

TELECOMMUNICATIONS AND THE CITY

Telecommunications and the City provides the first critical and state-of-the-art review of the relations between telecommunications and all aspects of city development and management.

Drawing on a range of theoretical approaches and a wide body of recent research, the book addresses key academic and policy debates about technological change and the future of cities with a fresh perspective. Through this approach the complex and crucial transformations underway in cities in which telecommunications have central importance are mapped out and illustrated. Key areas where telecommunications impinge on the economic, social, physical, environmental and institutional development of cities are illustrated by using boxed extracts and a wide range of case study examples from Europe, Japan and North America.

Rejecting the extremes of optimism and pessimism in current hype about cities and telecommunications, *Telecommunications and the City* offers a sophisticated new perspective through which city—telecommunications relations can be understood. It will be of interest to students and researchers in urban studies, planning, urban geography, sociology, public administration, communications and technology studies.

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**TELECOMMUNICATIONS
AND THE CITY**

electronic spaces, urban places

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PREFACE

This book explores the complex and poorly understood set of relationships between telecommunications and the development, planning and management of contemporary cities. It provides a new interdisciplinary and international perspective on how remarkable advances in telecommunications affect all aspects of urban development: social, economic, physical, environmental, geographical and governmental. This book represents the first attempt to provide such a broad and synoptic approach to fill the gap left by the long neglect of telecommunications in urban studies and policy-making.

Because of this neglect, the book's 'journey' through the most important types of city—telecommunications relations is analogous to an early expedition into largely uncharted territory. This journey is assisted only by a highly imperfect map; there are many gaps and areas of poorly understood territory. This is because the study of telecommunications in cities remains so immature, but it is also due to the extremely rapid rate of change in the subject. This book develops a new framework to analyse the diverse range of policy and research that is emerging on telecommunications and cities.

We aim to stimulate more sophisticated debate and research on city—telecommunications relationships. We also aim to assist teaching by providing a book that draws together a diverse and eclectic range of material which is presented in accessible form. However, we remain unable to provide answers to all questions about this embryonic subject; inevitably, this book raises as many questions as it answers.

This book was developed because of the problems we have experienced in developing a course on telecommunications and urban development for town planning students. We and our students have all been confused by the range, complexity and diversity of material on the subject. We have also been frustrated by the difficulties often involved in tracking down literature and obscure 'grey' material on the subject. We found that in the literature on the subject profound pessimism

coexists with Utopian optimism but there is very little actual empirical study of how telecommunications relate to cities. At the same time, however, we have been disappointed and surprised that no coherent book exists on the subject which brings the diffuse, specific and specialised material together to introduce how cities and telecommunications are related.

Hence we have written this book. In it we emphasise and illustrate the complex relationships which exist between telecommunications and cities by covering neglected subjects such as the urban environment, urban government and urban utilities as well as the more familiar ground of socioeconomic development, transport and urban form. We set out the debates between dystopian and Utopian theorists and establish a framework for considering the range of relationships between cities and telecommunications. We link these theories to debates about the social, economic, geographical, political and environmental development of contemporary cities, and bring out the technological dimensions of each. Finally, we consider questions of urban management, planning and policy integrally with our wider considerations of urban development and telecommunications.

The book will appeal to students of urban studies, local government studies, geography, planning and technology and communications studies who are interested in new technologies and the city. It will also interest urban policy-makers who are keen to inform themselves about state-of-the-art research and policy in this burgeoning and increasingly important area. The book has been designed to act as a set text for advanced specialised courses in telecommunications and cities. It is also suitable as a basis for exploring specific issues and topics, as each section includes a context-setting introduction and an up-to-date guide to further reading on each subject.

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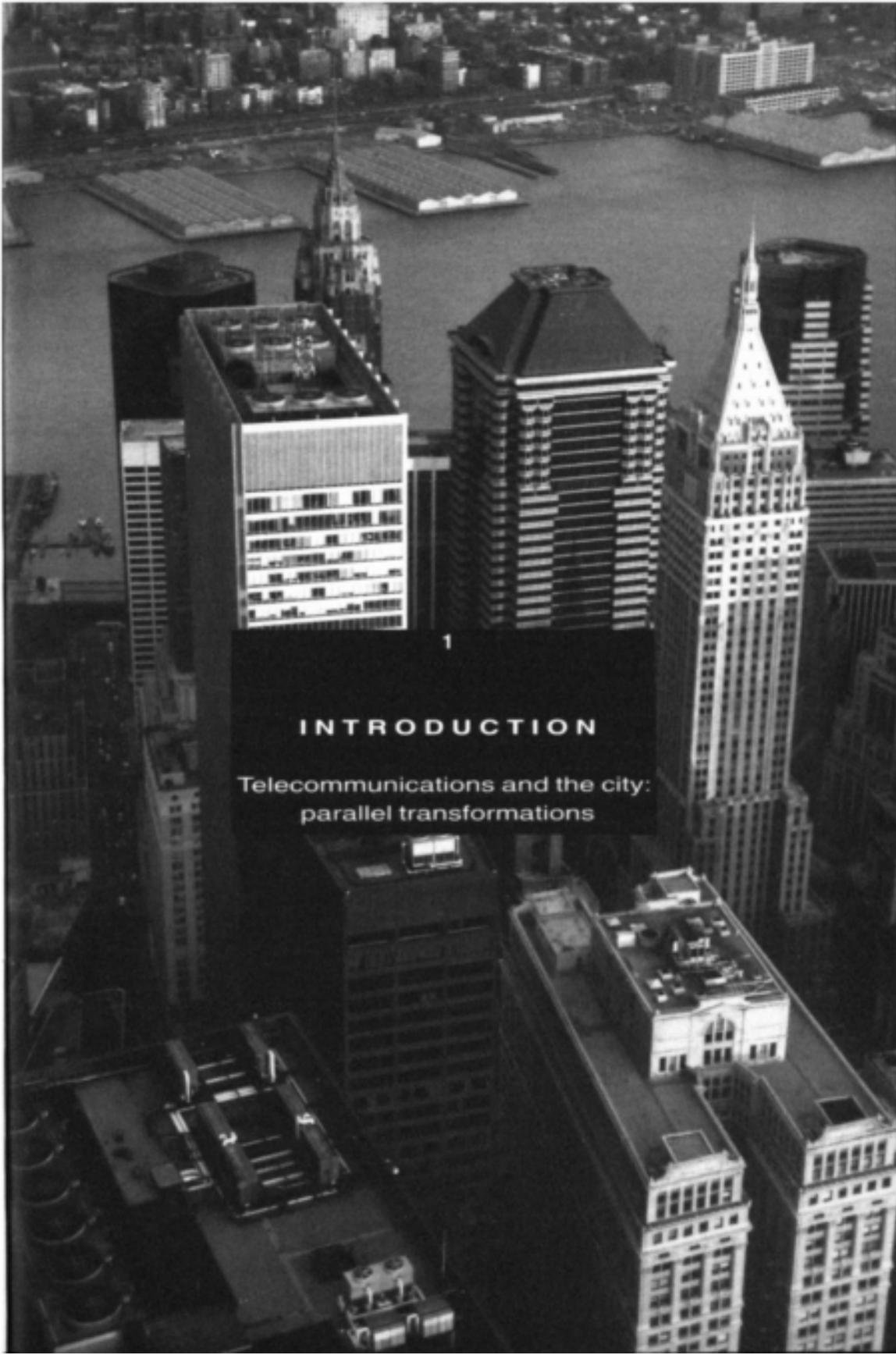
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- Box 4.1 'Telecommunications, world cities and urban policy', by M. Moss, *Urban Studies* (1987), vol. 24, pp. 534–546.
- Box 5.1 'The overexposed city', by Paul Virilio, *Zone* (1987), vol. 1, no. 2. Urzone Inc.
- Box 6.2 *The New Urban Infrastructure—Cities and Telecommunications*, J. Schmandt *et al.* (eds), pp. 107–110 *passim*. Praeger Publishers, an imprint of Greenwood Publishing Group, Inc., Westport, CT, 1990. Copyright © 1990 by the University of Texas at Austin. Abridged and reprinted with permission of Greenwood Publishing Group, Inc. All rights reserved.
- Box 6.3 'Using computers for the environment', by J. E. Young, in L. R. Brown *et al.* *State of the World 1994* (1994). Worldwatch Institute, Norton New York.
- Box 6.4 *An Enhanced Urban Air Quality Monitoring Network: A Feasibility Study*, by Environmental Resources Limited (February 1991). Department of the Environment, Air Quality Division.
- Box 7.1 'New information technology and utility management', *Cities and New Technologies* (February 1992), pp. 51–76. OECD, Paris.
- Box 7.2 *Information Horizons: The Long-Term Social Implications of New Information Technologies*, by I. Miles *et al.* (1988), pp. 119–121. Edward Elgar Publishing Ltd.
- Box 7.3 'Confusing signals on the road to nowhere', by J. Whitelegg, *The Times Higher Education Supplement* (19 November 1993), pp. x–xi.
- Box 7.4 'The intelligent city: utopia or tomorrow's reality?', by J. Laterrasse, in F. Rowe and P. Veltz (eds), *Telecom, Companies, Territories* (1992). Presses de L'ENCP.
- Box 8.1 'Foresight and hindsight: the case of the telephone', in I. de Sola Pool (ed.), *The Social Impact of the Telephone* (1977), pp. 140–145. MIT Press. © I. de Sola Pool 1977.

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Newcastle upon Tyne
May 1995

An aerial, black and white photograph of a city skyline, likely New York City, featuring several prominent skyscrapers. A dark rectangular box is superimposed over the center of the image, containing the page number '1', the title 'INTRODUCTION', and the subtitle 'Telecommunications and the city: parallel transformations'.

1

INTRODUCTION

Telecommunications and the city:
parallel transformations

TELECOMMUNICATIONS AND URBAN TRANSFORMATIONS

A rapid transformation is currently overtaking advanced industrial cities. As we approach the verge of a new millennium, old ideas and assumptions about the development, planning and management of the modern, industrial city seem less and less useful. Accepted notions about the nature of space, time, distance and the processes of urban life are similarly under question. The boundaries separating what is private and what is public within cities are shifting fast. Urban life seems more volatile and speeded up, more uncertain, more fragmented and more bewildering than at any time since the end of the last century.

Apparently central to this transformation, according to nearly all commentators, are remarkable leaps in the capability and significance of telecommunications. Much of contemporary urban change seems to involve, at least in part, the application of new telecommunications infrastructures and services to transcend spatial barriers instantaneously. Telecommunications—literally communications from afar—fundamentally adjust space and time barriers—the basic dimensions of human life (Abler, 1977). They connect widely separated points and places together with very little delay—that is, in ways that approach ‘real time’.

As telecommunications themselves become digital and based on microelectronics, they are merging with digital computer and media technologies. These are diffusing into a growing proportion of homes, institutions, workplaces, machines and infrastructures. The result of this merging is a process of technological convergence and a wide and fast-growing range of so-called ‘telematics’ networks and services. Following the French word *télématique*, coined in 1978 by Nora and Minc (1978), ‘telematics’ refers to services and

infrastructures which link computer and digital media equipment over telecommunications links. Telematics are providing the technological foundations for rapid innovation in computer networking and voice, data, image and video communications. It is increasingly obvious that telematics are being applied across all the social and economic sectors and functions that combine to make up contemporary cities. It is also clear that telematics operate at all geographical scales—from within single buildings to transglobal networks. As William Melody argues, ‘information gathering, processing, storage and transmission over efficient telecommunications networks is the foundation on which developed economies will close the twentieth century’ (Melody, 1986).

As part of this transformation, cities are being filled with what Judy Hillman calls ‘gigantic invisible cobwebs’ of optic fibre, copper cable, wireless, microwave and satellite communications networks (Hillman, 1991; 1). The corridors between cities, whether they be made up of land, ocean or space, are in turn developing to house giant lattices of advanced telecommunications links. These connect the urban hubs together into global electronic grids. Such grids now encircle the planet and provide the technological basis for the burgeoning flows of global telecommunications traffic: voice flows, faxes, data flows, image flows, TV and video signals. Instantaneous electronic flows now explode into the physical spaces of cities and buildings and seem to underpin and cross-cut all elements of urban life.

Clearly, then, contemporary cities are not just dense physical agglomerations of buildings, the crossroads of transportation networks, or the main centres of economic, social and cultural life. The roles of cities as electronic hubs for telecommunications and telematics networks also needs to be considered. Urban areas are the dominant centres of demand for telecommunications and the nerve centres of the electronic grids that radiate from them. In fact, there tends to be a strong and synergistic connection between cities and these new infrastructure networks. Cities—the great physical artefacts built up by industrial civilisation—are now the powerhouses of communications whose traffic floods across global telecommunications networks—the largest technological systems ever devised by humans.

Many have argued that these shifts are part of a wider technological and economic revolution which seems to be underway within advanced industrial societies and within which both the development of telecommunications and urban change hold central significance (see Miles and Robins, 1992). A wide and sometimes confusing range of analytical perspectives have developed that try to chart this transformation from an industrial, manufacturing dominated society to one dominated by information, communications, symbols and services.¹ Because western

societies are fundamentally urban societies—with between 60 and 90 per cent of their populations living in towns and cities—cities are at the front line of this revolution. Cities are the dominant population, communication, transaction and business concentrations of our society. This makes them the central arenas within which we would expect the effects of current telecommunications innovations to be felt. As we move towards an urban society based more and more on the rapid circulation of messages, signs and information via global electronic networks, it would therefore be hard to pinpoint a more important set of technology—society relations than those which link cities to telecommunications.

THE URBAN ‘IMPACTS’ OF TELECOMMUNICATIONS

But what are the implications of these shifts? What becomes of cities in an era dominated by electronic flows and networks? What fate lies in store for our urban areas in the world where ‘virtual corporations’, ‘virtual communities’ and the abstract ‘electronic territory’ of ‘cyberspace’ are developing, based fundamentally on the use of telematics as space and time transcending technologies?

The growing use and significance of telecommunications throws up many profound and fundamental questions which go to the heart of current debates about cities and urban life both today and in the future. For example, how do cities and urban life interrelate with the proliferation of electronic networks in all walks of life and at all geographical scales? What happens to cities in the shift away from an economy based on the production and the circulation of material goods to one based more and more on the circulation and consumption of symbolic and ‘informational’ goods? (Lash and Urry, 1994). How are cities to sustain themselves economically given that more and more of their traditional economic advantages seem to be accessible, ‘on-line’, from virtually any location? Are cities being affected physically by advances in telecommunications as many claim they were in previous eras by the railway and the automobile? How does the movement from physical, local neighbourhoods to specialised social communities sustained over electronic networks—such as those on the Internet—affect the social life of cities? How are social power relations and the traditional social struggles within cities reflected in the new era of telecommunications? What is the relevance of telecommunications for burgeoning current debates about the ‘environmental sustainability’ of industrial

cities? And what do all these changes imply for the ways in which cities are planned, managed and governed?

Such questions have recently stimulated much speculation and debate about the future of cities and the role of advances in telecommunications in urban change. Many commentators excitedly predict very radical changes in the nature of the city and urban life as advanced telecommunications, telematics and computers weave into every corner of urban life and so ‘impact’ on cities. Arguments that this will mean the dissolution of the cities and the emergence of decentralised networks of small-scale communities or ‘electronic cottages’ are widespread. In fact they are so common that visions of the end of cities seem almost to have reached the status of accepted orthodoxy within some elements of the popular media. Here, speculations abound surrounding the apparently revolutionary importance of the ‘communications revolution’, the ‘information age’, the ‘information superhighway’, ‘cyberspace’ or the ‘virtual community’ for the future of cities.

Unfortunately, however, these debates tend to be heavily clouded by hype and half-truth. They have generated much more heat than light. Such debates often tend also to be extremely simplistic, relying on assumed and unjustified assumptions about how telecommunications impact on cities. Many accounts of city—telecommunications relations amount to little more than poorly informed technological forecasts. Often, these are aimed at attracting media attention or generating sales and glamour for technological equipment. As a result, remarkably little real progress has been made in debates about telecommunications and cities. Amidst all the general hype about telecommunications and cities, remarkably little real empirical analysis of city—telecommunications relations exists.

This leaves the terrain open to extremes of optimism and pessimism. On the one hand, utopianists and futurologists herald telecommunications as the quick-fix solution to the social, environmental or political ills of the industrial city and industrial society more widely. On the other, dystopians or anti-utopians paint portraits of an increasingly polarised and depressing urban era dominated by global corporations who shape telematics and the new urban forces in their own image. Meanwhile, the increasing importance of telecommunications in cities has stimulated urban policy-makers, managers and planners to begin to get involved in the development of telecommunications within their cities. But they, too, often remain confused about how their cities are really affected by developments in telecommunications. This, and the need to be seen to be successful means that they themselves can become prone to hyping up their urban telecommunications policies in the language of the quick technical fix.

The immaturity and neglect of urban telecommunications studies means that

there has been a tendency to approach the whole subject without trying to justify the theory or methodologies adopted. In the excitement to address these neglected and important areas, Warren (1989) notes what he calls a ‘candy store effect’:

The topic [of telematics and urban development] creates a ‘candy store’ effect by providing license to deal with a range of phenomena. The result is an effort to cover far too much with no logic or theory offered to explain why some consequences are discussed and others are not and why some evidence is presented and other findings are not.... We are left with an analysis which lacks any theoretical base and an explicit methodology, gives more attention to marginal than primary effects of telematics, and, in many instances, is in conflict with a significant body of research.

(Warren, 1989; 339)

THE NEGLECT OF TELECOMMUNICATIONS IN URBAN STUDIES

This ‘candy store’ effect is one symptom of the wider immaturity and neglect of telecommunications issues in both urban studies and urban planning and policy-making. In many ways, cities can be thought of as giant engines of communication—physical, social and electronic (Meier, 1962; Pool, 1977). We might therefore expect technologies that allow communication over distances—that is *tele* communications—to be a central focus of disciplines which aim to understand the city and professions involved in urban planning and management. This is especially so given that telecommunications are absolutely central to current innovation and restructuring all of the activities that combine to make cities: in manufacturing, transportation, consumer and producer services; in leisure, media and entertainment industries; in education, urban government, public services and urban utilities; and in social and cultural life.

But, despite these two points, telecommunications remain far from being a central focus in urban studies or urban policy-making. The subject of telecommunications and cities is a curiously neglected and extremely immature field of policy and research. Urban telecommunications studies remains perhaps the most underdeveloped field of urban studies. Telecommunications is also one of the least developed areas of urban policy (Mandlebaum, 1986). Recently Michael Batty argued that ‘interest and insights into the impact of communications patterns on the city with respect to information flow have...been virtually non-existent’ (Batty,

1990a; 248) and that current ‘understanding of the impacts of information technology on cities is still woefully inadequate’ (ibid.; 250).

Urban studies and policy remain remarkably blind to telecommunications issues. Compared to the enormous effort expended by urban analysts and policy-makers on, say, urban transportation, urban telecommunications have received only a tiny amount of attention. Vast libraries and many professional bodies and dedicated journals now exist in the field of urban transport issues; only a handful of books have directly looked at telecommunications and the city.² Things have not greatly changed since Bertram Gross argued in 1973 that ‘urban planners seem most comfortable when dealing with urban problems in terms of *transportation*. Indeed, the most advanced techniques and the most “scientific” body of knowledge readily available to such decision makers are those of transport.... Urban planners...must become aware of the problems and possibilities of telecommunications’ (Gross, 1973; 29). ‘Urban analyst’ or ‘commentator’ could easily replace ‘planner’ here. At most only about a dozen urban commentators in the Anglo-Saxon world have directly researched the relationships between telecommunications and urban development since Gross made that statement. Only rarely have these had much impact of the urban disciplines.

This relative neglect means that the field has been left open to other non-urban specialists who have developed very influential speculations on how cities might relate to telecommunications. Importantly, though, these speculations have not been based on any particular understanding or analysis of cities *per se*. Instead, they have tended to start with rather simplistic and Utopian approaches. Often, new technologies have been seen unproblematically as technical-fix-style solutions for the perceived social and environmental inadequacies of the industrial city. Often, these ideas have been directly fuelled by interests in computing and telecommunications industries, keen to foster positive public images to new technologies as a stimulus to the growth of markets (Slack and Fejes, 1987). Mark Hinshaw was one of the first to diagnose the link between the so-called ‘utopianist’ approaches that were then increasingly influential and the neglect of telecommunications by urban planning and urban studies. He remarked that:

Many planners may well feel that communications technology will have little or no effect on urban development. Virtually any recognition at all of the relationships between urbanism and communications has come from academics and professionals outside the fields most directly involved in urban analysis and policy development. Most of the literature coming from such sources, however, treats communication and information-generating hardware as the *means of solving most of the urban problems with which we are presently confronted*.

(Hinshaw, 1973; 305. Emphasis added)

THE NEED FOR MORE SOPHISTICATED APPROACHES TO CITY-TELECOMMUNICATIONS RELATIONS

While recent efforts to understand city—telecommunications relations have grown markedly (Brunn and Leinbach, 1991), it is still clear that urban telecommunications researchers and policy-makers are still fighting an uphill battle. Facing them are the overwhelming invisibility of the subject, the long legacy of neglect, and the powerful influence of the utopianists and futurists who have tended to fill the vacuum left by the neglect of telecommunications in urban studies. We believe that these problems are significant enough to challenge the paradigms underpinning urban studies and policy. They mean that—while they are increasingly numerous—references to telecommunications in both the policy and urban studies literature still tend to be general and speculative rather than specific or grounded in real analysis. Conceptual sophistication still tends to be rudimentary.

As with much social research on technology, literature on telecommunications and cities still tends to invoke what Gökalp (1988) calls ‘grand metaphors’ of the nature of telecommunications-based change in cities. Invariably, modern telecommunications are seen as a ‘shock’, ‘wave’ or ‘revolution’ impacting or about to impact upon cities. Technological determinism is common: current or future urban changes are often assumed to be determined by technological changes in some simple, linear cause and effect manner. The use of simple two-stage models to describe changes in cities and society is common. Cities are seen to be placed in a new age in which telecommunications increasingly have a prime role in reshaping their development. Most usual here are notions that capitalism is in the midst of a transformation towards some ‘information society’ (Lyon, 1988) or ‘post-industrial society’ (Bell, 1973), or that a more general ‘communications revolution’ (Williams, 1983) or ‘third wave’ (Toffler, 1981) is sweeping across urban society.

Most often, because of the general inability to analyse real change and the influence of futurology, analysis centres on speculating the impacts of telecommunications on future cities in a general and vague way. Actual telecommunications-based developments in real contemporary cities are rarely analysed in detail. Even when they are, because they are so intangible and difficult to untangle that they are often described using physical analogies with the more comprehensible elements of the industrial city. Thus, the satellite ground station becomes the ‘teleport’, the highly capable trunk network becomes the ‘information

super *highway*'; the computer conferencing system becomes the 'virtual *community*' or the 'electronic *neighbourhood*'; the local community electronic bulletin board is labelled the '*Public Square*'. The wide range of such metaphors and grand scenarios which have now been offered up to describe the increasingly telecommunications-based city is shown in Figure 1.1. This lists the various telecommunications-related labels and metaphors that have been used to describe the contemporary city.

A related tendency is to assume that the 'impacts' of telecommunications on cities are all the same, and are seen to be relatively simple, homogeneous, linear and one-directional (Gökalp, 1988). The difficulty of undertaking empirical studies of such impacts however, means that they tend to remain assumed rather than being tested empirically. Many commentators, for example, have predicted that, because they allow instantaneous communications, telecommunications across distance will automatically undermine the spatial 'glue' that concentrates all large cities (see, for example, Martin, 1978; Toffler, 1981). But usually these expectations remain just that: forecasts of some future urban state rather than empirical analyses of real change. In fact, evidence points to a wide range of

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|--|
| The 'invisible city' (Batty, 1990) |
| The 'informational city' (Castells, 1989) |
| The 'weak metropolis' (Dematteis, 1988) |
| The 'wired city' (Dutton <i>et al.</i> , 1987) |
| The 'telecity'(Fathy, 1991) |
| The 'city in the electronic age' (Harris, 1987) |
| The 'information city' (Hepworth, 1987) |
| The 'knowledge-based city' (Knight, 1989) |
| The 'intelligent city' (Latterasse, 1992) |
| The 'Virtual city' (Martin, 1978) |
| 'Electronic communities' (Poster, 1990) |
| 'Communities without boundaries' (Pool, 1980) |
| 'Electronic cottage' (Toffler, 1981) |
| The city as 'Electronic spaces' (Robins and Hepworth, 1988) |
| The 'overexposed city' (Virilio, 1987) |
| The 'Flexicity' (Hillman, 1993) |
| The 'Virtual Community' (Rheingold, 1994) |
| The 'non-place urban realm' (Webber, 1964) |
| 'Teletopia' (Piorunski, 1991) |
| 'Cyberville' (Von Schuber, 1994, quoted in Channel 4,1994; 1 |

Figure 1.1 Metaphorical characterisations of the contemporary city

experiences in city—telecommunications relations; a complex set of new processes is leading to a new type of ‘telegeography’ (Staple, 1992). This is based on the degree to which nation states, regions, cities, rural areas, neighbourhoods and households are the foci of investment in telecommunications or are switched into the new globally driven dynamics of telematics-based change.

Such technological determinism and forecasting does little to foster more sophisticated views of city—telecommunications relations in contemporary cities. In fact, what little evidence there is suggests that these approaches are far too simplistic. In this book we show how the effects of telecommunications on cities seem to be far more ambiguous and complex than many would have us believe. Rather than revolutionising cities by suddenly disinventing them—spreading their contents equally across regions and nations—telecommunications and telematics are intimately involved in complex and diverse incremental urban changes across all areas of urban life. Their impacts on cities are not all the same; they are not even all in the same direction. In fact, when one starts to scrutinise the relationships between cities and telecommunications in more detail, a wide range of complex relationships emerge. These defy easy description and make the use of crude ‘shock’, ‘wave’ or ‘revolution’ labels extremely unhelpful. Telecommunications are intimately involved in many of the social, economic, environmental and geographical changes that make up the urban restructuring process. Invariably, however, the precise nature of this involvement is subtle and difficult to disentangle.

Given the immaturity and neglect of urban telecommunications studies, this book is an attempt to develop a more sophisticated and considered approach to analysing the complex relations between cities and telecommunications. Adopting an interdisciplinary and international perspective, the book aims to help to overcome the divorce which exists between the urban and telecommunications studies communities, so allowing an integrated and socio-technical understanding of tele-mediated urban change to be developed. In other words, we want to explore the complex interactions between technologies and the social, economic, cultural and political change underway in contemporary cities. We aim to avoid the pitfalls of the extremes of optimism and pessimism, of crude technological or social determinism, and of the simple recourse to some all-explaining grand metaphor. Rather, we aim to ground our analysis in a comparative evaluation of the theoretical approaches available, to build on empirical evidence where it is available and to synthesise work from a wide variety of disciplines and sources on the full range of key issues which arise at the complex interface between cities and telecommunications. Critical social science is the perspective towards which we aspire.

In the remaining chapters of the book, we trace how telecommunications are emerging to challenge the prevailing paradigms underpinning urban understanding and policy-making. We explore the theoretical perspectives that can be adopted to explore telecommunications developments in cities. We then go on to review some of the key aspects of city—telecommunications relations—economic, social, environmental, infrastructural, physical and governmental. These themes provide ‘windows’ through which we can start to explore the complex relations between cities and telecommunications. Although far from perfect, we believe that this broad cross-cutting perspective allows us usefully to construct a more complete picture of these relations than has been built up before.

Before we can do these things, however, we need to introduce the context by summarising the current forces transforming both cities and telecommunications; we do this in the rest of this chapter. First, we shall look at the remarkable technological and regulatory transformations currently underway in telecommunications. Second, we shall briefly review the profound economic, political and social changes that have radically restructured advanced industrial cities over the past fifteen years or so.

THE TRANSFORMATION OF TELECOMMUNICATIONS: FROM THE ‘PLAIN OLD TELEPHONE SERVICE’ (POTS) TO TELEMATICS

In less than two decades, the telecommunications industry has moved from a slow-moving and largely ignored sector to an important force which is increasingly involved in the current transformation of capitalist society. Already, the telecommunications industry is on the verge of becoming the world’s largest; it is certainly the world’s fastest growing (*Business Week*, 1994). For example, within Western Europe telecommunications accounted for 2 per cent of Gross Domestic Product in 1984; by the year 2000 this is expected to be 7 per cent and 60 per cent of all jobs will be supported either directly or indirectly by telecommunications (Mulgan, 1991).

STANDARDISATION AND EQUALISATION: THE 'PLAIN OLD TELEPHONE SERVICE' ERA

Incredibly, only fifteen years ago, telecommunications were virtually synonymous with one service—the basic telephone or Plain Old Telephone Service (POTS). At this time, telecommunications meant, effectively, telephones with some minor flows of telexes, telegraphs and data communications (and, of course, the broadcasting services necessary for TV and radio). Between the nationalisation of the first telephone systems at the start of the twentieth century and the mid-1970s, all western nations except the United States maintained a state monopoly over their telecommunications networks through their Postal Telegraph and Telephone (PTT) authorities, who also ran national postal systems (see Figure 1.2). In the United States, AT&T operated a private monopoly in a similar fashion. These monopolies were maintained in order to roll out basic telephone systems, known as Public Switched Telecommunications Networks (or PSTNs) that were universally accessible within and between the cities of the national urban system. PSTNs were based on the use of analogue signals (where the voice was transmitted as an electrical wave that was its direct analogy), electromechanical telephone exchanges (which had physical moving parts to connect lines) and copper wires for transmitting signals. When high capacity was needed coaxial copper cable was laid; when only one telephone was to be linked up, a narrow, twisted-pair copper cable was strung to the house or office. During this period, the telephone was extended from an élite service for perhaps 15 per cent of the population to a service for the majority (60–75 per cent of the population). Telephone services were often seen to be a quasi-public good where a single, universal network was necessary because of the vast costs of developing a network through all parts of the nation state and the need for less affluent users and areas to gain access to the telephone.

Fundamentally, then, the emphasis in this so-called POTS era was on standardisation and social and geographical equalisation. Tariffs to services were kept the same despite very wide disparities in the costs of serving people. Underpinning this were systems of cross-subsidy from the lucrative trunk routes and heavy users (cities and businesses) to rural and lower income users. This was not surprising as PTTs and the universal service concept were developed as part of the elaboration of wider Keynesian welfare states during this period (Lüthe, 1993). 'The arrangement served the important goal of interconnecting society and operated as a means of redistribution' (Noam, 1992; 3). Often, PSTNs were

	<i>'Plain Old Telephone Service' POTS era</i>	<i>Telematics era</i>
Regulation	Single, national monopoly (either public or private), under Postal, Telegraph and Telephone Administration (PTT).	Liberalised competition.
Organisations delivering telecommunications services	PTT	
Technologies involved	Analogue Public Switched Telephone (PSTN) network. Mainly copper cables and electromechanical switches.	Wide variety: privatised or market-driven PTT, new private entrants, other utilities. Telephone, telex and vast range of data, image and video communications services
Services involved	Telephone, telex, some data, plus separate radio and television services.	Wide variety: updated digital PSTN interlinked with competing systems and overlays such as radio, microwave plus local cable systems.
Geographical characteristics	Desired universal access to, and diffusion of, telephone: spatial equalisation.	'Cherry picking' of lucrative customers on increasingly international basis focused on big business centres: spatial polarisation.
Urban policy relevance	Negligible. National regulation ensured relatively equal access. Policy-making highly divorced from city level.	Substantial and growing: new importance of access to networks plus growing unevenness of 'telegography'. New policy opportunities and growth of local social and economic strategies.

Figure 1.2 General characteristics of the transformation from the 'Plain Old Telephone Service' era (POTS) to the 'telematics era'

also laid out in advance of demand as part of the broader effort at state level to stimulate regional equalisation and national economic development. In sum, ‘for a century, telephony throughout Europe had been a ubiquitous, centralized, hierarchical network operated by a monopolist’ (ibid.; 3).

In general, the distant, centralised nature of PTTs meant that POTS and the PSTN tended to be ignored at the level of city authorities. But the low urban salience of POTS did not mean that the elaboration of national telephone grids had no urban effects during this time. As Pool (1977) has demonstrated, the development of these extensive and standardised PSTN networks had important effects on the development of cities. They integrated national urban systems. They supported the development of central business districts and skyscrapers (as offices could separate from factories and still control them at a distance from central business districts). They allowed social networks to be continued in widely dispersed suburbs. They encouraged the planned zoning of cities, because phone companies came to rely on the predictability that zoning gave their own network expansion plans. Finally, PSTNs supported a whole new range of phone-based business practices (Pool, 1977). More generally, as telephones became diffused through the economic and social fabric of society, they provided an important boost to the elaboration of the mass production and mass consumption system of capitalist society, based on individual households who were able to act at a distance in ‘real time’ by communicating with each other and a wide range of service providers.

TECHNOLOGICAL CONVERGENCE AND POLITICAL LIBERALISATION: TOWARDS THE TELEMATICS ERA

Since the late 1970s, the world of telecommunications has been in continuous turmoil. Radical technological and regulatory change has been a constant feature. The previously separate areas of telecommunications, computing and media technologies are now converging around a core group of digitalised technologies (see Figure 1.3). Essentially, these new technologies allow all types of information—voice, data, sounds, images and video signals—to be processed and transmitted in the form of the ‘bit’ streams of binary code used in computers—as a series of zeros and ones. This is the basis behind the much-vaunted multimedia technologies and services, which allow sounds, images, voice and data to be

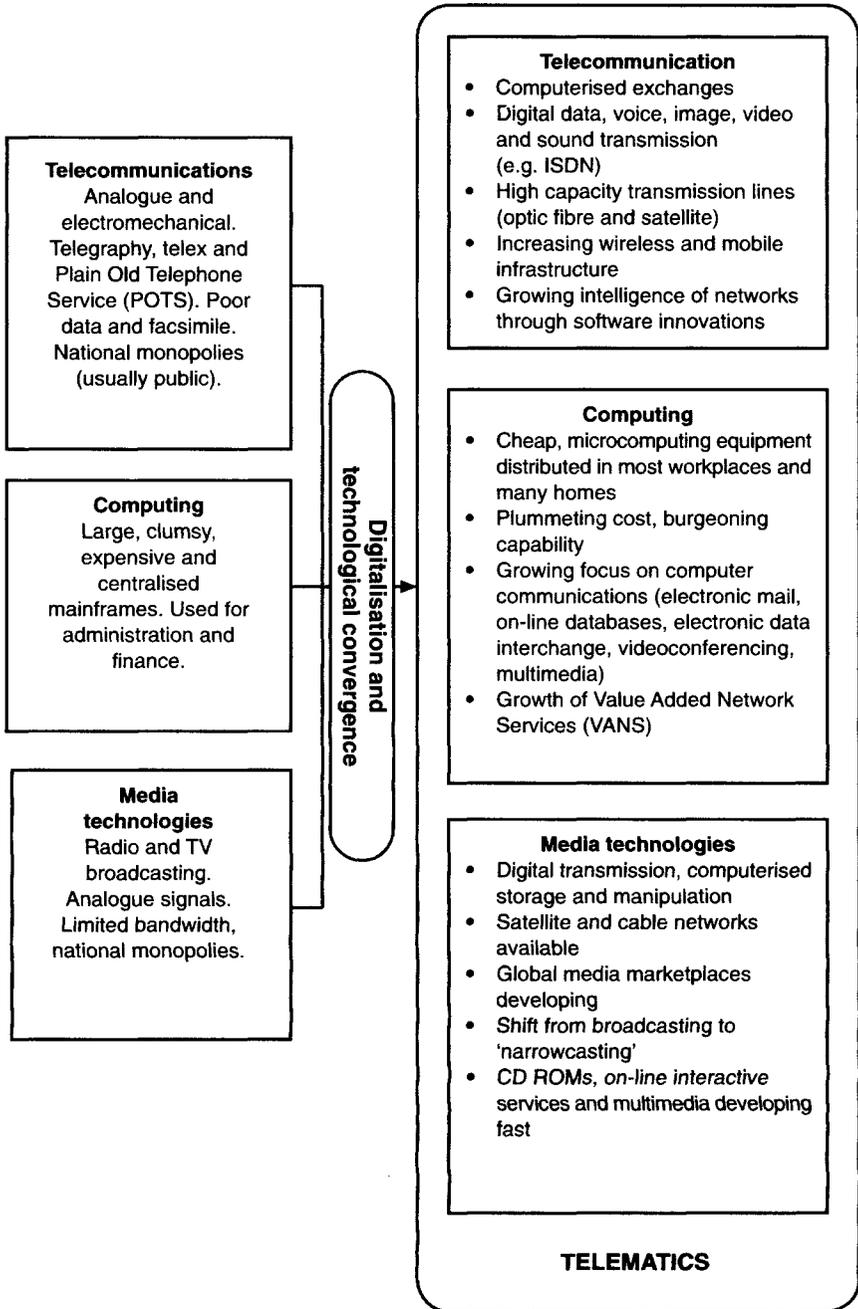


Figure 1.3 Technological convergence and the development of telematics

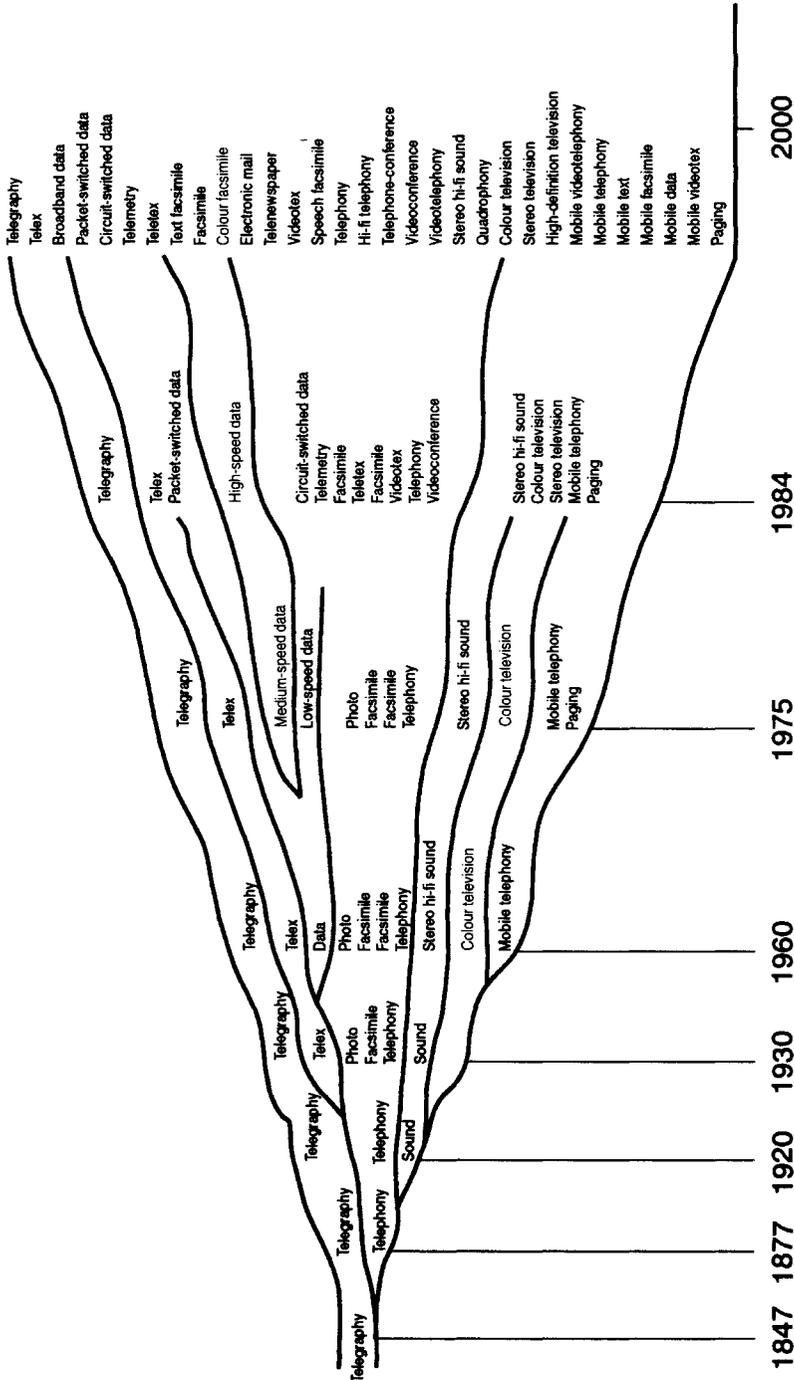


Figure 1.4 The expanding range of telecommunication services: prospects for the year 2000
source: Adapted from Ungerer, 1988

managed and transmitted in an integrated way. Digital telecommunications are more capable, more accurate, more flexible and often less costly than analogue telecommunications. The result has been an explosion of technologies and services and a remarkable rate of change (see Figure 1.4). A multitude of telecommunications networks and services have been proliferating within and between cities ever since and as this innovation tends to be most advanced and rapid in cities, it is centrally important to urban development.

Unfortunately, this dazzling variety and speed often defies understanding of the technological and regulatory dynamics at work. The simplest way to try and understand the radical shift in telecommunications is to split it into its four interrelated elements. These are:

- changes in the types of switching used in telecommunications networks;
- changes in the way that the transmission of communications signals occurs between the switches;
- changes in the terminal equipment that are the sources and destinations of communications flows;
- shifts in the ways in which telecommunications are regulated.

Digital switching and intelligent networks

On the switching side, now that telecommunications networks are largely digital, their switches increasingly consist of highly sophisticated computers rather than sets of electromechanical equipment. The national telecommunications infrastructures of the POTS era are increasingly being upgraded to digital standards. This makes them capable of dealing with higher volumes of traffic more cheaply and with greater accuracy. Video, image and data signals can be handled as easily as voice flows—provided the networks have the bandwidth (transmission space) and switching capabilities to accommodate these. New, more capable telecommunications systems for carrying this broader range of services are also being developed (for example, the Integrated Services Digital Network (ISDN) which offers seamless communication of voice, data, image and sound over a basic phone line). New advances here in using computers to compress signals mean that much more can be squeezed out of even the basic copper-wire telecommunications link to the telephone.

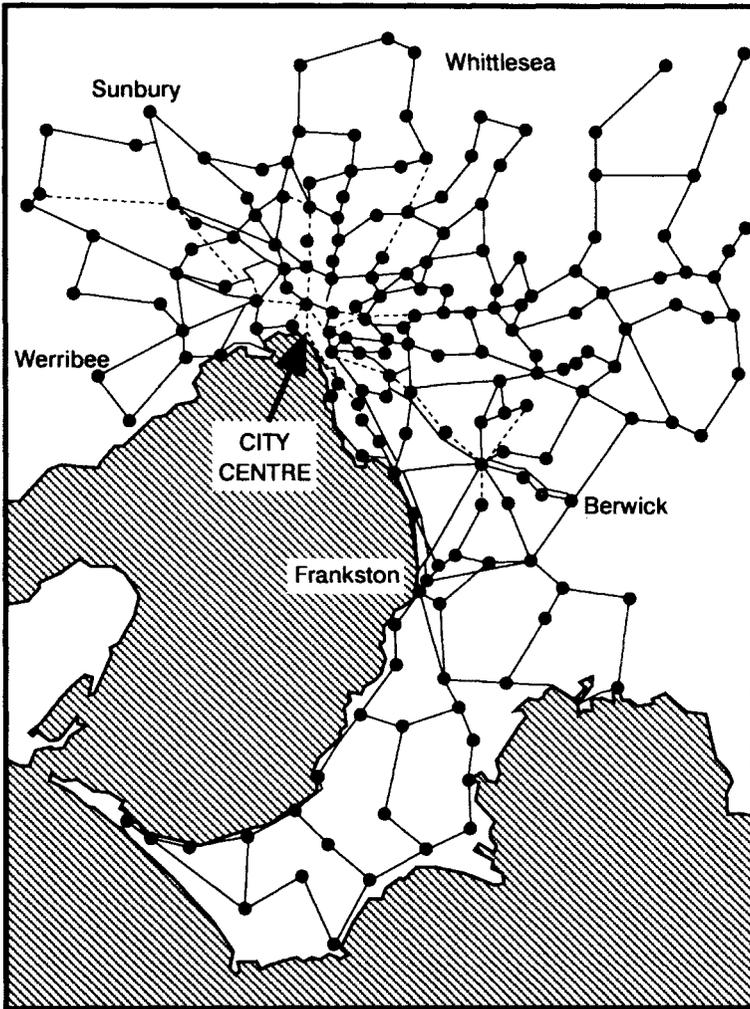
At a more advanced level, completely new computer-controlled switching systems

are being deployed; an example of this is the so-called 'Intelligent Network'. Here the control of service flows and the management of vast telecommunications networks rest with a few centrally located computers and the sophisticated software which runs on them. This means that the flexibility and capability of networks is much enhanced and can be upgraded simply by reprogramming computers rather than relaying networks or replacing switches.

Increasingly, such networks operate at the global scale, geared to the sophisticated communications needs and the lucrative markets of transnational corporations (TNCs). The \$10 billion per year market for the leading 2,500 TNCs drives technological innovation, as the TNCs attempt to develop single networks on a global basis through which their flexibility, speed of response and competitiveness can be improved (Keen, 1986; Valovic, 1993). The scale of such private, corporate networks, which weave many localities and cities together in 'real time', often now surpasses that of many national telecommunications infrastructures. IBM's own network, for example, has 800,000 users in 90 countries (Roche, 1993).

New telecommunications networks and infrastructures

On the transmission side, the traditional copper and coaxial cable links are increasingly being supplemented or replaced by optic fibre, wireless, microwave and highly efficient satellite systems. The capabilities of optic fibres are now legendary and have entered popular consciousness: each hair-like strand can now accommodate up to 60,000 simultaneous telephone calls (as opposed to 6–7,000 for a much wider coaxial cable). This technology has a particular lustre which attracts technological forecasters. Many Utopian forecasts about telecommunications and cities centre on the idea of a universally accessible optic fibre grid to all homes. Cost and technical barriers, however, still mean that this is far from being realised: optic fibre remains concentrated as the trunks of national and global electronic grids or the local links to very large users of telecommunications such as office blocks. Often, the largest cities, as the main centres of demand for advanced telecommunications, now have substantial and fast-growing optic fibre infrastructures at the metropolitan level. This is demonstrated in Figure 1.5, which shows the current growth in Melbourne's optic fibre network. Increasingly, these metropolitan networks are being connected through international and



----- Existing optic fibre network, 1989
————— Planned optic fibre network, 1994

Figure 1.5 The expanding optic fibre network in Melbourne, Australia
Source: Adapted from Newton, 1991

intercontinental optic fibre networks. The growth of transoceanic optic fibre networks across the Atlantic and Pacific has been especially crucial in underpinning the shift towards a global information economy. Between 1986 and 1996, for example, the number of optic fibre ‘voice paths’ across the Atlantic is expected to rise 66 times from 22,000 to 1.45 million (Staple, 1992). This dramatic growth is shown diagrammatically in Figure 1.6.

Advances in both switching and transmission have allowed four new ranges of telecommunications infrastructures to develop which are largely centred on cities. First, there are wireless and mobile communications systems which link telephones and computers by radio signals to fixed telephone networks. Such systems are laid out in ‘cells’ to build up coverage of a building, city or region. Others work directly through satellite connections. Wireless networks allow telephone and data communications to operate on the most flexible basis and are being widely heralded as the next revolution as communications systems become

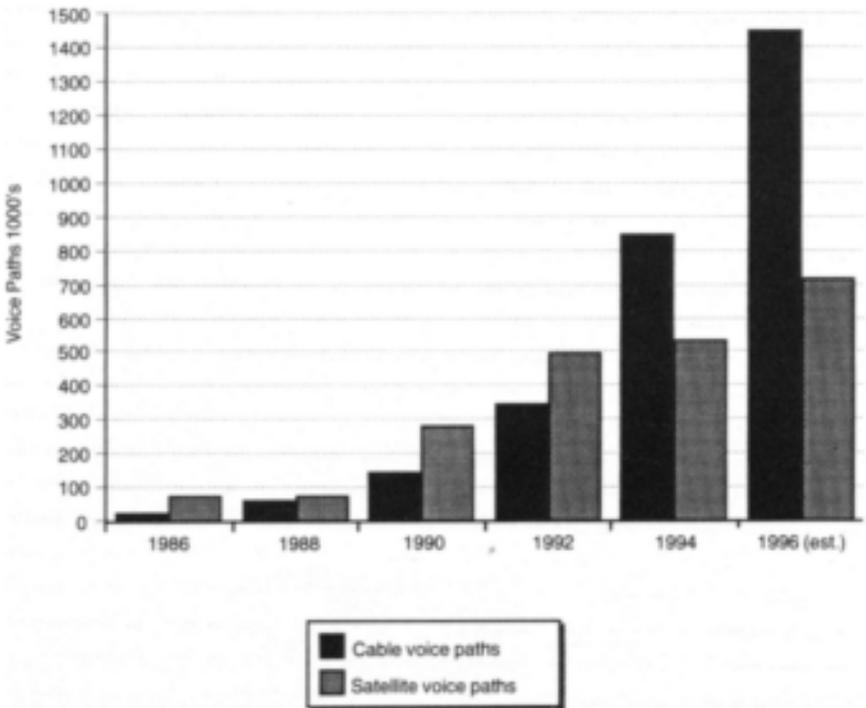


Figure 1.6 The number of voice paths across the Atlantic by satellite and transoceanic cable

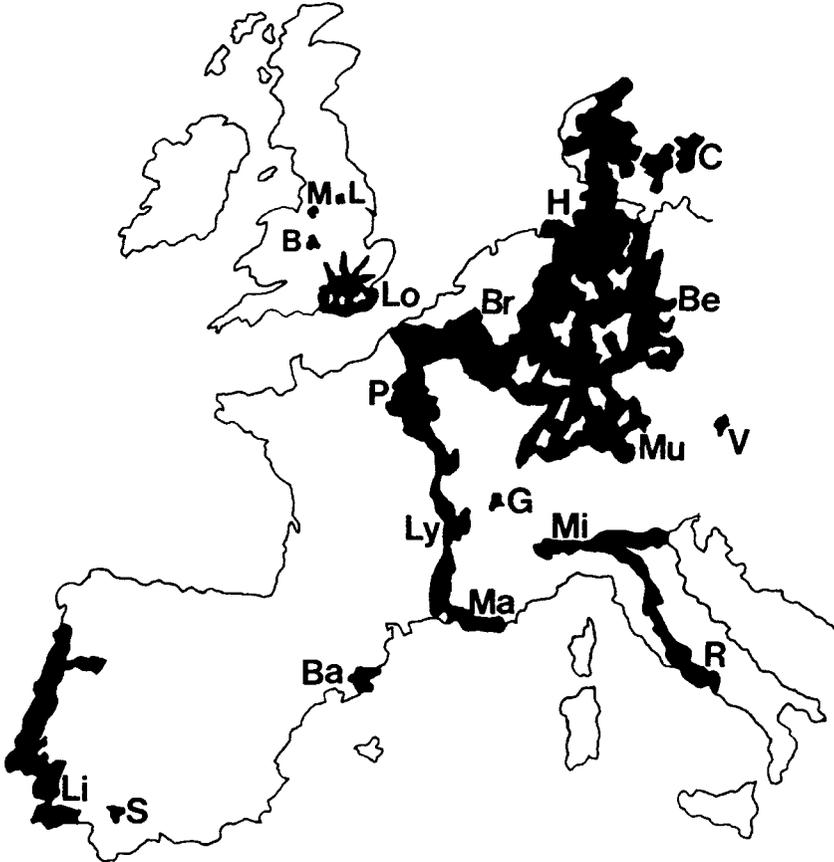
Source: Adapted from Staple, 1992

mobile and personal rather than tied to fixed buildings, as with the traditional PSTN network. Wireless systems are currently the fastest growing area of telecommunications and this rapid growth has led some to proclaim that ‘when the history of communications in the 20th century is written, the 1990s will be remembered as the decade of wireless communications’ (Spector, 1993; 403). Annual rates of increase in the numbers of mobile phones globally approach a remarkable 50–60 per cent, as technology has improved, networks have been rolled out to wider and wider areas, costs have been slashed, and competition between new private mobile operators has grown (*Financial Times*, 1994). New technologies and lower costs are now allowing wireless phones to begin entering the mass market. Physically vulnerable groups and blue-collar workers who face customers are now using mobile phones as well as the stereotypical ‘yuppies’ who dominated their use in the 1980s (Wood, 1994).

However, because of the costs to private companies of rolling out these systems they tend to be centred on cities and urban corridors where demand is most concentrated. Figure 1.7 shows the way in which the new digital mobile networks within Europe known as GSM are developing along the main business corridors while ignoring the more rural and remote areas.

Second, there are *broadband cable networks*. These are overwhelmingly urban networks, built primarily to deliver Cable TV (CATV) services to residential consumers. Cable is the basis for distributing much larger numbers of TV channels that have traditionally been accessed via terrestrial radio-based TV transmission. Increasingly, however, these networks are becoming more sophisticated and capable, with optic fibre trunks and new digital switching technologies complementing or replacing the coaxial copper cable of previous systems. The result is a slow growth of other interactive services, from telecommunications to ‘pay per view’, teleshopping and other value added services. In some nations, cable networks are allowed to compete directly with the PSTN in mainstream telecommunications services, as in the UK, where many cable companies make larger revenues from telecommunications than television services.

Third, there are a new generation of *satellite* infrastructures. In 1990 there were over 200 communications satellites in orbit, from eighteen nations or communications agencies (Kellerman, 1993; 46). Demands for satellite services are growing fast, particularly in Europe and Asia. As the skies become more crowded with a widening range of powerful satellites, a plethora of new services—from broadcasting through high-speed data communications to paging, navigation and mobile phones—are developing based on satellite communications. The proliferation of satellite TV, known as Direct Broadcasting by Satellite (DBS)



Key to cities			
B	Birmingham	Ly	Lyon
Ba	Barcelona	M	Manchester
Be	Berlin	Ma	Marseilles
Br	Brussels	Mi	Milan
C	Copenhagen	Mu	Munich
G	Geneva	P	Paris
H	Hamburg	R	Rome
L	Leeds	S	Seville
Li	Lisbon	V	Vienna
Lo	London		

Figure 1.7 An example of the urban bias of market-led telecommunications development: the availability of GSM digital mobile telecommunications in Europe, 1992

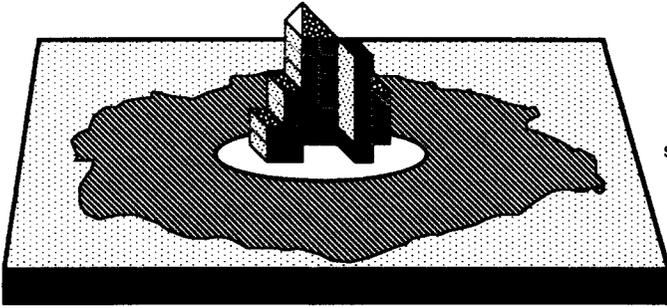
is the best-known example here, but there are many other satellite services available geared towards voice, data and video communications.

The ground stations needed to link up with satellites used to require major developments and special sites. Often this rare example of telecommunication being very visible and requiring major physical developments led to large-scale planning and urban development projects like teleports through which cities ambitiously tried to develop their economies. Now, however, miniaturisation and technological changes are reducing these requirements. Satellite phones and transmission equipment can now be fixed to individual buildings or even be portable by humans. This is particularly so with a new range of Very Small Aperture Terminal (VSAT) networks, which can provide a flexible and cheap substitute to terrestrial corporate networks because they rely on small micro ground stations that can be attached easily to individual buildings. Thus the great advantages of satellite communications—its flexibility, the pervasive coverage of satellite ‘footprints’ and the relative ease of deployment—are becoming even more important for specialised applications.

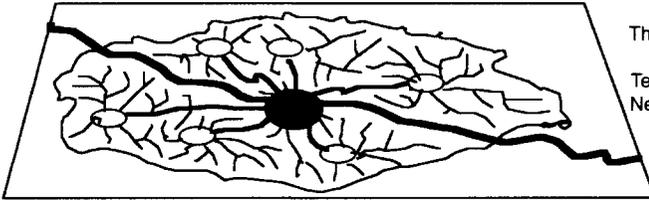
Finally, there are *microwave systems*. These support short-distance, point-to-point and line-of-sight transmission for voice, data or TV/video services. They are especially useful in congested city centres where they link heavy telecommunications users with the nodes of terrestrial networks, so bypassing the often inadequate cables in the local loop between nodes and customers’ premises. When many microwave towers are strung together, whole national and international telecommunications networks can be developed.

The layering of urban telecommunications infrastructure

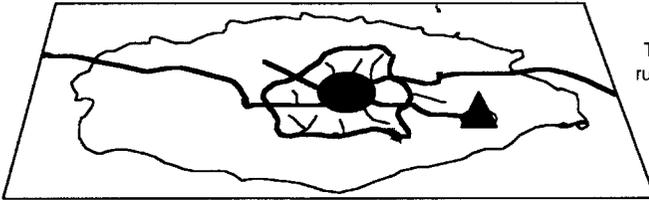
With this proliferation of infrastructures beyond the basic PSTN, many telecommunications networks are now being superimposed within and between cities where only one—the PSTN—tended to exist previously. This layering of the telecommunications networks within a typical western city is illustrated in Figure 1.8, which shows schematically how the older, modified PSTN now tends to be superimposed with other competing telecommunications networks (where liberalisation has occurred), which centre on the most profitable areas. It also shows the layouts of cable and mobile systems and satellite ground stations. In fact, this itself is an oversimplification. Such are the fast-moving dynamics in many



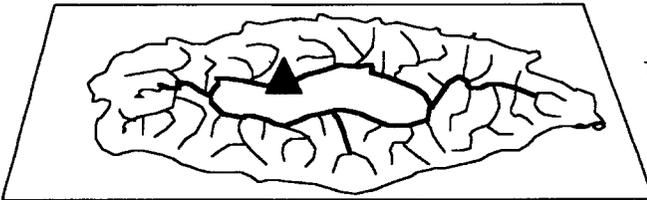
The physical spaces of the city



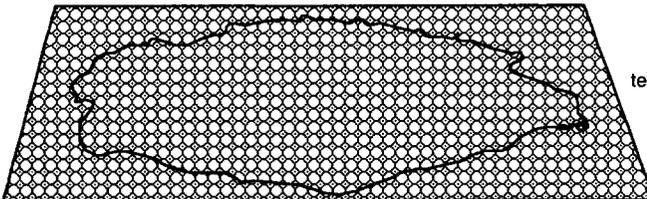
The traditional Public Switched Telecommunications Network (PSTN), run by the ex-PTT



The new network run by a competitor to the PTT



The broadband cable network



The mobile and wireless telecommunications network (one of several competitors)



Satellite Groundstation

Figure 1.8 The superimposition of different telecommunications infrastructures within a typical medium-sized western city

larger cities that up to a dozen different telecommunications networks can be superimposed within the centres of cities like London and New York, based on complex combinations of hard infrastructure, private leased lines, and 'resold' capacity on general telecommunication lines.

The transformation of customer premises equipment (CPE)

Paralleling these changes in transmission and infrastructure, the terminal equipment which subscribers use to communicate with has been completely transformed in the past fifteen years. This change has been most dramatic in computers. The bulky, expensive and slow computers of the 1960s that used to sit squat in the basements of office blocks are now museum pieces. The radical improvement in the performance and cost of microelectronics has meant that smaller, cheaper and far more powerful items of computerised equipment now inhabit virtually every workplace and a growing proportion of homes. Personal computers (PCs), in particular, have diffused through all economic and social sectors and are now an accepted fixture of everyday life. The processing power of PCs now doubles every two years while their costs are actually falling. Increasingly, these lowering costs and increased capabilities mean that personal computers are shifting from stand-alone workstations to communications and work terminals, linked via the improved telecommunications systems discussed above. In many professional circles, an electronic mail address is an increasingly expected element of a person's contact details.

A crucial development here has been the improvement of computer network technologies. The most important twin advances are the development of broadband computer networks within small sites or a small group of buildings known as Local Area Networks (LANs) and the linking together of computers, computerised equipment and LANs across wider geographical distances via telecommunications lines such as the networks used by transnational corporations known as Wide Area Networks (WANs). In addition, many computer networks and broadband infrastructures at the scale of the city are developing called Metropolitan Area Networks (MANs).

Some WANs, having reached a critical mass of users, are growing with startling rates. For example the Internet—the network of Wide Area computer networks that links universities, research institutions and thousands of organisations around the

world—is now estimated to have between 20 and 35 million electronic mail users and to be growing at around 10–20 per cent per month. Figure 1.9 shows the exponential recent growth of the Internet, which is now expanding into many new commercial areas, driven by the increasing involvement of media conglomerates who are trying to take advantage of the network's commercial potential.

Many other types of terminal have also developed to complement the phone and PC as entry points on to telecommunications networks. Facsimile machines are now extremely common. Pagers are increasingly being used to keep in touch. Mobile computers and Personal Digital Assistants (PDAs) are providing sophisticated platforms for managing complex business schedules on the move. Videotex terminals (like the French Minitel) have diffused widely (although unevenly). Digital entertainment and media systems within the household are proliferating, such as CD-ROMs and interactive CDs. Some of the latest of these use 'virtual reality' technology in which people are immersed in 'virtual environments' constructed by computers. For these a wide range of what Mitchell (1995) calls 'exoskeletal devices'—'datagloves', helmets, visual and audio sensors and

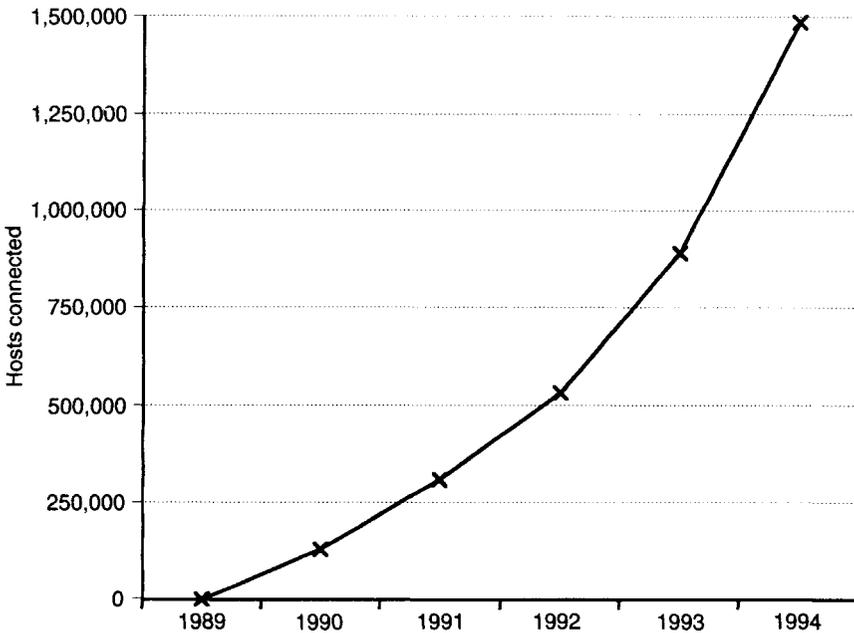


Figure 1.9 The exponential growth of the Internet 1989–1994

Source: Ogden, 1994

surrounding screens—are being developed which link into computers and allow this real-time sensory immersion to take place. In addition, microchips now control many phones and an increasing range of domestic and industrial appliances—TVs, stereos, utility meters, even cookers and heating systems—as well as office, transport and factory equipment. All of these are already geared, or are being redesigned, to orient towards inter-communication across distance via telecommunications networks. In addition, many pieces of terminal equipment are now being developed which aim to take advantage of the new switching and transmission capability of telecommunications: videophones, ISDN terminals, highly capable interactive and high definition televisions and multimedia personal computers, to name but a few.

On the financial front, networked electronic fund transfer (EFT) and point-of-sale terminals (EFTPOS) are replacing traditional shop tills. Together with electronic credit cards and so-called ‘smart cards’ (which have a microchip embedded in them for storing information and money), these are allowing an increasingly diverse range of transactions to occur electronically and cash free, through transfers of money between bank accounts. In the manufacturing and logistics areas, Electronic Data Interchange (EDI) terminals are stringing out across supply chains, providing computerised systems for linking firms into complex transactional chains. Automatic Teller Machines (ATMs) are complementing bank cashiers. Computerised production machinery is replacing mechanical equipment.

Such is the crucial significance of these widening arrays of high technology equipment that the US Commerce Department recently estimated that fully 38 per cent of all economic growth since 1990 has derived from such sales (*Business Week*, 1994; 36). If we consider the global set of telecommunications networks to be a single set of global networks, it is possible to trace the growth in the number of terminals attached—wired telephones, mobile telephones, fax machines, data modems and videoconferencing sets. This is shown in Figure 1.10.

Not surprisingly, paralleling these trends in switching, transmission and terminal equipment has been an explosion of innovation and a proliferation of telematics services supporting the communication of data, sounds, images and video between these diverse sets of computerised equipment—as well as advanced forms of human voice communications. Figure 1.4 (p. 16) shows how this convergence is allowing a rapid growth in the range of telecommunications available. For the first time, such telematics services, which are embraced under the umbrella term Value Added Network Services (VANS), allow many different

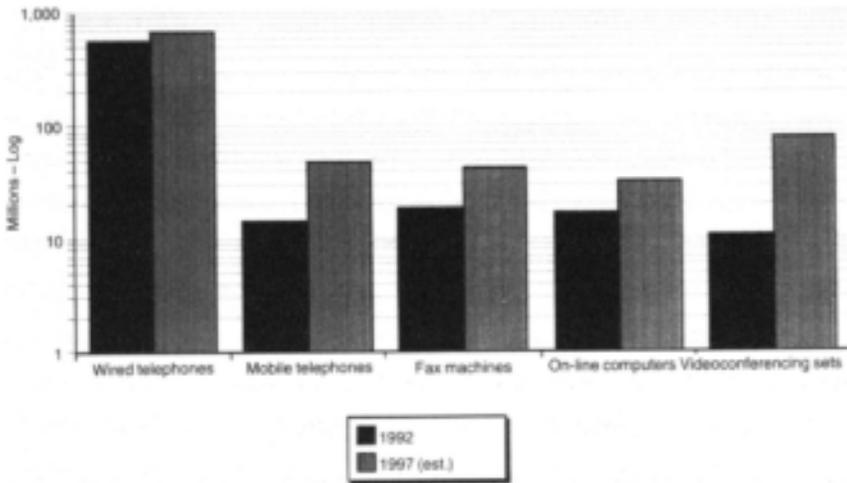


Figure 1.10 Equipment plugged into the world's telecommunications networks 1992–1997 (estimated)
 Source: Staple, 1992

types of computer-mediated information flows (e.g. on-line databases), computer-mediated communications (e.g. electronic mail), and computer-mediated transactions (e.g. Electronic Data Interchange or Automatic Teller Machines) to be supported both within and between cities. Such services increasingly merge voice, data, image and video signals in complex mixtures of multimedia telematics flows.

Just as important, though, are the plummeting costs of telematics hardware, software and services. As each year passes, more information can be processed and sent longer distances for lower costs. Technological change, the growth of markets and increasing competition is leading to rapid cost reductions while performance and capability are continually enhanced. The example of France, which is summarised in Figures 1.11 and 1.12, is typical here. While personal computers in France are less than one third of the real costs they were in 1988 (Figure 1.11), the real costs of telecommunications are also falling dramatically (Figure 1.12).

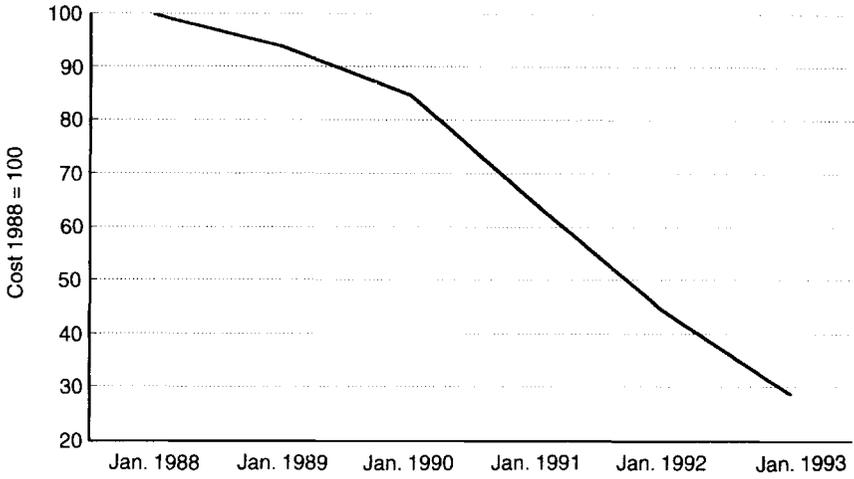


Figure 1.11 The plummeting cost of personal computers: the French case 1988–1993
 Source: Adapted from Volle, 1994

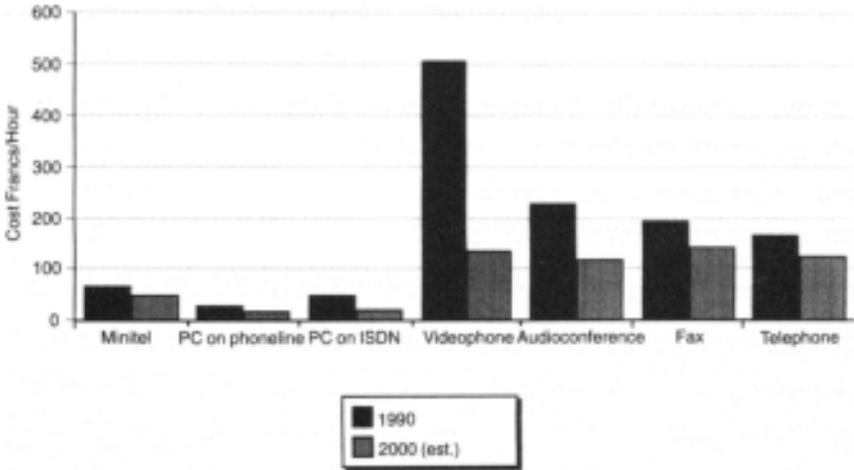


Figure 1.12 The plummeting costs of telecommunications services: the French example
 Source: Volle, 1994

Changing regulatory regimes

These inter-related changes are, in turn, forcing shifts in the way that states regulate telecommunications and the media. It is increasingly difficult, if not impossible, for nation states to monopolise control over these proliferating telematics networks in the name of a single national public interest—as they did with the basic POTS/PSTN service:

The idea of collective solutions, of a general public interest that is more important than individual interests, has found it hard to make the transition from the relatively standardised services of telegraphy, telephony and television to the more complex worlds of the fax, electronic mail, videotex and high-definition television.

(Mulgan, 1991; 243)

The United States, Britain and Japan were the first nations to shift towards competition in the early 1980s; increasingly, all western nations are finding it impossible not to do so because of the risk of business disinvestment and poor competitiveness in this key sector. Pressures from international business interests to deliver and benefit from a global, commercialised marketplace in telematics are becoming increasingly powerful. John Sale, a network strategist for Rank Xerox, summarises the approach of TNCs and their lobbying for more liberalisation in continental Europe, where shifts away from the PTT monopolies have been relatively slow. He admits that his company's 'position is that if you don't allow it in [continental] Europe, we will build it in the U.S. or get the permission to do it in the U.K.' (quoted in Schenker, 1994; 12). National political movements towards neoliberalism are also pushing privatised and marketised regimes of telecommunications regulation as the route towards faster innovation and national economic competitiveness in these vital infrastructures. Supranational bodies such as the European Union, the G7 and the General Agreement on Tariffs and Trade (GATT) are also becoming powerful advocates of global, liberalised markets in communications and telematics services.

As a result, most nation states are now liberalising and often privatising their telecommunications regimes and turning them into marketplaces for a multiplicity of different communications and information services. Usually, this process starts by relaxing controls over who can deliver telematics services or develop new telecommunications infrastructures like mobile. Although national approaches vary considerably, partial or full privatisation of the PTT often follows along with new regulations allowing other entrants to compete in telecommunications

markets. When this occurs, privatised PTTs such as BT in the UK often emerge as some of the largest and most powerful private corporations within national and local economies.

These complex changes mean that telecommunications and telematics markets are extremely complex and fast-moving. Within them, incumbent PTTs (for example, France Télécom) fight it out to serve lucrative users with many new market entrants. Included here are new private sector operators (like MCI, BT and AT & T), specialised global data network operators (for example, IBM), basic infrastructure providers who are increasingly involved in telecommunications (utility and transport companies such as British Rail), private IT suppliers (like Motorola) and smaller entrepreneurs (like Hutchinson Telecom) (Kok, 1992). Increasingly, these organisations are forging global alliances so that they can extend to cover the lucrative and booming markets for global telecommunications on a one-stop basis, focusing on TNCs (Cooke and Wells, 1991).

Thus, companies that were only a few years ago privileged as public monopolies within nation states now face many foreign competitors on their home soil, as well as the imperative to extend their own efforts to other nations. The result is a frantic process of globalisation, with telecommunications services and infrastructures driven more and more by an international logic and international flows of capital. To make matters even more complex, the technological convergence between computing, telecommunications, information and broadcasting industries is also stimulating a flurry of mergers, acquisitions and alliances as tentative efforts are made to make the most of the blurring of boundaries. Cable companies are joining telecom companies; newspaper and media conglomerates are buying into cable companies; equipment companies are forging alliances with entertainment and telecom companies. Telematics and media giants are therefore emerging which are truly global and well placed to try and engineer and benefit from the growing multi-media synergies between telecommunications, computing, media and services within global, private markets. AT&T, for example, has recently announced a World Partners Program, which links it to several PTTs; BT and MCI have an alliance to build global networks; France Télécom and Deutsch Telekom have developed a partnership; and Microsoft, the software giant, and TCI, the cable company, recently formed an alliance to develop interactive television.

These extremely rapid processes of globalisation and restructuring are leading to a more international and open set of liberalised markets which are linked closely into international flows of technology, services and capital. But, ironically, this convergence in national regulation is actually associated with an increasing

heterogeneity in terms of the spatial and social development of telecommunications infrastructures and services. The old POTS-style certainties of standardisation and equalisation are replaced by fragmentation and polarisation. Not surprisingly, market-based regimes for telecommunications tend to encourage much greater extremes and contrasts between the most favoured groups and areas and the least favoured. This tends to mean that cross-subsidies supporting universal services tend to decline and much more variegated patchworks of telecommunications infrastructures roll out within and between cities. Recent experience in Britain shows that while companies compete ruthlessly to 'cherry pick' from lucrative areas and markets such as those dominated by large financial services companies, poor areas with low demand are left with inferior and older infrastructures (Graham and Marvin, 1994). Sometimes, the most marginal users of the telephone actually drop off the basic networks, driven by higher line rents and tariff rebalancing (a process through which rates are cut for the higher and longer distance users and increased for the marginal users who benefited most from the universal service idea). This polarised pattern in access to, and use of, telecommunications, is even more extreme when the more advanced services are considered. The result is a complex and uneven electronic landscape within and between cities.

But the stakes here go way beyond telecommunications policy and the development of cities. Industrial, innovation and trade policy are also crucially affected by these global shifts, stimulating Japan, Europe and the USA to construct 'information superhighway' policies with which to boost their economic positions and their strength in export markets for hardware, software, consultancy support and services (Lanvin, 1993). In the United States, the frenzy of alliance formation between the 'Baby Bells'—the regional telecom monopolies—and cable and entertainment companies effectively consists of a jostling for position to make the profits that seem likely with the development of the much-vaunted information superhighway or national information infrastructure (NII). In post-Maastricht Europe, the aim is to replace the fragmented set of national monopoly telecommunications and telematics systems with a single market made up of one 'European Information Space' (European Union, 1994). All these shifts also have important implications for cities and urban development because cities are the centrepieces of these national and increasingly international telematics marketplace (Graham, 1993).

THE TRANSFORMATION OF CITIES: TOWARDS PLANETARY URBAN NETWORKS

The rest of this book will be concerned with exploring in detail how these technological and regulatory developments affect cities and urban development. Nevertheless, it is also necessary here to examine briefly the remarkable shifts in cities that have paralleled these radical changes in the telecommunications sector. A key argument of this book is that the complex development of telematics and their infusion into cities cannot be divorced from considering the parallel crisis and restructuring that is underway in western cities themselves. The last twenty years have witnessed remarkable changes in the economic, social and geographical makeup of western capitalist cities—and in their political and cultural dynamics (Moss, 1987; Healey *et al.*, 1995).

ECONOMIC RESTRUCTURING, TELECOMMUNICATIONS AND CITIES

The end of the long post-war boom in western capitalist society has triggered a massive restructuring which has radically altered cities. Globalisation and the intensification of global competition have torn away the traditional industrial fabric of many western cities through ‘deindustrialisation’ (Dicken, 1992). Huge transfers of manufacturing activity have focused on less developed and newly industrialised countries (LDCs and NICs) creating a global division of labour. The vertically integrated manufacturing giants of the so-called ‘Fordist’ era are everywhere being replaced by more responsive and flexible networked corporations operating across these global distances and tending to buy in goods and services from small firms. In western cities, information, high-tech manufacturing, service and leisure industries have grown (albeit patchily), forcing great changes in urban labour markets and urban socioeconomic dynamics. Political shifts towards liberalisation and the growth of investment markets have led to a remarkable boom in financial services. This has fuelled the growth of the larger cities which are placed at the hubs of the global electronic and financial services networks.

The result of these shifts is that economic activity involving processing and adding

value to knowledge and information now dominate the economies of western cities as never before (Knight and Gappert, 1989). Even commodity-based industries such as retailing and manufacturing are increasingly information rich. With the unprecedented turbulence, competitiveness and volatility of markets, higher inputs of knowledge and information are being used to reduce uncertainty and improve responsiveness. Because information has such a central place in production in all sectors, it, too, is emerging as a key commodity to be bought, sold, traded and exchanged in markets. This is made possible by the capabilities that telematics bring for processing, storing and controlling vast flows of electronic information on a continuous and real-time basis. In short, as a result of all these shifts, industrial cities have been transformed into 'post industrial' (Savitch, 1988) or 'information' cities (Hepworth, 1987), dominated by consumption industries and the processing and circulation of knowledge and symbolic goods rather than physical goods. A corresponding shift has gone on in the labour markets of cities, with 60–70 per cent of new jobs typically now concerned with some form of information processing, distribution or production. Investment in telematics—the basic information infrastructures of cities—now

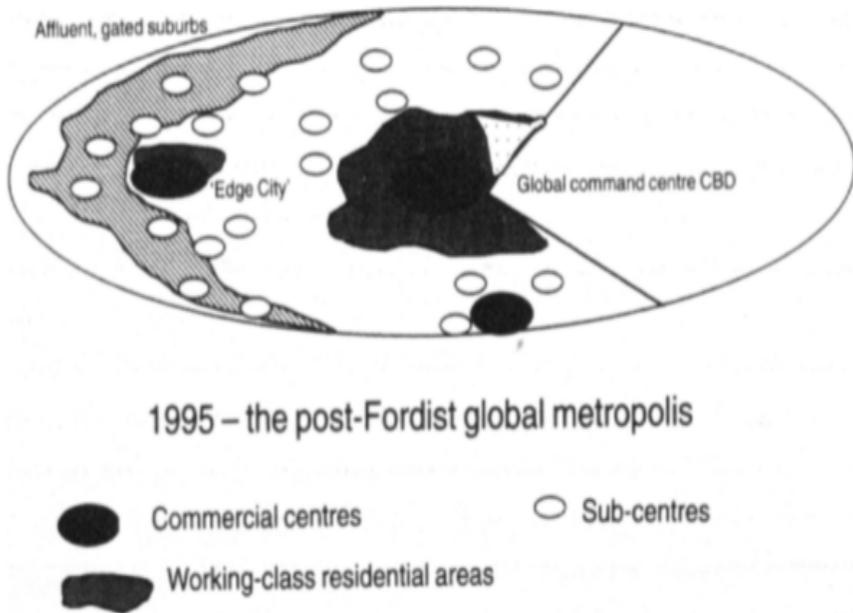


Figure 1.13 Industrial investment in the USA in telematics and other industrial machinery
 Source: *Business Week*, 1994

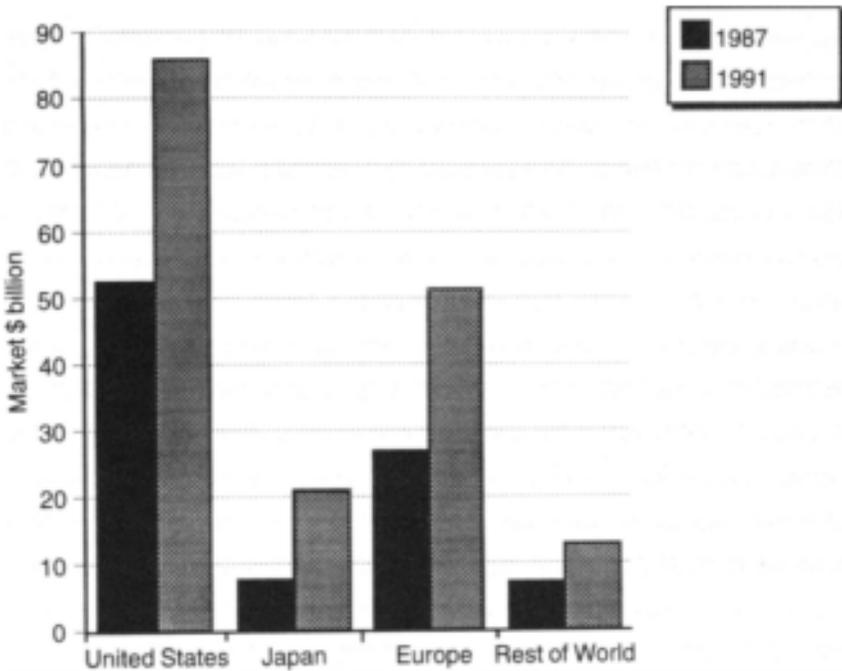


Figure 1.14 The global market for computing and communications services 1987–1991
Source: Gille and Mathonnet, 1994

surpasses investment in other industrial machinery (see Figure 1.13 for the example of the United States). Because telematics make information so easy to move around, these shifts increasingly take a global complexion, tied in with the wider shifts towards globalisation and the growing power of TNCs. The result of the pervasive application of telematics across all economic sectors is that markets for computers and communications equipment are growing rapidly. As shown in Figure 1.14, this growth is dominated overwhelmingly by the three urbanindustrial blocks which are the powerhouses of global capitalism: North America, Western Europe and Japan.

This economic transformation in cities, however, has been associated with the growth of structural unemployment. The growth of well-paid, knowledge intensive jobs has been dwarfed by the loss of manufacturing jobs and the growth of poor quality jobs in retailing, leisure and tourism. Globalisation and the application of telematics also seem to be associated with the fracturing and disintegration of city economies, as they become ‘exposed’ to global telematics networks that invisibly and

silently cross-cut them (Virilio, 1987). The result is that cities are being restructured from internally integrated wholes to collections of units which operate as nodes on international, and, increasingly, global economic networks (Dematteis, 1994). It is increasingly impossible to understand the forces that are shaping the restructuring of cities from a purely local perspective; contemporary city economies can only be understood through their relations to global economic, political and technological changes. The instantaneity of telematics networks is a key facilitator of this linking of the 'local' into the 'global', largely through the construction of corporate telematics networks and global transport networks (Mazza, 1988). As a result, cities are now being tied together with a new level simultaneity. The interactions between and within cities now approaches real time—or at least operates with an unprecedented velocity. The global urban world now operates as a vast set of international systems based on electronic telecommunications-based flows of information, money, services, labour power, commodities and images as well as by advanced transport networks. Dematteis speaks of the emergence of a 'planetary metropolitan system' (Dematteis, 1988).

But the fortunes of cities are very uneven within these shifts. The world financial capitals have emerged as key command and control centres where the best jobs are located. Certain smaller, usually non-industrial cities have managed to specialise in advanced manufacturing, research and development or high technology services. Others have emerged as key tourist centres. At the same time, however, many older industrial cities have had to compete even for low order service jobs such as those in back offices, branch plant manufacturing and shopping centres. In this context, because of the speed of these systems and the erosion of the attachment to place, city economies are more turbulent and face very uncertain futures.

URBAN SOCIAL AND CULTURAL CHANGE

Such economic restructuring and the telematics-based globalisation of cities has been associated with profound urban social and cultural change. On the social front, the urban economic crisis of the 1980s precipitated the end of the post-war welfare—Keynesian consensus and the ascendancy of neo-liberal approaches to urban management (Harvey, 1989; Healey *et al.*, 1995). In concert with the effects of economic restructuring, these changes have forced social and geographical polarisation within cities.

The ways in which new telecommunications and telematics innovations are involved in the social life of cities tends to both reflect and support this polarisation. While affluent and elite groups are beginning to orient themselves to the Internet and home informatics and telematics systems, other groups are excluded by price, lack of skills or threaten to be exploited at home by such new technologies. Advanced telecommunications and transport networks open up the world to be experienced as a single global system for some. But others remain physically trapped in 'information ghettos' where even the basic telephone connection is far from a universal luxury.

The growing divisions between affluent and poor areas can lead to rising fear of crime, the 'fortressing' of neighbourhoods through electronics surveillance systems, and an increasingly home-based urban culture where people's working, shopping, access to services and social interaction may become mediated more via telematics rather than by social interaction in the public spaces of cities. The parallel shift toward market-based telecommunications regimes has added further momentum to this polarisation and growing unevenness in the social landscapes of cities. It is clear that while many speak of 'time—space compression' through new technologies, it is important to differentiate between the diverse social experiences of these processes of change for different groups of people.

A major area of debate currently centres on the degree to which telematics can be used to support socially liberating and progressive changes within cities—by overcoming the isolation of disabled groups for example. Whilst there are certainly some examples of such liberating applications, for example with 'virtual communities' for marginalised and housebound groups, critical commentators stress that, on the whole, such technologies may in fact be a basis for exacerbating further the social and geographical polarisation within urban places. Current evidence certainly suggests that the future of those in cities who are at the margins of the information society seems grim. The hyped-up promises of technological fixes in the new telematics era threaten to have a distinctly hollow ring when considering the position of the most disadvantaged groups within the contemporary city.

These changes in the social dynamics of western cities are in turn interwoven with the *cultural* dimensions of globalisation, a process which is closely tied into wider shifts towards a global, 'post-modern' urban culture (Lash and Urry, 1994). For example, advances in telecommunications and telematics are, along with the liberalisation of media regulations, helping to support the emergence of truly global cultural and media industries. These feed into support social and cultural change in international systems of cities (Morley and Robins, 1995). There is little

doubt that the human experience of place and the social construction of cultural identities by groups and individuals are being radically altered in these 'global times'. This is because new advanced telecommunications act as conduits for flows of images, knowledge, information and symbols which integrate places and people into the global cultural system in 'real time'. Thus, traditional national mass broadcasting systems are giving way to a broadening range of global systems of mass communications (cable and satellite TV) and interactive personal communications (such as electronic mail and the World Wide Web on the Internet). Through these systems a growing proportion of social interaction and cultural flow take place.

But interpreting the implications and effects of these shifts remains highly contested. To some, shifts towards a more participative and interactive media culture through the explosion of the Internet and 'cyberspace' represent the empowerment and liberation of individuals and groups who were simply passive consumers of media in the past. To critics, though, the globalisation of urban culture is little more than the ruthless commodification of all information by fast-growing media conglomerates such as Rupert Murdoch's News International corporation. It is argued that this erases local differences; it superimposes western cultures over non-western ones; it polarises social access to information; and it leads to a cacophony of signs which often alienates urban inhabitants within an 'uprooted' and bewildering global culture.

Whether one stresses the positive or critical interpretations, or some blend of the two, there is little doubt that, in this movement-dominated post-modern world, the whole cultural idea of cities is being redefined. This transformation is creating a 'global sense of place' which challenges all previous ideas about what it means to live in a region, nation or city. But this does not simply erase the attachment of people to urban places. Instead, a complex interaction between telemediated cultural exchanges in electronic spaces and place-based ones in urban places is emerging. Networked communities of interest now span the globe, based on specialised foci of interest or various combinations of ethnicity, gender, sexuality, profession, etc. These mesh and interact with place-based communities, but in ways which we have only begun to understand.

URBAN ENVIRONMENTS

These economic and social shifts have led to a growing concern amongst urban planners and policy-makers to address the *environmental* dimensions of their cities. Planners are trying to address the legacies of pollution and dereliction from the industrial era as well as the side-effects of burgeoning traffic congestion. The need to compete as an attractive business environment is joining with wider social awareness to force environmental issues to the top of the urban agenda. Concern now centres on the need for environmentally sustainable urban futures. Once again much attention here has turned to the potential role of telecommunications and telematics for contributing towards the development of more sustainable cities (Gillespie, 1992). Most often, however, this analysis has been hampered by the assumption that telematics-based flows of electronic information can be used directly to substitute for the environmentally damaging flows of physical transportation. More critical scrutiny of such ideas casts doubt on such claims, however, because they rely on oversimplified conceptions of the relationships between urban environments and telecommunications.

Rather than simply substituting for transportation, telecommunications have a wide range of contradictory linkages. Telecommunications can help to stimulate more travel as cheaper and more accessible forms of communication generate new demands for the physical movement of people and goods. At the same time new services such as road information systems and auto route guidance can help drivers to overcome the uncertainties of traffic congestion, thereby improving the attractiveness of the road network. Although telecommuting and teleworking initiatives may be able to help reduce levels of peak-time congestion they have a multitude of second-order effects. The teleworker has to heat and power the home during the day, the road space created by the teleworker can quickly induce new traffic on to the road network while weakening the need to live in close physical proximity to work can encourage urban sprawl. Similar contradictions also occur in the energy, water and waste sectors. Telecommunications do not necessarily lead to reductions in material flows through cities. While the new control capabilities of telematics do have the potential to shape the level and/or time of resource consumption the current supply-oriented logic of network management does not necessarily provide much incentive to infrastructure to reduce total flows.

URBAN TRANSPORT AND INFRASTRUCTURE

Telecommunications are radically transforming the management and provision of urban transportation and infrastructure networks. Old ideas about the role of monopolistic, standardised and universally available infrastructure networks available to meet all demands for movement, mobility, heat, power and water supply are being challenged. Increasingly telecommunications are supporting the splintering of infrastructure services to facilitate competition on what were previously considered to be monopolistic networks. Telecommunications enable infrastructure providers more effectively to control their networks by identifying the costs of servicing different types of customers. At the same time these capabilities provide the opportunity of providing premium, enhanced and value added services to particular groups of customers.

The application of telecommunications technologies in the management of networks is developing in tandem with shifts towards the liberalisation and privatisation of infrastructure networks. Privatisation has transformed service provision from monopolistic, universally available, standardised systems into complex new patterns of service provision. Increasing levels of choice for large users mean that incumbent operators are forced to remove cross subsidies from large to small users to compete with new entrants who cherry pick their most valuable customers. Telematics play a central role in these new logics of infrastructure management. For instance, Geographical Information Systems (GISs) provide the tools for allocating costs to different types of customer, allowing new entrants to target the most lucrative and profitable customers. The new control capabilities of telematics networks being fitted over what were previously 'dumb' infrastructure networks provide much more sophisticated control and operational systems. These can significantly improve the efficiency and profitability of networks by more effectively balancing demand and supply of services. New smart metering technologies enable premium customers to have increasing levels of choice while prepayment metering technology based on smart cards allows utilities to socially dump expensive, marginal and poor customers.

Telecommunications are also having profound implications within the transportation sector. Historically, there have always been close linkages between communication technologies and transportation. The telegraph and later the telephone enabled railway companies to standardise time while monitoring and controlling the movement of trains across their rail networks. In the contemporary city these linkages have significantly strengthened as the bundle of applications

within the road transportation informatics technologies lead to important changes in the use and management of transportation networks. Electronic road pricing systems have been demonstrated in cities across Europe allowing transport authorities potentially to charge for road space according to levels of congestion in real time. The development of freight logistic systems linking together production and distribution sites electronically is enabling companies drastically to cut warehouse stocks and centralise warehouse and distribution functions, thereby more closely utilising the transport network as part of the production process. These companies are also relying more heavily on transportation informatics to maintain real time contact with drivers to route deliveries according to congestion levels and the demands of retailers. Public transport operators are also utilising telematics to provide real time information to users and to make efficient use of expensive transport capacity by more efficiently meeting demands.

Consequently, telematics are facilitating radical transformation in all types of infrastructure networks. New information and telematics technologies are helping to create new markets in infrastructure services, introduce competition on to networks, differentiate between particular types of customers and provide a wide range of value added services. But these new logics of network management hardly figure in the urban policy literature. With the exception of telecommunications networks themselves, there has been relatively little academic or policy interest in how the new capabilities of telecommunications are transforming the management and provision of urban networked services.

URBAN PHYSICAL FORM

Reflecting the economic, social and political restructuring of western cities, the urban *landscape* and *physical urban forms* of advanced industrial cities are in turn being radically reshaped. Global economic forces are taking over local property markets. Derelict or decaying old industrial spaces are being transformed into post-modern urban developments as foci of global consumption and culture (Relph, 1987; Knox, 1993). The sprouting of new telecommunications equipment, and the infusion of many new telecommunications infrastructures into the old fabric of the city, have been an essential part of this transformation. In addition the deconcentration of many cities, and the emergence of the multcentred urban area—what Jean Gottman (1983) called ‘megapololis’—has been, at least in part, facilitated by the new

capabilities of telecommunications and telematics for supporting dispersed economic activities away from urban cores (Hall, 1993). Suburban office complexes, business and technology parks, out-of-town shopping malls and, increasingly, whole 'Edge Cities' are reshaping the physical layout of urban areas, using the combined decentralising power of automobiles and telematics (Garreau, 1988). Core cities are being turned into extended urban regions; these themselves now blend into wider megalopoli; at the final level megalopoli merge into the planetary metropolitan system. Instead of single centres linked into some single central place hierarchy, then, very complex networks between cities are emerging based on complex complementary relationships. This trend is particularly advanced in North America. But this decentralisation does not represent the end of cities as we know it. Complex combinations of both decentralisation and centralisation are occurring simultaneously, with the world cities in particular the focus of new pressures for more centralisation because of telematics.

URBAN PLANNING, POLICY AND GOVERNANCE

The overwhelming importance of the *economic* imperative in cities means that the increasing emphasis of urban governance is on public—private partnerships oriented towards an explicit economic development agenda rather than the social, redistributive one that characterised the post-war period (Healey *et al.*, 1995). City authorities have been plunged into a new competitive era in which they act as 'urban entrepreneurs' in increasingly global 'marketplaces' for investment from multinational corporations, public agencies, media, sport and leisure corporations and tourists (Harvey, 1989).

Because city economies today operate as fragmented collections of nodes on global networks, this fight for an improved nodal status is intense and very competitive. Increasingly, elected local governments work in corporatist ways with non-elected public agencies and local firms, utilities and property interests to fight for the regeneration of their cities. Telecommunications companies of all types are, once again, involved here as growing players in such local coalitions—because they are dependent upon long-term revenues from the infrastructure they have, quite literally, sunk into the physical fabric of their home cities. Therefore they have much to gain from supporting the local growth of information-intensive economic sectors (Logan and Molotch, 1987). The importance of telecommunications and telematics

to the image and competitiveness of urban areas mean that they are a key focus of such entrepreneurial policy. These new approaches to urban government reflect the emergence of truly international systems of interlinked cities, where urban policy-makers need to consider the role of their city as a node on urban networks, mediated by advanced telecommunications and global transport systems. To parallel the globalisation of their markets, telecommunications companies are increasingly being set up on a global basis so as to meet the needs of multinational corporations for private, global networks (Graham and Marvin, 1995).

Urban governance and public services are also being transformed through the application of telematics. The wider shift from Keynesian to individualistic and conservative welfare regimes is driving cost cutting, privatisation and restructuring in urban welfare services at the same time as increased polarisation is increasing demands for these services. In these circumstances, the talk is now to reinvent government more along business lines and to use telematics innovations as the new mechanism for delivering services with minimum costs and maximum flexibility. As a result, telematics-based restructuring in urban governments is burgeoning, often with the result of replacing physical, staffed service delivery offices with virtual and electronic ones. Many routine functions are also being outsourced to distant, even less developed country, locations.

THE STRUCTURE OF THE BOOK

The rest of this book is structured around nine chapters, summarised in Figure 1.15. In Chapter 2 we try to address the growing sense that many current ways of looking at cities are becoming obsolescent because of the neglect of many telecommunications-based changes underway in cities and urban life. We explore in detail how the invisibility of telecommunications-based change in cities combines with their space and time-adjusting qualities to challenge fundamentally many of the assumptions that still underpin much urban analysis and most urban planning and policy-making. Attempts to grapple with the need for new conceptual frameworks which map and explain telecommunications-based changes in cities are then explored.

In Chapter 3 we go on to critically evaluate the competing theoretical perspectives that can be used to address city—telecommunications relations. Four of these are identified: technological determinism, utopianism and futurism,

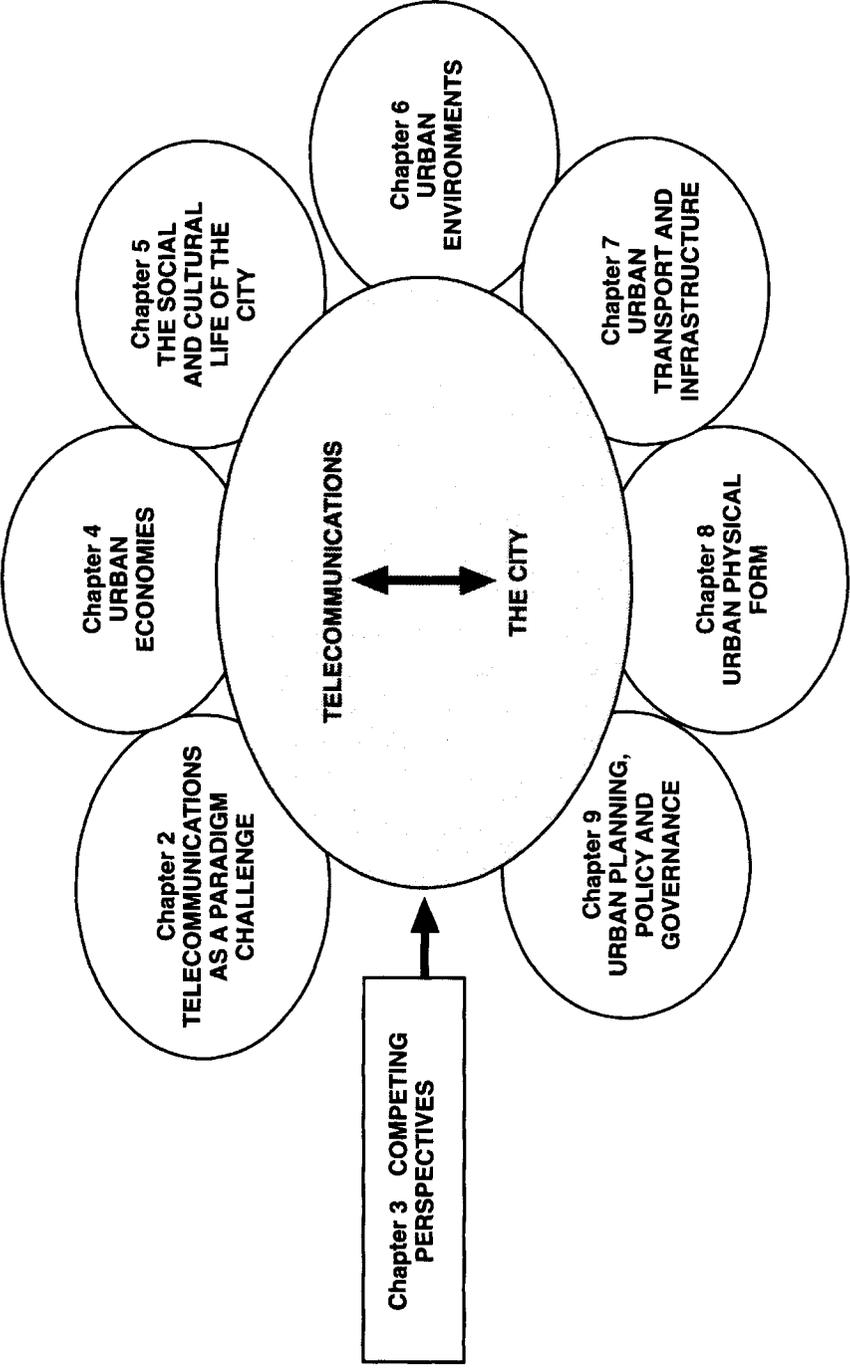


Figure 1.15 The structure of the book

urban political economy and the social construction of technology (SCOT) approach. Examples of these are given through extracts from the work of the leading analysts that have adopted these perspectives. This analysis is used to develop a new approach to city-telecommunications relations which provides the framework for the rest of the book.

Each of the following six chapters then goes on to use this approach as the basis for analysing a key aspect of city—telecommunications relations. These are the development of urban economies (Chapter 4), the social and cultural life of cities (Chapter 5), the urban environment (Chapter 6), urban transport and infrastructure (Chapter 7), the physical form of cities (Chapter 8), and urban planning, policy and governance (Chapter 9). Finally, in the concluding chapter, we pull out some key issues which emerge from the approach and attempt to assess the implications of telecommunications for the reality of socioeconomic and cultural life, development and policy within the turbulent and uncertain world of modern cities.

NOTES

1. At least six of these can be identified: the information economy approach (Hepworth, 1989), the post-industrial and information society theses (Bell, 1973), the technoeconomic paradigm approach (Hall and Preston, 1988), the post-Fordist approach (Amin, 1994) and the post-modern approach (Harvey, 1989).

2. Included here are the books by Meier (1962); Dutton *et al.* (1987); Castells (1989); Brotchie *et al.* (1991); Schmandt *et al.* (1990); OECD (1992); and Mitchell (1995). More peripheral accounts are by Hepworth (1989) and Gottman (1990).

BIBLIOGRAPHY

- Abler, R. (1974) 'The geography of communications', in M. Eliot Hurst (ed.), *Transportation Geography*, New York: McGraw Hill, 327–346.
- (1975) 'Effects of space adjusting technologies on the human geography of the future', in R. Abler, D. Janelle, A. Philbrick and J. Sommer (eds), *Human Geography in a Shrinking World*, North Scituate, MA: Duxburg Press.
- (1977) 'The telephone and the evolution of the American metropolitan system', in I. de Sola Pool (ed.), *The Social Impact of the Telephone*, London: MIT Press, 318–341.
- Adam, B. (1990) *Time and Social Theory*, Cambridge: Polity.
- Adamiak, M.G., Roberts, D.C. and Ketz, S.D. (1990) 'A microprocessor-based system for the implementation of variable spot pricing of electricity', *IEEE Computer Applications in Power*, 3(4), 43–48.
- Adams, J. (1991) *Energy Management Application Study*, PC 2000, Martlesham Heath, Suffolk: British Telecom Laboratories.
- ADUML (1991) *Plan de Développement Urbain de la Communication*, Agence de Développement D'urbanisme de la Métropole Lilloise.
- Agre, P. (1994) 'Orwell was off by 499 channels and what to do about it', mimeo.
- Aiello, J. (1994) 'Computer-based work monitoring: electronic surveillance and its effects', *Journal of Applied Social Psychology* 23(7), 499–507.
- Aird, W.W. (1988) 'The radical impact of telecommunications—as an emerging agent of design change', *Architecture* 77(2), 112–116.
- Aldrich, M. (1982) *Videotex: Key to the Wired City*, London: Quiller.
- Allen, J. and Pryke, M. (1994) 'The production of service space', *Environment and Planning D: Society and Space* 12, 453–475.
- Alles, P. and Esparza, S. (1994) 'Telecommunications and the large city—small city divide: evidence from Indiana cities', *Professional Geographer* 46(3), 307–316.
- Alovic, T. (1993) *Corporate Networks: The Strategic Use of Telecommunications*, Norwood Ma: Artech House.
- Ambrose, P. (1994) *Urban Process and Power*, London: Routledge.
- Amin, A. (1994) *Post-Fordism: A reader*, Oxford: Blackwell.
- Amin, A. and Thrift, N. (1992) 'Neo-Marshallian nodes of global networks', *International Journal of Urban and Regional Research* 16(4), 571–587.
- (1995) 'Globalisation, institutional 'thickness' and the local economy', in P. Healey, S. Cameron, S. Davoudi, S. Graham and A. Madani Pour (eds), *Managing Cities: The New Urban Context*, London: Wiley, 91–108.
- Anderson, B. (1983) *Imagined Communities*, London: Verso.

- Antonelli, C. (1988) *New Information Technologies and Industrial Change: The Italian Case*, London: Kluwer.
- Appadurai, A. (1990) 'Disjuncture and difference in the global cultural economy', *Theory, Culture and Society* 7, 295-310.
- Arnbak, J. (1993) 'The European (r)evolution of wireless digital networks', *IEEE Communications Magazine*, December, 74-80.
- Arrow, K. (1980) 'The economics of information', in L. Destorzos and J. Moses (eds), *The Computer Age: A Twenty Year View*, Cambridge, Ma: MIT Press.
- Athanasiou, T. (1985) 'High-tech alternativism: the case of the community memory project', in P. Golding (ed.), *Making Waves: The Politics of Communications*, London: Radical Science Collective/Free Association, 37-51.
- Atkins, W.S. Management Consultants (1991) *Markets for Environmental Monitoring Instrumentation*, London: Department Of Trade and Industry, HMSO.
- Atkinson, R. (1995) 'Technological change, service employment and the future of cities', mimeo, Washington: Office of Technology Assessment.
- Aufderheide, P. (1992) 'Cable television and the public interest', *Journal of Communication* 42(1), 52-65.
- Ausubel, J.H. (1989) 'Regularities in technological development: an environmental view', in J.H. Ausubel and H.E. Sladovich, *Technology and the Environment*, Washington D.C.: National Academy Press.
- Ausubel, J.H. and Herman, R. (eds) (1988) *Cities and their Vital Systems: Infrastructure Past, Present, and Future*, Washington D.C.: National Academy Press.
- Baddeley, S. and Dawes, N. (1987) 'Information technology support for devolution', *Local Government Studies*, July/August, 1-16.
- Bakis, H. (1995) 'Territories and telecommunications—shift of the problematics: from the "structuring" effect to "potential for interaction"'. Paper given at the conference on 'Telecom Tectonics', Lansing, Michigan, March.
- Bakis, H., Abler, R. and Roche, E. (1993) *Corporate Networks, International Telecommunications and Interdependence*, London: Belhaven.
- Bankston, R. (1993) 'Instant access to city hall: an examination of how local governments use interactive video to reach citizens', *Multimedia Communications: Forging the Link*, Conference Report, Chapter 75.
- Bannister, N. (1993) 'Banks step up war on cash with plastic card that can be topped up by phone', *The Guardian*, 9 December.
- (1994a) 'Networks tap into low wages', *The Guardian*, 15 October, 40.
- (1994b) 'Go-slow on the European multimedia superhighway', *The Guardian*, 26 October.
- Bannister, N. and Atkinson, D. (1995) 'Banks profit from hi-tech job losses', *The Guardian*, 3 April, 3.
- Bartolucci, A. and Morini, A. (1992) 'The future uses of intelligent homes', *Proceedings of Housing Technology and Socio-Economic Change*, World Congress on Housing, Birmingham, UK, 495-503.
- Batten, D. (1994) 'Network cities: flexible urban configurations for the 21st century', mimeo.
- Batty, M. (1987) 'The intelligent plaza is only the beginning', *The Guardian*, 17 September, 19.
- (1990a) 'Invisible cities', *Environment and Planning B: Planning and Design*, 17, 127-130.
- (1990b) 'Intelligent cities: using information networks to gain competitive advantage', *Environment and Planning B: Planning and Design* 17(2), 247-256.
- (1991) 'Urban information networks: the evolution and planning of computer-communications infrastructure', in J. Brotchie, M. Batty, P. Hall and P. Newton (eds), *Cities of the 21st Century*, London: Longman, 139-158.
- Batty, M. and Barr, B. (1994) 'The electronic frontier: exploring and mapping cyberspace', *Futures* 26(7), 699-712.
- Beard, S. (1994) 'The futures market', *The Observer Life*, 20-21.

- Beaumont, J.R. and Keys, P. (1982) *Future Cities: Spatial Analysis of Energy Issues*, Chichester: Research Studies Press.
- Beckouche, P. and Veltz, P. (1988) 'Nouvelle économique, nouveau territoire', supplement to the *June Datar Letter*.
- Bell, D. (1973) *The Coming of Post Industrial Society*, New York: Basic.
- Bell, E. (1994) 'Nation shall network unto nation', *The Observer*, 5 June, 5.
- Bellamy, C. and Taylor, J. (1994) 'Introduction: exploiting I.T. in public administration—towards the information polity?', *Public Administration*, 7(2), Spring, 1–12.
- Bender, G. and Druckrey, T. (1994) *Culture on the Brink: Ideologies of Technology*, Seattle: Bay Press.
- Beniger, J. (1986) *The Control Revolution: Technological and Economic Origins of the Information Society*, Cambridge Mass: Harvard University Press.
- Bernard, C. (1994) 'De la conception à la réalisation', *France Télécom News*, Septembre, 3–12.
- Bernardini, O. and Galli, R. (1993) 'Dematerialization: long term trends in the intensity of use of materials and energy', *Futures*, May, 431–448.
- Berrie, T. and Berrie, T. (1993) 'Utility management, ownership and accountability in the 1990s', *Utilities Policy*, January, 81–85.
- Berry, B.J.L. (1973) *The Human Consequences of Urbanisation*, New York: St Martin's Press.
- Bianchini, F. (1989) 'The crisis of urban public social life in Britain: origins of the problem and possible responses', *Planning Practice And Research* 5(3), 4–8.
- (1990) 'Reimagining the city', *Working Paper No.18*, Liverpool: Centre For Urban Studies, University Of Liverpool.
- Biehl, D. (1986) *The Contribution of Infrastructure to Regional Development*, Final Report, Brussels: Infrastructure Study Group, CEC.
- Bijker, W, Hughes, T. and Pinch, T. (eds), (1987) *The Social Construction Of Technological Systems*, Cambridge: MIT Press.
- Bijker, W. and Law, J. (1992) *Shaping Technology, Building Society: Studies In Sociotechnical Change*, London: MIT Press.
- Biocca, F. (1992) 'Communication within virtual reality: creating a space for research', *Journal Of Communication* 42(4), 5–21.
- Bird, J., Curtis, B., Putnam, T, Robertson, G. and Tickner, L. (1993) *Mapping The Futures: Local Cultures, Global Change*, London: Routledge.
- Bleeker, S. (1994) 'Towards the virtual corporation', *The Futurist*, March—April, 11–14.
- Boer, B. (1990) 'Big deal: closing the trade gap', *Telecom World*, September, 10–12.
- Boettinger, H. (1989) 'And that was the future...telecommunications: from future-determined to future-determining', *Futures*, June, 277–290.
- Boghani, A., Kimble, E. and Spencer, E. (1991) *Can Telecommunications Help Solve America's Transportation Problems*, Cambridge Ma: Arthur D.Little Inc.
- Bogue, R. (1992) 'Europe senses opportunities', *Physics World*, 31–35.
- Bowie, N. (1990) 'Equity and access to information technology', in Institute for Information Studies, *The Annual Review*, Institute for Information Studies, 131–167.
- Boyer, C. (1993) 'The city of illusion: New York's public places', in P.Knox (ed.), *The Restless Urban Landscape*, Englewood Cliffs: Prentice Hall, 111–126.
- Brain, D. and Page, A. (1991) *Review of Current Experiences and Prospects for Teleworking*, Brussels: European Commission.
- Brasier, M. (1989) 'Merrill Lynch flees costly Wall Street', *The Guardian*, 29 June.
- Breheny, M.J (ed.) (1992) *Sustainable Development and Urban Form*, London: Pion.
- Brewer, H. (1989) 'Diversification attempts by electric utilities: a comparison of potential vs. achieved diversification', *Energy Policy*, June, 228–234.

- British Broadcasting Corporation (1993) 'Caught on camera', Close Up North Television Documentary, Newcastle.
- British Telecom (1991) *BT Environmental Policy Statement*, March.
- (1992a) *BT and the Environment*, Environmental Performance Report 1992, London: British Telecom.
- (1992b) *A Study of the Environmental Impact of Teleworking*, a Report by BT Research Laboratories, London: British Telecom.
- Brody, H. (1993) 'Information highway: the home front', *Technology Review*, August-September, 31-40.
- Brotchie, J., Batty, M., Hall P. and Newton, P. (eds) (1991) *Cities of the 21st Century*, London: Halsted.
- Brotchie, J., Hall, P. and Newton, P. (eds) (1987) *The Spatial Impact of Technological Change*, London: Croom Helm.
- Brotchie, J., Newton, P., Hall, P. and Nijkamp, P. (eds) (1985) *The Future of Urban Form: The Impact of New Technology*, London: Croom Helm and Nichols.
- Brown, A. (1994) 'The tedium is the technology', *The Independent*, 28 January, 13.
- Brown, L. (1994) 'The seven deadly sins of the information age', *Intermedia*, June/July, 22(3).
- Bruce, A. (1993) 'Prospects for local economic development: a practitioners view', *Local Government Studies* 19(3), 319-340.
- Brunn, S. and Leinbach, T. (eds) (1991) *Collapsing Space and Time: Geographic Aspects of Communications and Information*, London: Harper.
- Buckingham, L., Culf, A. and Goldenberg, S. (1993) 'The battle for global vision', *The Guardian*, 23 October, 23.
- Budd, L. (1994) 'The growth of global strategic alliances in different financial centres', paper presented at the conference Cities, Enterprises and Society on the Eve of the 21st Century, Lille, March.
- Budd, L. and Whinster, S. (eds) (1992) *Global Finance and Urban Living*, London: Routledge.
- Buijs, S. (1994) 'Urban networks', *Flux*, January-March, 51-58.
- Burrows, R. (1995) 'Cyberpunk as social theory', mimeo.
- Business Week* (1994) 'Digital juggernaut', 13 June, 36-39.
- Calhoun, C. (1986) 'Computer technology, large-scale social integration and the local community', *Urban Affairs Quarterly* 22(2), 329-349.
- Callon, M., Courtaï, J., Turner, W. and Baulin, S. (1983) 'From translation to problematic networks: an introduction to co-word analysis', *Social Science Information* 22, 191-235.
- Camden Council (1990) 'Proposed integrated voice and data network', mimeo.
- Cancelieri, A. (1992) *Habitat du futur*, Paris: Documentation Francaise.
- Capello, R. (1989) 'Telecommunications and the spatial organisation of production', Newcastle Studies of the Information Economy, Working Paper No. 10.
- Capello, R. and Gillespie, A. (1993) 'Transport, communication and spatial organisation: future trends and conceptual frameworks', in G. Giannopoulos and A. Gillespie, *Transport and Communications in the New Europe*, London: Belhaven, 24-58.
- Carey, J. (1989) *Communication as Culture: Essays on Media and Society*, London: Routledge.
- Caso, O. and Tacken, M. (1992) 'Deconcentration of work, effects on the design of dwellings', *Proceedings of Housing Technology and Socio-Economic Change*, World Congress on Housing, Birmingham, UK, 504-520.
- Cassirer, H.R. (1990) 'Dissent—communications vs. the environment?', *Intermedia* 18(1), 10-12.
- Castells, M. (1985) 'High technology, economic restructuring and the urban-regional process in the United States', in M. Castells (ed.), *High Technology, Space and Society*, London: Sage, 11-39.
- (1989) *The Informational City: Information Technology, Economic Restructuring and the Urban—Regional Process*, Oxford: Blackwell.

- Castells, M. and Hall, P. (1994) *Technopoles of the World: The Making of 21st Century Industrial Complexes*, London: Routledge.
- Caulkin, S. (1994a) 'Why city must be slicker', *The Observer*, 13 February, 8.
- (1994b) 'Engineering problems', *The Observer*, 28 August, 6.
- CEC (Commission of the European Communities) (1990) *Green Paper on the Urban Environment*, Com(90) 218, Brussels: CEC.
- (1991) *Europe 2000: Outlook for the Development of the Community's Territory*, Brussels: CEC.
- (1992a) *Perspectives on Advanced Communications in Europe*, Volume I, Summary, Brussels: CEC.
- (1992b) *Exploratory Investigation of Employment Trends in Rural Areas*, Brussels: CEC.
- CEED (1992) 'The environmental impact of teleworking', *CEED Bulletin* 38, March-April, 10–11.
- Channel 4 (1994) *Once Upon a Time in Cyberville* (programmetranscript), London: Channel4.
- Chevin, D. (1991) 'All the right connections', *Building*, 19 July, 46–48.
- Chinitz, B. (1964) 'Introduction: city and suburb', in B.Chinitz (ed.), *City and Suburb: the Economics of Metropolitan Growth*, Englewood Cliffs, NJ: Prentice Hall, 3–50.
- Chittick, D.R. (1992) 'Technology's impact on the environment: both problem and solution', *AT&T Technical journal*, March/April, 2–4.
- Christopherson, S. (1992) 'Market rules and territorial outcomes: the case of the United States', *International Journal of Urban and Regional Research* 17(2), 274–288.
- (1994) 'The fortress city: privatized spaces, consumer citizenship', in A.Amin (ed.), *Post Fordism: A Reader*, Oxford: Blackwell, 409–427.
- Clark, M., Burall, P. and Roberts, P. (1993) 'A sustainable economy', in A.Blowers (ed.), *Planning for a Sustainable Environment*, London: Earthscan.
- Clarke, R. (1986) *The Handbook of Ecological Monitoring*, Oxford: Gems/Upep Publication, Clarendon Press.
- Clarke, T. (1991) 'Machine dreams', *Marxism Today*, June, 40.
- Coates, J.F. (1982) 'New technologies and their urban impact', in G.Gappert and R.Knight (eds), *Cities in the 21st Century*, London: Sage.
- Confederation of British Industry (1989) *Transport in London: The Capital at Risk*, London, CBI.
- Cooke, P. (1983) *Theories of Planning and Spatial Development*, London: Hutchinson.
- (1988a) 'Flexible integration, scope economies and strategic alliances: social and spatial mediations', *Environment and Planning D: Society and Space* 6, 281–300.
- (1988b) 'Modernity, postmodernity and the city', *Theory, Culture And Society*, 5, 475–492.
- Cooke, P. and Morgan, K. (1991) *The Network Paradigm: New Departures in Corporate and Regional Development*, RIP Report No. 8, University of Cardiff.
- Cooke, P., Moolaert, F., Swyngedouw, E., Weinstein, O. and Wells, P. (1992) *Towards Global Localization*, London: UCL Press.
- Cooke, P. and Wells, P. (1991) 'Uneasy alliances: the spatial development of computing and communications markets', *Regional Studies* 25(4), 345–354.
- Coolidge, A.B., Coates, J.F., Hitchcock, H.H. and German, T. (1982) *Environmental Consequences of Telematics: Telecommunication, Computation, and Information Technologies*, EPA Report, 6000/8–81, April (13).
- Cooper, I. and Elans, P. (1993) *Cities and Sustainability*, AFRC-SERC Clean Technology Unit and ESRC, London.
- Corey, K. (1987) 'The status of the transactional metropolitan paradigm', in R.Knight and G.Gappert (eds), *Cities of the 21st Century*, London: Sage.
- (1991) 'The role of information technology in the planning and development of Singapore', in S.Brunn and T.Leinbach

- (eds), *Collapsing Space and Time: Geographic Aspects of Communications and Information*, London: Harper, 217–231.
- (1993) 'Using telecommunications and information technology in planning an information-age city: Singapore', in H. Bakis, R. Abler and E. Roche (eds), *Corporate Networks, International Telecommunications and Interdependence*, London: Belhaven, 49–76.
- Cornelius, S. (1994) 'GIS in the Environment', in D.R. Green, D. Rox, and J. Cadoux-Hudson (eds), *Geographic Information 1994*, London.
- Cornford, J. and Gillespie, A. (1992) 'The coming of the wired city? The recent development of cable in Britain', *Town Planning Review*, 63(3), 243–264.
- (1993) 'Cable systems, telephony and local economic development in the UK' *Telecommunications Policy*, November, 589–602.
- Cornford, J., Gillespie, A. and Robins, K. (1991) 'Telecommunications and the competitive advantage of cities in the European urban system', paper presented at the Communications and Economic Development Conference, Manchester, May.
- Cornford, J., Graham, S. and Marvin, S. (1994) 'Towards phones for all? Universal service in a liberalised environment', Programme on Information and Communications Technology, Newcastle Working Paper, No.14.
- Cornish, E. (1993) 'Man and megamachine', *The Futurist*, March–April, 38–39.
- Corr, F. and Hunter, J. (1992), 'Worldwide communications and information systems', *IEEE Communications Magazine*, October, 58–62.
- Cowe, R. (1994) 'Milk rounds and small shops face extinction', *The Guardian*, 9 June.
- Cox, K. (1993) 'The local and the global in the new urban politics: a critical view', *Environment and Planning D: Society and Space* 11, 433–448.
- Cox, K. and Mair, A. (1988) 'Locality and community in the politics of local economic development', *Annals of the Association of American Geographers*, 78 (2), 307–325.
- Cramer, J. and Zegveld, W.C.L. (1991) 'The future role of technology in environmental management', *Futures*, June, 23 (5), 451–468.
- Cronberg, T, Duelund, P., Jensen, O. and Qvortrup, L. (eds) (1991) *Danish Experiments: Social Constructions of Technology*, Copenhagen: New Society Social Science Monographs.
- Curry, M. (1995) 'GIS and the inevitability of ethical consistency', in J. Pickles (ed.), *Ground Truth: The Social Implications of Geographic Information Systems*, London: Guildford Press, 68–87.
- Curtis, T. and Means, K. (1991) 'Market segmentation and the IBN policy debate', in M. Elton (ed.), *Integrated Broadband Networks: The Public Policy Issues*, Amsterdam: Elsevier, 23–38.
- Dabinett, G. and Graham, S. (1994), 'Telematics and industrial change in Sheffield, UK', *Regional Studies* 28(6), 605–617.
- Daniels, P. (1988) 'Producer services and the post-industrial space-economy', in D. Massey and J. Allen (eds), *Uneven Redevelopment*, London: Hodder and Stoughton, 107–123.
- Danziger, J., Dutton, W, Kling, R. and Kraemer, K. (1982) *Computer in Politics*, New York: Columbia University Press.
- Darby, G. (1994) 'Can digital kiosks for travellers bring digital services to the local loop and make a city, a village, smart? A development strategy', *Pacific Telecommunications Council, 16th Conference Proceedings*, 230–233, Travellers Services.
- Dauncey, G. (1990) 'The role of new metering technologies in combating the greenhouse effect', *Proceedings of Sixth International Conference on Metering Apparatus and Tariffs for Electricity Supply*, Institution Of

- Electrical Engineers, Conference Publication No.317, London.
- Davies, S. (1994) 'They've got an eye on you!', *The Independent*, 2 November.
- Davis, J. (1993) 'Cyberspace and social struggle', *Computer Underground Digest*, 28 November, 5 (89).
- Davis, J.S., Nelson, A.C. and Dueker, K.J. (1994) 'The new 'burbs—the exurbs and their implications for planning policy', *Journal of the American Planning Association*, Winter, 45–58.
- Davis, M. (1990) *City of Quartz: Excavating the Future in Los Angeles*, London: Verso.
- (1992) 'Beyond Blade Runner: urban control, the ecology of fear', *Open Magazine*, Westfield, New Jersey.
- (1993) 'Who killed LA? A political autopsy', *New Left Review* 199, 29–54.
- Dawson J. (1992) 'European city networks: experiments in trans-national urban collaboration', *The Planner*, 10 January, 7–9.
- Dawson, T. (1994), 'Framing the villains', *New Statesman and Society*, 28 January, 12–13.
- Dear, M. (1993) 'In the city, time becomes invisible: land use planning and the emergent postmodern urbanism', mimeo.
- (1995) 'Prolegomena to a post modern urbanism', in P.Healey, S.Cameron, S. Davoudi, S.Graham and A.Madani Pour (eds), *Managing Cities: The New Urban Context*, London: Wiley, 27–44.
- De Gournay, C. (1988) 'Telephone networks in France and Great Britain', in J.Tarr and G. Dupuy (eds), *Technology and the Rise of the Networked City in Europe and North America*, Philadelphia: Temple, 322–338.
- Delebarre, M. (1992) 'Information technology: an opportunity for cities', in OECD, *Cities and New Technologies*, Paris: OECD 15–16.
- Dematteis, G. (1988) 'The Weak Metropolis', in L.Mazza (ed.), *World Cities and the Future of the Metropolis*, Milan: Electra.
- (1994) 'Global networks, local cities', *Flux* 15, 17–24.
- Department of Energy (1994) *Energy, Emissions and the Social Consequences of Telecommuting. Energy Efficiency in the US Economy*, Technical Report One, DoE/PO-0026, US Government.
- Department of the Environment (1988) *Telecommunications, Planning Policy Guidance*, No. 8, London: HMSO.
- De Roo, P. (1994) 'Chapitre 1 La Métropolité', in A.Sallez (ed.), *Les Villes, Lieux D'Europe*, Mouchy: Datar, 9–17.
- Detienne, K. (1993) 'Big brother or friendly coach? Computer monitoring in the 21st century', *The Futurist*, September–October, 33–37.
- Deutsch, K. (1966) 'On social communications and the metropolis', in A.Smith (ed.), *Communication and Culture*, London: Holt, Rinehart and Winston, 386–396.
- Devins, D. and Hughes, G. (1995) 'Down the information superhighway to urban information inequality?', mimeo.
- Dicken, P. (1992) *Global Shift: The Internationalization of Economic Activity*, London: Paul Chapman.
- Dickey, J. (1985) 'Urban impacts of information technology', in J.Brotchie, P.Newton, P. Hall and P.Nijkamp (eds), (1985) *The Future of Urban Form: The Impact of New Technology*. London: Croom Helm and Nichols, 175–187.
- Dillon, D. (1994) 'Fortress America', *Planning*, June, 8–12.
- Dimcock, M. (1933) *British Public Utilities and National Development*, London: George Allen and Unwin.
- Dizard, W. (1982) *The Coming Information Age*, London: Longman.
- Dordick, H., Bradley, H. and Harris, B. (1988) *The Emerging Network Marketplace*, Norwood Nj: Ablex.
- Douglas, I. (1983) *The Urban Environment*, London: Edward Arnold.
- Downing, J. (1989) 'Computers for political change: PeaceNet and public data access', *Journal of Communication* 39(3), 154–162.
- Downing, J., Fasano, R., Friedland, P., McCullough, M., Mizrahi, T. and Shapiro, J. (eds) (1991) *Computers for Social Change and Community Organizing*: London: Hawath Press.

- Doyle, L. (1994) 'Identity cards arriving by stealth in Europe', *The Independent*, Thursday, 3 September, 1.
- Druckrey, T. (1994) 'Introduction', in G. Bender and T. Druckrey (eds), *Culture on the Brink: Ideologies of Technology*, Seattle: Bay Press, 1-12.
- DTI (1993) 'Edward Leigh announces entry of electricity companies into telecoms', press release, 25 May.
- Ducatel, K. (1990a) 'Rethinking retail capital', *International Journal of Urban and Regional Research* 14(2), 207-221.
- (1990b) 'Future shop', *Transact Technical Innovation Supplement*, Winter.
- (1992) 'Future shop', *Technical Innovation*, Winter, 1-5.
- (1994) 'Transactional telematics and the city', *Local Government Studies* 20(1), 60-77.
- Duncan, K. and Ayers, J. (1988) (eds) *Teleports and Regional Economic Development*, New Holland: Elsevier.
- Dunford, M. and Perrons, D. (1983) *The Arena of Capital*, London: Macmillan.
- Dunn, P. and Leeson, L. (1993) 'The art of change in Docklands', in J. Bird, B. Curtis, T. Putnam, G. Robertson and L. Tickner (1993) *Mapping the Futures: Local Cultures, Global Change*, London: Routledge, 136-149.
- Dupuy, G. (1992) 'New information technology and utility management', in OECD, *Cities and New Technologies*, Paris: OECD, 51-76.
- Durham, P. (1994) CCTV-Newcastle City Centre, personal communication.
- Dutton, W. (1993) 'Electronic services delivery and the inner city: the risk of benign neglect', mimeo.
- Dutton, W., Blumler, J. and Kraemer, K. (eds) (1987) *Wired Cities: Shaping the Future of Communications*, Washington: Communications Library.
- Dutton, W. and Guthrie, K. (1991) 'An ecology of games: the political construction of Santa Monica's Public Electronic Network', *Informization in the Public Sector* 1, 279-301.
- Dutton, W., Guthrie, K., O'Connell, J and Wymer, J. (1991) *State and Local Innovations in Electronic Services: The Case of Western and North Western United States*, Report prepared for the Office Of Technology Assessment, Congress of the United States.
- Dutton, W., Taylor, J., Bellamy, C, Raab, C. and Peltu, M. (1994) 'Electronic service delivery: themes and issues for the public sector', ESRC Programme on Information and Communications Technologies Policy, Research Paper 28.
- Dziegielewski, B. and Beaumann, D.D. (1992) 'The benefits of managing urban water demands', *Environment* 34(9), 7-41.
- Economic and Transport Planning Group (1989) 'Telecommunications in rural England', report to the Rural Development Commission and OFTEL, Rural Research Series No. 2, Salisbury: Rural Development Commission.
- Ecler, P. (1994) 'Privacy on parade: your secrets for sale!', *The Futurist*, July-August, 38-43.
- Edge, D. (1988) 'The social shaping of technology', *Edinburgh PICT Working Paper* No. 1.
- Edgington, D.W. (1989) 'New strategies for technology development in Japanese cities and regions', *Town Planning Review* 60(1), 1-27.
- Elam, J., Edwards, D. and Mason, R. (1989) 'Now US cities compete through information technology: securing an urban advantage', *The Information Society* 6, 153-178.
- Elkin, T., McLaren, D. and Hillman, M. (1991) *Reviving the City: Towards Sustainable Urban Development*, London: Friends Of The Earth.
- Emberley, P. (1989) 'Places and stories: the challenge of technology', *Social Research* 56, 741-785.
- Environmental Resources Limited (1991) *An Enhanced Urban Air Quality Monitoring Network—Feasibility Study*, Department of the Environment, Air Quality Division, February, A7-A11.

BIBLIOGRAPHY / 400

- Eubanks, G. (1994) 'Moving towards a networked society', *Business and Technology Magazine*, March, 42.
- European Union (1994) *High Level Group on European Information Society*, Report to the European Council, 25 June.
- Fala, I. (1994) 'Nineteen-ninety four', *The Independent*, 7 November, 23.
- Fathy, T. (1991) *Telety: Information Technology and its Impact on City Form*, London: Praeger.
- Featherstone, M. (1990) 'Global culture: an introduction', in M. Featherstone (ed.), *Global Culture: Nationalism, Globalization and Modernity*, London: Sage, 1–14.
- Featherstone, M. and Burrows, R. (1995) *Cyberpunk/Cyberspace/Cyberbodies*, London: Sage.
- Financial Times* (1991) *World Telecommunications Survey*, 7 October.
- (1992) *Telecommunications in Business*, survey supplement, 18 June.
- (1994) *Mobile Communications Survey*, 5 September.
- Finnigan, R., Salaman, G. and Thompson, K. (eds) (1987) *Information Technology: Social Issues—A Reader*, Sevenoaks: Hodder and Stoughton.
- Fischer, C. (1992) *America Calling: A Social History of the Telephone to 1940*, Oxford: University of California Press.
- Fishman, R. (1990) 'Metropolis unbound: the new city of the twentieth century', *Flux* 1, 43–56.
- Florida, R. and Kenney, M. (1993) 'The new age of capitalism: immovation-mediated production', *Futures*, July/August, 637–651.
- Forester, T. (1989) 'The myth of the electronic cottage', in T. Forester (ed.), *Computers in the Human Context: Information Technology, Productivity and People*, Oxford: Blackwell, 213–227.
- (1991) 'The electronic cottage revisited: towards the flexible workstyle', *Urban Futures* 5, 27–33.
- Foucault, M. (1977) *Discipline and Punish*, New York: Pantheon.
- Frederick, H. (1993) 'Computer networks and the emerging global civil society', in L. Harasim (ed.), *Global Networks*, Cambridge Mass: MIT Press, 283–296.
- Freeman, C. (1987) 'The case for technological determinism', in R. Finnegan, G. Salaman and K. Thompson (eds), *Information Technology: Social Issues—A Reader*, Sevenoaks: Hodder and Stoughton, 5–18.
- (1991) 'Information technology and the new economic paradigm', in H. Schutte (ed.), *Strategic Issues in Information Technology: International Implications for Decision Makers*, Maidenhead: Pergamon, 159–175.
- Friendreis, J. (1989) 'The information revolution and urban life', *Journal Of Urban Affairs* 11(4)327–337.
- Frissen, V. (1992) 'Trapped in electronic cages: gender and new information technologies in the private and public domain: an overview of research', *Media Culture and Society* 14, 31–49.
- Furlong, M. (1989) 'An electronic community for older adults: the Seniornet network', *Journal of Communication* 39(3), 145–161.
- Gaffikin F. and Warf, B. (1993) 'Urban policy and the post-Keynesian state in the United Kingdom and the United States', *International Journal of Urban and Regional Research*, 17, 67–84.
- Gale D. (1990) 'At the other end of nature', *The Guardian*, 13 April, 26.
- Gandy, O. (1989) 'The surveillance society: information technology and bureaucratic social control', *Journal of Communication* 39(3), 61–76.
- Gann, D. (1990) 'Intelligent buildings and smart homes', in G. Locksley (ed.), *The Single European Market and Information and Communication Technologies*, London: Belhaven.
- (1991) 'Buildings for the Japanese information economy: neighbourhood and resort offices', *Futures*, June, 469–481.
- (1992) *Intelligent Buildings—Producers and Users*, Brighton: Science Policy Research Unit, University of Sussex.

- Gappert, G. (ed.) (1987) *Cities of the 21st Century*, Sage Urban Affairs Annual Review, 23.
- Garnham, N. (1994) 'Whatever happened to the information society?', in R.Mansell (ed.), *Management of Information and Communication Technologies*, London: Aslib, 42–51.
- Garreau, R. (1988) *Edge City: Life on the New Frontier*, New York: Doubleday.
- Geller, H.S. (1989) 'Implementing electricity conservation programs: progress towards least-cost energy services among US utilities', T.Johansson (eds), *Electricity: Efficient End-Use and New Generation Technologies, and their Planning Applications*, Lund: Lund University Press.
- Gershuny, J. and Miles, I. (1983) *The New Service Economy*, London: Frances Pinter.
- Giannopoulos, G. and Gillespie, F. (eds) (1993) *Transport and Communications Innovation in Europe*, London: Belhaven.
- Gibbs, D. (1993) 'Telematics and urban economic development policies: time for caution?', *Telecommunications Policy*, May/June, 250–256.
- Gibson, D., Kozmetsky, G. and Smilor, R. (1993) *The Technopolis Phenomenon: Smart Cities, Fast Systems, Global Networks*, Lanham Mass.: Rowman and Littlefield.
- Gibson, W. (1984) *Neuromancer*, London: Harper and Collins.
- Giddens, A. (1979) *Central Problems in Social Theory*, London: Macmillan.
- Giddens, A. (1990) *The Consequences of Modernity*, Oxford: Polity Press.
- Gille, L. and Mathonnet, P. (1994) 'Les services de Proximité', in P.Musso (ed.), *Communiquer Demain*, Mouchy: Datar, 109–122.
- Gillespie, A. (1991) 'Advanced communications networks, territorial integration and local development', in R.Camagni (ed.), *Innovation Networks*, London: Belhaven, 214–229.
- (1992) 'Communications technologies and the future of the city', in M.Brehehy (ed.), *Sustainable Development and Urban Form*, London: Pion, 67–77.
- Gillespie, A. and Hepworth, M. (1988) 'Telecommunications and regional development in the information economy', *ESRC Programme on Information and Communications Technologies, Working Paper 1*.
- Gillespie, A. and Robins, K. (1989) 'Geographical inequalities: the spatial bias of new communications technologies', *Journal of Communication*, 39(3), 7–18.
- (1991) 'Non-universal service? Political economy and communications geography', in P.Hall and P.Newton (eds), *Cities of The 21st Century*, London: Halsted, 159–170.
- Gillespie, A. and Williams, H. (1988) 'Telecommunications and the reconstruction of regional comparative advantage', *Environment and Planning A* 20, 1311–1321.
- Giuliano, G. (1992) 'Transportation demand management: promise or panacea?', *Journal of the American Planning Association* 58(3), 327–335.
- Goddard, J. (1975) *Office Location in Urban and Regional Development*, London: Oxford
- (1990) 'The geography of the information economy', *PICT Policy Research Papers, no.11*, Programme on Information and Communications Technologies, Swindon: Economic and Social Research Council.
- (1992) 'New technology and the geography of the UK information economy', in K.Robins (ed.), *Understanding Information: Business, Technology, Geography*, London: Belhaven, 165–177.
- (1994) 'ICTs, space and place', in R. Mansell (ed.), *Management of Information and Communication Technologies*, London: Aslib, 274–285.
- Godfrey, D. and Parhill, D. (1979) *Gutenberg Two*, Toronto: Porcupine.
- Gökalp, I. (1988) 'Global networks: space and time', in G.Muskens and J.Gruppelaar (eds), *Global Telecommunications: Strategic Considerations*, Dordrecht: Kluwer, 186–210.
- (1992) 'On the analysis of large technical systems', *Science, Technology and Human Values* 17(1), 578–587.

- Gold, J. (1985) 'The city of the future and the future of the city', in R.King (ed.), *Geographical Futures*, Sheffield: Geographical Association, 92–101.
- (1990) 'A wired society? Utopian literature, electronic communications and the geography of the future city', *National Geographic Journal of India* 36(1–2), 20–29.
- (1991) 'Fishing in muddy waters: communications media and the myth of the electronic cottage', in S.Brunn and T. Leinbach (eds), (1991) *Collapsing Space and Time: Geographic Aspects of Communications and Information*, Harper: London, 327–341.
- Golding, P. (1990) 'Political communication and citizenship: the media and democracy in an unequalitarian social order', in M.Ferguson (ed.), *Public Communication: The New Imperatives*, London: Sage, 84–100.
- Golding, P. and Murdock, G. (1986) 'Unequal information: access and exclusion in the new communications marketplace', in M.Ferguson (ed.), *New Communications Technologies and the Public Interest*, London: Sage, 71–83.
- Goldmark, P. (1972) 'Tomorrow we will communicate to our jobs', *The Futurist*, April, 55–59.
- Gonzalez-Manet, E. (1988), *The Hidden War of Information*, New Jersey: Ablex.
- Goodchild, B. (1990) 'Planning and the modern/postmodern debate', *Town Planning Review* 61 (2), 119–137.
- Gottman, J. (1982) 'Urban settlements and telecommunications', *Ekistics* 302, Sept/Oct, 411–416.
- (1983), *The Coming of the Transactional City*, Institute for Urban Studies, University of Maryland, Monograph Series, No. 2.
- Gowdy, V. (1994) 'Alternatives to prison', *The Futurist*, January–February, 53.
- Graham, S. (1991) 'Telecommunications and the local economy: some emerging policy issues', *Local Economy* 6(2), August, 116.
- (1992a) 'Electronic infrastructures and the city: some emerging municipal policy roles in the UK' *Urban Studies* 29(5), 755–781.
- (1992b) 'The role of cities in telecommunications development', *Telecommunications Policy* 16(3), 187–193.
- (1993) 'The changing communications environment: opportunities and threats for British cities', *Cities* 10(2), 158–166.
- (1994) 'Networking cities: telematics in urban policy—a critical review', *International Journal of Urban and Regional Research* 18(3), 416–431.
- (1995a) 'Cities, nations and communications in the global era: urban telematics policies in France and Britain', *European Planning Studies* 3(3), 357–380.
- (1995b) 'From urban competition to urban collaboration? The development of interurban telematics networks', *Environment and Planning C: Government and Policy* (forthcoming).
- Graham, S. and Dominy, G. (1991) 'Planning for the information city: the UK case', *Progress in Planning* 35(3), 169–248.
- Graham, S. and Marvin, S. (1994) 'Cherry picking and social dumping: British utilities in the 1990s', *Utilities Policy* 4(2), 113–119.
- (1995) 'More than ducts and wires: Post Fordism, cities and utility networks', in P.Healey, S.Cameron, S.Davoudi, S. Graham and A.Madani Pour (eds), *Managing Cities: The New Urban Context*, London: Wiley, 169–190.
- Grant, W. (1994) 'Transport and air pollution in California', *Environmental Management and Health*, 1, 31–34.
- Graves, J. (1986) *Liberating Technology: Steps Towards a Benevolent Society*, London: Peter Owen.
- Gregory, D. (1994) *Geographical Imaginations*, Oxford: Blackwell.
- Greig, J. (1987) 'Integrated building technology is here', *Architectural Journal Supplement*, 25 November, 36–39.

- Gross, B. (1973) 'Introduction', in G.Gerbner, L.Gross and W.Melody (eds), *Communications Technology and Social Policy*, London: Wiley, 289–292.
- Grubler, A. (1989) *The Rise and Fall of Infrastructures*, Heidelberg: Physica-Verlag.
- Gurstein, P. (1991) 'Working at home and living at home: emerging scenarios', *The Journal of Architectural and Planning Research* 8(2), 164–180.
- Guthrie, K. (1991) 'The politics of citizen access technology: the development of community communication and information utilities in four cities', unpublished Phd dissertation, University of Southern California.
- Guthrie, K. and Dutton, W. (1992) 'The politics of citizen access technology: the development of public information utilities in four cities', *Policy Studies Journal*, 20(4), 574–597.
- Gwilliam, K.M. and Geerlings, H. (1994) 'New technologies and their potential to reduce the environmental impact of transportation', *Transportation Research A*, 28a(4), 307–319.
- Hägerstrand, T. (1970) 'What about people in regional science?', *Papers, Regional Science Association* 24, 7–21.
- Hall, P. (1985) 'Optimism and pessimism in future planning', in J.Brotchie, P.Newton, P.Hall, and P.Nijkamp (eds), *The Future of Urban Form: The Impact of New Technology*, London: Croom Helm.
- (1987) 'The anatomy of job creation: nations, regions and cities in the 1960s and 1970s', *Regional Studies* 21, 95–106.
- (1988), *Urban and Regional Planning*, London: Routledge.
- (1991) 'Three systems, three separate paths', *Journal of the Americal Planning Association*, Winter, 16–20.
- (1992) 'New technologies, participation, integration and lifestyle', in OECD *Cities and New Technologies*, Paris: OECD, 255–262.
- (1993) 'Forces shaping urban Europe', *Urban Studies* 30(6), 883–898.
- Hall, P. and Preston, P. (1988) *The Carrier Wave: New Information Technology and the Geography of Innovation, 1846–2003*, London: Unwin.
- Hall, S. and Jacques, M. (1989) *New Times: The Changing Face of Politics in the 1990s*, London: Lawrence and Wishart.
- Hammer, M. (1990) 'Reengineering work: don't automate, obliterate', *Harvard Business Review*, July-August, 104–112.
- Hammer, M. and Champy, J. (1993) *Reengineering the Corporation*, New York: New York Books.
- Hansen, U. (1990) 'Delinking of energy consumption and economic growth', *Energy Policy* 18(7), 631–640.
- Harasim, L. (1993) 'Global networks: an introduction', in L.Harasim (ed.), *Global Networks: Computers and International Communication*, London and Cambridge, Mass.: MIT Press, 3–14.
- Haraway, D. (1991) 'A manifesto for cyborgs: science, technology, and socialist-feminism in the late twentieth century', in D.Haraway (ed.), *Simians, Cyborgs and Women: The Reinvention of Nature*, New York: Routledge, 149–181.
- Harding, A. (1991) 'The rise of urban growth coalitions, UK-style?', *Environment and Planning C: Government and Policy* 9, 295–317.
- Harkness, R.C. (1977) 'Selected results from a technology assessment of tele-communication—transportation interactions', *Habitat* 2(1/2), 37–48.
- Harris, B. (1987) 'Cities and regions in the electronic age', in J.Brotchie *et al.*, *The Spatial Implications Of Technological Change*, London: Croom Helm.
- Harrison, B. (1994) 'The dark side of flexible production', *Technology Review*, May-June.
- Harrison, M. (1995) *Visions of Heaven and Hell*, London: Channel Four Television.
- Hart, D. (1983) 'Urban economic development measures in West Germany and the United States', K.Young, and C.Mason (eds), *Urban Economic Development:*

- New Roles and Relations*, London: Macmillan.
- Harvey, D. (1985) *The Urbanization of Capital*, Oxford: Blackwell.
- (1988) 'Urban places in the "global village": reflections on the urban condition in late twentieth century capitalism', in L. Mazza (ed.), *World Cities and the Future of the Metropolis*, Milan: Electra.
- (1989) 'From managerialism to entrepreneurialism: the transformation of urban governance in late capitalism', *Geografisker Annaler 71 (Series B)*, 3–17.
- (1989) *The Condition Of Postmodernity*, Oxford: Blackwell.
- (1993) 'From space to place and back again: reflections on the condition of postmodernity', J. Bird, B. Curtis, T. Putnam, G. Robertson and L. Tickner, *Mapping The Futures: Local Cultures, Global Change*, London: Routledge, 3–29.
- Hasagawa, F. (1990) 'Tokyo: a highly information-oriented city', in IC² Institute, *The Technopolis Phenomenon*; Austin, Texas: IC² Institute, 77–92.
- Hausken, T. and Bruening, P. (1994) 'Hidden costs and benefits of government card technologies', *IEEE Technology and Society Magazine*, Summer, 24–32.
- Healey, P., Cameron, S., Davoudi, S., Graham, S. and Madani-Pour, A. (eds) (1995) *Managing Cities: The New Urban Context*, London: Belhaven.
- Heilmeyer, G. (1992) "'Global" begins at home', *IEEE Communications Magazine*, October, 50–57.
- Hemrick, C. (1992) 'Building today's global computer Internetworks', *IEEE Communications Magazine*, October, 44–49.
- Hepworth, M. (1986) 'The geography of technological change in the information economy', *Regional Studies* 20(5), 407–424.
- (1987) 'The information city', *Cities*, August, 253–262.
- (1989a) 'Wheel and wires', *Town and Country Planning*, May, 145–146.
- (1989b) *The Geography of the Information Economy*, London: Belhaven.
- (1990) 'Planning for the information city: the challenge and response', *Urban Studies* 27(4), 537–558.
- (1991a) 'The municipal information economy', in J. Brotchie, M. Batty, P. Hall and P. Newton (eds), *Cities of the 21st Century*, London: Longman, 171–178.
- (1991b) 'Information cities in 1992 Europe', *Telecommunications Policy*, June, 175–181.
- (1992) 'Telecommunications and the future of London', *Policy Studies*, Summer, 13(2), 31–45.
- Hepworth, M.E., Dominy, G and Graham, S. (1989) 'Local authorities and the Information economy in Great Britain', *Newcastle Studies Of the Information Economy*, No. 11, University of Newcastle upon Tyne.
- Hepworth, M. and Ducatel, K. (1992) *Transport in the Information Age: Wheels and Wires*, London: Belhaven Press.
- Hepworth, M.E., Green, A.E. and Gillespie, A.E. (1987) 'The spatial division of information labour in Great Britain', *Environment and Planning*, A 19, 793–806.
- Herbert, D. and Thomas, C. (1982) *Urban Geography: A First Approach*, London: Wiley.
- Herman, R., Ardekani, S.A. and Ausubel, J.H. (1989) 'Dematerialisation', in Ausubel, J.H. and Sladovich, H.E. (1989) *Technology and the Environment*, Washington DC: National Academy Press.
- Hill, G.M. (1992) 'Reinventing systems in the utility industry', *Journal of Systems Management* 43(7), July, 23–35.
- Hill, S. (1988) *The Tragedy of Technology*, London: Pluto.
- Hillman, J. (1991) *Revolution or Evolution? The Impact of Information and Communications Technology on Buildings and Places*, London: Royal Institute of Chartered Surveyors.
- (1993) *Telelifestyles and the Flexicity: A European Study*, Dublin: European Foundation For the Improvement Of Living And Working Conditions.

- Hinshaw, M. (1973) 'Wiring megalopolis: two scenarios', in G. Gerbner, L. Gross and W. Melody (eds), *Communications Technology and Social Policy: Understanding The New "Cultural Revolution"*, London: Wiley, 305–317.
- Hirschl, T. (1993) 'Electronics, permanent unemployment and state policy', mimeo.
- Holcomb, B. (1991) 'Socio-spatial implications of electronic cottages', in S. Brunn and T. Leinbach (eds), *Collapsing Space and Time: Geographic Aspects of Communications and Information*, London: Harper Collins, 342–353.
- Holmes, S.J. and Campbell, D. (1990) 'Communicating with domestic electricity meters', in *Proceedings of Sixth International Conference on Metering Apparatus and Tariffs for Electricity Supply*, London: Institution Of Electrical Engineers, Conference Publication No. 317, 129–133.
- Houlihan, B. (ed.) (1992) *The Challenge of Public Works Management: A Comparative Study of North America, Japan and Europe*, Brussels: IIAS.
- Howells, J. (1988) *Economic, Technological and Locational Trends in European Services*, Aldershot: Avebury.
- Howells, J. and Wood, M. (1993) *The Globalisation of Production and Technology*, London: Belhaven.
- Howkins, J. (1987) 'Putting wires in their social place', in W. Dutton, J. Blunder, and K. Kraemer (eds), *Wired Cities: Shaping the Future of Communications*, Washington: Communications Library.
- Hudson, H.E. and Parker, E.B. (1990) 'Information gaps in rural America: telecommunications policies for rural development', *Telecommunications Policy* 14, 193–205.
- Hughes, T. (1983) *Networks of Power: Electrification in Western Society, 1880–1930*, Baltimore: Johns Hopkins University Press.
- Hughes, T.P. (1987) 'The evolution of large technological systems, in W.E. Bijker, T.P. Hughes and T. Pinch (eds), *The Social Construction of Technological Systems*, Cambridge, Ma: MIT Press, 51–82.
- Hunt, R. (1994) 'The man machine', *The Guardian Weekend*, 24 April, 40–45.
- Huston, D.R. and Fuhr, P.L. (1993) 'Intelligent materials for intelligent structures', *IEEE Communications Magazine*, October, 40–44.
- Huws, U. (1985) 'Terminal isolation: the atomisation of home and leisure in the wired society', in Radical Science Collective (ed.), *Making Waves: The Politics of Communications*, London: Free Association, 9–25.
- IBEX (1991) *Review of Possible Roles of Teleports in Europe, Parts 1, 2 and 3*, Report to the European Commission.
- IEE (1992) 'Telecommunications and the Environment', *IEE Review*, June, 212.
- Imrie, R. and Thomas, H. (1993) 'The limits of property-led regeneration', *Environment and Planning C: Government and Policy* 11, 87–102.
- Innis, H. (1950) *Empire and Communication*, Toronto: University of Toronto Press.
- Irvine, S. (1993) 'Terminal illness', *Real World* 6, 4–7.
- Irwin, M. and Merenda, M. (1989) 'Corporate networks, privatisation and state sovereignty', *Telecommunications Policy*, December, 329–335.
- Itoh, S. (1988) 'Urban development by teleport', in K. Duncan and J. Ayers (eds), *Teleports and Regional Development*, North Holland: Elsevier, 235–241.
- Iwama, M. and Kano, S. (1993) 'Toward the global intelligent network', *IEEE Communications Magazine*, March, 22–24.
- Jacobs, J. (1962) *The Death and Life of Great American Cities*, London: Jonathan Cape.
- Jaeger, C. and Dürrenberger, G. (1991) 'Services and counter urbanisation: the case of Central Europe', in P. Daniels (ed.), *Services and Metropolitan Development: International Perspectives*, London: Routledge.
- Jameson, F. (1984) 'Postmodernism, or the cultural logic of late capitalism', *New Left Review* 146, 53–92.
- Janelle, D. (1991) 'Global interdependence and its consequences', in S. Brunn and T. Leinbach (eds), (1991) *Collapsing Space and Time: Geographic Aspects of*

- Communications and Information*, London: Harper, 49–81.
- Janokovic, L. (1993) *Intelligent Buildings Today and in the Future*, Proceedings of a conference University of Central England, 7 October, Birmingham UK.
- Jarratt, J. and Coates, J.F. (1990) 'Future use of cellular technology—some social implications', *Telecommunications Policy*, February, 78–84.
- Jenkins, P. (1992) 'Eye can see you', *New Statesman and Society*, 21 February, 14–15.
- Johnson, N. (1967) 'Communications', *Science Journal*, October.
- (1970) 'Urban man and the communications revolution', *Regional Urban Communications*, Detroit: Metropolitan Fund Inc.
- Johnston, P. (1993) 'Teleworking as an enabler factor for economic growth and job creation in Europe', paper presented at the Telematics and Innovation Conference, Palma, Majorca, 17–19 November.
- Jones, D. (ed.) (1970) *Communication and Energy in Changing Urban Environments*, Sevenoaks: Butterworth.
- Keating, M. (1991) *Comparative Urban Politics: Power and the City in the US. Canada, Britain and France*, Aldershot: Elgar.
- Keegan, V. (1994) 'Fibre firepower', *The Guardian*, 25, February, 2–3.
- Keen, P. (1986) *Competing in Time: Using Telecommunications for Competitive Advantage*, Cambridge Mass.: Harper and Row.
- (1991) *Shaping the Future: Business Design Through Information Technology*, Cambridge Mass: Harvard University Press.
- Keith, M. and Pile, S. (1993) *Place and the Politics of Identity*, London: Routledge.
- Keller, P. (1989) 'The Manto project: telematics—opportunities and risks for traffic and settlement, International Geographical Union, *Geography of Telecommunications and Communications*, Geneva, 7–8 November.
- Kellerman, A. (1993) *Telecommunications and Geography*, London: Belhaven.
- Kellner, P. (1989) 'Electronic requiem for cities', *The Independent*, 14 August.
- Kemp, R. and Soete, L. (1992) 'The greening of technological progress—an evolutionary perspective', *Futures* 24(5), 437–457.
- Kennett, P. (1994) 'Modes of regulation and the urban poor', *Urban Studies* 31(7), 1017–1031.
- Kern, S. (1983) *The Culture of Time and Space, 1880–1918*, London: Weidenfeld and Nicolson.
- King, A. (1993) 'Identity and difference: the inter nationalization of capital and the global—ization of culture', in P.Knox (ed.), *The Restless Urban Landscape*, Englewood Cliffs: Prentice Hall, 83–97.
- Knight, R. (1989) 'City development and urbanization: building a knowledge based city', in R.Knight and G.Gappert (eds), *Cities in a Global Society*, Sage: London, 223–242
- Knight, R. and Gappert, G. (eds), (1989) *Cities in a Global Society*, Sage: London.
- Knox, P. (1993) 'Capital, material culture and socio-spatial differentiation', in P.Knox (ed.), *The Restless Urban Landscape*, Englewood Cliffs: Prentice Hall, 1–33.
- Kok, B. (1992) 'Privatisation in telecommunications—empty slogan or strategic tool?', *Telecommunications Policy*, December, 699–704.
- Kraemer, K. (1982) 'Telecommunications/transportation substitution and energy conservation', Part 1, *Telecommunications Policy*, March, 39–99.
- Kraemer, K. and King, J.L. (1982) 'Telecommunications/transportation substitution and energy conservation', Part 2, *Telecommunications Policy*, June, 87–99.
- Kraemer, K. and King, J. (1987) 'The role of information technology in managing cities', *Local Government Studies*, 14(2), 23–47.
- Kraemer, K., King, J. and Schetter, D. (1985) *Innovative use of Information Technology in Facilitating Public Access to Agency Decision Making*, Report

- prepared for the Office of Technology Assessment, Congress of the United States.
- Kraemer, K., King, J., Dunkle, D. and Lane, J. (1986) *Trends in Municipal Information Systems 1975-1985*, Irvine Ca: Public Policy Research Organization.
- Krier, D. and Goodman, I. (1992) *Energy Efficiency: Opportunities For Employment*, Report prepared for Greenpeace.
- Kroker, A. (1992) *The Possessed Individual: Technology and Postmodernity*, London: Macmillan.
- Kubieck (1988) 'The technological infrastructure of home interactive telematics: ISDN and alternative systems', in F.Van Rijn and R.Williams (eds), *Concerning Home Telematics*, North Holland: Elsevier, 97-125.
- Kuhn, T. (1970) *The Structure of Scientific Revolutions*, Chicago: Chicago University Press.
- Kuttner, R. (1993) 'The pitfalls of the virtual corporation', *Boston Globe*, 30 July.
- Lanvin, B. (ed.) (1993) *Trading in a New World Order: The Impact of Telecommunications and Data Services on International Trade in Services*, Boulder: Altwater.
- Lash, S. and Urry, J. (1994) *Economies of Signs and Space*, London: Sage.
- Laterrasse, J. (1992) 'The intelligent city: utopia or tomorrow's reality?', in F.Rowe and P.Veltz (eds), *Telecom, Companies, Territories*, Paris: Presses De L'ENPC.
- Laterrasse, J., Chatzis, K. and Coutard, O. (1990) 'Information et gestion dynamique ou: quand les reseaux deviennent intelligents', *Flux 2*, Automne.
- Latour, B. (1987) *Science in Action: How to Follow Scientist and Engineers Through Society*, Milton Keynes: Open University Press.
- Laudon, K. (1977) *Communications Technologies and Democratic Participation*, New York: Praeger.
- Lavocat, E. (1989) 'From networked towns to town networks: new solidarities, new territories and the impact of telecommunications', *Netcom 2*(2), November, 381-403.
- Law, J. and Bijker, W. (1992) 'Postscript: technology, stability and social theory', in W. Bijker and J.Law (eds), *Shaping Technology, Building Society: Studies in Sociotechnical Change*, London: MIT Press.
- Leary, T. (1994) *Chaos and Cyberculture*, Berkeley: Ronin.
- Lee, M. (1991) 'Social responsibilities of the telecommunications business', *IEEE Technology and Society Magazine* 10(2), 29-30.
- Lefebvre, H. (1984) *The Production of Space*, Oxford: Blackwell.
- Leinberger, C. (1994) 'Flexexecutives: redefining the American dream', *Urban Land*, August, 51-54.
- Lerner, S. (1994) 'The future of work in North America: good jobs, bad jobs, beyond jobs', *Futures* 26(2), 185-196.
- Levidow, L. and Robins, K. (1989) *Cyborg Worlds: The Military Information Society*, London: Free Association Books.
- Ley, D. and Mills, C. (1993) 'Can there be a postmodernism of resistance in the urban landscape?', in P.Knox (ed.), *The Restless Urban Landscape*, Englewood Cliffs: Prentice Hall, 255-278.
- Leyshon, A. (1994) 'The geography of financial exclusion', paper presented at a seminar at Newcastle University, November.
- Lion, C.P. and Van De Mark, G. (1990) 'Los Angeles', in J.Schmandt et al. (eds), *The New Urban Infrastructure—Cities and Telecommunications*, New York: Praeger.
- Lloyd, P. and Dicken, P. (1982) *Location in Space*, London: Unwin.
- Locksley, G. (1992) 'The information business', in K.Robins (ed.), *Understanding Information: Business, Technology, Geography*, London: Belhaven.
- Logan, J. and Molotch, H. (1987) *Urban Fortunes*, London: University of California Press.
- Logan, J. and Swanstrom, T. (1990) 'Urban restructuring: a critical view', in J.Logan and T.Swanstrom (eds), *Beyond the City Limits: Urban Policy and*

- Economic Restructuring in Comparative Perspective*, Philadelphia: Temple, 3–26.
- Longhini, G. (1984) 'Coping with high tech headaches', *Planning*, American Planning Association, March 1984, 28–32.
- Loukaitou-Sideris, A. (1993) 'Privatisation of public open space: the Los Angeles experience', *Town Planning Review* 64(2), 139–167.
- Levering, J. (1988) 'The local economy and local economic strategies', *Policy and Politics* 16(3), 145–157.
- (1995) 'Creating discourses rather than jobs: the crisis in the cities and the transition fantasies of intellectuals and policy makers', in P.Healey, S.Cameron, S.Davoudi, S. Graham and A.Madani-Pour (eds), *Managing Cities: The New Urban Context*, London: Belhaven/Wiley, 109–126.
- Lüthe, R. (1993) 'On the political economy of "post Fordist" telecommunications: the US experience', *Capital and Class* 51, 81–120.
- Lynn, D.A. (1976) *Air Pollution—Threat And Response*, Massachusetts: Addison-Wesley.
- Lyon, D. (1988) *The Political Economy of the Information Society*, Cambridge: Polity Press.
- (1993) *The Electronic Eye: The Rise of Surveillance Society*, London: Polity.
- Lytard, J. (1984) *The Postmodern Condition: A Report on Knowledge*, Manchester: Manchester University Press.
- McBeath, G. and Webb, S. (1995) 'Cities, subjectivity and cyberspace', mimeo.
- McGowan, F. (1993) 'Transeuropean networks: utilities as infrastructures', *Utilities Policy*, July, 179–186.
- McHale, J. (1976) *The Changing Information Environment*, London: Elek.
- Machart, J. (1994) 'Roubaix Euroteport', *Technopolis International*, March.
- Mackenzie, D. and Wajzman, J. (eds) (1985) *The Social Shaping of Technology*, Milton Keynes: Open University Press.
- Mckie, R. (1994) 'Never mind the quality, just feel the collar', *The Observer*, 13 November, 1.
- McLuhan, H.M. (1964) *Understanding Media: The Extensions of Man*, London: Sphere Books.
- McNeil, M. (1991) 'The old and new worlds of information technology in Britain', in J. Corner and S.Harvey (eds), *Enterprise and Heritage: Crosscurrents of National Culture*, London: Routledge.
- Macuiszko, K. (1990) 'A quiet revolution: community on-line systems', *Online*, November, 24–32.
- Madani-Pour, A. (1995) 'Reading the city', in P. Healey, S.Cameron, S.Davoudi, S.Graham and A.Madani (eds), *Managing Cities: The New Urban Context*, London: Wiley.
- Madden, D. (1992) 'Light at the end of the tunnel', *Financial Times*, 30 January.
- Mair, A. (1993) 'New growth poles? Just-in-time manufacturing and local economic development strategy', *Regional Studies* 27(3), 207–221.
- Maisonrouge, J. (1984) 'Putting information to work for people', *Intermedia*, 12(2), 31–33.
- Malecki, E. (1991) *Technology and Economic Development*, London: Longman.
- Manchester City Council (1991) *Manchester: The Information City*, Manchester: City Council.
- Mandelbaum, S. (1986) 'Cities and communication: the limits of community', *Telecommunications Policy*, June, 132–140.
- Mansell, R. (1994) 'Introductory overview', in R.Mansell (ed.), *Management Of Information and Communication Technologies*, London: Aslib, 1–7.
- Marchant, M. (1987) *Grand Aventure Du Minitel*, Paris: Larousse.
- Marcou, T. (1990) 'Ville Moyenne network: a flow of information and experiences', *ELISE, On-Line Services: A Tool For Local Development*, Brussels, Belgium: Commission of European Communities.
- Marsh, S. (1994) 'Competitive communication strategies', *Logistics Information Management*, 7(2), 25–31.
- Martin, J. (1978) *The Wired Society*, London: Prentice Hall.

- (1981) *Telematic Society: A Challenge for Tomorrow*, Englewood Cliffs: Prentice-Hall.
- Martin, M. (1991) 'Communication and social forms: the development of the telephone, 1876–1920', *Antipode* 23(3) 307–333.
- Marvin, S. (1992) 'Urban policy and infrastructure networks', *Local Economy* 7(3), 225–247.
- (1993) *Telecommunications and the Environmental Debate*, Working Paper No. 20, Department Of Town And Country Planning, University Of Newcastle.
- (1994) 'Green signals: the environmental role of telecommunications in cities', *Cities*, 11(5), 325–331.
- Marvin, S. and Cornford, J. (1993) 'Regional policy implications of utility regionalization', *Regional Studies* 27(2), 159–165.
- Marvin, S. and Graham, S. (1993) 'Utility networks and urban planning: an issue agenda', *Planning Practice and Research* 8(4), 6–14.
- Mason, R. (1983) *Xanadu*, New York: Acropolis Books.
- (1988) 'Living in tomorrow's electronic home today', in F.Van Rijn and R. Willials (eds), *Concerning Home Telematics*, North Holland: Elsevier, 165–170.
- Mason, R. and Jennings, L. (1982) 'The computer home: will tomorrow's housing come alive?', *The Futurist* 16(1), February, 35.
- Masser, I., Sviden, O. and Wegener, M. (1992) *The Geography Of Europe's Futures*, London: Belhaven.
- Massey, D. (1984) *Spatial Division of Labour*, London: Macmillan.
- (1991) 'The political place of locality studies', *Environment and Planning A* 23, 267–281.
- (1992) 'Politics and space/time', *New Left Review* 196,65–84.
- (1993) 'Power-geometry and a progressive sense of place', in J.Bird, B.Curtis, T.Putnam, G.Robertson and L.Tickner, *Mapping The Futures: Local Cultures, Global Change*, London: Routledge, 59–69.
- Maunder, W.J. (1989) *The Human Impact of Climate Uncertainty*, London: Routledge.
- Mayer, M. (1995) 'Urban governance and the post-Fordist city', in P.Healey, S.Cameron, S.Davoudi, S.Graham and A.Madani Pour (eds), *Managing Cities: The New Urban Context*, London: Wiley.
- Mazza, L. (1988) 'Introduction', in L.Mazza (ed.), *World Cities and the Future of the Metropolis*, Milan: Electra, 13–19.
- Meehan, E. (1988) 'Technical capability versus corporate imperatives: towards a political economy of cable television and information diversity', in V.Mosco, *The Political Economy of Information*, Madison: Wisconsin University Press, 167–187.
- Meier, R. (1962) *A Communications Theory of Urban Growth*, Cambridge: MIT Press.
- (1985) 'High tech and urban settlement', in J.Brotchie, P.Newton, P.Hall, and P.Nijkamp (eds), *The Future of Urban Form The Impact of New Technology*, London: Croom Helm.
- Melbin, M. (1978) 'Night as frontier', *American Sociological Review* 43 (1), 5–6.
- Melody, W. (1986) 'Implications of the information and communications technologies: the role of policy research', *Policy Studies* 6, 46–58.
- Meyer, S.L. (1977) 'Conservation of resources, telecommunications, and micro-processors', *Journal Of Environmental Systems* 7(2), 121–129.
- Meyrowitz, J. (1985) *No Sense of Place: The Impact of Electronic Media on Social Behavior*, New York: Oxford.
- Miles, I. (1988) *Home Informatics*, London: Pinter.
- Miles, I. and Robins, K. (1992) 'Making sense of information', in K.Robins (ed.), *Understanding Information: Business, Technology, Geography*, London: Belhaven, 1–26.
- Miles, I, Rush, H., Turner, K. and Bessant, J. (1988) *Information Horizons: The Long-term Social Implications of New*

- Information Technologies*, Cheltenham: Edward Elgar.
- Mill, P.A., Hartkopf, V., Loftness, V. and Drake, P. (1993) 'The challenge to smart buildings: user-controlled ecological environments for productivity', *The Technopolis Phenomenon*, 53-68.
- Miller, R. (1994) 'Global R & D networks and large-scale innovations: the case of the automobile industry', *Research Policy* 23, 27-46.
- Milne, C. (1991) 'Opening the debate on universal service in the UK', *Telecommunications Policy* 15(2), 85-87.
- Mingione, E. (1991) *Fragmented Societies: A Sociology of Economic Life Beyond the Market Paradigm*, Oxford: Blackwell.
- Mitchell, D. (1994) 'Landscape and surplus value: the making of the ordinary in Brentwood, Ca', *Environment and Planning D: Society and Space* 12, 7-30.
- Mitchell, W. (1995) *City of Bits: Space, Place and the Infobahn*, Cambridge Mass: MIT Press.
- Mitchelson, R. and Wheeler, J. (1994) 'The flow of information in a global economy: the role of the American urban system in 1990', *Annals of the Association of American Geographers* 84(1), 87-107.
- Moeller, D.W. (1992) *Environmental Health*, Massachusetts: Harvard University Press.
- Mokhtarian, P.L. (1988) 'An empirical evaluation of the travel impacts of teleconferencing', *Transportation Research-A* 22a, 283-289.
- (1990) 'A typology of relationships between telecommunications and transportation', *Transportation Research* 24a(3), 231-242.
- Mokhtarian, P.L., Handy, S.L. and Saloman, I. (1994) 'Methodological issues in the estimation of the travel, energy, and air quality impacts of telecommuting', *Transportation Research A*.
- Money, P. (1992) 'White collar jobs flow from Britain as data processors are lured by cheap labour', *The Guardian*, 25 August.
- Moore, S. (1993) 'Satellite TV as cultural sign: consumption, embedding and articulation', *Media, Culture And Society* 15, 621-639.
- Moran, R. (1993) *The Electronic Home: Social and Spatial Aspects*, Dublin: European Foundation of Living and Working Conditions.
- Morgan, K. (1992) 'Digital highways: the new telecommunications era', *Geoforum* 23(3), 317-332.
- Morley, D. and Robins, K. (1990) 'Non-tariff barriers: identity, diversity and difference', in G.Locksley (ed.), *The Single European Market and Information and Communications Technologies*, London: Belhaven, 44-56.
- Morley, D. and Robins, R. (1995) *Spaces of Identity*, London: Routledge.
- Mosco, V. (1988) 'Introduction: information in the pay-per society', in V.Mosco and J. Wasko (eds), *The Political Economy of Information*, Madison: University of Wisconsin Press, 3-26.
- Mosco, V. and Wasko, J. (1988) *The Political Economy of Information*, London: University of Wisconsin Press.
- Moss, M.L. (1986) 'Telecommunications and the future of cities', *Land Development Studies* 3, 33-44.
- (1987) 'Telecommunications, world cities and urban policy', *Urban Studies* 24, 534-546.
- (1988) 'Telecommunications: shaping the future', in G.Stemlieb and J.W.Hughes (eds), *Market Geography: Nation, Region and Metropolis*, New Brunswick, NJ: Rutgers University Press, 255-275.
- Motiwalla, J., Yap, M. and Hung, L. (1993) 'Building the intelligent island', *IEEE Communications Magazine*, October, 28-34.
- Mouftah, H. (1992) 'Multimedia communications: an overview', *IEEE Communications Magazine*, May, 18-19.
- Moulaert, F., Swyngedouw, E. and Wilson, P. (1988) 'Spatial responses to Fordist and post Fordist accumulation and regulation',

- Papers of the Regional Science Association* 64, 11–23.
- Moyal, A. (1992) 'The gendered use of the telephone: an Australian case study', *Media, Culture and Society* 14(1): 51–72.
- Muid, C. (1992), 'New public management and information: a natural combination?', *Public Policy and Administration* 7(3), 75–79.
- Mulgan, G. (1989) 'A tale of new cities', *Marxism Today*, March, 18–25.
- (1991) *Communication and Control: Networks and the New Economies of Communication*, Oxford: Polity Press.
- Mumford, L. (1934) *Technics and Civilization*, London: Routledge and Kegan Paul.
- Murdock, G. (1993) 'Communications and the constitution of modernity', *Media, Culture and Society* 15, 521–539.
- Murdock, G. and Golding, P. (1989) 'Information poverty and political inequality: citizenship in an age of privatized communication', *Journal of Communication* 39(3): 180–195.
- Myers, N. (1994) 'Gross reality of global statistics', *The Guardian*, Monday, 2 May.
- Nakicenovic, N. (1988) 'Dynamics and replacement of US transport infrastructures', in J.H.Ausubel and R.Herman, *Cities and their Vital Systems—Infrastructure Past, Present and Future*, Washington: National Academy Press, 175–221.
- Nalsbitt, J. and Aburdene, P. (1991) *Megatrends 2000—Ten Directions for the 1990s*, New York: Avon Books.
- Naughton, J. (1994) 'Smile, you're on TV', *Observer, Life*, 13 November, 38–42.
- Negrier, E. (1990) 'The politics of territorial network policies: the example of video-communications networks in France', *Flux*, Spring, 13–20.
- Negroponce, N. (1995) *Being Digital*, London: Hodder and Stoughton.
- New York Telephone (1993) *The Role of Advanced Telecommunications Technology in Government Operations Today*, New York: NY Telephone.
- Newberry, D. (1990) 'Pricing and congestion: economic principles relevant to pricing roads', *Oxford Review of Economic Policy* 5(2), 22–38.
- Newman, P. (1991) 'Greenhouse, oil and cities', *Futures*, May, 335–348.
- Newstead, A. (1989) 'Future information cities: Japan's vision', *Futures*, June, 263–276.
- Newton, P. (1991a) 'The new urban infrastructure: telecommunications and the urban economy', *Urban Futures* 5, 54–75.
- (1991b) 'Telematic underpinnings of the information economy', in J.Brotchie, M.Batty, P.Hall and P.Newton (eds), *Cities of the 21st Century*, London: Longman, 95–126.
- (1993) 'Australia's information landscapes', *Prometheus* 11(1), 3–29.
- Nicol, L. (1985) 'Communications technology: economic and spatial impacts', in M.Castells (ed.) *High Technology, Space and Society*, London: Sage, 191–209.
- Nijkamp, P. (1993a) *Europe on the Move*, Avebury: Aldershot.
- (1993b) 'Towards a network of regions: the United States of Europe', *European Planning Studies* 1(2), 149–167.
- Nilles, J.M. (1988) 'Traffic reduction by telecommuting: a status review and selected bibliography', *Transportation Research—A*, 22a(4), 301–317.
- (1993) 'Tework in the US today', paper presented at The Telematics And Innovation Conference, Palma, Majorca, 17–19 November.
- Nilles, J.M., Carlson, F.R., Gray, P and Hanneman, G. (1976a) 'Telecommuting—an alternative to urban transportation congestion', *IEEE Transactions on Systems, Man, and Cybernetics* 6(2).
- Nilles, J.M. et al. (1976b) *The Telecommunications-Transportation Trade-off: Options For Tomorrow*, Chichester: Wiley.
- Noam, E. (1992) *Telecommunications in Europe*, Oxford: Oxford University Press.
- Noll, A. (1989) 'The broadbandwagon! A personal view of optical fibre to the home', *Telecommunications Policy*, September, 197–201.
- Noothoven Van Goor, J. and Lefcoe, G. (eds) (1986) *Teleports in the Information Age*, North-Holland: Elsevier.

- Nora, S. and Minc, A. (1978) *The Computerisation of Society*, Cambridge: MIT Press.
- Norfolk, S. (1994) 'Houston streets: a world apart', *The Independent*, 9 November, 26.
- North Communications (undated) *Multimedia Networks*, promotional brochure.
- Northumbria Police (1991) *A Proposed Urban Surveillance System for Newcastle upon Tyne*, mimeo.
- Northumbria Police (1995) *CCTV: Initial Findings*, Newcastle.
- Nortoft, P. (1991) 'Data communication standards for power utilities: a European perspective', *IEEE Transactions on Power Systems* 7(1), 215-221.
- Nowotny, H. (1982) 'The information society: its impact on the home, local community and marginal groups', in H.Bjorn Andersen, M.Earl, O.Holst and E.Mumford (eds), *Information Society, For Richer, For Poorer*, North Holland: Elsevier.
- Oades, R. (1990) 'Cabling intelligent buildings', *Architectural Journal*, 22 and 29 August, 60-63.
- OECD (1991) *Urban Infrastructure: Finance and Management*, Paris: OECD.
- OECD (1992) *Cities and New Technologies*, Paris: OECD.
- OFFER (1992) *Metering Consultation Paper*, London, January.
- Office Of Technology Assessment (OTA) (1993) *Making Government Work: Electronic Delivery of Federal Services*, OTA-Tct-578, Washington DC: Government Printing Office.
- Ogden, M. (1994) 'Politics in a parallel universe: is there a future for cyberdemocracy?', *Futures* 26(7), 713-729.
- Ohba, R. (1992) *Intelligent Sensor Technology*, New York: Wiley.
- Olalquiaga, C. (1992) *Megalopolis: Contemporary Cultural Sensibilities*, Minneapolis: University of Minnesota Press.
- Openshaw, S. and Goddard, J. (1987) 'Some implications of the commodification of information and the emerging information economy for applied geographical analysis in the UK', *Environment and Planning A* 19, 1423-1439.
- O'Riordan, T. (1981) *Environmentalism*, London: Pion.
- Parfait, Y. (1994) 'Science parks and state-of-the-art telecommunications networks', *Technopolis International*.
- Parker, E. (1976) 'Social implications of computer/telecom systems', *Telecommunications Policy* 1(1), 3-20.
- Parker, S. and Cocklin, C. (1993) 'The use of geographical information systems for cumulative environmental effects assessment', *Computers, Environment and Urban Systems*, 17, 393-407.
- Parkinson, M. (1992) 'City links', *Town and Country Planning*, September, 235-236.
- (1994) 'European cities towards 2000: the new age of entrepreneurialism?', mimeo.
- Parsons, P. (1989) 'Defining cable television: structuration and public policy', *Journal Of Communication* 39(2), 10-26.
- Pascal, A. (1987) 'The vanishing city', *Urban Studies* 24, 597-603.
- Patri, P. (1987) 'The smart building: an overview', in J.M.Noothoven Van Goor and G. Lefcoe (eds), *Teleports in the Information Age*, North-Holland: Elsevier Science.
- Pedersen, F. (1982) 'Power and participation in an information society: perspectives', in K. Grewlich and F.Pedersen (eds), *Power and Participation in an Information Society*, Brussels: European Commission, 249-289.
- Pelton, J. (1989) 'Telepower: the emerging global brain', *The Futurist*, September-October, 9-11.
- (1992) *Future View: Communications, Technology and Society in the 21st Century*, New York: Johnson Press.
- Perez, C. (1983) 'Structural change and the assimilation of new technologies in the economic and social system', *Futures*, October, 357-375.
- Perry, C. (1977) 'The British experience 1876-1912: the impact of the telephone during the years of delay', in I.Pool (ed.),

- The Social Impact of the Telephone*, Cambridge Mass.: MIP Press, 69–96.
- Pickup, L. et al. (1990) 'Measuring the potential effects of road transport informatics on travel patterns in European cities', *Transport Policy*. PTRC Report Volume P330.
- Pickvance, C. and Preteceille, E. (1991) (eds) *State Restructuring and Local Power: A Comparative Perspective*, London: Pinter.
- Pilkington, E. (1994) 'Ghetto blaster', *The Guardian Weekend*, 4 June, 34–40.
- Pinch, S. (1985) *Cities and Services: The Geography of Collective Consumption*, London: Routledge.
- (1989) 'The restructuring thesis and the study of public services', *Environment And Planning A* 21, 905–926.
- Piore, M. and Sabel, C. (1984) *The Second Industrial Divide*, New York: Basic Books.
- Piorinski, R. (1991) 'Télétopia: Nouvelles technologies et aménagement de territoire', *Futuribles*, November, 47–65.
- Piperno, F. (1986) 'Innovation technologique et transformation de l'être social', in M. Tahon and A. Corten (eds), *L'italic: Le Philosophe et Le Gendarme*, Montréal: Vlb Editeur, 126–128.
- Pool, I. de Sola (ed.) (1977) *The Social Impact Of The Telephone*, Boston: MIT Press, 140–145.
- (1980) *Communities Without Boundaries*, Cambridge Mass.: MIT Press.
- (1982) 'Communications technology and land use', in L.S. Bourne (ed.), *Internal Structure of the City*, Oxford: Oxford University Press.
- (1983) *Technologies Of freedom*, Belnap Press.
- Pool, I. de Sola, Decker, C., Dizard, S., Israel, K., Rubin, R. and Winstein, B. (1977) 'Foresight and hindsight: the case of the telephone', in I. Sola Pool (ed.), *The Social Impact of the Telephone*, Boston: MIT Press, 127–157.
- Porat, M. (1977) *The Information Economy: Sources and Methods for Measuring the Primary Information Sector*, Washington: US Department Of Commerce, Office Of Telecommunications.
- Poster, M. (1990) *The Mode of Information: Poststructuralism and Social Context*, London: Polity Press.
- Postman, N. (1992) *Technopoly: The Surrender of Culture to Technology*, New York: Vintage.
- Pred, A. (1977) *City Systems in Advanced Economies*. London: Hutchinson.
- Preston, P. (1990) 'History lessons: some themes in the history of technology systems and networks', PICT Paper, 1–2 March.
- Preteceille, E. (1990) 'Political paradoxes or urban restructuring: globalization of the economy and localization of polities', in J. Logan and T. Swanstrom (eds), *Beyond the City Limits*, Philadelphia: Temple University Press.
- Price Waterhouse (1990) 'The economic impacts of information technology and telecommunications in rural areas', final report to DGXII, Commission of the European Communities, Brussels, London: Price Waterhouse.
- Pryke, M. and Lee, R. (1994) 'Place your bets: globalisation, financial instruments and the nature of competition between and within financial centres', paper presented at the conference, Cities, Enterprises and Society on the Eve of the 21st century, Lille, March.
- Putnam, T. (1993) 'Beyond the modern home: shifting the parameters of residence', in J. Bird, B. Curtis, T. Putnam, G. Robertson and L. Tickner, *Mapping the Futures: Local Cultures, Global Change*, London: Routledge, 150–168.
- Quillinan, J. (1993) 'Curse of the money's tomb', *Telecom World*, Spring, 13–15.
- Qvortrup, L. (1988) 'The challenge of telematics: social experiments, social informatics and orgware architecture', in G. Muskens and J. Gruppelaar (eds) *Global Telecommunications Networks: Strategic Considerations*, Dordrecht: Reidel.
- (1989) 'The Nordic telecottages: community teleservice centres for rural regions', *Telecommunications Policy*, March, 59–68.

- Qvortrup, L., Ancelin, C., Fawley, J., Hartley, J., Pichault, F. and Pop, P. (eds) (1987) *Social Experiments with Information Technology and the Challenge of Innovation*, Dordrecht: Reidel.
- Regional Trends (1991) London: HMSO.
- Reich, R. (1992) *The Work Of Nations*, New York: Simon and Schuster.
- Relph, E. (1987) *The Modern Urban Landscape*. Baltimore: Johns Hopkins Press.
- Rheingold, H. (1994) *The Virtual Community*, London: Seeker and Warburg.
- Richardson, R. (1994a) 'Telebased customer services', *Communicore*, newsletter of Newcastle PICT Centre, No. 2.
- (1994b) 'Back officing front office functions—organisational and locational implications of new telemediated services', in R. Mansell (ed.) *Management of Information and Communication Technologies*, London: Aslib, 309–335.
- (1994c) 'Finance floods out of the high street', *Planning Week* 31, March, 10–11.
- Richardson, R., Gillespie, A. and Cornford, J. (1994) 'Requiem for the teleport? The teleport as a metropolitan development and planning tool in western Europe', *Newcastle Programme on Information and Communications Technologies, Working Paper 17*.
- Rittner, D. (1992) *Ecolinking: Everyone's Guide to Online Environmental Information*, Berkeley: Peachpit Press.
- Roarke Associates (Nd) *A Proposal for Congestion Relief on London and South East Rail Services*, London.
- Robins, K. (1989) 'Global times', *Marxism Today*, December, 20–27.
- (ed.) (1992) *Understanding Information: Business, Technology and Geography*, London: Belhaven.
- Robins, K. and Gillespie, A. (1992) 'Communication, organisation and territory', in K. Robins (ed.), *Understanding Information: Business, Technology and Geography*, London: Belhaven, 145–164.
- Robins, K. and Hepworth, M. (1988) 'Electronic spaces: new technologies and the future of cities', *Futures*, April, 155–176.
- Robins, K. and Webster, F. (1986) 'Broadcasting politics: communications and consumption', *Screen* 27(3–4), 30–44.
- Robins, K. and Cornford, J. (1990) 'Bringing it all back home', *Futures*, October, 870–879.
- Robson, B. (1992) 'Competing and collaborating through urban networks', *Town and Country Planning*, September, 236–238.
- Roche, E. (1993) 'The geography of information technology infrastructure in multinational corporations', in H. Bakis, R. Abler and E. Roche, *Corporate Networks, International Telecommunications and Interdependence*, London: Belhaven, 181–205.
- Rodenburg, E. (1992) *Eyeless in Gaia: The State of Global Environmental Monitoring*, Washington D.C.: World Resources Institute.
- Roos, J. (1994) 'A post-modern mystery', *Intermedia*, August–September, 24–28.
- Rose, G. (1993) 'Some notes towards thinking about the spaces of the future', in J. Bird, B. Curtis, T. Putnam, G. Robertson, and L. Tickner, *Mapping The Futures: Local Cultures, Global Change*, London: Routledge, 70–86.
- Rosenberg, J., Kraut, R., Gomez, L. and Buzard, A. (1992) 'Multimedia communications for users', *IEEE Communications Magazine*, May, 20–36.
- Rosenfield, A.H., Bulleit, D.A. and Peddie, R.A. (1986) 'Smart meters and spot pricing: experiments and potential', *IEEE Technology And Society Magazine*, 5(1), 23–28.
- Roszak, T. (1994) *The Cult of Information*, Berkeley: University of California Press.
- Rotenberg, R. and McDonogh, G. (eds) (1993) *The Cultural Meaning Of Urban Space*, Westport Co: Bergin and Garvey
- Rouse, M.J. and Cranfield, R.F. (1988) 'An overview of the trends and future direction of information technology in the water industry', *Water Pollution Research And Control* 21, 1129–1135.
- Royal Society for Nature Conservation (1990) *Information and Guidelines for Bids For BT Environment City Designation*, London.

- Rullani, E. and Zanfei, A. (1988) 'Area networks: telematics connections in a traditional textile district', in C. Antonelli *New Information Technologies and Industrial Change: The Italian Case*. London: Kluwer, 97-112.
- Ruzic, F. (1989) 'Teleports as precursors of the 21st century's information society', *The Information Society* 6, 109-116.
- Rydin, Y. (1993) *The British Planning System*, London: Macmillan.
- Sackman, H. and Boehm, B. (1972) *Planning Community Information Utilities*, Montvale, NJ: Afips Press.
- Sackman, H. and Nie, N. (1973) *The Information Utility and Social Choice*, Montvale, NJ: Afips Press.
- Salomon, I. (1986) Telecommunications and travel relationships: a review', *Transportation Research-A* 20a(3), 223-238.
- Salsbury, S. (1992) 'Emerging global computer and electronic information systems and the challenge to world stock markets', *Flux*, January-March, 27-40.
- Samarajiva, R. and Shields, P. (1990) 'Integration, telecommunications, and development: power of the paradigms', *Journal Of Communications* 40(3), 84-105.
- Sant, R. (1984) *Creating Abundance: America's Least Cost Energy Strategy*, Maidenhead: McGraw Hill.
- Santucci, G. (1994) 'Information highways worldwide: challenges and strategies', *I&T Magazine*. Spring, 614-23.
- Sassen, S. (1991) *The Global City: New York, London, Tokyo*, Princeton: Princeton University Press.
- Savage, M. and Warde, A. (1993) *Urban Sociology: Capitalism and Modernity*, London: Macmillan.
- Savitch, H. (1988) *Post-Industrial Cities: Politics and Planning in New York, Paris and London*, Princeton: Princeton University Press.
- Sawhney, H. (1992) 'The public telephone network: stages in infrastructure development', *Telecommunications Policy*, September, 538-552.
- Schenker, J. (1994) 'No shopping spree', *Communications Week International*, 21 February, 12-13.
- Schiller, D. and Fregaso, R. (1991) 'A private view of the digital world', *Telecommunications Policy*, June, 195-207.
- Schmandt, J., Williams, F., Wilson, R. and Strover, S. (eds) (1990) *The New Urban Infrastructure: Cities and Telecommunications*, London: Praeger.
- Schroeder, R. (1994) 'Cyberculture, cyborg post-Modernism and the sociology of virtual reality technologies', *Futures*, June, 26(5), 519-528.
- Schuler, R.E. (1992) 'Transportation and telecommunications networks: planning urban infrastructure for the 21st century', *Urban Studies* 29(2), 297-309.
- Scott, A. (1988) 'Flexible production systems: the rise of new industrial spaces in North America and western Europe', *International Journal of Urban and Regional Research* 12(2), 171-185.
- Shachar, A. (1994) 'Economic globalization and urban dynamics', mimeo.
- Shade, I. (1993) 'Gender issues and computer networking', mimeo.
- Shearer, D. (1989) 'In search of equal partnerships: prospects for progressive urban policy in the 1990s', in G. Squires (ed.), *Unequal Partnerships: the Political Economy of Urban Redevelopment in Postwar America*, London: Rutgers Press, 289-307.
- Sheth, J. and Sisodia, R. (1993) 'The information mall', *Telecommunications Policy*, July, 376-389.
- Shields, P., Dervin, B., Richter, C. and Soller, R. (1993) 'Who needs "POTS-plus" services? A comparison of residential user needs along the rural-urban continuum', *Telecommunications Policy*, November, 564-587.
- Shulman, S. (1992) 'Pay-per-view libraries', *Technology Review*, October, 14.
- Silverstone, R. (1994) 'Domesticating the revolution—information and communications technologies and everyday life', in

- R.Mansell (ed.), *Management of Information and Communication Technologies*, London: Aslib, 221–233.
- Silverstone, R., Hirsch, E. and Morley, D. (1992) *Consuming Technologies: Media and Information in Domestic Space*, London: Routledge.
- Simmons, T. (1994) 'Telecoms contribute to city's world status', *Municipal Review*, January/February, 210.
- Simon, J. (1993) 'The origins of US public utilities regulation: elements for a social history of networks', *Flux* 11, 33–41.
- Sioshansi, F.P. and Davis, E.H. (1989) 'Information technology and efficient pricing—providing a competitive edge for electric utilities', *Energy Policy*, 17(6), 559–607.
- Sklair, L. (1991) *Sociology of the Global System*, London: Harvester Wheatsheaf.
- Slack, J. (1987) 'The information age as ideology: an introduction', in J.Slack and F. Feijes (eds), *The Ideology of the Information Age*, Norwood, New Jersey: 1–12.
- Slack, J.D. and Feijes, F. (eds) (1987) *The Ideology of the Information Age*, Norwood, New Jersey: Ibex.
- Sleeman, J. (1953) *Mtish Public Utilities*, London: Issac Pitman.
- Smart, B. (1992) *Modern Conditions, Postmodern Controversies*, London: Routledge.
- Smith, R. (1994) 'Bell Atlantic's virtual workforce', *The Futurist*, March–April, 13–14.
- Sociomics (1992), *Exploratory Investigation of Employment Trends in Rural Areas Related to ECS*, Report to European Commission DG XIII.
- Soja, E. (1989), *Postmodern Geographies*, London: Verso.
- Sorkin, M. (ed.) (1992) *Variations on a Theme Park*, New York: Hill and Wang.
- Spector, P. (1993) 'Wireless communications and personal freedom', *Telecommunications Policy*, August, 403–407.
- Spooner, D. (1992) 'The Manchester host computer communications system', paper presented at the Centre for Local Economic Strategies Conference on Local Economic Development and Communications Policy, Manchester, 13 May.
- Squires, J. (1994) 'Private lives, secluded spaces: privacy as political possibility', *Environment and Planning D: Society and Space* 12, 387–401.
- Staple, G. (1992) *Telegeography: Global Telecommunications, Traffic Statistics and Commentary*, International Institute For Communications.
- State Of California (1990) *The California Telecommuting Pilot Project, Final Report*, Sacramento: Department Of General Services, State Of California.
- Stoker, G. and Young, S. (1993) *Cities in the 1990s*, London: Longman.
- Storgaard, K. and Jensen, O. (1991) 'IT and ways of life', in P.Cronberg, P.Dueland, O.Jensen and L.Qvortrup (eds), *Danish Experiments: Social Constructions of Technology*, Copenhagen: New Social Science Monographs, 123–139.
- Storper, M. and Scott, A. (1989) 'The geographical foundations and social regulation of flexible production complexes', in J. Wolch and M.Dear (eds), *The Power of Geography: How Territory Shapes Social Life*, Boston: Unwin Hyman, 21–40.
- Streeton, H. (1976) *Capitalism, Socialism and the Environment*, Cambridge: Cambridge University Press.
- Strover, S. (1988) 'Urban policy and telecommunications', *Journal Of Urban Affairs* 10(4), 341–356.
- (1989) 'Telecommunications and economic development: an incipient rhetoric', *Telecommunications Policy*, September, 194–196.
- Sui, D. (1994) 'GIS and urban studies: positivism, post-positivism and beyond', *Urban Geography* 15(3), 258–278.
- Sussman, G. and Lent, J. (1991) *Transnational Communications: Wiring the Third World*, London: Sage.
- Suzuki, S. (1993) 'IN roll out in Japan', *IEEE Communications Magazine*, March, 48–55.
- Swyngedouw, E. (1989) 'The heart of the place: the resurrection of locality in the age of hyperspace', *Geografiska Annaler* 71(B), 31–42.

- (1993) 'Communication, mobility and the struggle for power over space', in G. Giannopoulos and A. Gillespie, *Transport and Communications in the New Europe*, London: Belhaven, 305–325.
- Tarr, J.A. (1984) 'The evolution of urban infrastructure in the nineteenth and twentieth centuries, in R. Hanson, (ed.), *Perspectives on Urban Infrastructure*, Washington D.C.: National Academy Press.
- Tarr, J., Finholt, T. and Goodman, D. (1987) 'The city and the telegraph: urban telecommunications in the pre-telephone era', *Journal of Urban History* 14(1), 38–80.
- Tarr, J.A. and Dupuy, G. (eds) (1988) *Technology and the Rise of the Networked City in Europe and America*, Philadelphia: Temple University Press.
- Taylor, G. and Welford, R. (1994) 'A commitment to environmental improvement: the case of British Telecommunications, in R. Welford, *Cases in Environmental Management and Business Strategy*, London: Longman, 60–76.
- Taylor, J. and Williams, H. (1989) 'Telematics, organisation and the local government mission', mimeo.
- (1990) 'Themes and issues in an information polity', *Journal Of Information Technology*, 5, 151–160.
- Taylor, R. and Rushton, S. (1993) 'The psychology of "immersion" in virtual worlds', *Intermedia*, June–July, 40–43.
- Telecities (1994) *Telecities: The European Telematics Partnership*, promotional brochure.
- Terasaka, A., Wakabayashi, Y., Nakabayashi, I. and Abe, K. (1988) 'The transformation of regional systems in an information-oriented society', *Geographical Review of Japan* 61 (series B)(1), 159–173.
- Thompson, G. (1993) 'Fordist and post Fordist international economic relations? The globalisation of FDI and its public governance', mimeo.
- Thompson, J. (1990) *Ideology and Modern Culture*, Cambridge: Polity.
- Thrift, N. (1993) 'Inhuman geographies: landscapes of speed, light and power', in P. Cloke, M. Doel, D. Matless, M. Phillips and N. Thrift (eds), *Writing the Rural: Five Cultural Geographies*, London: Paul Chapman, 191–232.
- Tickell, A. and Peck, J. (1992) 'Accumulation, regulation and the geographies of post-Fordism: missing links in regulationist research', *Progress in Human Geography* 16(2), 190–218.
- Toffler, A. (1981), *The Third Wave*, New York: Morrow.
- Toke, D. (1990) 'Increasing energy supply not inevitable', *Energy Policy* 18(7), 671–673.
- Tokyo Teleport Center Inc (undated) *Toward the Realization of a Futuristic Information City*, promotional brochure.
- Tompkins, R. (1994) 'Shop-till-you-drop at the touch of a button', *Financial Times*, 9 June, 11.
- Tornqvist, G. (1968) 'Flows of information and the location of economic activities', *Lund Series in Geography*, Series B3.
- (1974) 'Flows of information and the location of economic activities', in M. Eliot-Hurst (ed.), *Transportation Geography: Comments and Readings*, New York: McGraw Hill.
- Toth, K. (1990) 'The workless society: how machine intelligence will bring ease and abundance', *The Futurist*, May–June, 33–37.
- Tucny, J. (1993) 'Space and the new technology of information—French experience', seminar paper, Centre for Research in European Urban Environments, University of Newcastle.
- Tuppen, C.G. (1992) 'Energy and telecommunications—an environmental impact analysis', *Energy And Environment* 3(1), 70–81.
- (1993) 'An environmental policy for British Telecommunications', *Long Range Planning* 26(5), 24–30.
- Ungerer, H. (1988) *Telecommunications in Europe*, Brussels: Commission of the European Communities.

- Valovic, T. (1993) *Corporate Networks: The Strategic Use of Telecommunications*, London: Artech.
- Van Meerten, R. (1994) 'Developing a European urban observatory and decision-support system', in M.de Forn (ed.), *Citytec*, conference report, Barcelona.
- Van Rijn, F. and Williams R. (eds) (1988) *Concerning Home Telematics*, North-Holland: Elsevier.
- Vidal, J. (1994) 'Sceptred aisle', *The Guardian*. 4 November.
- Virilio, P. (1984) *L'espace critique*, Christian Bourgois, Paris [translated from the French by Astrid Hustvedt].
- (1987) 'The overexposed city', *Zone* 1(2), 14–31.
- (1988) *La Machine de Vision*, Paris: Galilée.
- (1993) 'The third interval: a critical transition', in V.Andermatt-Conley (ed.), *Rethinking Technologies*, London: University of Minnesota Press, 3–10.
- Volle, M. (1994) 'Les Évolutions Technologiques', in P.Musso (ed.), *Communiquer Demain*, Mouchy: Datar, 65–82.
- Ward, S. (1990) 'Local industrial promotion and development policies 1899–1940', *Local Economy*, 2 August, 100–118.
- Warf, B. (1989) 'Telecommunications and the globalization of financial services', *Professional Geographer* 41(3), 257–271.
- Wark, M. (1988) 'On technological time: Virilio's overexposed city', *Arena*, 83, 82–100.
- Warren, R. (1989) 'Telematics and urban life', *Journal Of Urban Affairs* 11(4), 339–346.
- Watson, S. and Gibson, K. (eds) (1995) *Postmodern Cities and Spaces*, Oxford: Blackwell.
- Webber, M. (1964) 'The urban place and the non place urban realm', in M.Webber, J. Dyckman, D.Foley, A.Guttenberg, W. Wheaton and C.Whurster (eds), *Explorations Into Urban Structure*, Philadelphia: University of Pennsylvania Press, 79–153.
- Webber, M. (1968) 'The post-city age', *Daedalus*, Fall.
- Webster, F. and Robins, K. (1986) *Information Technology: A Luddite Analysis*, Norwood Nj: Ablex.
- Weckerle, C. (1991) 'Télématiques, action locale et "l'espace public"', *Espaces Et Sociétés* 62–63, 163–211.
- Westrum, R. (1991) *Technologies and Society: The Shaping of People and Things*, Belmont, Ca.: Wadsworth.
- White, P. (1994) 'Fragmentation of news—fragmentation of politics?', *Intermedia*, June/ July, 22(3), 20–22.
- Whitelegg, J. (1993) 'Confusing signals on the road to nowhere', *The Times Higher*, 19 November, x–xi.
- Wigan M. (1988) 'Changes in the relationship between transport, communications and urban form', *Transportation* 14, 395–417.
- Williams, F. (1983) *The Communications Revolution*, London: Sage.
- Williams, F. and Brackenridge, E. (1990) 'Transfer via telecommunications: networking scientist and industry', in F.Williams (ed.), *Technology Transfer: A Communications Perspective*, London: Sage, 172–191.
- Wilson, E. (1991) *The Sphinx and the City*, London: Virago.
- Wilson, K. (1986) 'The videotext revolution: social control and the cybernetic commodity of home networking', *Media, Culture and Society* 8, 7–39.
- Wilson, M. (1994) 'Jamaica's back offices: direct dial dependency?' mimeo.
- Wilson, R. (1992) 'Communications and power struggle', *Financial Times*, 30 January.
- Wilson, R. and Teske, P. (1990) 'Telecommunications and economic development: the state and local role', *Economic Development Quarterly* 4(2), May, 158–174.
- Winckler, M. (1991) 'Walking prisons: the developing technology of electronic controls', *The Futurist*, July–August, 34–36.
- Winner, L. (1978) *Autonomous Technology: Technics Out-of-Control as a Theme in*

- Political Thought*, Cambridge Mass.: MIT Press.
- (1986) *The Whale and the Reactor*, Chicago: University Of Chicago.
- (1993a) 'Beyond inter-passive media', *MIT Technology Review* August—September, 69.
- (1993b) 'Upon opening the blackbox and finding it empty: social constructivism and the philosophy of technology', *Technology and Human Values* 18(3), 362–378.
- Wise, D. (1971) 'Exploratory analysis of the impact of electronic communications on metropolitan form', mimeo.
- Wise, Deborah (1992) 'Phone home, BT, and get the curtains closed', *The Guardian*. 14 March, 37.
- Wolmar, C. (1993) 'Road pricing system for London "will soon be feasible"', *The Independent*, 1 April.
- Wood, J. (1994) 'Cellphones on the Clapham Omnibus—the lead-up to a cellular mass market', in R.Mansell (ed.), *Management of Information and Communication Technologies*, London: Aslib, 248–258.
- Worthington, J. (1993) 'Accommodation needs of the networked corporation', paper-presented at the Telematics and Innovation Conference, Palma, Majorca, 17–19 November.
- Young, J.E. (1993) *Global Networks—Computers in a Sustainable Society*, Worldwatch Paper 115.
- (1994) 'Using computers for the environment', in L.R.Brown *et al.*, *State Of The World*, New York: Norton, 99–116.
- Zimmerman, J. (1986) *Once Upon The Future*, London: Pandora Press.
- Zukin, S. (1991) *Landscapes of Power: from Detroit to Disneyland*, Berkeley: University of California Press.
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