and telesales flows, electronic data interchange (EDI), electronic financial transactions and stock market flows, as well as data and telephony flows. And specialized systems of satellite, broadband, cable and broadcasting networks support burgeoning arrays of television flow. Each application has associated with it whole multiplicities of human actors and institutions, who must continually struggle to enrol and maintain the communications technologies, along with other technologies, money and texts, into producing some form of functioning social order. These, and the hundreds of other actor-networks, are always contingent, always constructed, never spatially universal, and always embedded in the microsocial worlds of individuals, groups and institutions. Such sociotechnical networks 'always represent geographies of enablement and constraint' (Law and Bijker, 1992: 301); they always link the local and nonlocal in intimate relational, and reciprocal, connections.

Such a fully relational perspective has important implications for the ways in which we conceptualize place, space and time. For actor-network theory suggests that, rather than simply being space and time *transcending* technologies, telecommunications systems actually act as technological networks within which new spaces and times, and new forms of human interaction, control and organization are continually constructed (Latour, 1987).

Similarly relational rather than absolute theories of time-space are rapidly gaining influence in geography and urban studies (Harvey, 1996: Thrift, 1996a). The unthinking acceptance within urban studies that time and space act simply as objective, unvariant, external containers for the urban scene is now collapsing (Harvey, 1996: 256). Harvey draws on Whitehead's relational theories to suggest that the heterogeneous experience and construction of time within cities is a very real phenomenon. 'Multiple processes', he writes, 'generate multiple *real* as opposed to Leibniz's ideal differentiation in spatio-temporalities' (Harvey, 1996: 259, emphasis in original). Crucially for the conceptualization of place is his notion of 'cogredience' or 'the way in which multiple processes flow together to construct a single consistent, coherent, though multi-faceted time-space system' (Harvey, 1996: 260–61). Thus 'place' becomes an embedded and heterogeneous range of time-space processes; neighbourhoods, cities and regions, by implication, 'cannot be examined independently of the diverse spatio-temporalities such processes contain' (Harvey, 1996: 263–64). As Nigel Thrift (1996a: 2) puts it, drawing on his long-standing work on time geography (Thrift *et al.*, 1978), 'time is a multiple phenomenon; many times are working themselves out simultaneously in resonant interaction with each other.'

The continual recombination of the world, within actor-networks and their specific 'different spaces and different times', is possible because the Internet and other information and communications systems are based on 'technological networks'; these, despite the rhetoric of universality, are always specific and contingent in linking one place to another. To Latour (1993: 177–18), such technological networks

> are composed of particular places, aligned by a series of branchings that cross other places and require other branchings in order to spread. Between the lines of the network there is, strictly speaking, nothing at all: no train, no telephone, no intake pipe, no television sets. Technological networks, as the name suggests, are networks thrown over spaces, and they retain only a few scattered elements of those spaces. They are connected lines, not surfaces. They are by no means comprehensive, global or systematic, even through they embrace surfaces without covering them, and extend a very long way.

The merit of the actor-network perspective is the way it articulates human-technological recombinations and relationships through a rich, contextual, mapping which avoids essentializing sociotechnical relations. As an analytic perspective it helps to capture the complex and multiple relational worlds supported by information technologies. Its emphasis on sociotechnical 'hybrids' further underlines the growing difficulties of easily separating something called the 'social' (or, for that matter, the 'spatial') from the 'technological'. Rather than hypothesizing macrolevel technological 'revolutions' it stresses multiple, contingent worlds of social action, underlining the difficulties involved in achieving social ordering 'at a distance' through enrolling complex arrays of technological artifacts. In it humans emerge as more than just subjects whose lives are to be 'impacted'; as more than bit-players within macrolevel processes of global structural change. Actor-network theory underlines forcefully that 'living, breathing, corporeal human beings arrayed in various creatively improvised networks of relation still exist as something more than machine fodder' (Thrift, 1996a: 1466).

Work by Thrift (1996a; 1996b; 1996c) has used actor-network theory to show how highly concentrated urban spaces like the City of London, far from suffering some simple dissolution, have, over the past century, actually been continually recombined with new technological networks: the telegraph, telephone and, most recently, the telematics trading system. Such new technologies, he writes, do not produce some 'abstract and inhuman world, strung out on the wire' (Thrift, 1996a: 1480); they are subtly recombined with the spatial and social practices of workers and managers, operating within the complex, material and social spaces of the City.

Often, the use of faster and faster telematics systems actually *increases* the demands for face-to-face contact so that the interpretive loads surrounding information glut can be dealt with rapidly and competitively. 'The major task in the information spaces of telematic cities like the City of London', writes Thrift (1996a; 1481), 'become interpretation and, moreover, interpretation *in action* under the pressure of real-time events'. Thus the production of new material spaces, and the social practices that occur in them, is neither some technological cause-and-effect, nor some simple political-economic machination. Rather, it is

> the hybrid outcome of multiple processes of social configuration processes which are specific to particular differentially-extensive actor-networks (made up of people and things holding each other together) and generate their own space and own times, which will sometimes, and sometimes not, be coincident. There is, in other words, no big picture of the modern City to be had but only a set of constantly evolving sketches (Thrift, 1996a: 1485).

V Conclusions: space, place and technologies as relational assemblies

Two clear conclusions for how we might address the linkages between space, place and information technology emerge from our discussion of the three broad substitution, co-evolution and recombination perspectives.

First, we need to be extremely wary of the dangers of adopting, even implicitly, deterministic technological models and metaphors of technological change. The choice of words here is important. For example, the very notion of a technological 'impact', so long a central feature of mainstream technological debates in urban and regional studies (e.g., Brotchie *et al.*, 1987), is problematic, because of its attendant implications of simple, linear, technological cause and societal effect. In their extreme form, deterministic approaches deliver little but the 'logic' of apparent technological inevitability, naive

assumptions about simple, cause-and-effect, social and spatial 'impacts', and even messianic and evangelistic predictions of pure, technological salvation.

The co-evolution perspective teaches us that such perspectives fail to capture the ways in which new technologies are inevitably enrolled into complex social power struggles, within which *both* new technological systems and new material geographical landscapes are produced. The recombination perspective, on the other hand, teaches us that such broad-brush transition and 'impact' models ignore the full, contingent and relational complexity surrounding the social construction of new technologies, within and between specific places. It argues powerfully that, outside such contingencies, the meaning and effects of new information technologies can never be fully understood or simply generalized. To draw again on Thrift's (1996a: 1474) recent work:

> seen in this light, electronic communications technologies are no longer an economic, social or cultural earthquake, but rather a part of a continuing performative history of 'technological' practices, a complex archive of stances, emotions, tacit and cognitive knowledges, and presentations and re-presentations, which seek out and construct these technologies in certain ways rather than others.

Secondly, however, we need to be equally wary of the dangers of adopting simplistic concepts of *space* and *place*. Following the arguments of such authors as Giddens (1979), Massey (1993) and Harvey (1993; 1996) we need to reject the extremely resilient 'Euclidean' notions, still implicitly underlying many treatments of the geographies of information technology, that treat spaces and places simply as bounded areas, as definable, Cartesian spatial objects, embedded within some wider, objective framework of time-space. As Doreen Massey (1993: 66) suggests, places need to be defined *in relational terms, too*, as 'articulated moments in networks of social relations and understandings' rather than as 'areas with boundaries around'.

The message, then, is clear. Only by maintaining linked, relational conceptions of *both* new information and communications technologies *and* space and place will we ever approach a full understanding of the inter-relationships between them. For Latour's 'skein of networks' (1993: 120) involves *relational assemblies* linking technological networks, space and place, and the space and place-based users (and nonusers) of such networks. Such linkages are so intimate and recombinatory that defining space and place separately from technological networks soon becomes as impossible as defining technological networks separately from space and place.

The example of the contemporary city helps illustrate the point. Here, propinquity in material space has no *necessary* correlation with relational meaning, as was always assumed with the social physics concept of 'distance decay', with positivist urban simulations like the gravity model, and with many traditional planning treatments of the unitary, integrated city (Webber, 1964). Complex place and transport-based relational meanings – such as access to physical infrastructure, property, labour markets, an 'innovative milieu', social interaction and the use of cultural facilities – are constantly being recombined with local and nonlocal relational connections, accessed via technological networks (telecommunications, long-distance transport networks and, increasingly, long-distance energy supplies too).

The 'urban' thus can now be seen as a locus for many sociocultural, economic, and institutional networks and practices, spread out over diffuse and extended regions, and mediated by complex combinations of physical 'copresence' and technological mediation (see Healey *et al*., 1995). In some, the interlinkage and superimposition within physical urban space form meaningful nodes and connections – economic, social, cultural, physical. In others, the place-based relations are outweighed by the technologically

mediated links to far-off places. Thus, neighbours may or may not know each other's names and have meaningful social relations. Adjacent firms may or may not create meaningful linkages (adjacent back offices are likely to be tied intimately into their own distant corporate telematics networks but poorly linked to each other). Urban public spaces may or may not emerge as common cultural arenas in their articulations with global media flows and exchanges. Complex, subtle and contingent, combinations of electronic propinquity in the 'nonplace urban realm' (Webber, 1964) and place-based relational meanings based on physical propinquity and transport therefore need to be considered in parallel.

Such recombinations of 'technology' and 'place' represent merely the latest processes of urbanism and not some simple post-urban shift (Graham and Marvin, 1996). 'Cities cannot be seen as places which are leaking away into space of flows', writes Thrift (1996b: 6).

> This is to fundamentally misunderstand the ways in which new information technologies have normally acted as a supplement to human communication rather than as a replacement. Innovations like the telephone, the fax, and the computer are used to extend the range of human communication, rather than act as a substitute. It is not either/or but both/and.

Complex relational webs emerge here. As the global financial networks linking London, Paris or New York, or the TGV train networks linking Paris and the French provincial capitals demonstrate, the technological networks that support these distant linkages, while always local and always embedded in space and place, may actually provide 'tunnel effects' which bring certain spaces and places closer together, while pushing physically adjacent areas further away (Graham and Marvin, 1996). The global divisions of labour and telecommunications networks of transnational corporations (TNCs) provide another perfect example. For, as Paul Adams (1995: 277) suggests, 'in this milieu of globalization, the buildings housing the various functions of a transnational corporation [headquarters, control, research and development, manufacture, etc.], although dispersed around the globe, are intimately connected, yet they may have little or no connection with offices or housing that are directly adjacent'.

The relationships between the USA, UK and Japanese urban systems to the global financial capital that is sited within their nation are characterized by similar network–territory tensions. Some of the world's most sophisticated telematics networks now underpin such cities, linking them, 24 hours a day, through trillions of dollars of submillisecond global financial transactions, into a global financial marketplace (and, not uncoincidentally, the hubs of the global airline systems). One *individual office building* in Wall Street, New York, houses a computer system which supports global electronic financial trading of $1 trillion per day (UNRISD, 1995). Meanwhile, however, the immediate, provincial 'hinterlands' and domestic urban systems surrounding global financial capitals often fail to integrate closely into such global technological networks, despite the fact that they actually pass materially through or by them. Such relational actor-networks strewn across the planet mean, effectively, that 'the centres of two cities are often for practical purposes closer to each other than to their own peripheries' (Mulgan, 1991: 3).

But while cities are often spreading out to be vast, multicentred urban regions linked into global networks, place-based relational webs that rely on adjacency, propinquity and physical flows remain central to the experience of human social, economic and cultural life. The two rely on each other; they recursively interact. For, as Storper (1996) suggests, shifts towards growing reliance on telemediated information, image, electronic

transactions and financial flow, as well as the continuing importance of fashion, art, the media, dance, consumption, leisure, research, play, collective consumption, travel, tourism, education and governance (Thrift, 1996b), place a premium on reflexivity, interpretation and innovation – the key assets of urban areas. As he argues, 'the worlds of action which make up the [reflexive] city economy and society are hybrids, constrained by the machine-like forces of late modern capitalism, but themselves enabled by the ways that system not only permits, but in certain ways, thrives on social reflexivity' (Storper, 1996: 32).

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