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Economy, Society, and Technology: Analyzing the Shifting Terrains

The concept of a digital divide gained headway in the mid-to-late 1990s, at the same time that the Internet and dot-com booms were under way in the United States. In a sense, the digital divide approach—which often emphasized getting people connected anyway they could at all cost so that they wouldn't be left behind—reflected the general spirit of the times, which were based on a superficial understanding of the Internet's relationship to economic and social change. At an economic level, too much emphasis was being put on the so-called Internet economy, reflected in the wild surge of dot-com businesses, many of which went bankrupt after failing to earn a single dollar. At the societal level, the hottest idea was that of cyberspace, supposedly an entirely different plane of existence (e.g., Barlow 1996). Both of these perspectives reflected the errant view that information and communication technology (ICT) was creating a parallel reality and that it was thus necessary for people to make the leap across the divide from the old reality to the new one in order to succeed.

On the tail end of the dot-com boom, with the NASDAQ (technology stock exchange) having fallen more than 60% from its high point, and computer sales and Internet growth rates leveling off in the United States, it is easy to dismiss the entire era as a passing fad that should be put behind us. From this view, the digital divide can be seen as either passé (because most people who want computer and Internet access in the richest countries can now afford them) or irrelevant (because those who don't have Internet access don't really need it). A related perspective is to portray computers and the Internet as mere devices, without any particular public import—a perspective that led one

Bush administration official to compare the digital divide to a "Mercedes divide."[1]

While this cynicism may reflect a corrective to the misguided Internet obsession of the late 1990s, it too is mistaken. Although ICT has not created a parallel world that one must leap into at all cost, it has contributed to a profound change in the real world we live in. While the dot-com economy has gone bust, the underlying information economy surges on. While notions of cyberspace fade away, real-life applications of e-commerce, e-governance, and Internet-enhanced learning thrive. And while the current U.S. administration does not emphasize a digital divide, many governments around the world are stressing the importance of ICT for social inclusion.[2]

The shift from a focus on a digital divide to social inclusion rests on three main premises: (1) that a new information economy and network society have emerged; (2) that ICT plays a critical role in all aspects of this new economy and society; and (3) that access to ICT, broadly defined, can help determine the difference between marginalization and inclusion in this new socioeconomic era.

Informationalism

What is new in the U.S. and world economies is not just a rise and fall of dot-com businesses but rather a deeper and more long-lasting transformation: the emergence of a new stage of global capitalism. This new stage, referred to by some as postindustrialism (e.g., Bell 1973), has been labeled informationalism by Castells (2000b).[3] Informationalism represents a third industrial revolution (table 1.1). The first followed the invention of the steam engine in the eighteenth century and was characterized by the replacement of hand tools by machines, mostly in small workshops (Singer et al. 1958, cited in Castells 2000b). The second followed the harnessing of electricity in the nineteenth century and was characterized by the development of large-scale factory production (Mokyr 1990, cited in Castells 2000b). The third revolution came to fruition in the 1970s with the diffusion of the transistor, the personal computer, and telecommunications. In other words, what we have is not

Table 1.1
The Three Industrial Revolutions

	First Industrial Revolution	Second Industrial Revolution	Third Industrial Revolution
Beginning	Late 18th century	Late 19th century	Mid-to-late 20th century
Key technologies	Printing press, steam engine, machinery	Electricity, internal combustion, telegraph, telephone	Transistor, personal computers, telecommunications, Internet
Archetypical workplace	Workshop	Factory	Office
Organization	Master-apprentice-serf	Large vertical hierarchies	Horizontal networks

an Internet economy but an information economy in which computers and the Internet play an essential enabling role (Jarboe 2001).

Castells (1993; 2000b) has identified four features that distinguish informationalism from the prior industrial stage: the driving role of science and technology for economic growth; a shift from material production to information processing; the emergence and expansion of new forms of networked industrial organization; and the rise of socioeconomic globalization.

Science and Technology

Productivity and economic growth are "increasingly dependent upon the application of science and technology, as well as upon the quality of information and management, in the process of production, consumption, distribution, and trade" (Castells 1993, 15). This is in contrast to the pre-information era, when advanced economies increased their productivity principally through infusions of capital and labor to the productive process. The importance of science and technology in economics is illustrated by the economic, and eventually political, downfall of the Soviet Union. Soviet productivity advanced regularly until 1971, simply by pumping more capital and labor into a primitive industrial system.

However, once the Soviet economy became more complex because of industrialization, it needed to rely on more sophisticated scientific processes to sustain growth. Though the Soviet Union had a great number of top-notch scientists and engineers, the overcentralized nature of the command economy made it increasingly difficult to apply science and technology to industrial processes, and the growth rates plummeted (Castells 2000a; Castells and Kiselyova 1995). In contrast, countries that were able to more flexibly integrate science and technology into the production process, such as Singapore and Korea, thrived.

Information Processing

In advanced capitalist countries there has been a shift from material production to information-processing activities, both in terms of proportion of Gross National Product (GNP) and proportion of the population employed. This entails not only a shift from manufacturing to service but also a shift within the service sector from noninformation activities (e.g., cleaning floors) to information-processing activities (e.g., computer software writing) (Castells 2000b; Reich 1991). The information-intensive industries include health care, banking, software, biotechnology, and media. But even traditional industries, such as automobile and steel, are increasingly relying on information processing in order to produce competitive products.

Networked Organization

In addition to an increasing reliance on science and technology and a shift toward information processing rather than industrial processing, there has been in recent years a shift from the standardized mass production and vertically integrated large-scale organization of the Ford era to flexible customized production and horizontal networks of economic units. In order to be able to develop, interpret, and make use of new information and knowledge as quickly and flexibly as possible, new "post-Fordist" management techniques are used that emphasize a flattened hierarchy, multiskilled labor, team-based work, and just-in-time production and distribution (Castells 1993; Gee, Hull, and Lankshear 1996; Reich 1991). Whereas the typical firm of the early twentieth century was the auto plant, with rows of assembly line workers doing a single task under orders from above, the paradigmatic firm of the early twenty-first century is the software engineering company, with teams of multiskilled employees grouping and regrouping to take on complex tasks. Indeed, this type of reorganization has even changed the automobile industry, with Toyota plants now comprising teams of multifunctional specialists rather than individual assembly line workers (Corriat, cited in Castells 2000b). Changes in work relations and production processes do not imply by any means that workplace oppression or inequalities have ended; indeed, the new economy has weakened trade unions, increased the amount of part-time work, and placed many employees on almost twenty-four-hour demand. However, employer-employee relations and employee-employee relations have taken on new forms.

Globalization

The new economy is a global one in which capital, production, management, labor, markets, technology, and information are organized across national boundaries. Global foreign direct investment grew about eightfold from 1965 to 1995, and global export of goods and services nearly quadrupled in the same period (Castells 2000b). Globalization has relied, in part, on multinational firms but also increasingly on transnational networks of firms (including both multinationals and local firms).

An example of how these four radical changes have come together to transform the economy is seen in the automobile industry. In 1977 it took about 35 person-hours of labor to assemble an automobile in the United States. New Japanese production techniques, based on technological developments and multiskilled teamwork, had brought that down to 19.1 hours by 1988 (Reich 1991). Just-in-time production and distribution techniques allowed car manufacturers to save money on inventory and warehousing, and customized, flexible global production and distribution in the 1980s gave Japanese companies an advantage over slower, more cumbersome U.S. companies (though U.S. companies eventually started to catch up). In the future, new scientific developments are expected to dramatically reduce the weight and thus engine size of cars, while increased computing power will make combustion and driving more intelligent, to the point where the value of a car will be better understood by seeing it as "chip with wheels" rather than wheels with chips (Kelly 1997, 194). And the ability to competitively design, manufacture, market, and distribute such a product internationally will be, and already is, dependent on modern telecommunications, with executives, designers, managers, and sales people around the world consulting, collaborating, communicating, and sharing information via computer-mediated networks.

The transformation of the automobile industry, and of virtually every other industry in today's world, according to the imperatives of the information economy is undeniable. And equally undeniable is the critical role of computers and the Internet in allowing these changes to take place. Though dot-coms crest and fall, the rise of "click and mortar"—existing businesses that incorporate online communication into their day-to-day functioning—is here to stay. The Internet is "transforming business practices in its relation to suppliers and customers, in its management, in its production process, in its cooperation with other firms, in its financing, and in the valuation of stocks in financial markets" (Castells 2001, 64). One illustration of this is the stunning growth of business-to-business (B2B) e-commerce, which is projected to rise in the United States alone from $400 billion USD in 2000 to $3.7 trillion USD in 2003 and to grow even faster internationally (Castells 2001, citing information from the Gartner Group).

Probably the best single example of a model "click and mortar" company is Dell Computer. Dell's ascendancy from a University of Texas college student's personal startup company in 1984 to the forty-eighth largest corporation in the United States in 2001 (with revenues higher than Microsoft, Disney, or Cisco) has sparked a cottage industry of academic and business analysis as other firms try to "Dellize."[4] The role of ICT in Dell's success, and the lessons of this for the broad information economy, are illustrated well in an excellent analysis by Kraemer, Dedrick, and Yamashiro (2000). The following discussion draws from their case study.

Dell is perhaps best known by the public for marketing its computers to consumers over the Internet. This, however, is only part of a much broader ICT-based strategic approach, which began to take shape years before the Internet surfaced as a mass phenomenon. Simply put, Dell is an information company through and through. It deploys advanced ICT in every aspect of its operations in order to gather, refine, and make instant use of customized information about its customer base, the broader market, the production process, the supply chain, distribution challenges, and service requirements. Its inventory is tiny and its manufacturing is miniscule (virtually all components are outsourced and purchased from others), but its expertise in amassing information and honing it into knowledge is the key to its profitability and success.

Information and communication technologies are key at every level of the Dell business model. Direct sales to customers take place for the most part either over the Internet or by telephone, in which case the customer service phone agent is linked directly to up-to-date inventory information and order information. Fully 70% of the company's sales are to large businesses (i.e., Fortune 1000 companies earning more than $1 million annually), and these clients order products through company Web sites that specify the menu of configurations preapproved by the particular company. These corporate customers can also get online information from Dell about their purchase histories for Dell products in specific locations, thereby enabling them to better manage and plan replacement of their computing inventory.

Sales information is immediately plugged into Dell's build-to-order system, which automatically tracks and orders inventory from suppliers to meet production demand. Just-in-time production allows Dell to maintain a cash conversion cycle of minus 8 days, which means that Dell receives money from its customers more than a week before it spends it, while assembling computers exactly to customers' specifications. Technologization of the supply, production, and distribution system has allowed the company to reduce its inventory stock from 32 days' worth in 1994 to just 6 days' worth by 1998, while cutting administrative overhead from 15% to under 10%. The production process is global, with Dell purchasing $1.6 billion in components from Taiwanese companies alone in 1998. Marketing and sales are also global, with autonomous divisions established in the United States, Europe, Asia, and Japan. The ICT units of the company are designed to be small and flexible, and are broken into smaller units whenever they reach 100 people. Finally, the company's direct contact with its consumer base allows it to market its service as well as its sales, while also providing information on rapidly changing market demand that is used in the development of new product lines.

Dell is not without its problems. Like many technology companies, its stock fell sharply in 1999–2000. Other computer companies are working hard to adopt and adapt its business model, and Dell's competitive advantage as the leading build-to-order/direct sales firm may not last. The overall market for personal computers in the United States is slowing, and it is not yet certain that Dell can reposition itself in higher-end sales and services (see "Innovator's Dilemma" in chapter 3). In sum, Dell could yet fail—and that possibility also illustrates an essential aspect of the information economy: the rapid change of fortunes of individual companies. At the same time, though, the underlying economic trends across companies are much more stable: infusion of science and technology into the production process, added value through information processing, networked forms of association and organization, and globalized marketing and production, all fueled by rapid innovations in computing and telecommunications.

Economic Stratification

Another important characteristic of the informational economy, of particular importance to issues of social inclusion, is its association with global economic stratification, both within and across countries. Both the World Bank and the United Nations Development Programme have found a sharp rise in global inequality among countries over the past forty years. The World Bank, for example, has analyzed the gap between the richest twenty countries and the poorest twenty countries over the past forty years (*World Development Report 2000/01*). In 1960 per capita Gross Domestic Product (GDP) was eighteen times that in the poorest twenty countries. By 1995, however, this gap had widened to thirty-seven times as the richest countries became much richer while the poorest countries stayed poor or became even poorer.

The United Nations Development Programme (1999b) compared the GDP of the 20% of the world's people who live in the richest countries

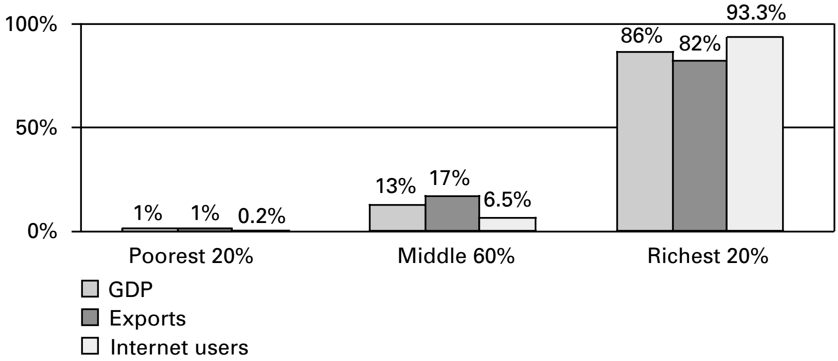

Figure 1.1
Shares of global GDP, exports, and Internet users among world's population, 1997.
Source: United Nations Development Programme (UNDP 1999b).

with the 20% of the world's people who live in the poorest countries. They found that the ratio between the two groups' GDP increased from 30 to 1 in 1960, to 60 to 1 in 1990, to 74 to 1 in 1997. By 1997, the fifth of the world's people living in the highest-income countries controlled 86% of world GDP, and the bottom fifth just 1% (figure 1.1). This corresponds to the shares of exports of goods and services received by the richest and poorest fifths and to the even sharper disparity in shares of Internet users.

This disparity of wealth, exports, and Internet use does not come about because poor countries are completely cut off from the world economy. Paradoxically, the countries of sub-Saharan Africa have a higher export/GDP ratio than developed economies do: 29 percent of GDP in the 1990s (Castells 2000b). However, exports from sub-Saharan African countries tend to be predominantly low-value primary commodities whose market value has steadily fallen in the past two decades, whereas the exports of the wealthy countries are based on high-technology and high-knowledge goods and services whose corresponding market value has steadily risen since the onset of informationalism. Between 1976 and 1996 the share of world trade composed of high- and medium-technology goods—defined as those requiring intensive research and development expenditures—rose from 33% to 54%, and the share of world trade composed of primary products fell from 45% to 24%

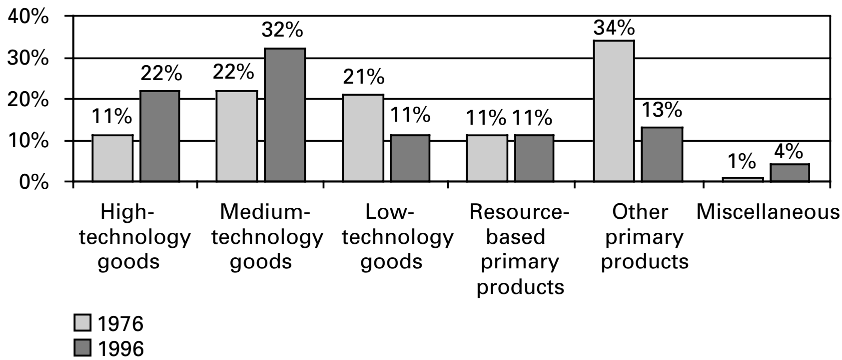

Figure 1.2
Percentage of goods in international trade by level of technology, 1976 and 1996. *Source*: *World Development Report 1998/99* (World Bank).

(figure 1.2) (World Development Report 1998/99). This pattern of rich countries getting richer while poor countries stay poor has resulted in the so-called twin peaks income distribution, with 2.4 billion people living in countries with average incomes of less than $1,000 USD per year, 5 billion people living in countries with average incomes of more than $11,500 USD per year, and relatively few people living in countries with average incomes of $5,000 to $11,500 USD per year (Milanovic 1999).

Global Inequality among Individuals

Global inequality among individuals is much more difficult to determine than inequalities between countries, but Francis Bourguignon and Christian Morrison (1999) have done an estimation using a measure of income inequality called the Theil index.[5] Their study shows that income inequality rose steadily through the nineteenth and early twentieth centuries, then remained at about the same level from 1920 until 1960, when it started to rise again sharply.

Branko Milanovic (1999) has carried out a study of income inequality from 1988 to 1993 based on actual household surveys of income in ninety-one countries. His data set was later reanalyzed by Yuri Dikhanov and Michael Ward (2000) and by Robert Wade (2001). Their analyses indicate that even in the short five-year period studied, global income

Table 1.2
World Income Distribution, 1988 and 1993

Inequality Measure	1988	1993	Percent Change
Richest decile's percentage of world income	48	52	8.3
Richest decile as percent of median	728	898	23.4
Poorest decile's percentage of world income	0.88	0.64	–27.3
Median as percent of poorest decile	327	359	9.8
Gini coefficient, world	63.1	66.9	6.0

Sources: Adapted from Wade (2001); Dikhanov and Ward (2000).

inequality (measured by the Gini coefficient, based on the sum total of difference from a mean) increased by 6% and the poorest decile's percentage of world income fell by 27.3% (table 1.2).

The main reason for this change seems to be a sharp distancing of the wealthiest decile from the median income; this corresponds roughly to the middle and upper classes in the wealthy countries and the elite in the poor countries—in other words, the fraction of the world's population that has been best able to profit from the information and communications technology revolution.

Inequality within Countries

Milanovic (1999) calculates that about three-quarters of the recent increase in global inequality is due to an exacerbation of intercountry differences and the one-quarter to an exacerbation of intracountry differences. Worsening inequality within countries is occurring at both ends of the spectrum, within rich and poor countries alike.

Inequality within Rich Countries Castells (2000a) analyzed the change in income inequality in thirteen OECD countries: ten of the thirteen countries experienced a growth of internal income inequality after 1979 (table 1.3). This included not only the United States, the United Kingdom, and Australia but also traditionally egalitarian countries such as Sweden, Denmark, and Japan—all countries with a relatively high diffusion of new technologies. Castells interprets this finding as evidence

Table 1.3
Change in Income Inequality After 1979 in OECD Countries

Country	Period	Average Annual Change in Income Inequality (%)
United Kingdom	1979–1985	1.80
Sweden	1979–1994	1.68
Denmark	1981–1990	1.20
Australia	1981–1989	1.16
Netherlands	1979–1994	1.07
Japan	1979–1993	0.84
United States	1979–1995	0.35
Germany	1979–1995	0.50
France	1979–1989	0.40
Norway	1979–1992	0.22
Canada	1979–1985	–0.02
Finland	1979–1994	–0.10
Italy	1980–1991	–0.64

Source: Reprinted from Castells (2000a).

of a "structural trend toward increasing inequality in the network society" (80). This trend is grounded in the current restructuring of postindustrial economies that in turn has meant large numbers of well-paying blue-collar jobs have disappeared. In the new economy, as explained by Reich (1991), the principal division is no longer between blue- and white-collar workers but rather among three new categories: routine production workers (e.g., data processors, payroll clerks, and factory workers); in-person service workers (e.g., janitors, hospital attendants, taxi drivers); and symbolic analysts (e.g., software engineers, management consultants, strategic planners). Employees in all three categories may use computers or the Internet in their jobs, but the first two do so in routine ways (e.g., inventory checks, ordering products), whereas the last make use of ICT for analysis and interpretation of data; creation of new knowledge; international communication and collaboration; and development of complex multimedia products.

Inequality within Poor Countries Within the handful of most impoverished countries of the world, inequality has remained relatively stable.

These countries remain outside the global ICT revolution, and the people are almost all equally poor. In some poor countries, however, economic restructuring has caused a similar polarization to that which has occurred within OECD countries. Probably the two most dramatic examples of inequality are in India and China. India has one of the largest and most developed information technology industries in the world. This industry has created a tiny group of multimillionaires and a small middle class of network and software engineers, computer programmers, and computer-assisted design specialists. At the same time, though, the benefits of the information technology revolution have had very little trickle-down effect on the country's overall population, most of which lives in desperate conditions in rural areas. The average GNP per capita in India is only $450 USD per year, 45% of adults are illiterate, and about one out of twelve children die before the age of five (*World Development Report 2000/01*).

China is a pronounced example not so much of the extent of inequality but rather of the rapid change in intracountry inequality. It has become much wealthier in recent years as the urbanized areas of the eastern seaboard (e.g., Guangzhou, Shanghai) have become integrated into the global economy. These are the same areas that have experienced rapid growth of Internet access and use, with ICT being used widely to facilitate business communication and scientific research (Foster and Goodman 2000). Nevertheless, the rural population of China remains poor, especially in the western part of the country. Gross domestic product per capita also varies in China from a high of $10,901 USD per year in Shanghai to $1,121 USD per year in Guizhou province, a ratio of 9.7 to 1 (UNDP 1999a).[6] In contrast, the ratio between per capita income in the wealthiest state in the United States to the poorest state is only 2 to 1 (United States Census Bureau 1995). This market income disparity within China has deadly consequences for people in rural areas of the country, as evidenced by China's diverging under-five mortality rates: 2.1% in the cities compared with 7.1% in the countryside (UNDP 1999a).

A similar situation holds in many other industrializing countries, such as Brazil, Mexico, and Egypt. A small percentage of the population is becoming increasingly prosperous, but a majority of the people suffer inadequate access to housing, health care, education, and stable employment. The well-to-do overlap substantially with those who have access to information and communication technologies, whereas the poor almost always lack access even to telephones.

Computer-Mediated Communication and the Network Society

While the economic sphere is a critical component of social inclusion, it is not the only component. What about the impact of ICT on other aspects of life?

Simply put, the broad trends seen in the informational economy are reverberating in all aspects of society. It for this reason that we can talk about not just the information economy but also the information society, or as Castells (2000b) puts it, the network society. Networks, based on interconnected nodes, have existed in human society since its inception, but they have taken on a new life in our time as they have become information networks powered by the Internet (Castells 2001, 2). Networks have great advantages over hierarchies because of their flexibility, speed, adaptability, and resilience. In the realm of biology, from the brain to the ecosystem, networks have proven their advantages over hierarchies time and again. In the realm of human activity, though, the communicative means for large-scale networking has been absent, and networks have until recently been unable to demonstrate their advantages over hierarchical forms of organization, which until now have been the only viable means for organizing activity on a large scale (Castells 2001). This is changing with the development of computer-mediated communication and the Internet.

Computer-mediated communication was initiated in science laboratories in the 1960s, promoted by the U.S. military in the late 1960s and early 1970s, and developed further in conjunction with key U.S. research universities through the efforts of a small cadre of programmers (Hafner and Lyon 1996).[7] This development took forms such as ARPANET, BITNET, and USENET in the 1970s and 1980s and exploded throughout the world via the Internet in the 1990s.

Computer-mediated communication qualitatively changed existing forms of representing, organizing, and sharing information in four important ways.

Written Interaction

Whether in society at large (Halliday 1993) or specifically in academia (Harnad 1991) or schools (Wells and Chang-Wells 1992), language has two main functions: it allows us to interact communicatively and to construe experience, that is to "interpret experience by organizing it into meaning" (Halliday 1993, 95). Throughout human history, the interactive role of language has been played principally by speech, whereas the permanence of written texts has made them powerful vehicles for interpretation and reflection (Bruner 1972; Harnad 1991). Writing, unlike speech, can be accessed and analyzed again and again by a limitless number of people at different times. Spoken language, on the other hand, is of the moment and deeply contextualized in a way that written texts are not. As such, the real strength of writing as a reflective and interpretive medium "was purchased at the price of becoming a much less interactive medium than speech" (Harnad 1991, 42).

Computer-mediated communication bridges this difference between spoken and written language. For the first time in human history, people can interact in a rapid written fashion at a distance. That allows them to quickly exchange ideas while maintaining a record of and reflecting on their own communication. People's own interactions can thus become the basis for epistemic engagement (Warschauer 1997).

Long-Distance Many-to-Many Communication

Written interaction, while powerful in and of itself, takes on greater significance when combined with another significant change in communication brought about by the communication revolution: long-distance many-to-many communication. For thousands of years, the only forums of many-to-many communication were the village meeting, town hall, and town square. In the twentieth century, new forms of communication such as the telephone conference call and ham radio were added to the range of "interactive broadcasting" technologies available to people, but since these were based on small, bounded numbers of oral networks, they failed to have a large social impact. In contrast, many-to-many computer-mediated communication can draw thousands of people into a single discussion, and millions of people around the world are now communicating online. While this has a potentially significant impact on almost every walk of life, from business (e-commerce) to romance (online chat and dating) to politics (public debate and grassroots organizing), one of the most profound effects is in the area of scholarship. Even before the full-blown Internet explosion of the 1990s, Stevan Harnad (1991) reported how scholarly skywriting—online exchange among scholars and scientists—was starting to reshape scientific inquiry. This exchange—which can take place via personal e-mail, specialized online scholarly forums, the online posting and archiving of works in progress and prepublication offprints, and electronic journals with much faster manuscript-to-published-document turn-arounds than paper journals—is speeding up and democratizing the means of production of knowledge. A century ago, a scientific breakthrough might have gone relatively unnoticed for months or years. Today, that same discovery can be known all over the world in a short time, and other scientists can ground their own existing and future research in these new findings without having to wait for the study to be written up and published in a print journal.[8]

A Global Hypertext

Long before the development of the personal computer, Vannevar Bush predicted the problem of information overload we are currently experiencing and proposed a system for dealing with it. In a remarkably prescient article in the *Atlantic Monthly*, Bush (1945) proposed the development of an information storage and indexing device called the memex. Bush's hypothetical memex abandoned "the traditional vertical links of library catalogs and indices—in alphabetical order, each listing under or after another—and instead externalized the associative processes of the human mind, via which any given idea was in the right circumstances equidistant, in effect equi-linkable, to any and all other ideas" (Levinson 1997, 140).

Though the memex was never built, its potential is being realized many times over by the Internet. The hypertextual organization of the Internet allows a horizontal, associative connection between sources of information just as Bush proposed. But in this case, the information linked is not that in a single office or library but a rapidly expanding mega-network of hundreds of millions of source documents put up by thousands of people all over the world.

Multimedia

Until the twentieth century, drawings, photographs, and other images played a relatively minor role in printed works, with the exception of medieval manuscripts, and audio and video elements were of course absent from printed works (Bolter 1991). The twentieth and now twenty-first centuries, on the other hand, have witnessed a steady rise of the visual and audiovisual as represented by film, radio, and television. A glance at today's mainstream books and newspapers as compared with those of a half-century ago will make clear how visual elements have expanded in the realm of print as well (Kress 1998). However, it is in computer-based multimedia, such as on the World Wide Web, that the mix of textual and audiovisual elements is most advanced. Audiovisual elements on the World Wide Web represent not just an add-on to text but a changed representational mode organized increasingly on the principle of display rather than narration (Kress 1998). Audiovisual texts are potentially a very powerful representational mode because they combine the illustrative power of the visual with the interpretive and analytic power of the written word. Multimedia have already come to dominate the world of business (e.g., advertising, presentations) and are increasingly prominent in government and education (Lanham 1993). The creation of multimedia also necessitates a complex array of semiotic, technical, and design skills and understandings, and differential access to these skills and knowledge will be one important divider between the "interacting" and the "interacted" in tomorrow's economy and society (Castells 2000b, p. 405).

The development and diffusion of computer-mediated communication represents a fourth revolution in human communication, cognition, and the means of production of knowledge, similar in impact to the three prior revolutions of language, writing, and print (Harnad 1991, 39). These new forms of networked communication make possible "an unprecedented combination of flexibility and task performance, of coordinated decision making and decentralized execution, of individualized expression and global, horizontal communication, which provide a superior organizational form for human action" (Castells 2001).

More than 500 million people are already connected to the Internet ("How Many Online?" 2001), and reliable forecasts point to 1–2 billion total users by the year 2010 (Castells 2001). Being part of this network is critical not only for economic inclusion but for almost all other aspects of life today, including education, political participation, community affairs, cultural production, entertainment, and personal interaction. ICT is making possible new organizational structures for social participation, from teen chat rooms, to online dating services, to political action Web sites, to Internet-based learning. None of these have completely supplanted face-to-face forms of communication and interaction, but they complement them as essential elements of social practice. As more forms of communication, social networking, community organization, and political debate and decision making gravitate to online media, those without access to the technology will be shut out of opportunities to practice their full citizenship. Sergio Amadeu da Silva, director of electronic governance for the City of São Paulo, expressed the importance of ICT access for social equality and inclusion in today's world:

> In the information society, the defense of digital inclusion is fundamental not only for economic motives or employability, but also for socio-political reasons, principally to ensure the inalienable right to communication. To communicate in the post-modern society is the power to interact with networks of information. It is not sufficient to have a free mind if our words cannot circulate like words of others. The majority of the population, on being deprived of access to communication via computer, is simply being prevented from communicating in the most flexible, complete, and extensive means. This digital *apartheid* represents a break down of a basic formal liberty of universal liberal democracy. This brings into existence two types of citizens, one group that can instantly access and interact with what others say, and one group that is deprived of that speed of communication.[9]

ICT is particularly important for the social inclusion of those who are marginalized for other reasons. For example, the disabled can make especially good use of ICT to help overcome problems caused by lack of mobility, physical limitations, or societal discrimination. Using ICT, a blind person can access documents by downloading them from the Internet and converting text to speech; a quadriplegic can pursue a college degree without leaving home; and a child suffering with AIDS can communicate with other children around the world. Sadly, though, disabled people, because of poverty, lack of social support, or other reasons, frequently lack the means to get online. In the United States, for example, only 21.6% of disabled people have home access to the Internet, compared with 42.1% of the nondisabled population (NTIA 2000). This disproportionately low rate of Internet connectivity by those who in many senses most need it, and in one of the world's most technologically advanced countries, is evidence that market mechanisms alone are not sufficient for achieving equitable ICT access.

Of course, not all forms of networking foster social inclusion. The gaping economic and social inequality of the current era has also given rise to more ominous networks. The Al Qaeda terrorist group—bringing together at various times the Egyptian Al Jihad, the Armed Islamic Group of Algeria, Abu Sayaff in the Philippines, the Islamic Movement of Uzbekistan, the Al Itihaad Al Islamiya of Somalia, and a host of other organizations—is the archetypical networked organization, deploying sophisticated computer-mediated communication and a variety of other international media and financial devices and institutions to connect its various nodes and cells (Ronfeldt and Arquilla 2001; Zanini and Edwards 2001). Similarly the Sicilian Cosa Nostra, the U.S. Mafia, Colombian cartels, Russian *mafiyas*, and Japanese *yakuza* coordinate their smuggling, gun-running, racketeering, counterfeiting, and prostitution rings in classical network fashion (Castells 2000a). While terrorist and criminal leaders themselves often come from privileged backgrounds, they prey on conditions of social exclusion to spread their wares and influence. And these conditions of social exclusion—such as widespread hunger, rampant spread of AIDS and other diseases, massive child labor, and frightening levels of sexual exploitation and abuse—are an expression of the heightened inequality and poverty of the new global economy. Simply put, global informational capitalism, left to its own devices, has torn down traditional modes of interaction and survival, leaving hundreds of millions of people in what Castells (2000a, 165) calls the "black holes of informational capitalism." These are the parts of the world that are least connected to the information society, from the shantytowns of Soweto to the *favelas* of São Paulo, from rural India to rural Appalachia.

Some would suggest that ICT is a luxury for the poor, especially in the developing world. However, with the rapid growth of the Internet as a medium of both economic and social transaction, it is in effect becoming the electricity of the informational era (Castells 2001), that is, an essential medium that supports other forms of production, participation, and social development. Whether in developed or developing countries, urban areas or rural, for economic purposes or sociopolitical ones, access to ICT is a necessary and key condition for overcoming social exclusion in the information society. It is certainly not the only condition that matters; good schools, decent government, and adequate health care are other critical factors for social inclusion. But ICT, if deployed well, can contribute toward improved education, government, and health care, too, and thus can be a multiplying factor for social inclusion.

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Technology and Social Inclusion

Rethinking the Digital Divide

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