Chapter 29

Telecommunications and Economic Space

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The vast majority of employment in industrialized nations, including the United States – particularly well-paying, white-collar employment – consists of information collection, processing, and transmission in one form or another. These functions have increased in importance as computers have dramatically declined in cost and risen in power, as the production and marketing of goods and services have steadily become more information-intensive, as technological changes have accelerated, as product cycles have shortened, and as a deregulated, worldwide market has increased uncertainty and increased the competition among places for investment and jobs. Economic activities have become stretched over ever-larger distances, including the worldwide spaces of the global economy, and the means to transmit information have grown accordingly (Akwule, 1992). As a result, contemporary economic landscapes are closely tied to the deployment and use of telecommunications systems.

Telecommunications are important in another capacity as well. If geography is the study of how human beings are distributed over the Earth's surface, a vital part of that process is how we know and feel about space and time. Although space and time appear as "natural" and outside of society, they are in fact social constructions: every society develops different ways of dealing with and perceiving them (Harvey, 1990). In this reading, time and space are socially created, plastic, mutable institutions that profoundly shape individual perceptions and social relations. Telecommunications have been critical to this process for more than 150 years, accelerating the flow of information across distance and bringing places closer to one another in relative space through time–space compression (Brunn and Leinbach, 1991). As we shall see, this is quite different from the annihilation of space that some writers predict.

Telecommunications are not a new phenomenon. Beginning with the invention of the telegraph in 1844, the transmission of information over long distances was made possible; communications became detached from transportation. For decades after the invention of the telephone in 1876, telecommunication was synonymous with the simple telephone service (Brooks, 1975; de Sola Pool, 1977; Marvin, 1988). Just

as the telegraph was instrumental to the colonization of the American West, in the late nineteenth century the telephone became critical to the growth of the American city-system (Abler, 1977), allowing firms to centralize their headquarters functions while they spun-off branch plants to smaller towns. Even today, despite the proliferation of several new technologies, the telephone remains by far the most commonly used form of telecommunications for businesses and households.

During the early and mid-twentieth century, the American Telegraph and Telephone Company (AT&T) enjoyed a monopoly over the US telephone industry and had few incentives to change; the primary focus was upon guaranteeing universal access, resulting in a 95 percent penetration rate among US households. The widespread deregulation of industry extended to telecommunications, and in 1984 AT&T was broken up into one long-distance and several local service providers ("Baby Bells"), and new firms such as MCI and Sprint entered the field (Warf, 1998). Faced with mounting competition, telephone companies have steadily upgraded their copper cable systems to include fiber optics lines, which allow large quantities of data to be transmitted rapidly, securely, and virtually error-free (Kahin, 1993).

In the 1980s and 1990s, as the cost of computing capacity dropped and the power increased rapidly with the microelectronics revolution, new technologies, particularly fiber optics and satellites, drastically increased the capacity of telecommunications. With the digitization of information in the late twentieth century, telecommunications steadily merged with computers to form integrated networks, most spectacularly through the Internet. New technologies such as fiber optics have complemented and at times substituted for telephone lines. Fax services and 800 number free toll calls are now standard for virtually all companies, and even newer technologies such as Electronic Data Interchange and wireless services are becoming increasingly popular. A substantial literature has demonstrated the importance of telecommunications in the globalization of producer services, particularly finance (Langdale, 1989; Warf, 1995). Within cities, digital networks have contributed to an ongoing reconstruction of urban space (Rheingold, 1993; Mitchell, 1995).

This chapter offers an overview of the role of telecommunications in economic geography. It begins by dispelling some popular myths about information systems, particularly simple post-industrial, technological determinist views that argue telecommunications entail a uniform decentralization of economic activity and the end of the importance of proximity. Second, it dwells on the role of such systems in financial markets, focusing on their impacts in global banking and securities. Third, it traces their importance to the global cities that are intimately bound to the global economy, such as New York, London, and Tokyo. Fourth, it examines the decentralization of clerical jobs at the local, regional, and global scales. Fifth, it focuses on urban infrastructural investments in this area, including telecommuting. Finally, it emphasizes the growing importance of the Internet, and social discrepancies in access to it.

Misconceptions about Telecommunications and Spatial Economic Change

There exists considerable confusion about the real and potential impacts of telecommunications on urban structure, in part due to the long history of exaggerated

claims made in the past, particularly by those subscribing to "post-industrial" theory (e.g. Toffler, 1980). Often such views, which are widespread among many academics and planners, hinge upon a simplistic, utopian technological determinism that ignores the complex, often contradictory, relations between telecommunications and local economic, social, and political circumstances.

For example, repeated proclamations that telecommunications would allow everyone to work at home via telecommuting, dispersing all functions and spelling the obsolescence of cities (O'Brien, 1992; Cairncross, 1997), have fallen flat in the face of the persistence of growth in dense urbanized places. In fact, telecommunications are generally a poor substitute for face-to-face meetings, the medium through which most sensitive corporate interaction occurs, particularly when the information involved is irregular, proprietary, and unstandardized in nature. Most managers spend the bulk of their working time engaged in face-to-face contact, and no electronic technology can yet allow for the subtlety and nuances critical to such encounters. For this reason, a century of technological change, from the telephone to fiber optics, has left most high-wage, white-collar, administrative command and control functions clustered in downtown areas. In contrast, telecommunications are ideally suited for the transmission of routinized, standardized forms of data, facilitating the dispersal of functions involved with their processing (i.e. back offices) to low-wage regions. In short, there is no *a priori* reason to believe that telecommunications inevitably lead to the dispersal or deconcentration of functions: by allowing the decentralization of routinized ones, information technology may actually enhance the comparative advantage of inner cities for non-routinized functions (albeit with jobs generally filled by suburban commuters). Telecommunications facilitate the simultaneous concentration and deconcentration of economic activities (Moss, 1987).

Popular notions that "telecommunications will render geography meaningless" (see O'Brien, 1992; Cairncross, 1997) are simply naïve. While the costs of communications have decreased, other factors have risen in importance, including local regulations, the cost and skills of the local labor force, and infrastructural investments. Economic space, in short, will not evaporate because of the telecommunications revolution. It is true that networks such as the Internet allow some professionals to move into rural areas, where they can conduct most of their business on-line (Kirn et al., 1990), gradually permitting them to escape from their long-time reliance upon large cities where they needed face-to-face contact. Yet the full extent to which these systems facilitate decentralization is often countered by other forces that promote the centralization of activity. Exactly how telecommunications are deployed is a contingent matter of local circumstances, public policy, and local niche within the national and world economy. In short, telecommunications may facilitate, but do not determine, economic development; an advanced communications infrastructure is a necessary but not sufficient precondition to stimulate growth.

Telecommunications and Finance

Telecommunications have probably had their most important economic impacts in financial markets. Banks, insurance companies, and securities firms, which are very information-intensive activities, have been at the forefront of the construction of an

extensive worldwide network of leased and private communication networks. Electronic funds transfer systems form the nerve center of the international financial economy, allowing banks to move capital around at a moment's notice, arbitraging interest rate differentials, taking advantage of favorable exchange rates, and avoiding political unrest (Langdale, 1989; Warf, 1989). With the breakdown of the Bretton Woods Agreement in 1971 and the collapse of fixed currency exchange rates, electronic trade in national currencies sky-rocketed (Solomon, 1997). Citicorp, for example, erected its Global Telecommunications Network to allow it to trade $200 billion daily in foreign exchange markets around the world. Such networks give banks an ability to move money – by some estimates, more than $1.5 trillion daily – around the globe at stupendous rates. Reuters, with 200,000 interconnected terminals worldwide, linked through systems such as Instinet and Globex, alone accounts for 40 percent of global financial trades each day (Kurtzman, 1993, p. 47). In securities markets, global telecommunications systems have facilitated the linking of stock and bond dealers through computerized trading programs (Hepworth, 1991). The volume and volatility of these markets rose accordingly. Trade on the New York Stock Exchange, the world's largest, rose from 10 million shares a day in the 1960s to more than 1 billion a day in the 1990s, and brokers buy and sell to foreign clients with as much ease as they do with those next door. Subject to digitization, information and capital have become two sides of the same coin. This process was essential to the rapid internationalization of finance that has occurred since the 1970s.

The ascendancy of electronic money has shifted the function of finance from investing to transacting, enhancing the attractiveness of speculation (e.g. in national currencies) rather than direct investments in productive capacity, and institutionalizing volatility in the process. Traveling at the speed of light, as nothing but assemblages of zeros and ones, global money performs an electronic dance around the world's neural networks in astonishing volumes. The world's currency markets, for example, trade roughly $800 billion every day, dwarfing the $25 billion that changes hands daily to cover global trade in goods and services. Every two weeks the total dollar volume of funds that pass through New York's fiber optic lines surpasses the annual product of the entire planet (Kurtzman, 1993). The boundaries of nation-states have little significance in this context: it is much easier, say, to move $1 billion from London to New York than a truckload of oranges from Florida to Georgia.

As large quantities of funds cross borders with mounting ease, national financial policies have become increasingly questionable in their effectiveness, making monetary controls over exchange, interest, and inflation rates ever harder to sustain. In the USA, for example, the Federal Reserve, worried about possible inflation, increased the reserve ratio of banks (the proportion legally required to be kept on hand rather than loaned out) seven times in 1994 and 1995, but found that its ability to restrict the national money supply had diminished severely. Now, it would be a mistake to exaggerate this phenomenon: clearly it is not the case that nation-states possess no leverage whatsoever over flows of capital. Yet telecommunications have obviously eased the manner in which financial capital transcends national borders.

Telecommunications have also affected the financial industries through the growth of offshore banking. Usually in response to highly favorable tax laws implemented to attract foreign firms, offshore banking has become important to

many micro-states in the Caribbean (e.g. the Cayman Islands, Bahamas), Europe (e.g. Luxembourg, Jersey, Gibraltar, San Marino, Liechtenstein, and the Isle of Man), the Middle East (e.g. Cyprus, Bahrain), and the south Pacific (e.g. Vanuatu) (Roberts, 1994). As the technological barriers to moving money around internationally have fallen, legal and regulatory ones have increased in importance, and financial firms have found the topography of regulation to be of the utmost significance in choosing locations.

Among US cities, telecommunications have accelerated the spatial reorganization of financial services. By relying upon economies of scale, large firms can combine services in a few centralized database management systems. American Express, for example, shifted its credit card processing to three facilities, and Aetna Insurance consolidated 55 claims adjustment centers into 22 metropolitan regions. Allstate Insurance consolidated 28 policy processing centers into three (Charlotte, Dallas, and Columbus), CNA centralized theirs in Reading, Pennsylvania, and Travelers Insurance established two in Knoxville, Tennessee, and Albany, New York. Other insurers are developing online marketing via the Internet. Among telecommunications carriers, US WEST is consolidating its customer service workers from 563 sites into 26, AT&T has six mega-centers, and Sprint opted for lower-cost places such as Jacksonville, Florida; Dallas, Texas; Kansas City, Missouri; Phoenix, Arizona; and Winona, Minnesota. Meanwhile, local sales offices in small towns have experienced a steady decline. This phenomenon exemplifies the manner in which telecommunications can simultaneously centralize as well as decentralize different economic activities.

Telecommunications and Global Cities

One of the most significant repercussions of the internationalization of financial markets has been the growth of "global cities," particularly London, New York, and Tokyo (Moss, 1987; Sassen, 1991). Global cities act as the "command and control" centers of the world system, serving as the home to massive complexes of financial firms, producer services, and corporate headquarters of multinational corporations. In this capacity, they operate as arenas of interaction, allowing face-to-face contact, political connections, artistic and cultural activities, and opportunities for elites to rub shoulders easily. While other cities (e.g. Paris, Toronto, Los Angeles, Osaka, Hong Kong, and Singapore) certainly can lay claim to being national cities in a global economy, the trio of New York, London, and Tokyo has played a disproportionate role in the production and transformation of international economic relations in the late twentieth century.

At the top of the international urban hierarchy, global cities are simultaneously: (a) centers of creative innovation, news, fashion, and culture industries; (b) metropoles for raising and managing investment capital; (c) centers of specialized expertise in advertising and marketing, legal services, accounting, computer services, etc., and (d) the management, planning and control centers for corporations and non-governmental organizations (NGOs) that operate with increasing ease over the entire planet (Knox, 1995). At their core, global cities allow the generation of specialized expertise upon which so much of the current global economy depends. Each city is tied through vast tentacles of investment, trade, migration, and

telecommunications to clients and markets, suppliers and competitors, scattered around the world. All three metropolises are endowed with enormous telecommunications infrastructures that allow corporate headquarters to stay in touch with global networks of branch plants, back offices, customers, subcontractors, subsidiaries, and competitors. This phenomenon again illustrates how geographic centralization can be facilitated by telecommunications (Moss, 1987).

However, telecommunications simultaneously threaten the agglomeration advantages of urban areas, particularly those obtained through face-to-face communications. This trend is particularly evident in finance, the bread-and-butter of global cities. For example, the National Associated Automated Dealers Quotation System (NASDAQ) has emerged as the world's fourth largest stock market; but unlike many other exchanges, NASDAQ lacks a trading floor, connecting half a million traders worldwide through telephone cable and fiber optic lines. Similarly, Paris, Brussels, Madrid, Vancouver, and Toronto recently abolished their trading floors in favor of screen-based trading. Whether this trend will lead to the dispersal of financial trading altogether in the future remains to be seen.

Telecommunications and Back Office Relocations

Another economic activity that has been heavily affected by telecommunications is routinized back office functions (Howland, 1993), which currently employ about 250,000 people in the USA. Back offices essentially perform data entry of office records, telephone books, library catalogues, stock transfers, payroll and billing, bank checks, insurance claims, and magazine subscriptions. These tasks involve unskilled or semi-skilled labor, primarily women, and frequently operate on a 24-hour-per-day basis. Back offices have few of the interfirm linkages associated with headquarters activities: they require extensive data processing facilities, reliable sources of electricity, and sophisticated telecommunications networks.

Historically, back offices have located next to headquarters activities in downtown areas to insure close management supervision and rapid turnaround of information. However, as central city rents rose in the 1980s and 1990s and companies faced shortages of qualified (i.e. computer-literate) labor, many firms began to uncouple their headquarters and back office functions, moving the latter out of the downtown areas to cheaper locations on the urban periphery (Moss and Dunau, 1986; Nelson, 1986).

Recently, given the increasing locational flexibility afforded by satellites and inter-urban fiber optics lines, back offices have also begun to relocate on a much broader, continental scale, making them increasingly footloose. Many financial and insurance firms and airlines moved their back offices from New York, San Francisco, and Los Angeles to low-wage communities in the Midwest and South. Phoenix, Atlanta, and Kansas City have been particularly significant beneficiaries of this trend. Omaha, Nebraska, claims to have created 100,000 tele-generated jobs in the last decade, in part because of its location at the crossroads of the national fiber optic infrastructure (Richardson, 1994). Similarly, with abundant cheap labor, San Antonio and Wilmington, Delaware, have become well-known centers of telemarketing (*Business Facilities*, 1995). Boulder, Colorado, and Columbus, Ohio, have moved in much the same direction, in part because of their centralized geographic location.

Internationally, this trend has taken the form of the offshore office. Offshore back office operations remained insignificant until transoceanic fiber optics lines enabled their relocation on an international scale (Warf, 1993). The capital investments in such operations are minimal and they possess great locational flexibility, maximizing their ability to choose among places based on slight variations in labor costs or profitability.

The primary motivation for offshore relocation is low labor costs, although other considerations include worker productivity, skills, turnover, and benefits. Offshore back offices are established not to serve foreign markets, but to generate cost savings for US firms by tapping Third World labor pools where wages are as low as one-fifth of those in the USA. Notably, many firms with offshore back offices are in industries facing powerful competitive pressures to enhance productivity, including insurance, publishing, and airlines. Several New York-based life insurance companies, for example, relocated back office facilities to Ireland (Lohr, 1988; McGahey et al., 1990). Often situated near Shannon Airport, they ship in documents by Federal Express and export the digitized records back via satellite or one of the numerous fiber optic lines that connect New York and London. Likewise, the Caribbean, particularly Anglophone countries such as Jamaica and Barbados, has become a particularly important locus for American back offices. American Airlines paved the way in the Caribbean when it moved its data processing center from Tulsa to Barbados in 1981. Through its subsidiary Caribbean Data Services (CDS), it expanded operations to Montego Bay, Jamaica, and Santo Domingo, Dominican Republic, in 1987. Manila, in the Philippines, has emerged as a back office center for British firms, with wages 20 percent of those in the UK (Money, 1992). Such trends indicate that telecommunications may accelerate the off-shoring of many low-wage, low-value-added jobs from the USA, with dire consequences for unskilled workers.

Telecommunications and Urban Space

Telecommunications have had important effects on the urban organization of space. Urban infrastructure investments in communications technologies have remained surprisingly unimportant to policymakers (Graham and Marvin, 1996). For example, only 5 percent of US municipalities have explicit plans for telecommunications. One reason is that there is no statistical correlation between local investment in telecommunications and economic growth (Schwartz, 1990; Cronin et al., 1993; Gibbs, 1993; Gibbs and Tanner, 1997); the widespread notion that "if you build it, they will come" is not necessarily true. However, while the telecommunications industry *per se* generates relatively few jobs, and while telecommunications do not guarantee economic development, such systems have become necessities for many firms.

Although large cities typically have much better developed telecommunications infrastructures than do small ones, the technology has rapidly diffused through the urban hierarchy (Alles et al., 1994). In the future, therefore, the competitive advantages based on telecommunications will diminish, forcing competition among localities to occur on the cost and quality of labor, taxes, and local regulations. Regions with an advantage in telecommunications generally succeed because they have attracted successful firms for other reasons.

Telecommunications affect the urban infrastructure in other, less obvious ways. One increasingly important effect of new information systems is "telework" or "telecommuting," in which workers substitute some or all of their working day at a remote location (almost always home) for time usually spend at the office (Grantham and Nichols, 1994–95). The self-employed do not count as teleworkers because they do not substitute it for commuting. Telework is most appropriate for jobs involving mobile activities or routine information handling such as data entry or directory assistance (Moss and Carey, 1995). Proponents of telework claim that it enhances productivity and morale, reduces employee turnover and office space, and leads to reductions in traffic congestion (especially at peak hours), air pollution, energy use, and accidents (Handy and Mokhtarian, 1995; Van Sell and Jacobs, 1994). For example, Ernst and Young reduced its office space in Chicago's Sears Tower by 10 percent through this method, and several federal government offices are experimenting with flexible workplace arrangements around Washington, D.C. (Office of Technology Assessment, 1995). The US Department of Transportation (1993) estimated that two million people in the USA (1.6 percent of the national labor force) telecommuted one to two days per week in 1992, while the Department of Energy (1994) estimated that 4.2 million (3.3 percent) did so, a volume expected to rise to 7.5 to 15.0 million (5 to 10 percent) of the US labor force by 2002. Further growth of telecommuting will encourage more decentralization of economic activity in suburban areas.

However, as Graham and Marvin (1996) point out, there are countervailing reasons why telecommunications may *increase* the demand for transportation rather than decrease it. First, while telecommuters spend fewer days at their workplace, it is not at all clear that they have shorter *weekly* commutes overall; indeed, by allowing them to live farther from their home, the total distances traveled may actually rise. Second, time freed from commuting may be spent traveling for other purposes, such as shopping or recreation. Telecommuting may alter the reasons for travel, but not necessarily the frequency or volume. Third, by reducing congestion, telecommuting may lead to significant induced effects, whereby others formerly inhibited from driving may be induced to do so. In short, whether or not an actual trade-off between telecommunications and commuting occurs (their substitutability rather than complementarity) is not clear.

Another potential, and growing, impact of information systems on urban form concerns transportation informatics, including a variety of improvements in surface transportation such as smart metering, electronic road pricing, synchronized traffic lights, automated toll payments and turnpikes, automated road maps, information for trip planning and navigation, travel advisory systems, electronic tourist guides, remote traffic monitoring and displays, and computerized traffic management and control systems, all of which are designed to minimize congestion and optimize traffic flow (particularly at peak hours), enhancing the efficiency, reliability, and attractiveness of travel (Office of Technology Assessment, 1995). Wireless technologies such as cellular phones allow more productive use of time otherwise lost to congestion. Such systems do not so much comprise new technologies as the enhancement of existing ones. In-vehicle navigation systems with inboard computers, such as the Intelligent Vehicle Highway System currently underway in southern California, represent the next generation of this technology. Finally, many buildings are

implementing information systems to replace manual reading of meters for utility consumption, monitor wind shear, or computerize the control of heating, ventilation, lighting, and security.

The widespread use of telecommunications has eased the locational mobility of firms and reinforced changes in the nature of urban planning. Desperate for jobs, many localities compete with one another with ever-greater concessions to attract firms, forming an auction that resembles a zero-sum game. The effects of such a competition are hardly beneficial to those with the least purchasing power and political clout. Left to sell themselves to the highest corporate bidder, localities frequently find themselves in a "race to the bottom" in which entrepreneurial governments promote growth – but do not regulate its aftermath – via tax breaks, subsidies, training programs, looser regulations, low-interest loans, infrastructure grants, and zoning exemptions (Hall and Hubbard, 1996). As a result, local planners have become increasingly less concerned with issues of social redistribution, compensation for negative externalities, provision of public services, and so forth, and more enthralled with questions of economic competitiveness, attracting investment capital, and the production of a favorable "business climate."

The Geopolitics of the Internet

Among the various networks that comprise the nation's and world's telecommunications infrastructure, the largest and most famous is the Internet, an unregulated electronic network connecting an estimated 100 million people in more than 100 countries (Warf, 1995). From its military origins in the USA in the 1960s, the Internet emerged on a global scale through the integration of existing telephone, fiber optic, and satellite systems, which was made possible by the technological innovation of packet switching and Integrated Services Digital Network (ISDN), in which individual messages may be decomposed, the constituent parts transmitted by various channels, and then reassembled, virtually instantaneously, at the destination. Spurred by declining prices of services and equipment, the Internet has grown worldwide at a rapid rate, the number of users doubling roughly every year. Popular access systems in the USA, such as Compuserve, Prodigy, and America On-Line allow any individual with a microcomputer and modem to "plug in" to cyberspace.

Despite exaggerations regarding the potential impacts of the Internet and the World Wide Web, such systems will clearly have substantial, if unanticipated, effects upon the social fabric over time (Negroponte, 1995). As Graham and Aurigi (1997, p. 26) note, "Large cities, based, in the past, largely on face-to-face exchange in public spaces, are dissolving and fragmenting into webs of indirect, specialized relationships." Information systems such as the Internet may reinforce existing disparities in wealth, connecting elites in different nations who may be increasingly disconnected from the local environments of their own cities and countries. Indeed, in a socio-psychological sense, cyberspace may allow for the reconstruction of "communities without propinquity," groups of users who share common interests but not physical proximity (Anderson and Melchior, 1995). In the age of the "City of Bits" (Mitchell, 1995), in which social life is increasingly mediated through computer networks, the reconstruction of interpersonal relations around the digitized spaces of cyberspace is of the utmost significance.

Significant discrepancies exist in terms of access to the Internet, largely along the lines of wealth, gender, and race: while one-third of US households have personal computers, only 12 percent have modems at home. Access to computers linked to the Internet, either at home or at work, is highly correlated with income; the median household income of Internet users is $79,000, almost twice the national average (*Internet World*, 1996). The Internet is also segregated by gender: roughly 80 percent of all US Internet users and 82 percent of World Wide Web users are male (Doctor, 1994; Doheny-Farina, 1996; Miller, 1996). A survey by the *Los Angeles Times* of 1,200 networked computer users in southern California found that they are overwhelmingly wealthy, young, and white (Harmon, 1996). A survey by the National Telecommunications and Information Administration (1995) revealed that white households used networked computers three times more frequently than did black or Latino ones (NTIA 1995). The elderly likewise often find access to the Internet to be intimidating and unaffordable, although they comprise the fastest-growing demographic group of users. American Internet users thus tend to be overwhelmingly white and middle class, well educated, younger than average, and employed in professional occupations demanding college degrees.

Social and spatial differentials in access to the skills, equipment, and software necessary to get onto the electronic highway threaten to create a large, predominantly minority underclass deprived of the benefits of cyberspace (Wresch, 1996). This phenomenon must be viewed in light of the growing inequalities throughout industrialized nations generated by labor market polarization (i.e. deindustrialization and growth of low-income, contingent service jobs). Modern economies are increasingly divided between those who are comfortable and proficient with digital technology and those who neither understand it nor trust it, disenfranchising the latter group from the possibility of citizenship in cyberspace. Despite the falling prices for hardware and software, basic entry-level machines for Internet access cost roughly $1,000 – an exorbitant sum for low-income households. Internet access at work is also difficult for many: for employees in poorly paying service jobs that do not offer access to the Internet at their place of employment (the most rapidly growing category of employment), the obstacles to access are formidable.

Nor does the public educational system offer an easy remedy. Even in the USA the wide discrepancies in funding and the quality of education among school districts, particularly between suburban and central city schools, may reproduce this inequality rather than reduce it (Kozol, 1991). While some public libraries offer free access to the Internet, there are currently only about 80 networked ones in operation in 29 states (Guthrie and Dutton, 1992; Schuler, 1996). Mounting financial constraints in many municipalities, moreover, have curtailed the growth of these systems (Norris and Kraemer, 1996). Even within the most digitized of cities there remain large pockets of "off-line" poverty (Thrift, 1995; Resnick and Rusk, 1996; Sawicki and Craig, 1996). Those who need the Internet the least, already living in information-rich environments with access through many non-Internet channels (e.g. newspapers and cable TV), may have the most access to it, while those who may benefit the most (e.g. through electronic job banks) may have the smallest chance to log on.

To some degree, public policy can ameliorate these social and spatial discrepancies (Bowe, 1993; Kahin, 1993). The Clinton administration launched the National Information Infrastructure (NII), promising to connect every classroom, library,

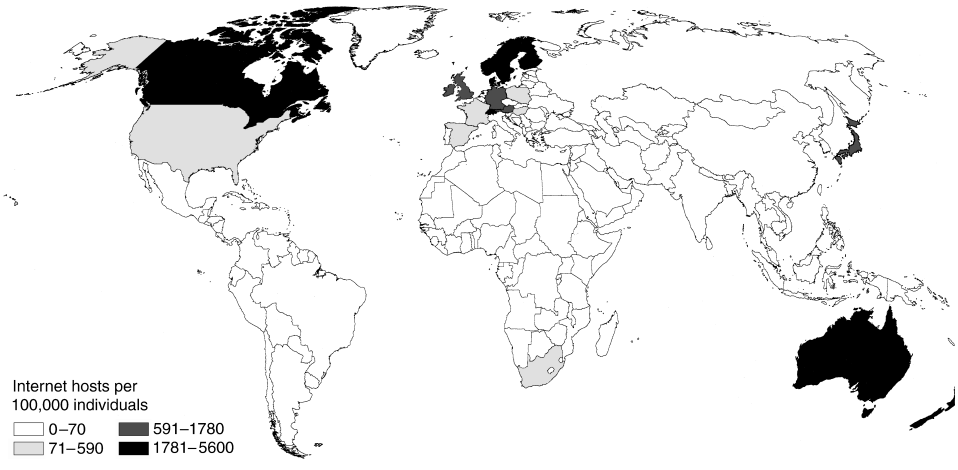

Figure 29.1 Internet hosts per 100,000 persons, January 1998
Source: Compiled by author from data at http://www.nw.com/zone/WWW/dist-byname.html

hospital, and clinic in the nation by the year 2000 (NTIA, 1995). In 1996, the Telecommunications Act sought to reduce spatial inequalities by guaranteeing access to basic telecommunications services, an important step for low-income rural areas where the marginal costs of installation and maintenance tend to be high.

These discrepancies in access are replicated at the international level, where, given the American and European dominance, the "World Wide Web" hardly lives up to its name. Inequalities in access to the Internet internationally, measured in terms of hosts per 100,000 people (figure 29.1), reflect the long-standing bifurcation between the First and Third Worlds. The best-connected nations are in Scandinavia, Canada, and Australia; the USA, surprisingly, is ranked relatively low in this regard, a reflection of its sizeable, poorly served population. Yet due to the enormous size of the American economy, 90 percent of all international Internet traffic is either to or from the USA. Even Japan remains relatively poorly connected in this regard. Outside of North America and Europe, the vast bulk of the world's people, particularly in the Third World, have little to no Internet access.

Access to the Internet is deeply conditioned by the density, reliability, and affordability of national telephone systems. Most Internet communications occurs along lines leased from telephone companies, many of which are state-regulated (in contrast to the largely unregulated state of the Internet itself). Prices for access vary by length of the phone call, distance, and the degree of monopoly: in nations with telecommunications monopolies, prices are 44 percent higher than in those with deregulated systems (*Economist*, 1996). The global move toward deregulation in telecommunications will likely lead to more use-based pricing (the so-called "pay-per" revolution), in which users must bear the full costs of their calls, and fewer cross-subsidies among different groups of users (e.g. between commercial and residential ones), a trend that will likely make access to cyberspace even less affordable to low-income users.

Conclusions

Economic activity today is overwhelmingly dominated by the production of intangibles, in which knowledge, information, and communications are critically important. The geography of the world economy rests heavily upon invisible flows of data and capital, binding places unevenly to the world-system. Telecommunications have also transformed the ways in which economic landscapes are constructed, suturing localities to global "spaces of flows" that move at the speed of light and giving firms unprecedented mobility and flexibility (Castells, 1996). At the end of the millennium, telecommunications had ushered in a vast round of time–space compression, linking places together to an historically unprecedented degree. Markets, labor processes, transportation routes, planning policies, and spatial structures have changed accordingly.

Cities and regions search for a competitive advantage in this world in several ways. In large metropolitan areas with dense complexes of firms bound together by face-to-face interactions, telecommunications have left skilled, high-wage functions largely intact, but not unchallenged – as the electronic trading of stocks suggests. By allowing firms to stay in contact with operations around the world, telecommunications have contributed to the centralization of key activities in global cities such as New York, London, and Tokyo, which rely upon their extensive connections to the global telecommunications infrastructure to serve as nerve centers of the world economy. For such tasks, telecommunications have been largely unable to substitute for face-to-face interactions. Other services that process routinized information, however, and rely upon unskilled, low-wage labor, are highly vulnerable to substitution by new telecommunications systems and have decentralized (e.g. back offices). A key theme in understanding the new economic landscapes of the information economy is that telecommunications tend to reinforce the agglomeration of high-wage, high-value-added, white-collar functions while decentralizing low-wage, low-value-added, blue (or pink)-collar ones.

In short, telecommunications have a variety of impacts upon cities and regions, both positive and negative, local and global, centralizing and decentralizing. To appreciate the complexity of these effects requires a step back from the simple utopianism and technological determinism that tends to pervade much public opinion and policymaking. Whether they be the telephone, Geographic Information Systems (Pickles, 1995), or the Internet, telecommunications systems are a social product, interwoven with relations of class, race, gender, and power (Jones, 1995; Shields, 1996). A growing body of critical literature has detailed how electronic systems are used to monitor everyday life, including credit cards, visas and passports, tax records, medical data, police reports, telephone calls, utility records, automobile registration, crime statistics, and sales receipts (Lyon, 1994). In this light, telecommunications can be used against people as well as for them. The unfortunate tendency in the popular media to engage in technocratic utopianism largely obscures these power relations. *Contra* this post-industrial utopian perspective, social categories of wealth and power and geographical categories of core and periphery continue to be reinscribed in cyberspace.

Given the rapid rate of technological change in the late twentieth century, predictions about the future of telecommunications are hazardous at best. Capitalism has

had a very long history of technological and economic changes that periodically refashion local and global landscapes: the information revolution of the late twentieth century is the latest chapter in this story.

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