Roger (eds) (1999) *What's New about New Media?*, special issue *of New Media and Society*, vol. 1. London: Sage.
Jones, Steve (ed.) (1999) *Cybersociety 2.0*. London: Sage.
de Kerckhove, Derrick (1997) *Connected Intelligence: The Arrival of the Web Society*. Toronto: Somerville House.
Levy, Pierre (1995) *Qu'est-ce que le virtuel?* Paris: La Decouverte.
Nelson, Chris and Jones, Steve (2001) "Revolutionary times for music," *Boston Globe*, January 16: A11.
Owen, Bruce M. (1999) *The Internet Challenge to Television*. Cambridge, MA: Harvard University Press.
Packer, Randall and Jordan, Ken (eds) (2001) *Multimedia: From Wagner to Virtual Reality*. New York: W. W. Norton.
Schiller, Dan (1999) *Digital Capitalism: Networking the Global Market System*. Cambridge, MA: MIT Press.
Silverstone, Roger and Hirsch, Eric (1992) *Consuming Technologies. Media and Information in Domestic Spaces*. London: Routledge.
Suarez, Manuel (2001) "Free music, the music industry, and the Internet," University of California, Berkeley, unpublished research paper for CP229 seminar.
UNESCO (1999) *World Communication Report, 1999–2000*. Paris: UNESCO.

e-Links

www.artmuseum.net
On electronic art.

www.worldofescher
On Escher and tessellations.

Chapter 8

The Geography of the Internet: Networked Places

The Internet Age has been hailed as the end of geography. In fact, the Internet has a geography of its own, a geography made of networks and nodes that process information flows generated and managed from places. The unit is the network, so the architecture and dynamics of multiple networks are the sources of meaning and function for each place. The resulting space of flows is a new form of space, characteristic of the Information Age, but it is not placeless: it links places by telecommunicated computer networks and computerized transportation systems. It redefines distance but does not cancel geography. New territorial configurations emerge from simultaneous processes of spatial concentration, decentralization, and connection, relentlessly labored by the variable geometry of global information flows.

I will explore the contours of this space by focusing first on the geography of the Internet itself. I will then analyze the influence of

information and communication technologies on the spatial transformation of cities and regions. I will also address a myth of our time: the end of the workplace thanks to telecommuting, by reporting on the actual developments in metropolitan mobility. I will consider the potential changes brought by the Internet in our home environment, and in our relationship to public space. Finally, I will examine the social differentation induced by this networking geography.

The Internet's Geography

The geographical dimension of the Internet can be analyzed from three perspectives: its technical geography, the spatial distribution of its users, and the economic geography of Internet production. The *technical geography* refers to the telecommunications infrastructure of the Internet, the connections between the computers that organize Internet traffic (routers), and the distribution of the Internet's broad bandwidth; that is, the telecommunication lines dedicated to Internet data packet traffic. A number of pioneering researchers have been working on mapping the Internet for some time, most notably John Quaterman, head of MIDS.com, as well as the work conducted around the consulting firm Telegeography (2000), founded by John Staple. Cheswick and Burch (2000), working from Bell Laboratories, have built a remarkable, evolving database on the topography of connections between Internet nodes. Martin Dodge (1998–2001) (Cybergeography.com) and Townsend (2001) have also contributed to the mapping of the Internet's infrastructure, while other researchers, including Cukier (1999) and Abramson (2000), have analyzed the meaning of this spatial configuration. The graph on the cover of this book, produced by Cheswick and Burch, reflects the topography of the Internet, based on trace routes in January 2000. I take the liberty of referring the reader to the websites listed at the end of the chapter to visualize, with the help of beautiful images, the structure and evolution of the Internet's technical network.

These studies show the complexity, pervasiveness, and global reach of the Internet backbone. Every node is connected to every

node through a myriad of possible routes. However, because the US has much greater bandwidth capacity than the rest of the world, the US plays a central role in the connections between countries. According to Cukier, in 1999 the Internet's technical structure "resembled a star with the United States at its center" (1999: 53). It is often the case that connections between two European or Asian cities, let alone African or Latin American ones, are first routed through a US node. However, according to Telegeography, this is changing, as bandwidth increases in other areas of the world, particularly in Europe. Most traffic is still routed through the United States but new nodes emerge as key routers. Townsend (2001) observes that major metropolitan areas rely on a backbone made up of a network of networked cities. In sum, technically speaking, the Internet backbone is global in its reach, but territorially uneven in its layout in terms of capacity. While intercountry differences are declining, dependency upon the United States is gradually being replaced by technical dependency upon connection to a large, broad bandwidth network of networks linking the major metropolitan centers around the world, with the main nodes still predominantly located in the United States.

Concerning the *geography of users*, figs 8.1 and 8.2, elaborated by Matthew Zook on the basis of NUA surveys, show the highly uneven territorial distribution of the Internet in September 2000, both in terms of the number of users and of the penetration rate relative to the population of each country. Thus, North America, with over 161 million users, was the dominant region of the world, and, together with Europe's 105 million users, constituted the bulk of the total 378 million Internet users, in sharp contrast to the distribution of the population in the planet. Thus, the Asia Pacific region, with over two-thirds of the world's population, only accounted for 90 million users, some 23.6 percent of the total; Latin America had only about 15 million users; the Middle East 2.4 million; and Africa 3.11 million, of which the majority was in South Africa. In terms of density of use of the Internet, Scandinavia, North America, Australia, and (interestingly enough) South Korea, came clearly above all other countries, followed by the UK, The Netherlands, Germany, Japan, Singapore, Taiwan, Hong Kong, then Southern

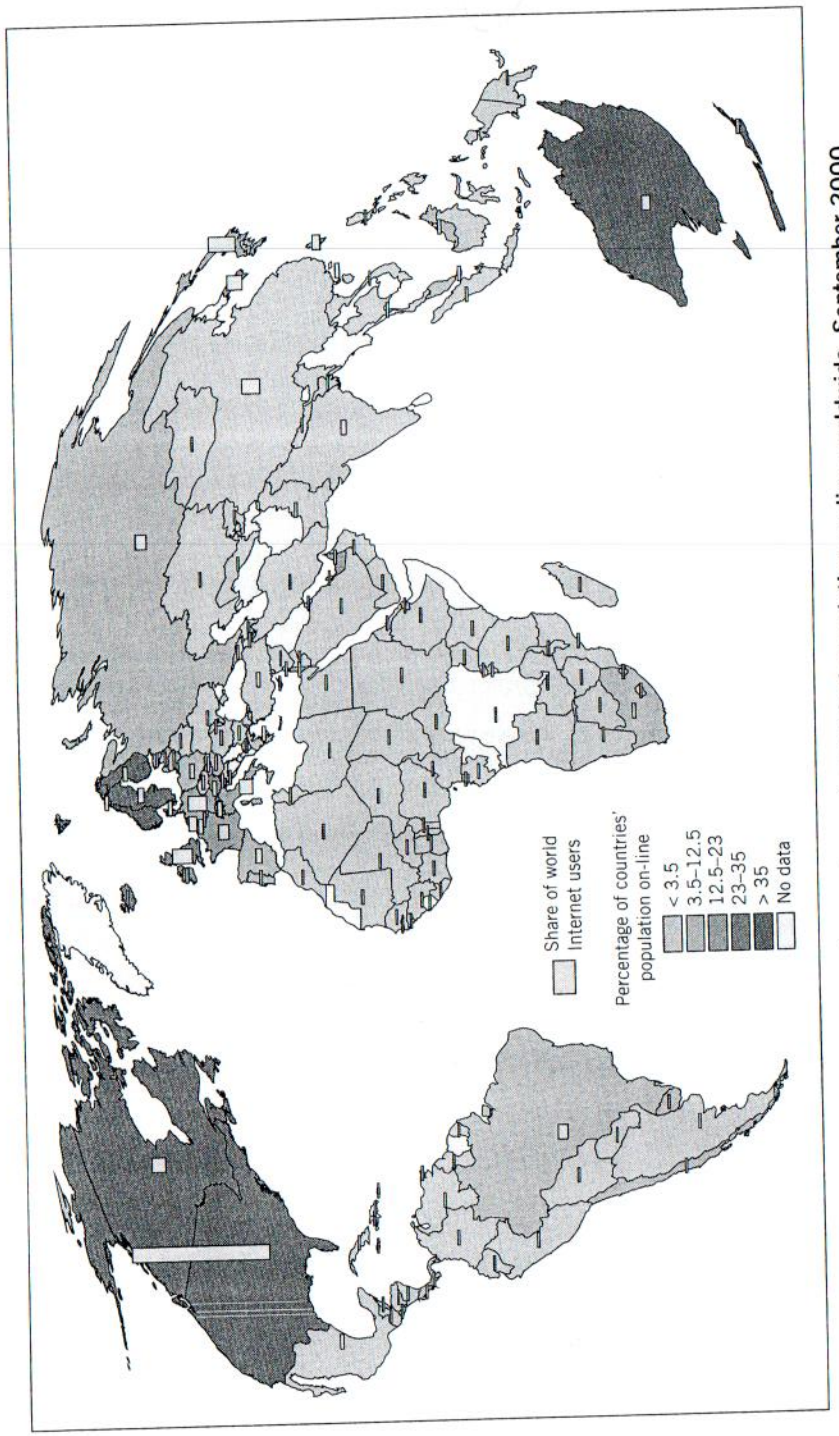

Fig. 8.1 Share of world Internet users and percentage of countries' population on-line worldwide, September 2000

Source: Zook (2001*a*)

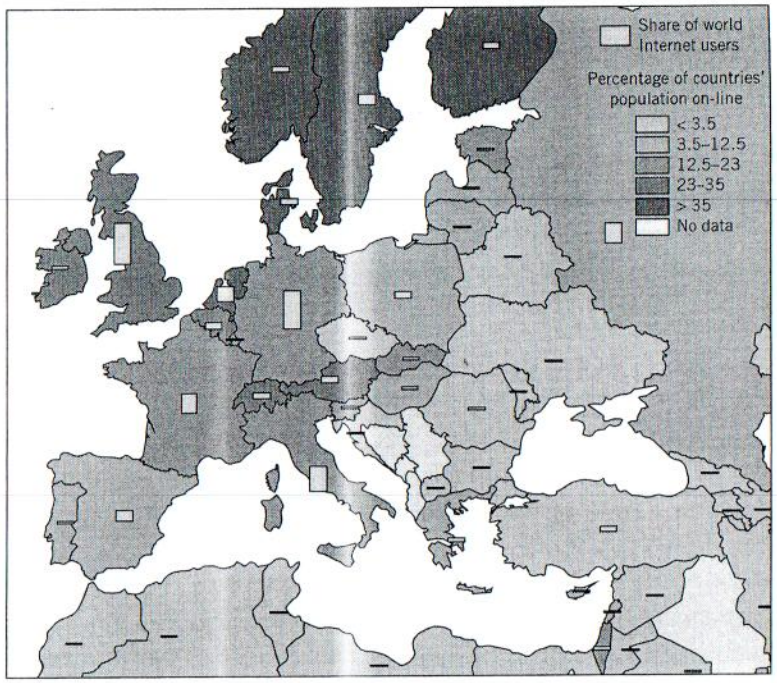

Fig. 8.2 Share of world Internet users and percentage of countries' population on-line in Europe, September 2000

Source: Zook (2001*a*)

Europe; at a greater distance came the rest of Asia, Latin America, the Middle East, and, at the very bottom, Africa.

I shall elaborate on the implications of this differential diffusion of the Internet in Chapter 9. However, while exploring its geography, it is essential to emphasize that the use of the Internet is highly differentiated in territorial terms, following the uneven distribution of technological infrastructure, wealth, and education in the planet. This geographical pattern evolves over time. Thus, according to NUA surveys, in the first global surveys of Internet use at the end of 1996, of a total of 45 million users, North America accounted for 30 million, with another 9 million in Europe, and the rest of the world sharing the other 6 million (most of them in

Australia, Japan, and East Asia). Internet use is diffusing fast, but this diffusion follows a spatial pattern that fragments its geography according to wealth, technology, and power: it is the new geography of development.

Within countries, there are also major spatial differences in the diffusion of Internet use. Urban areas come first, both in developed and developing countries, and rural areas and small towns considerably lag behind in their access to the new medium, in a blatant denial of the futurologists' image of the electronic cottage, working and living in the countryside. Retardation in the diffusion of the Internet in rural areas has been observed in the United States, in Europe, and even more so in developing countries. For instance, in China, the three largest cities, Beijing, Shanghai, and Guangzhou, in September 2000, according to NUA surveys, accounted for about 60 percent of Internet users. In contrast, the penetration rate for the country as a whole remained at less than 2 percent of the population. Within urban areas, major metropolitan areas, and particularly the most important cities, tend to be the ones with the fastest and largest adoption of the Internet. There are, however, exceptions in countries with a decentralized urban structure, such as Germany, where Munich, Berlin, and Hamburg adopted the Internet faster, or the United States, where dynamic areas, such as Austin or Seattle, were intensive users at an earlier time than older industrial cities, such as Chicago or Philadelphia. Yet, overall, there is a strong correlation between metropolitan dominance and early adoption of Internet use. So, Internet diffusion proceeds unevenly over time and space, by successive layers of incorporation that may reflect in a diversity of social geographies in the future.

However, while the use of the Internet is expected to diffuse broadly in the coming years, at least in the most developed countries and in the metropolitan areas of the developing world, a more selective, *economic geography is emerging concerning the production of the Internet*. This is certainly the case with the Internet's equipment manufacturing and technology design. Silicon Valley and its global networks, together with the Ericsson world network centered on Sweden, the Nokia world network centered on Finland, the NEC world network centered on Japan, and perhaps a few other net-

works built around mighty corporations of the pre-Internet era (ATT, IBM, Microsoft, Motorola, Phillips, Siemens, Hitachi) continue to concentrate in a few milieux of innovation most of the technological know-how on which the Internet is based. Indeed, Cisco Systems, controlling over 80 percent of the market for Internet routers, was planning by the end of 2000 to build a giant campus in Coyote Valley, near San Jose, in Silicon Valley, to house 20,000 employees, on top of the thousands already working for Cisco in the area, so that the majority of its global labor force would be concentrated in a few miles.

While new centers of Internet-related technological innovation, such as Austin, and Denver–Boulder, were growing fast, the overall geography of Internet-related hardware closely follows the pattern identified years ago by Peter Hall and myself in our worldwide scanning of technopoles (Castells and Hall, 1994): dense spatial concentrations of major companies and innovative start-ups, as well as their ancillary suppliers, located in a few technological nodes, usually in the periphery of large metropolitan areas, then linked up with each other by telecommunications and air transportation. No undifferentiated spatial diffusion, but highly selective, metropolitan concentration, and global networking. A similar locational pattern seems to be followed by Internet software companies, Internet media services, and Internet service providers. However, the metropolitan areas that host the leading firms reflect the diverse origins of each company: for instance, Washington, DC, home of AOL, or Seattle, home of Amazon. Yahoo!, e-Bay, e*Trade, and a long list of leaders of the early Internet industry were spin-offs from Silicon Valley's and San Francisco's entrepreneurial milieux.

Nevertheless, as I emphasized in Chapter 3 on e-business, it would be too narrow a vision to consider the Internet industry as made up exclusively of Internet manufacturers, Internet software companies, Internet service providers, and Internet portals. The commercial Internet is not just about web companies, it is about companies in the web. Thus, we need an assessment of the geography of Internet content providers at large; that is, of the Internet domains of all kinds that generate, process, and distribute

information. Since information is the key product of the Information Age, and the Internet is the fundamental tool for the production and communication of this information, the economic geography of the Internet is, by and large, the geography of Internet content providers.

Matthew Zook has conducted the most rigorous, analytical effort to date to map Internet content providers, and to make sense of their spatial patterning in the world, within countries, within regions, and within cities, between 1996 and 2001 (Zook, 2000*a*, *b*; 2001*a*, *b*). To do so, he constructed a database locating a random sample of Internet domains, on the basis of their registration postal addresses, according to a methodology that can be checked on his website (see the Appendix to this chapter). He also mapped the thousand top websites (ranked by Alexa.com), measured by the number of hits from users, and ranked them by numbers of webpages consulted. Figs 8.3–8.6 display the location of Internet content providers, measured by the location of domain addresses, in the world, in Europe, in the United States, and in New York City as of July 2000. Zook calculated both the number of domains in the world and in each country, and the density of domains, standardizing by population for each country, and by the number of businesses for the commercial Internet in the United States. Reading from Zook's tables for his July 2000 sample (which are not given here for simplicity's sake), he found the United States to account for the lion's share of Internet domains, with about 50 percent of the total, followed by Germany with 8.6 percent and the UK with 8.5 percent. Canada (3.6 percent), South Korea (2.5 percent) and France (2.1 percent) were in the middle, with all other countries below 2 percent.

Standardizing by population, the dominance of the developed world is still more accentuated, with the US showing a ratio of 25.2 Internet domains per thousand population, compared to Brazil's 0.5, China's 0.2, and India's 0.1. Europe shows a strong internal diversity, with Switzerland, Denmark, Finland, and The Netherlands ranking at the top, with over 15.0 per thousand population, and Southern Europe at the bottom, with Spain, for instance, showing a ratio of 3.4 per thousand, representing only

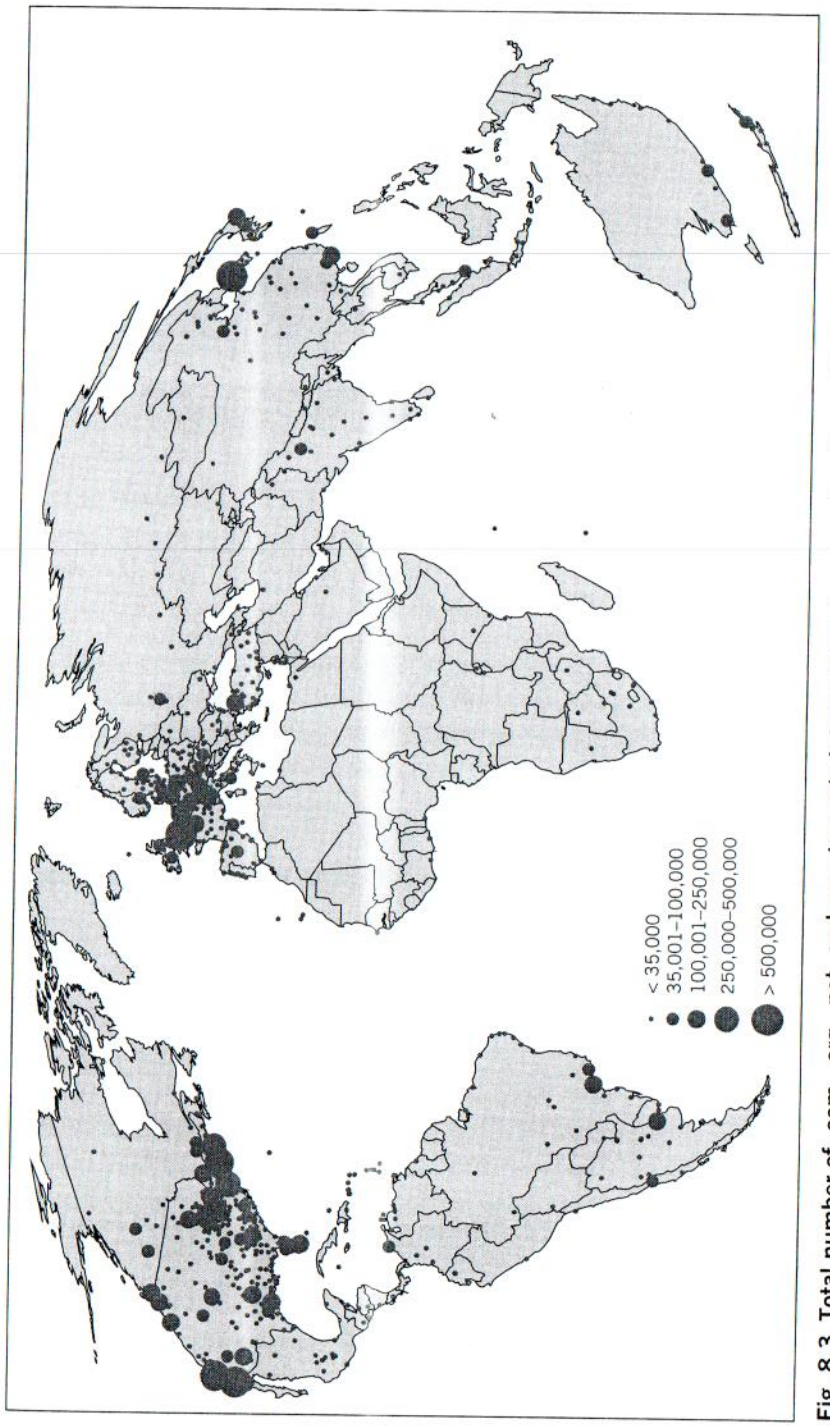

Fig. 8.3 Total number of .com, .org, .net, and country code Internet domain names by city worldwide, July 2000
Source: Zook (2001*a*)

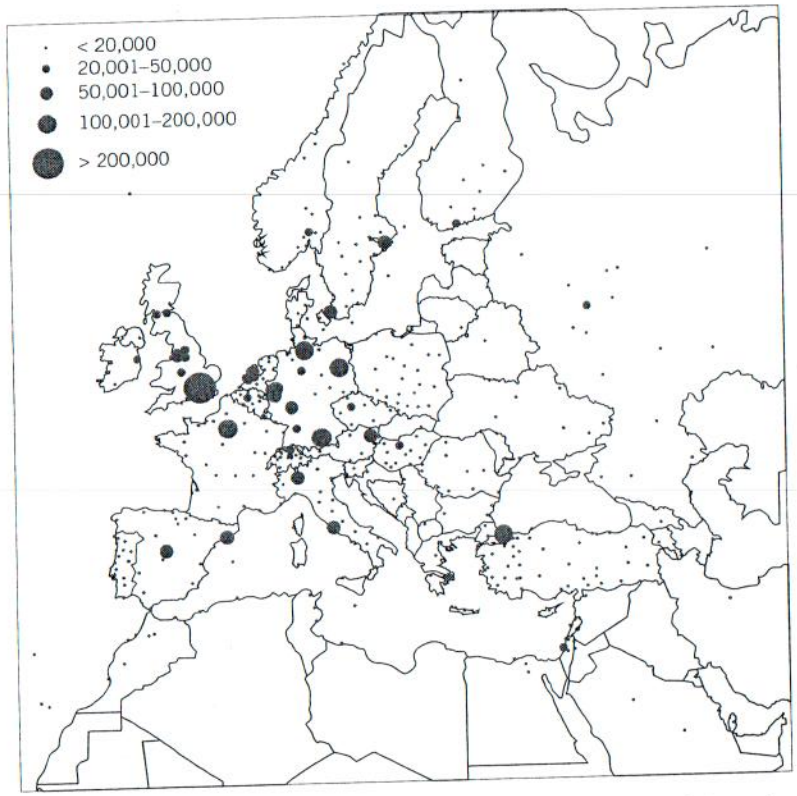

Fig. 8.4 Total number of .com, .org, .net, and country code Internet domain names by city in Europe, July 2000

Source: Zook (2001*a*)

1 percent of world domains. The case of Japan is significant, accounting for only 1.6 percent of world domains, with a domain/population ratio of only 1.7 per thousand, although this is probably changing rapidly with the expansion of Do-Co-Mo.

What these data say is that Internet domains are highly concentrated by country, with substantial dominance by the US. This concentration is much higher than the concentration of Internet users, suggesting a growing asymmetry between production and consumption of Internet content, with the US producing for everybody else, and the developed world producing for the rest of the world—

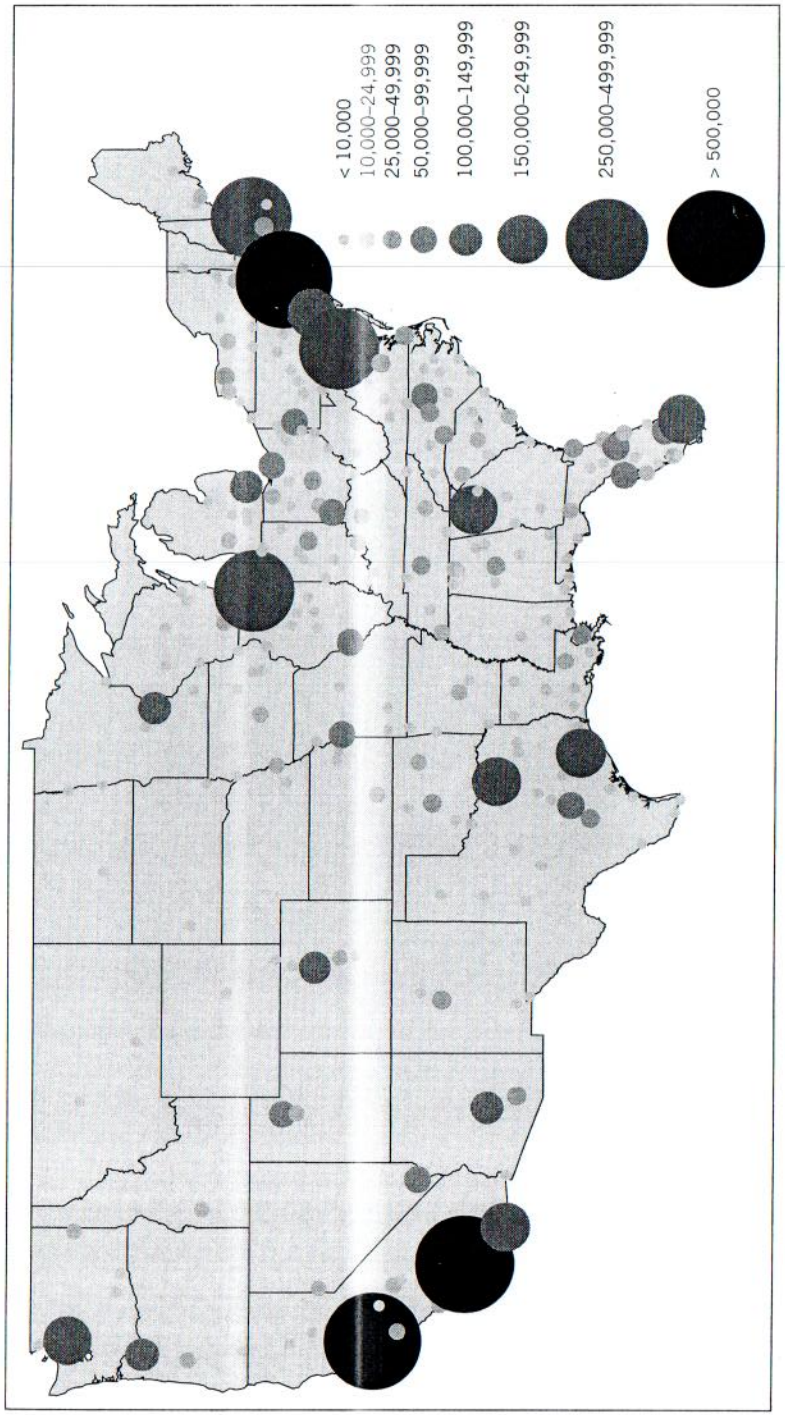

Fig. 8.5 Total number of .com, .org, .net, and country code Internet domain names by city in the US, July 2000

Source: Zook (2001*a*)

with the exception of Japan which consumes much more than it produces. South Korea represents an interesting case as it displays one of the highest penetration rates in the world both in the production and consumption of Internet content. Although there is no convincing explanation for this Korean specificity, the South Korean anomaly should introduce caution against a hasty cultural interpretation of the reason why Japan lags behind in Internet content provision.

These data should be interpreted in a time-dynamic perspective. In 1997, Quaterman reported that 83 percent of all dot.com domains were located in the US, while the US, Canada, and the UK represented 90 percent of all dot.com domains. In January 2000, the relative figures had declined to 67 percent and 74 percent (remember that Zook's database refers to all domains, and not just dot.com domains). So, there is indeed a trend toward greater diffusion of the commercial Internet's content provision. But this geographical diffusion starts from a very high level of spatial concentration in a few countries, whose dominance in designing and distributing content will be felt for a considerable period of time. Furthermore, many of these content providers entered foreign markets with expertise and capital (for example, Yahoo! was the most widely used portal in Europe in 2000).

The US dominance is even greater when measured in terms of top sites and pageviews. In 2000, the US accounted for 65 percent of the top thousand websites, and 83 percent of the total pageviews of Internet users. Again, South Korea is the surprise phenomenon here, ranking second after the US in its percentage of total pageviews—a tribute to the high level of use of the Korean Internet by Koreans. South Korea only accounted for 5.6 percent of total pageviews but this percentage was well above the 2.9 percent for the UK or the 1.1 percent for Germany. Since Japan also fared better in top websites and pageviews than in content provision, it may be that the language barrier in accessing English sites favors nationally based Internet content.

Zook's data also allow analysis of the location of Internet domains by city, with a database of 2,500 cities worldwide. The results are highly significant. In January 2000, the top five cities, accounting

Fig. 8.6 Distribution of .com Internet domain names by zip code in New York Metropolitan Region, July 2000

Source: Zook (2001a)

for 1 percent of world population, accounted for 20.4 percent of Internet domains. The top fifty cities, with only 4 percent of world population, contained 48.2 percent of Internet domains, and the top 500 cities, with 12.4 percent of the population, represented 70 percent of Internet domains. Moreover, the concentration of Internet domains between 1998 and 2000 increased for the top five cities by 2.7 percentage points, and for the top ten cities by 1.3 percentage points. This is in contrast to the phenomenon of the diffusion of the Internet from its original location. In other words, Internet content provision is increasingly, and overwhelmingly, a metropolitan phenomenon.

Where are these Internet concentrations located? According to Zook's data, in January 2000, seventeen out of the top twenty cities in the ranking of Internet domains were in the United States. The largest concentration was in the Greater New York area (CMSA), followed by Greater Los Angeles (CMSA), and San Francisco–Oakland–San Jose. London came fourth in the ranking, Seoul seventh, and Hong Kong nineteenth. Within countries, the general rule is the metropolitan concentration of Internet domains, particularly in the largest metropolitan areas. Thus, London accounts for 29 percent of Britain's domains, and the highest density in the UK relative to its population. This predominance of London in Internet content provision has also been verified in the study by Dodge and Shiode (2000) on the Internet's "real estate" in Britain, by calculating the spatial distribution of IP addresses. Birmingham, Cambridge, Oxford, and Nottingham, completed the upper tier of Britain's Internet geography. In France, Paris accounted for 26.5 percent of Internet domains. In Spain, Madrid and Barcelona together represented over 50 percent of Internet domains. Stockholm concentrated the largest share of Internet content provision in Sweden, and so did Helsinki in Finland, and Copenhagen in Denmark. Only Germany has a decentralized system of Internet content provision, with Berlin, Munich, and Hamburg sharing relatively low percentages of concentration, ahead of other areas. This reflects the flat hierarchy of the German urban system, suggesting that Internet content provision adapts to the pre-existing metropolitan structure, rather than reversing it. However, when

domain sites were adjusted for population, Zurich and Munich appeared at the top of the European ranking, reflecting Zurich's role in finance and Munich's role in high-technology and media industries.

In the United States, there is an overwhelming metropolitan dominance in Internet content provision, with a particularly concentrated structure at the top of the ranking. In terms of Internet domains, New York, Los Angeles, and San Francisco/Silicon Valley top the rest of the cities by far. Adding the fourth and fifth largest areas (Seattle and Washington, DC), these areas together accounted for 18.7 percent of domains worldwide, and 38.1 percent of the top thousand sites in the world, as well as for 64.6 percent of pageviews of the top thousand sites. In contrast, the rest of the US represented only 27 percent of the world's top websites and 16.9 percent of pageviews. In other words, the concentration of Internet content providers in the US reflects in fact its concentration in a few metropolitan areas, and particularly at the top of this Internet metropolitan hierarchy, formed by New York, Los Angeles, San Francisco, Seattle, and Washington, DC.

Measuring the Internet content provision specialization of these areas, standardizing by population, and by the number of businesses, a new hierarchy appears, with the San Francisco Bay area at the top, Los Angeles in third place, and New York in fourteenth place, with smaller areas, highly intensive in Internet provision high on the list. This is the case for Provo-Orem (Utah), San Diego, and (of course) Las Vegas (gambling, porno, tourist information). What is important in this analysis is that the Internet domain hierarchy does not really follow population distribution in the United States. For instance, the San Francisco Bay area is much higher than Chicago in absolute numbers of domains, and in terms of specialization. San Francisco has twice the number of domain names per firm than Chicago, Philadelphia, Dallas, or Houston.

Finally, moving inside metropolitan regions, Zook shows the high level of concentration of Internet domains in certain areas. Thus, in the city of San Francisco, there is an extraordinary concentration of Internet content providers in the South of Market

area. In New York, fig. 8.6 shows the overwhelming concentration in Manhattan, and inside Manhattan in a few neighborhoods: the so-called Silicon Alley, at the tip of Manhattan; and south of Central Park, on the East Side. In Los Angeles, there is also a pattern of spatial concentration of Internet content providers in a few areas, particularly around Santa Monica, the Ventura Freeway Corridor, and the San Gabriel Valley.

Thus, research shows that Internet content provision, as measured by domains addresses, follows a pattern of high spatial concentration. This supposedly footloose activity has a higher location quotient than most other industries. It is concentrated in a few countries; it is overwhelmingly located in metropolitan areas, and particularly in some of the wealthiest metropolitan areas of the world; it is usually (but not always) concentrated in the largest metropolitan areas of each country; it is concentrated in a few, leading metropolitan locations in each country with high levels of specialization in those areas that started the commercial Internet; and it is concentrated in specific areas, and neighborhoods within metropolitan areas. The geography of the Internet's content providers is characterized by taking over the world's virtual sites from a few physical places. The question is why?

Zook has investigated the matter in the United States, using both statistical analysis and case studies. There are three main answers. The first refers to the connection to the metropolitan structure of the information economy. Internet domains are related to information production organizations. The large spatial clusters of these organizations in advanced services, finance, media, entertainment, education, health, technology, and the like, are predominantly in metropolitan areas, and particularly in areas such as New York, Los Angeles, and Washington, DC. So, the spatial patterning of the Internet follows not the distribution of the population but the metropolitan concentration of the information economy. However, this is not the only answer because major information production centers, such as the Chicago area, do not rank as high as Internet content providers.

The second answer refers to the connection to pre-existing milieux of technological innovation, which provide the know-how

of new technologies, and the network of suppliers, which could sustain new entrepreneurial initiatives: this is the case for the San Francisco Bay area, for Seattle, Austin, San Diego, Denver–Boulder, and for a number of high-technology hubs riding the new wave of the information-technology revolution. But this only partially explains the case of New York, the largest concentration of Internet content providers in 2000. New York was built on the design expertise accumulated in the world of media, advertising, and art, yet it had little technological base of its own. Zook found that the key missing link, which explains the prominent role of both New York and San Francisco in the provision of Internet content, is the spatial structure of the venture capital industry, including the personalized version of "angel investors" (Zook, 2001*a*).

Venture capital plays an essential role in financing innovation and entrepreneurialism in the Internet economy, as I showed in Chapter 3. Venture capitalists have an intimate connection to Internet start-up companies. They work with the companies on a weekly basis, they nurture and advise them, they are part of the same process of work (Gupta, 2000). In other words, venture capital is an integral component of the Internet industry. And the geography of venture capital is highly concentrated. In the late 1950s, in the first stage of the micro-electronics-led revolution, it was concentrated in the San Francisco and Boston areas, although New York-based investment banks were always a major source of capital everywhere (for instance, the emblematic micro-electronics company of Silicon Valley, Fairchild Semiconductors, was started with capital from New York investors). In the 1990s, New York became a major player in the Internet content industry, as well as Los Angeles, both financed by venture capital. The reasons for this spatial patterning of venture capital firms are two-fold. Most venture capital originated from inside the high-technology industry, from investors who had made money in the industry, knew it well, and were ready to take risks because of their insider knowledge, often with backing from outside investment, particularly from New York. However, insider knowledge was essential for the development of a dynamic and rich venture-capital sector in the San Francisco Bay area.

The process by which New York became a hub of the Internet content industry was different. Wall Street firms learned from Silicon Valley how profitable technology investments could be. They spun off specialized units to scan opportunities, at the time when New York's bursting entrepreneurial culture was discovering the potential of the Internet in its cultural/commercial dimension. The convergence of the New York information economy, New York money, New York media, New York art, and New York business savvy launched Silicon Alley, and beyond, reinventing the New York economy once again. The geography of Internet production is the geography of cultural innovation. A geography that Peter Hall (1998) has demonstrated was historically rooted in the major urban centers of the world—and still is.

The Internet Age: An Urbanized World of Sprawling Metropolises

One of the founding myths of futurology about the Internet Age refers to the end of cities. Why keep these cumbersome, congested, filthy creatures from our past when we have the technological possibility of working, living, communicating, and enjoying from our mountain top, our tropical paradise, or our little house on the prairie? And yet, while you are reading this book our blue planet will probably be crossing the threshold when 50 percent of the world's population live in cities (up from 37 percent in 1970), and the projections are for about two-thirds of the population being urbanized by 2025. Sub-Saharan Africa, the least urbanized region in the world, is the one with the fastest rate of urban growth (an annual 5.2 percent in 1975–95), so that by 2020, 63 percent of the population will be likely to live in cities. In 1998–9, Western Europe was 82 percent urban, Russia 75 percent, and the US 77 percent. In 1996, Japan and the Korean peninsula were 78 percent urban, Brazil 80 percent, South East Asia 37 percent, Pakistan 35 percent. China, with 30 percent in 1996, and India with 28 percent in 1998, were still, by and large, rural countries, and they account for over one-third of humankind. Yet, the projections are for

India's urban population to almost double between 1996 and 2020, jumping from 256 million to 499 million. China's urban population is expected to increase even faster, from 377 million in 1996 to 712 million in 2020, thus representing over half of the projected total population of China. In all likelihood, the twenty-first century will see a largely urbanized planet, with the population increasingly concentrated in very large metropolitan regions—leaving most of the planet's land mass sparsely inhabited.

At the turn of the millennium, in the rich countries, the proportion of people living in areas of over one million people was 30 percent, and one-third of Latin Americans lived in these large metropolitan areas. Moreover, the statistical categories are misleading because the functional spatial units where people live encompass much larger populations linked by fast transportation systems that shrink distance and give people the option of being in a major node of economic and social livelihood without being in the proximity of one of its centers. The entire planet is being reorganized around gigantic metropolitan nodes that absorb an increasing proportion of the urban population, itself the majority of the population of the planet.

But what has the Internet to do with it? First, the story I have just told is the opposite of the official story of Internet-based futurologists. I read, in mid-2000, one of the most prominent representatives of the trade forecasting once again the end of cities, and declaring that the Internet would be the golden opportunity for rural regions of the world, such as South America—which, of course, at the same date was already 80 percent urban, and counting. So, to consider the actual data on the spatial patterning of human settlements is a healthy reminder of the realities of our world while trying to ascertain the spatial dimension of the Internet. But, secondly, and more importantly, the Internet is in fact the technological medium that allows metropolitan concentration and global networking to proceed simultaneously. The networked economy, tooled by the Internet, is an economy made up of very large, interconnected metropolitan regions. I shall explain.

While our economy and society are built around decentralized networks of interaction, the spatial pattern of human settlements is

characterized by unprecedented territorial concentration of population and activities (Borja and Castells, 1997). Why so? Why do urban and metropolitan areas continue to grow in size and complexity, in spite of increasing technological ability to work, and interact, at a distance? The fundamental reason is the spatial concentration of jobs, income-generating activities, services, and human development opportunities in cities, and particularly in the largest metropolitan areas. This is, on the one hand, because increasing productivity in the advanced sector of the economy, and the crisis of agricultural and extractive activities, eliminate jobs in rural areas and backward regions, inducing new rural–urban migrations. On the other hand, metropolitan areas concentrate the higher-value generating activities, both in manufacturing and services; because they are the sources of wealth, they provide jobs, both directly and indirectly. And because there is a higher level of income in these areas, they offer greater opportunities for the provision of essential services, such as education and health. Furthermore, even for those migrants at the bottom of urban society, the spillover of opportunities provides better chances for survival first, and for the promotion of future generations later, than anything they could find in increasingly marginalized rural areas and backward regions. As long as metropolitan areas continue to be cultural centers of innovation, their residents have access to unparalleled opportunities for cultural enhancement and personal enjoyment, thus improving the quality and diversity of their consumption.

Yet, why does the new production and management system of the Information Age favor metropolitan concentration? Knowledge generation and information-processing are the sources of value and power in the Information Age. Both depend on innovation, and on the capacity to diffuse innovation in networks that induce synergy by sharing this information and knowledge. A twenty-year-old tradition of urban and regional research has shown the importance of territorial complexes of innovation in facilitating synergy. What Philippe Aydalot, Peter Hall, and I named some time ago as "milieux of innovation" seem to be at the heart of the ability of cities, and particularly of large cities, to become the sources of wealth in the Information Age. This is certainly the case for Silicon Valley (and

the San Francisco Bay area in general), the acknowledged birthplace of the information-technology revolution (Saxenian, 1994). But, as shown by Peter Hall and myself in our world survey of technopoles, the argument extends to all societies. All major centers of technological innovation have appeared in and from large metropolitan areas: Tokyo–Yokohama, London, Paris, Munich (succeeding Berlin after the war), Milan, Stockholm, Helsinki, Moscow, Beijing, Shanghai, Seoul–Inchon, Taipei–Hsinchu, Bangalore, Bombay, São Paulo–Campinas, and, in the US, the San Francisco Bay area, Los Angeles/Southern California Technopole, Greater Boston, and, lately, Seattle, although there are secondary milieux of innovation in areas such as Austin, North Carolina's research triangle, Princeton's corridor, and Denver. New York used to be a major exception (which has an historical explanation), largely compensated for by its innovative role in finance, business services, media, and cultural industries. But its ability to seize the opportunity of the Internet economy has propelled New York to the forefront of innovation. Moreover, Peter Hall extended the argument of the relationship between cities and innovation to the entire Western history of cultural creativity and entrepreneurial innovation (Hall, 1998). If so, it seems logical that when we reach the Information Age, and cultural creativity becomes a productive force, major cities enjoy more than ever their competitive advantage as sources of wealth.

But the innovative potential of cities is not restricted to information-technology industries. It extends to a whole range of activities dealing with information and communication, thus based on networking and the Internet. Innovation is essential in advanced business services, which form the leading money-making sector in our economy. Services such as finance, insurance, consulting, legal services, accounting, advertising, marketing comprise the nerve center of the twenty-first century economy. And they are concentrated in large metropolitan areas, with New York/New Jersey, and Los Angeles/Orange County being the prominent areas in the United States. Advanced services are unevenly distributed between the central business district and the new suburban centers, depending on the history and spatial dynamics of each area. What is

critical is that these advanced service centers are territorially concentrated, built on interpersonal networks of decision-making processes, organized around a territorial web of suppliers and customers, and increasingly communicated by the Internet among themselves.

A third set of value-generating activities concentrated in metropolitan areas are the cultural industries: media, in all their forms; entertainment; art; fashion; publishing; museums; cultural creation industries, at large. These industries are among the fastest growing, and the highest value-generating activities in all advanced societies. They also rely on the spatial logic of territorially concentrated milieux of innovation, with a multiplicity of interactions, and face-to-face exchanges at the core of the innovation process—to be complemented, not contradicted, by on-line interaction.

Fourth, in the whole range of activities associated with the emergence of the new economy, highly educated workers and entrepreneurs are the key source of innovation and value creation. These knowledge creators are attracted to vibrant urban areas, to cities such as San Francisco, New York, London, Paris, Barcelona. And they build their networks and milieux that attract additional talent. This is the argument developed by Kotkin (2000) to explain the differential dynamics of American cities in the late 1990s.

Let us now connect these trends to Zook's observation of the increasing concentration of Internet domains in the largest metropolitan areas in the world. Since the Internet processes information, the Internet hubs are located in the main information systems which are the basis of the economy and institutions of metropolitan regions. However, this does not mean that the Internet is just a metropolitan phenomenon. Instead, it is a network of metropolitan nodes. There is no centrality, but nodality, based on a networking geometry.

It is precisely because of the existence of telecommunication networks, and computer networks, that these milieux of innovation, and these high-level networks of decision-making, can exist in a few nodes in the country, or in the planet, reaching out to the whole world from a few blocks in Manhattan, in Wilshire Boulevard, in Santa Clara County, in San Francisco's South of Market, in the City

of London, in Paris' Quartier de l'Opera, in Tokyo's Shibuya, or in São Paulo's Nova Faria Lima. While concentrating much of the production and consumption capacity of a vast hinterland, these territorial complexes of knowledge generation and information-processing, link up with each other, ushering in a new global geography, made up of nodes and networks.

Wherever, and whenever, a major node of this global network is formed, it expands, and it generates a new spatial form, the metropolitan region, which is characterized by the functional connection between activities scattered in a vast territory, usually defined in terms of a specific labor market, consumer market, and media market (for example, television). The metropolitan region is not just a very large urban area. It is also a distinctive spatial form, close to what a brilliant journalist, Joel Garreau, labeled as *Edge City*, after reporting on new spatial developments in some of the largest American metropolitan areas (Garreau, 1991). In most cases, the metropolitan region does not even have a name, let alone a political unity or institutional agency. When we speak of the "Bay Area" (in my case meaning the San Francisco Bay area), we are referring to a large constellation of cities and counties, stretching at least from Santa Rosa in the North Bay to Santa Cruz in the South of the South Bay, and from the Western cliffs of San Francisco to the outer suburbs of the East Bay, all the way to Livermore; that is, almost 7 million people living in an expanse that is about 60 miles long and 40 miles wide. Indeed, the largest city in the San Francisco Bay area is not San Francisco, but San Jose, with a population close to one million in 2000. The real settlement pattern is already reaching far beyond this area, linking up with the Central Valley, and absorbing, across the Nevada border, Lake Tahoe, and towards the South, Monterey and Carmel, as secondary residences for Bay Area dwellers.

An even more striking case is the Southern California metropolitan region, which merges in one largely integrated space the area extending from Ventura in the north, to the southern tip of Orange County, with about 17 million people living, working, consuming, and travelling in this territory without boundaries, name, or identity, other than as a labor market and a consumer market.

Furthermore, the freeway links up Orange County with San Diego, and beyond the border, with Tijuana, making this area a binational, multicultural, nameless, mega-urban constellation. Outside California, the New Jersey–New York–Long Island–Rhode Island–Connecticut, the Washington, DC–Maryland–Virginia conurbation, or the New England mega-region are similar examples of new spatial agglomerations.

In Asia, some of the largest metropolitan regions in the world are being formed, such as the region in the process of articulation between Hong Kong–Shenzhen–Canton–Macau–Zuhai and the Pearl River delta, with a population of about 60 million. Or the Tokyo–Yokohama–Nagoya region, extending, via Shinkansen, to Osaka–Kobe, and Kyoto, within a 3–4-hour transportation time framework (Lo and Yeung, 1996). Seoul–Inchon, Shanghai–Pudon, Bangkok metropolitan region, Jakarta megapolis, Calcutta, Bombay (Mumbai), Greater Mexico City, Greater São Paulo, Greater Buenos Aires, Greater Rio de Janeiro, Paris–Ile de France, Greater London, and Greater Moscow, are all major areas, most of which have no clear boundaries, or defined identity, beyond the vague images of what used to be their central city. And I am not even mentioning areas of 7 million plus, such as Lima, Bogotá, or Manila, which continue to grow both as magnets *vis-à-vis* their hinterlands in crisis, and as sources of growth and survival through their connections to global networks.

In Western Europe, the building of a dense high-speed train network is integrating London with Paris, Paris with Lyons and Marseille, and with Northern Italy; Paris–Lille–Brussels with The Netherlands; and Frankfurt and Cologne with the French network; from the South, Lisbon–Seville–Madrid–Barcelona–Bilbao are scheduled to link up with the European network in 2004. Overall, in Central/Western Europe an extraordinary concentration of population, production, management, markets, and urban amenities are being connected within 3-hour transportation time-frames, let alone air shuttles with a dense network of flights between 40 minutes and 2 hours connecting most of Western Europe. Thus, the new spatial structure emerging at the heart of Western Europe is that of a series of interconnected metropolitan regions, each one

connecting several conurbations, each one with millions of people, and jointly harnessing a significant share of the world's wealth and information (Hall, 1997).

These settlements blur the traditional distinctions between cities and countryside, and between cities and suburbs. They include, in spatial discontinuity, built-up areas of various density, open space, agricultural activities, natural areas, residential expanses, and a concentration of services and manufacturing activities, scattered along transportation axes, made up of freeways and mass transit systems. There is no real zoning—as workplaces, residential, and commercial areas are dispersed in various directions. Moreover, while these regions are usually centered around a major central city, smaller urban centers gradually become absorbed in intra-metropolitan networks. New nodes constantly emerge, as areas concentrate business/industrial activities decentralized from their previous locations. Other localities grow in their role of providers of services for the metropolitan population at large. This regional metropolitan structure is entirely dependent upon transportation and communications. And communication and information systems are organized by and around the Internet. Work at a distance, from home, or between spatially disjointed locations, increases considerably—but not in the form forecasted by futurologists. Rather than telecommuting, we are observing the emergence of multi-modal metropolitan mobility. I will elaborate on this fundamental point.

Telework, Tele-life, and the New Patterns of Metropolitan Mobility

Work from the electronic cottage was supposed to usher in a new kind of human settlement, with workplaces fading away, and homes becoming the center of multi-functional activity. In fact, telecommuting is not a widespread practice, and work from home is only partly related to the Internet. Thus, in the US, supposedly the most advanced area in the world in terms of flexibility of working patterns, in 1997 only about 6.43 percent of the labor force were estimated to work at home on a regular basis, with 47

percent of them working on average 15 hours a week, and the rest, about 23 hours a week (US Bureau of Labor Statistics, elaborated by Zayas, 2000). Furthermore, only a fraction of these workers worked predominantly from home, and many of them did not use computers. In a series of studies conducted by Mohktarian and by Handy in the 1990s (Mohktarian, 1991, 1992; Mohktarian, Handy, and Salomon, 1995), it was shown that the percentage of the labor force that in a given day in California worked from home was, on average, less than 2 percent. In fact, a 1991 national survey on homework in the US found that fewer than half of homeworkers used computers: the rest worked with a telephone, pen, and paper (Mohktarian, 1992: 12). A 1993 survey by Link Resources in the US estimated at 6.1 percent the proportion of US workers working at home, but on average work at home was only one or two days per week. A 1999 survey by Pratt Associates in the US estimated the percentage of homeworkers at about 10 percent, but work at home was limited to nine days per month on average (reported by Zayas, 2000).

In one of the most comprehensive overviews of the phenomenon, Gillespie and Richardson (2000) analyzed data on telecommuting, workplace, teleservices, and metropolitan travel in a comparative perspective, contrasting the UK with other European countries and with the US. In line with other researchers on teleworking, they began by differentiating distinct kinds of work at a distance, then reviewed the evidence for each form of activity. Electronic homeworking was found to be limited in all contexts, and usually part-time, one or two days a week. Most electronic homeworkers still need to commute to their office most days. Some studies suggest that trips saved by working at home replaced public transportation trips, not the automobile. Indeed, other studies seem to indicate that teleworking increases the use of the automobile because it makes the car available for other members of the household, and because it cuts down "trip chaining;" that is, the process by which people drop children at school or pick up groceries on the way to work. Ability to work at home part-time, particularly for the professional labor force, leads to residential location further from workplaces, thus increasing commuting distance for those trips that are still necessary. So, over-

all, the study by Mohktarian, Handy, and Salomon (1991) showed that in the US, for telecommuters working an average of 1.2 days a week at home, the reduction of miles traveled per vehicle was less than 0.51 percent. Gillespie and Richardson (2000) estimate that the reduction is probably lower in the UK.

However, there are other forms of work at a distance, on the basis of the Internet, that have important spatial consequences. One is the development of remote offices, or "call centers," located on the periphery of metropolitan areas. Rather than bringing sophisticated telecommunications equipment to their workers' homes, companies build call centers and data-processing centers which concentrate workers but diffuse their calls throughout the country and throughout the world. Many of these centers, for instance in the UK, are located in lower-cost areas, generally served by women employees living in the suburbs or small towns in the area of influence of major cities (such as Edinburgh, Glasgow, Leeds, which have been attracting telebanking jobs). The reasons for the concentration of work in these telecenters have to do mainly with management procedures, but not necessarily related to control of the worker. In fact, in a fully computerized system, it would be easy to constantly monitor the worker's activity. What management of information requires is, in fact, the opposite: to give workers as much initiative as they can handle, under conditions defined and organized by management. The informal transmission of information, tacit knowledge of the company, group dynamics, and economies of scale for advanced telecommunications equipment seem to be among the key elements underlying the growth of these "electronic communication factories" that become a new form of workplace in the Internet economy.

In a striking manifestation of the new spatial concentration of telecommunicated business operations, there was a boom in "telecommunication hotels" in downtown Los Angeles in the late 1990s. Taking advantage of vacant office space in downtown, as the result of the crisis of the Los Angeles economy in 1990–94, over 150 firms specializing in telecommunications and Internet-related switching operations occupied commercial and historic buildings, and provided the use of telecommunications equipment for dozens

of firms. This created a cluster of what some observers call "telecommunications factories," leading to displacement of residents, business, and cultural amenities (Horan, 2000: 4).

Another major development is mobile teleworking, which is on the verge of increasing dramatically with the explosion of wireless-based Internet access (WAP) and mobile access to the Internet. Professional workers spend more and more time in the field, relating to their clients and partners, traveling across the metropolitan area, across the country, and across the world, while keeping in touch with their office via the Internet and mobile phones (Kopomoa, 2000). Companies are now reducing desk assignment for their employees, so that they use the space they need only when they need it. So, the emerging model of work is not the home teleworker, but the nomadic worker and the "office on the run."

What the Internet makes possible is a multiple configuration of work spaces. The overwhelming majority of people do have workplaces to which they go regularly. But many also work from home (not instead of, but in addition to, their usual workplace), they work from their cars, trains, and planes, from their airports and their hotels, on their vacations and in the night—they are always on call, as their beepers and mobile phones never stop ringing. The individualization of working arrangements, the multi-location of the activity, and the ability to network all these activities around the individual worker, usher in a new urban space, the space of endless mobility, a space made of flows of information and communication, ultimately managed with the Internet.

The picture becomes even more complex if, in addition to professional tasks, we introduce the management of everyday life, from telebanking to teleshopping. Places do not disappear, people still go shopping to the malls—after checking options and prices on the Internet, or the other way around. This, in turn increases, not decreases, mobility and transportation needs. Summarizing their findings, Gillespie and Richardson (2000: 242) write:

> the "reduced demand for travel" scenario . . . may be decidedly misleading . . . Not only are communication technologies expanding the "activity spaces" within which work takes place, leading to longer distances traveled, but in addition, journey patterns associated with new ways of working are becoming more diffuse and less nodal, and hence more difficult to accomplish by public transport. This effect is exacerbated by companies adjusting their premises stock to accommodate more effectively new ways of working, leading to a reduction in demand for conventional city-center offices and an increase in demand for office space in office park environments with high levels of accessibility to the motorway sytem. At the same time the substitution of tele-mediated for face-to-face banking and other services risks further undermining the role of city centers and high streets, as branch offices are closed and customers are served from large teleservices centers, themselves usually located on business parks . . . Teleworking and tele-activities are, then, perhaps best understood not as developments that suppress the demand for mobility but, rather, as forms of what might best be described as "hypermobility."

So, metropolitan regions in the Internet Age are characterized, simultaneously, by spatial sprawl and spatial concentration, by the mixing of land-use patterns, by hypermobility, and dependence on communications and transportation, both intra-metropolitan and inter-nodal. What emerges is a hybrid space, made up of places and flows: a space of networked places.

Living Places in the Space of Flows: William Mitchell's E-topia

For a few paragraphs I am going to break a basic rule I follow in most of my writing. I will explore some of the future implications for our living environment of information technologies in the making. I am going to do so by relying on the analysis of William Mitchell. I usually distrust visions of the future. Yet Mitchell's knowledge of the matter is so deep, and he is so careful in situating technological forecasting in the complexity of social and cultural interactions, that by reporting on his analysis I hope to add a new dimension to the understanding of the spatial transformations associated with the rise of the Internet, and its future expansion as a communications environment (Mitchell, 1999, personal communication, 2001).

Trends in the relationship between architecture, design, and technology seem to be moving in the direction of building "intelligent

environments." Work proceeding at MIT's Media Lab, particularly by Joe Jacobson, focuses on materials sensitive to electrical stimuli, so that our daily environment could be made of sensors surrounding us like pigment in the wall. Naturally, this also extends to our clothing, our cars, our objects, our work environments. Networking technologies of the Jini type would allow these objects to communicate among themselves, and with us at our request, in a flexible environment of information. I would add myself that the "Blue Tooth" technology introduced by Nokia/Ericsson in 2000 may enhance this network of constant interconnection of our daily objects. Broadband Internet, always connected, and mobile access to it, may link us permanently with our home environment and with the world at large. The communicated home may be necessary to handle the diversity of tasks/experiences that are likely to take place within it. The home does not become the workplace, and in many cases it is the workplace that could feel like home for disaffected, lone professionals, as Arlene Hochschild (1997) found in her research on workers in a large corporation. Yet, the home becomes multidimensional, and needs to support a diversity of experiences, functions, and projects for a household whose members have a growing diversity of interests. As Mitchell (1999: 22–3) writes:

> This does not mean that the majority of us will become full-time, stay-at-home telecommuters, and that traditional workplaces—particularly downtown offices—will simply disappear. Despite decades of interest in the possibility of telecommuting, there is little evidence that it will take over to such an extent. But we will certainly see increasingly flexible work schedules and spatial patterns, and many people will divide their time, in varying proportions, among traditional types of workplaces, *ad hoc* work settings that serve while they are on the road, and electronically equipped home workplaces . . . We will not have a world where there's no there anywhere. Just the opposite in fact. We will increasingly take advantage of digital telecommunications technology to stay more closely in touch with places that are particularly meaningful to us when we travel. There will still be some place we call "home."

And this home will have its *genius loci* (the genius of the place), an intranet connecting devices equipped with sensors and powerful software, able to respond to the needs of those living in the place,

"focusing global resources in local tasks." Buildings will develop electronic network systems, connecting to each other and to each unit in the building. Implications for planning and zoning are considerable, starting with the end of the separation between residential and working functions in a given spatial area. Indeed, San Francisco's South of Market and New York's South of Houston are characterized by work/living spaces that reconstruct the unity of the experience of the pre-industrial era, while being linked to the world via the Internet. Urban designers are particularly inspired by the potential rich texture of this space of mixed uses and multi-dimensional activity.

Indeed, the challenge for architects and urban planners is how to avoid isolation, how to reintegrate the functional self-sufficiency of individualized spaces with the shared experience of common places on which urban life will continue to be based. As Mitchell (2000: 82) writes: "For architects and urban designers, the complementary task is to create an urban fabric that provides opportunities for social groups to intersect and overlap rather than remain isolated by distance or defended walls—the laptop at the piazza café table instead of the PC in the gated condo."

Cities are faced with a challenge: throughout history they were socio-spatial forms able to articulate synchronous and asynchronous communication, the essential process for transforming information into decision-making. The Internet substitutes for this function. Thus, place-based activities, on which cities are founded, need to compete by adding value to face-to-face experiences that can only take place in cities. It follows that public space and monumentality (museums, cultural centers, public art, architectural icons) will play a key role in marking space, and facilitating meaningful interaction. How these trade-offs between electronic flows and urban places are translated into spatial forms is a largely contingent matter, depending on history, culture, and societies: "It is a mistake to overgeneralize, as futurist gurus have been prone to do. The diverse architectural and urban forms of the future will surely reflect the balances and combinations of interaction modes that turn out to work best for particular people, at particular times and places, facing their own specific circumstance within a new economy of presence" (Mitchell, 1999: 144).

Building on Mitchell's theory, Thomas Horan has reported the development of new forms of architectural, urban, and metropolitan design that treat functionally and symbolically the specificity of these new, "fluid locations." By such he refers to "the need for place design to address the unprecedented spatial fluidity we now have to perform day-to-day activities anywhere and at anytime" (Horan, 2000: 13). He examines a number of design experiences in the United States and Europe, from home to public libraries and community networks, that show the emergence of a hybrid space of urban places and electronic networks whose understanding and treatment form the new frontier for architecture and urban design.

Indeed, as Mitchell (2000: 155) concludes: "The power of place will still prevail . . . Physical settings and virtual venues will function interdependently and will mostly complement each other within transformed patterns of urban life rather than substitute within existing ones. Sometimes we will use networks to avoid going places. But sometimes, still, we will go places to network." However, not everybody seems to be invited to the new, meaningful space promised by the Internet Age because the cities of our time are being increasingly segregated by the logic of splintering networks.

Dual Cities and Glocal Nodes: Splintering Networks

What characterizes the networking logic embedded in the Internet-based infrastructure is that places (and people) can be as easily switched off as they can be switched on. The geography of networks is a geography of both inclusion and exclusion, depending on the value attached by socially dominant interests to any given place. In a path-breaking investigation, Stephen Graham and Simon Marvin (2001) have shown how the networks of urban infrastructure are splintering urban areas around the world, both in developed and developing countries. Urban infrastructures built on the principle of universal service were the cornerstone of modern urbanization, and underlay the formation of industrial cities as integrated functional and social systems. During the 1990s, liberalization, privatization, and deregulation, together with rapid technological change, and the globalization of investment, reversed the historical trend, diversifying urban infrastructure according to market capacity, functional priorities, social privileges, and political choices. Graham and Marvin (2001) document the increasing specialization and segmentation of infrastructure in water, power, transportation (roads, rails, airports, mass transit), and in telecommunications.

The uses of the Internet are dependent not only on connectivity, but on the quality of the connection. Standard telephone lines are not sufficient to carry and distribute the potential of Internet-based communication. Market competition, and deregulation have created extraordinary differences between cities and within cities around the world in the ability to network efficiently. Fiber-optic grids and advanced telecommunication systems have become a necessary condition for cities to compete in the global economy. Thus, around the world, key business areas are being equipped with state-of-the-art telecommunications gear, forming what Graham and Marvin call "glocal nodes;" that is, specific areas that link up throughout the planet with equivalent areas anywhere, while being loosely integrated, or not integrated at all, with their surrounding hinterland. They cite the case of Bangkok's "new towns in town" development enclaves, as well as the multimedia super corridor in Malaysia. I could add myself the development of Nova Faria Lima on the periphery of São Paulo, taking over as Brazil's global node from the decaying downtown and the old business concentration along Avenida Paulista. Or the development of Pudong, across the river from downtown Shanghai, a gigantic business complex organized around advanced telecommunication systems, largely isolated from much of the activity taking place in the bustling Chinese metropolis.

Yet this glocality is not confined to the industrializing world. Graham and Marvin describe how the City of London has been installing in recent years the most advanced telecommunications infrastructure in Europe, with at least six overlaid, fiber-optic grids superimposed on the City. Or else, Lima's new global business center, in the San Andres area, whose determinant role and segregating impact on Lima's metropolitan growth has been documented

by Miriam Chion (2000). As for Graham and Marvin (2001), their analysis of one of these telecommunication networks in the City of London, operated by COLT, shows the concentration of its carrying capacity in the financial district, with broader grain extensions reaching to the West End and to the new business spaces in the Docklands. Another London network, built by WorldCom, with only 180 km of optic fiber within the City of London, had already secured by 1998, 20 percent of the whole UK international telecommunications traffic. Schiller (1999) documents similar developments in the UK and in the US, and Kiselyova and Castells (2000) find an analogous pattern in the restructuring of Russian telecommunications in the 1990s.

Overall, there is a global trend toward building dedicated telecommunication infrastructures that bypass the general telephone system, and link up directly the major business centers that generate and consume the overwhelming proportion of data traffic over the Internet. Internet networks also segment cities in terms of the purchasing power assigned to each area by market research. In the United States, by mid-1999, about 86 percent of Internet delivery capacity were concentrated in the affluent suburbs and business centers of the twenty largest cities.

Splintering networks accentuate the global trends toward increasing socio-spatial segregation in cities around the world whose extreme manifestation is the explosion of gated communities in many countries of the world, from California to Cairo, from Johannesburg to Bogotá (Blakely and Snyder, 1997). Indeed, Douglas Massey (1996) has shown that the increase of spatial segregation in the 1990s is mainly due to chosen spatial separation by affluent groups, which leave the city they fear. In this context, the Internet allows segregated, affluent enclaves to remain in contact with each other, and with the world, while severing their ties with their uncontrolled, surrounding environment. The backwardness of devalued spaces in their telecommunications infrastructure reinforces their isolation and digs the trenches of their place-based existence. A new urban dualism is emerging from the opposition between the space of flows and the space of places: the space of flows that links places at a distance on the basis of their market

value, their social selection, and their infrastructural superiority; the space of places that isolates people in their neighborhoods as a result of their diminished chances to access a better locality (because of price barriers), as well as the globality (because of lack of adequate connectivity). However, this is only a structural tendency because people do react against their exclusion, and assert their rights, and their values, often using the Internet for their resistance and in support of their alternative projects, as I analyzed in Chapter 6. Yet, in the absence of social mobilization, and policies guided by the public interest, the splintering networks resulting from unfettered deregulation of telecommunications and the Internet, threaten to contribute to a new, and fundamental, social cleavage: the global digital divide.

Appendix: Methodology and sources for constructing the maps of Internet domains and Internet users

The maps of Internet users and Internet domains have been researched, developed, and plotted by Matthew Zook, as part of his PhD dissertation at the University of California, Berkeley (Zook, 2001*a*). These maps are reproduced in this book with the consent and support of Matthew Zook. My deepest thanks to him for his collegial generosity.

Maps of domains

The .com, .org, .net and .edu domain name data set for the maps is based on a tabulation conducted by Matthew Zook in July 2000. It uses an Internet utility program known as "whois" which returns contact information for a particular domain. Included in this information is a mailing address, contact names with phone numbers and e-mails, the date the domain name was registered, the last time it was updated, and the name servers responsible for the domain.

Geocoding domains to cities outside the US is done by matching country–city pairs in a global database of cities. Locating a domain to a specific country is almost 100 percent successful and locating it

in a specific city is about 60 percent successful. This lower success rate is largely due to an incomplete world city database. Geocoding domains to US metropolitan areas was based on zip codes and the use of a zip code to MSA translation table.

The July 2000 survey was based on a randomly selected sample of 4 percent of all domain names (sample size = ~ 750,000). The sample is obtained by querying randomly selected three-digit combinations, e.g. def or sx1, and then randomly selecting 15 percent of the domains that start with this combination. Because three-digit combinations are not geographically biased, this provides a random selection for determining the geographical location of domains. Because these figures are based on samples there is a degree of error associated with these figures. However, given the large sample size, this error is less than 0.1 percent.

The counts for country code domains is based on statistics posted on each country code registrar's home page and supplemented by data from DomainStats (http://www.domainstats.com/). More information, analysis, and recent data on the geography of domain names are available at Matthew Zook's website (http://www.zooknic.com/).

Maps of users

NUA's estimation of the number of Internet users worldwide is based upon the aggregation of surveys by a variety of sources worldwide. See http://www.nua.ie/surveys/how_many_online/methodology.html for more details.

Reading Links

Abramson, B. D. (2000) "Internet globalization indicators," *Telecommunications Policy*, 24: 69–74.

Audretsch, David B. and Feldman, Maryann P. (2000) "The telecommunications revolution and the geography of innovation," in James Wheeler, Yuko Aoyama, and Barney Warf (eds), *Cities in the Telecommunications Age: The Fracturing of Geographies*. London: Routledge.

Baldassare, Mark (2000) *California in the New Millennium: The Changing Social and Political Landscape*. Berkeley, CA: University of California Press.

Blakely, Edward J. and Snyder, Mary G. (1997) *Fortress America: Gated Communities in the United States*. Washington, DC: The Brookings Institution.

Borja, Jordi and Castells, Manuel (1997) *Local and Global: The Management of Cities in the Information Age*. London: Earthscan.

Castells, Manuel (1989) *The Informational City*. Oxford: Blackwell.

—— (1996/2000) *The Rise of the Network Society*. Oxford: Blackwell.

—— and Hall, Peter (1994) *Technopoles of the World: The Making of Twenty-first Century Industrial Complexes*. London: Routledge.

Chion, Miriam (2000) "Globalization and localization in the transformation of metropolitan Lima in the 1990s," unpublished PhD dissertation, University of California, Department of City and Regional Planning, Berkeley, California.

Cukier, K. N. (1999) "Bandwidth colonialism? The implications of Internet infrastructure on international e-commerce," paper presented at the INET '99 Conference, June 22–25, San Jose, California.

Daniels, Peter W. (1993) *Service Industries in the World Economy*. Oxford: Blackwell.

Dodge, Martin and Shiode, Narushige (2000) "Where on earth is the Internet? An empirical investigation of the geography of the Internet real estate?," in James Wheeler, Yuko Aoyama, and Barney Warf (eds), *Cities in the Telecommunications Age: The Fracturing of Geographies*, pp. 42–53. London: Routledge.

Freire, Mila and Stren, Richard (eds) (2001) *The Challenge of Urban Government: Policies and Practices*. Washington, DC: The World Bank Institute.

Garreau, Joel (1991) *Edge City: Life on the New Frontier*. New York: Doubleday.

Gillespie, Andrew and Richardson, Ronald (2000) "Teleworking and the city: myths of workplace transcendence and travel reduction," in James Wheeler, Yuko Aoyama, and Barney Warf (eds), *Cities in the Telecommunications Age: The Fracturing of Geographies*, pp. 228–48. London: Routledge.

Graham, Stephen and Marvin, Simon (1996) *Telecommunications and the City*. London: Routledge.

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

Gupta, Anil K. and Sapienza, Harry J. (1992) "Determinants of venture capital firms' preferences regarding the industry diversity and geographic scope of their investments," *Journal of Business Venturing*, 7: 347–62.

Gupta, Udayan (ed.) (2000) *Done Deals: Venture Capitalists Tell their Stories*. Boston, MA: Harvard Business School Press.

Hall, Peter (1997) *Megacities in Europe*. Amsterdam: University of Amsterdam, Center for Metropolitan Studies, Megacities Lectures Series.

—— (1998) *Cities in Civilization*. New York: Pantheon.

Harvard Design Magazine (2000) *Sprawl and Spectacle*, special issue. Cambridge, MA: Harvard Graduate School of Design.

Hochschild, Arlene R. (1997) *The Time Bind: When Work Becomes Home and Home Becomes Work*. New York: Metropolitan Books.

Horan, Thomas A. (2000) *Digital Places: Building our City of Bits*. Washington, DC: The Urban Land Institute.

Kiselyova, Emma and Castells, Manuel (2000) "Russia in the Information Age," in Victoria Bonnell and George Breslauer (eds), *Russia in the New Century*, pp. 126–57. Boulder, CO: Westview Press.

Kopomoa, Timo (2000) *The City in your Pocket: Birth of the Mobile Information Society*. Helsinki: Gaudeamus.

Kotkin, Joel (2000) *The New Geography: How the Digital Revolution is Reshaping the American Landscape*. New York: Random House.

Kuntsler, James H. (1993) *The Geography of Nowhere*. New York: Simon and Schuster.

Leyshon, Andrew and Thrift, Nigel (1997) *Money/Space: Geographies of Monetary Transformation*. London: Routledge.

Lo, Fu-chen and Yeung, Yue-man (eds) (1996) *Emerging World Cities in the Pacific Asia*. Tokyo: United Nations University Press.

Massey, Douglas (1996) "The age of extremes: concentrated affluence and poverty in the twentieth century," *Demography*, 33(4): 395–41.

Michelson, Ronald L. and Wheeler, James O. (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.

Mitchell, William J. (1995) *City of Bits*. Cambridge, MA: MIT Press.

—— (1999) *E-topia*. Cambridge, MA: MIT Press.

Mohktarian, Patricia L. (1991) "Telecommuting and travel: state of practice, state of the art," *Transportation*, 18 (4): 319–42.

—— (1992) "Telecommuting in the United States: letting our fingers do the commuting," *Telecommuting Review: The Gordon Report*, 9 (5).

—— , Handy, S.L., and Salomon, I. (1995) "Methodological issues in the estimation of the travel, energy, and air quality impacts of telecommuting," *Transportation Research*, 29A (4): 283–302.

Moss, Mitchell L. and Townsend, Anthony (2000) "How telecommunications systems are transforming urban spaces," in James Wheeler, Yuko Aoyama and Barney Warf (eds), *Cities in the Telecommunications Age: The Fracturing of Geographies*, pp. 228–48. London: Routledge.

Quarterman, J. (1997) "Is .'com' primarily US or international?," *Matrix News*, 7: 8–10.

Sassen, Saskia (1991) *The Global City: London, Tokyo, New York*. Princeton, NJ: Princeton University Press.

Saxenian, Anna Lee (1994) *Regional Advantage*. Cambridge, MA: Harvard University Press.

Schiller, Dan (1999) *Digital Capitalism: Networking the Global Market System*. Cambridge, MA: MIT Press.

Scott, Allen and Soja, Edward (eds) (1998) *The City of Los Angeles and Urban Theory at the End of the Twentieth Century*. Berkeley, CA: University of California Press.

Townsend, A. (2001) "Networked cities and the global structure of the Internet," *American Behavioral Scientist*, 44(10) (June).

Waldinger, Roger (ed.) (forthcoming) *The New Urban Immigrants*.

Wheeler, James, Aoyama, Yuko, and Warf, Barney (eds) (2000) *Cities in the Telecommunications Age: The Fracturing of Geographies*. London: Routledge.

Zayas, Madeleine (2000) "Telecommuting: myths and realities," Berkeley, CA: University of California, unpublished research paper for seminar CP 229.

Zook, M. A. (2000*a*) "Internet metrics: using hosts and domain counts to map the Internet globally," *Telecommunications Policy*, 24 (6/7).

—— (2000*b*) "The web of production: the economic geography of commercial Internet content production in the United States," *Environment and Planning A*, 32: 411–26.

—— (2001*a*) "The geography of the Internet industry: venture capital, Internet start-ups, and regional development," unpublished PhD disertation, University of California, Department of City and Regional Planning, Berkeley, California.

—— (2001*b*) "Old hierarchies or new networks of centrality?: the global geography of the Internet content market," *American Behavioral Scientist*, 44(10).

e-Links

Cheswick, Bill and Burch, Hal (2000) "The geography of cyberspace directory: mapping the Internet," at www.cybergeography.org/mapping.html
Major mapping projects of the Internet.

Dodge, M. (1998–2001) *Atlas of Cyberspace*, at <http://www.cybergeography.org/atlas/>

Telegeography (2000) *Hubs and Spokes: A Telegeography Internet Reader*. Washington, DC: Telegeography Inc., at <www.telegeography.com>

www.zooknic.com
Matthew Zook's continuing research on the geography of the Internet industry.

www.domainstats.com
Updates on the growth of country code domain names.

www.cybergeography.com
Maps of cyberspace.

www.alexa.com
Monthly ranking of the web's 1,000 most visited websites.

www.mediametrix.com
Monthly ranking of websites.

www.nua.ie/surveys/how_many_online/index.html
Statistical estimates of Internet users worldwide.

Chapter 9

The Digital Divide in a Global Perspective

The centrality of the Internet in many areas of social, economic, and political activity is tantamount to marginality for those without, or with only limited, access to the Internet, as well as for those unable to use it effectively. Thus, it is little wonder that the heralding of the Internet's potential as a means of freedom, productivity, and communication comes hand in hand with the denunciation of "the digital divide" induced by inequality on the Internet. The differentiation between Internet-haves and have-nots adds a fundamental cleavage to existing sources of inequality and social exclusion in a complex interaction that appears to increase the gap between the promise of the Information Age and its bleak reality for many people around the world. Yet, the apparent simplicity of the issue becomes complicated on closer examination. Is it really true that people and countries become excluded because they are disconnected from Internet-based networks? Or, rather, it is because of their connection that they become dependent on economies and cultures in which they have little chance of finding their own path of material well-being and cultural identity?