# From Unequal Access to Differentiated Use: A Literature Review and Agenda for Research on Digital Inequality*

Paul DiMaggio, Eszter Hargittai, Coral Celeste, and Steven Shafer

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**From Unequal Access to Differentiated Use:**
**A Literature Review and Agenda for Research on the Digital Inequality**

The Internet boosts immeasurably our collective capacity to archive information, search through large quantities of it quickly, and retrieve it rapidly. It is said that the Internet will expand access to education, good jobs, and better health; and that it will create new deliberative spaces for political discussion and provide citizens with direct access to government. In so far as such claims are plausible, Internet access is an important resource and inequality in Internet access is a significant concern for social scientists who study inequality.

This paper reviews what we know about inequality in access to and use of new digital technologies. Until recently, most research has focused on inequality in access (the "digital divide"), measured in a variety of ways. We agree that inequality of access is important, because it is likely to reinforce inequality in opportunities for economic mobility and social participation. At the same time we argue that a more thorough understanding of digital inequality requires placing Internet access in a broader theoretical context, and asking a wider range of questions about the impact of information technologies and informational goods on social inequality.

In particular, five key issues around which we structure this paper.

(1) *The digital divide*. Who has access to the Internet, who does not have access, and how has this changed? This is the topic about which information is currently most abundant.

(2) *Is access to and use of the Internet more or less unequal than access to and use of other forms of information technology?* Even if access to and use of the Internet is profoundly unequal, the Internet's spread may represent a net increase in equality over the pre-Web media landscape. The implications of the new digital technologies for inequality in access to information can only be understood in the context of a comparative analysis of the impact of inequality on access to and use of all the major communication media: not just the Internet, but broadcast media, newspapers and magazines, telephones, and even word

of mouth. If publishers stopped printing newspapers and put all the news online, would inequality in information about politics and world affairs diminish, become greater, or stay the same?

(3) *Inequality among persons with access to the Internet.* We place great importance on understanding socially structured variation in the ability of persons with formal access to the Internet to use it to enhance their access to valuable information resources. Among the increaseing number of Internet users, how do such factors as gender, race, and socioeconomic status shape inequality in ease, effectiveness, and quality of use? What mechanisms account for links between individual attributes and technological outcomes? In particular, we are interested in the impact of social inequality on where, how easily, and with how much autonomy people can go online; the quality of the hardware and connection users have at their disposal; how skilled they are at finding information; how effectively they can draw on social support in solving problems that they encounter in their efforts to do so; and how productively they use their Internet access to enhance their economic life chances and capacity for social and political participation.

(4) *Does access to and use of the Internet affect people's life chances?* From the standpoint of public policy, the digital divide is only a problem insofar as going online shapes Internet users' life chances and capacity for civic engagement What do we know about the effects of Internet access and use on such things as educational achievement and attainment, labor-force participation, earnings or voting? To what extent, if at all, do returns vary for different types of users? If there are no effects or if the benefits for use are restricted to the already advantaged, then the case for government intervention to reduce inequality in access to digital technologies is correspondingly weaker.[1]

(5) *How might the changing technology, regulatory environment and industrial organization of the Internet render obsolete the findings reported hear?* Because the Internet is a relatively new technology – browsers have only been available for about a decade and the Web was only fully privatized in the mid-1990s – one cannot assume that the results of research undertaken in past years will be replicated even a few years hence. The Internet is a moving target. with many economic and political interests vying to control its ultimate configuration. How might institutional changes – in economic

control, in the codes that drive the technology, or in government regulatory and legislative actions – alter observed patterns of inequality in access and use?

We begin with a brief account of the origins and spread of Internet technology. Next, in order to place the contents of this chapter in a broader perspective, we review earlier attempts to address the relationship between technological change and social inequality. Finally, we review the literature on each of the main questions noted above and, where the research is lacking, develop an agenda for the work that needs to be done.[2]

**A brief history of the Internet**

By "Internet" we mean the electronic network of networks that span homes and workplaces (i.e., *not* "intranets" dedicated to a particular organization or set of organizations) that people use to exchange e-mail, participate in interactive spaces of various kinds, and visit sites on the World Wide Web. Because the Internet blazed into public consciousness with blinding rapidity, it is important to recall how briefly it has been a part of our collective lives: As early as 1994, just 11 percent of U.S. households had online access (NTIA 1995), and that was used almost exclusively for e-mail or for such specialized purposes as financial trading through dedicated connections. At the same time, the Internet has deep roots: a computerized network linked scientists by the late 1960s, and the military devised a similar network a few years later. The various forbearers were linked into an Internet in 1982. But only since 1993, after graphical interfaces became available and the scope of commercial activity broadened, did use of the medium begin to extend rapidly outside academic and military circles (Abbate 1999, Castells 2001).

From that point on, access to and use of the Internet spread swiftly. The number of Americans on-line grew from 2.5 million in 1995 (Pew 1995) to 83 million in 1999 (IntelliQuest 1999), with 55 million Americans using the Internet on a typical day by mid-2000 (Pew 2000:5). Based on the Current Population Survey (CPS), in December 1998 the Internet had penetrated 26.2 percent of U.S. households. Less than two years later the figure stood at 41.5 percent, and almost 45 percent of individuals age 3 or older were reported to go online at home, school, work or elsewhere (NTIA 2000). By September 2001,

more than half of U.S. households had Internet service, and almost 54 percent of individuals went online (NTIA 2002).[3] (Many more have "access" in the sense of an available connection [whether or not they choose to use it] at home, work, school, library or community center.) Since autumn 2001, growth in Internet use has stalled in the U.S., as fewer new users have come online and some existing users have gone offline (Lenhart et al. 2003).

Compared to other technologies, the Internet diffused rapidly, its trajectory similar to those of television and radio, each of which reached more than 50 percent of households within a few years of commercial introduction (Schement and Forbes 1999). Unlike those media, however, the Internet's adoption rate has slowed well short of full penetration. The gravity of the digital divide depends on whether slowing adoption after 2000 reflected a short-term effect of economic recession or a durable ceiling. Based on the experience of telephone service and cable television, which, like Internet service, entail monthly payments rather than a one-shot purchase, the latter seems more likely.

**Technology and inequality: A selective tour of social-scientific perspectives**

The Internet is one in a long series of information and communications technologies --- from speech, to printing, movable type, telegraphy, telephony, radio, and television --- that arguably influenced patterns of social inequality by destroying existing competencies and permitting early adopters to interact with more people and acquire more information over greater distances and in a shorter time. Before focusing on the Internet, then, we ask how the work of earlier generations of social analysts might place digital media into a broader context.

The most notable conclusion is how little attention students of social inequality have paid to changes in communication technology. For the most part, researchers who *have* been more concerned with technologies of production (the factory system and various forms of automation, for example) than with technologies of consumption. Nonetheless, four ways in which technological change may influence social inequality are evident.

*Competence destruction increases inequality*. Braverman (1974) argued that capitalist firms seek to develop technologies that "deskill" workers: that permit firms to substitute unskilled operatives for workers with scarce craft skills in order to reduce wages and exert more effective workplace control. If this were the case, wage inequality would increase as unskilled jobs replace skilled jobs . Research on the deskilling hypothesis (Spenner 1983) found substantial support at the occupation level but little fir the labor force as a whole. New technologies, it seemed, had predictable trajectories, at their inception generating new skilled occupations that were "de-skilled" over time. The continual emergence of new technologies, however, ensured that skill levels in the labor force as a whole were stable or increasing, even as those for specific occupations declined. More recent research finds less support for the deskilling hypothesis even at the firm level. Companies vary substantially in the extent to which they implement versions of technology that locate expertise and control, respectively, in white-collar technicians or shop-floor workers (Kelley 1990). The shift in findings appears to reflect a change in managerial practice, which may reflect the combination of more educated workers, a shift in managerial ideologies, weaker unions, and more capital-intensive labor processes (Fernandez 2001).

*New technologies reduce inequality by generating demand for more skilled workers*. In contrast, many students of social change argue that technological advance promotes equality. There are three versions of this argument. First, some claim that technological upgrades that replace workers with machines reduce inequality (at the workplace level) by substituting fewer better-paid and more-skilled workers for larger numbers of unskilled workers. In the short run, whether such a change reduces inequality in the economy at large depends on demographic factors and the speed with which "redundant" workers are retrained. Second, some studies show that management may implement technological change in ways that do not replace operatives, but rather that make work more complex and workers more autonomous. Indeed, Castells (1996) argues that the increased use of digital communications technologies to tailor goods and services to smaller markets supports a trend toward more flexible workplaces, more skilled work, and more autonomous workers. Third, some students of inequality believe that, as Blau and Duncan put it (1967: 428), "technological progress has undoubtedly improved chances of upward

mobility and will do so in the future," whether or not it reduces structural inequality. In this view, technological change reshuffles the decks, enabling early movers from modest backgrounds to achieve success in new occupations. Galor and Tsiddon (1997) contend that technological innovation increases both equality of opportunity and *in*equality of income (because employers pay premiums for new workers relative to the existing labor force).

*New technologies influence inequality indirectly by altering the structure of political interests and the capacity of groups to mobilize*. In this view, technology alters the occupational structure, which in turn influences the political sphere, leading to changes in policy as an unanticipated result. Despite its Rube-Goldbergesque indirection, this model's history is venerable. Marx argued that the factory system would lead to capitalism's demise by reducing skilled workers to a proletarianized mass and concentrating them in vast workplaces where they would organize revolt (1887 [1867]). Veblen (in *Engineers and the Price System* (1983 [1921])) and others argue that technological advance created a "new class" of intellectual laborers (engineers, scientists, technicians, researchers) with interests and values opposed to those of management. These new workers, so the story goes, are committed to technical rationality, on the one hand, and to cosmopolitan and egalitarian values on the other (Gouldner 1970). Plausible as this formulation is, firm-level research finds little evidence that technical workers view themselves as a collectivity with distinctive interests (Lewin and Orleans 2000); and in public-opinion research, "new class" members, while socially tolerant, are no more egalitarian or economically liberal than other members of the middle class (Brint 1984).

*New technologies enhance social equality by democratizing consumption*. Whereas the first three approaches emphasize the results of technological change at the point of production, another tradition has emphasized how new technologies reduce barriers to consumption and, in so doing, level status distinctions and reduce the impact of social honor, conventional manners, dress, deportment or taste on economic success. According to Max Weber, "Every technological repercussion and economic transformation threatens stratification by status and pushes the class situation into the foreground" (1978 [1956]: 938). In particular, new information technologies, from movable type and cheap newsprint to

telephone service and the Internet, may democratize the consumption of information by reducing the cost of communication. Scholars who believe such technologies reduce inequality emphasize price effects, whereas naysayers emphasize the advantage of the well off in putting new information to productive use.

Despite the diversity of views, most students of technology agree on three conclusions, all of which apply to the Internet. *First, the specific forms that new technologies take, and therefore their social implications, are products of human design that reflect the interests of those who invest in them.* For example, the military built the Arpanet as a decentralized network that could withstand the results of enemy attack; ironically, this very decentralization and redundancy made it attractive to libertarian computer scientists, who developed the Internet in ways that accentuated those features. The Internet's architecture is currently changing to better serve the economic interests of commercial enterprises (Lessig 1999; Castells 2001). *Second, technologies are continually reinvented by their users as well as their designers.* As the Internet's user base shifted from idealistic young technologists to upscale consumers, and as government policy sought to support emerging e-businesses, sites and technologies that enhance commercial uses and easy access to information have displaced more complex technologies that emphasized interaction and technical problem-solving. *Third, it follows from the first two principles that technologies adapt to ongoing social practices and concerns rather than "influencing" society as an external force* (Fischer 1992). Rather than exploit all the possibilities inherent in new technologies, people use them to do what they are already doing more effectively. Technology may contribute to change by influencing actors' opportunities, constraints, and incentives; but its relationship to the social world is co-evolutionary, not causal.

## The Digital Divide

Social scientists and policy makers began worrying about inequality in Internet access as early as 1995 (Anderson et al. 1995), when just 3 percent of Americans had ever used the World Wide Web (Pew Center 1995). At first, most believed the Internet would enhance equality of access to information by reducing its cost. As techno-euphoria wore off, however, observers noted that some kinds of people used

the Internet more than others; and that those with with higher Internet access also had greater access to education, income and other resources that help people get ahead (Hoffman and Novak, 1998, 1999; Benton 1998; Strover 1999; Bucy 2000). Concern that the new technology might exacerbate inequality rather than ameliorate it focused on what analysts have called the "digital divide" between the online and the offline.

Since the mid 1990s, researchers have found persistent differences in Internet use by social category (NTIA 1995, 1998, 1999, 2000, 2002; Lenhardt et al. 2003). Although operational definitions of access vary from study to study, most make a binary distinction between people who use the Web and other Internet services (especially e-mail) and people who do not. At first, "access" was used literally to refer to whether a person had the means to connect to the Internet *if she or he so chose* (NTIA 1995). Later "access" became a synonym for use, conflating opportunity and choice. This is unfortunate because studies that have measured both access *and* the extent of Internet use have found, first, that more people have access than use it (NTIA 1998; Lenhart et al. 2003 report that 20 percent of residents of Internet households never go online); and, second, that whereas resources drive access, demand drives intensity of use among people who have access. Thus young adults are less likely to have home access than adults between the ages of 25 and 54 (NTIA 2000); but in Internet households, teenagers spend more time online than adults (Kraut et al 1996).

The view of the "Digital Divide" as a gap between people with and without Internet access was natural at the onset of diffusion, because the Internet was viewed through the lens of a decades-old policy commitment to the principle of universal telephone service. Thus the federal agency responsible for achieving universal access to telephone service, the National Telecommunications and Information Administration (NTIA), claimed jurisdiction over policies affecting the distribution of access to the Internet. The goal of universal access, enunciated in the Communications Act of 1934, was echoed in the Telecommunications Act of 1996, which mandated that the FCC pursue the same objective for new "advanced telecommunications services" that reached high levels of penetration (Neuman et al 1998; Leighton 2001).

The NTIA's research publications echoed this tradition. The universal-service paradigm was profoundly concerned with household access (defined in binary fashion), with special concern for inequality between rural and urban areas (a salient distinction due to both the challenging economics of rural telephone service and the bipartisan appeal of programs that assist rural America) (Hall 1993; Schement & Forbes 1999). The telephone paradigm's influence is evident in the NTIA's first study of the digital divide (*Falling Through the Net*, 1995). The report's authors carefully framed their attention to the Internet as continuous with existing policy, noting: "At the core of U.S. telecommunications policy is the goal of `universal service' – the idea that all Americans should have access to affordable telephone service. The most commonly used measure of the nation's success in achieving universal service is `telephone penetration'…" (ibid.:1).

Consistent with tradition, that report included data only on households, emphasized a binary distinction between "haves" and "have-nots," and – most strikingly – presented all data separately for rural, urban, and central-city categories. (The latter reflected the grafting of Great Society concerns with racial inequality onto traditional concerns with rural America --- a union reflected in references to rural "have-nots" and "disadvantaged" central-city dwellers.) As the NTIA's research program evolved, new categories of "have-nots" – based on race, income, education, age, and, most recently, disability status (NTIA 2000) were added. Beginning in 1999, data were reported for individuals as well as households.

Thanks to the NTIA's research program we have a series of valuable snapshots (based on the Current Population Survey in 1994, 1997, 1998, 2000, and 2001) of intergroup differences in Internet use:

1. *Region and place of residence*. Rates of Internet use are highest in the northeast and far west, and lowest in the southeast. Of Americans aged 3 or older (the NTIA reporting base for most purposes), state-level estimates range from 42 percent online in Mississippi to 69 percent in Alaska (NTIA 2002: 7-8). Suburbanites are most likely to use the Internet (57 percent), followed by rural dwellers (53 percent) and central-city residents (49 percent) (ibid: 19).

2. *Employment status*. In 2001, 65 percent of employed people 16 years of age or older were Internet users, compared to just 37 percent of those who were not working (NTIA 2002: 12).

3. *Income.* Internet use rates rise linearly with family income, from 25 percent for persons with incomes of less than $15,000 to almost 80 percent for those with incomes above $75,000.

4. *Educational attainment.* Among persons 25 years or older, educational attainment is strongly associated with rates of Internet use. Proportions online range from less than 15 percent of those without high-school degrees to 40 percent of persons with high-school diplomas, and more than 80 percent of college graduates (NTIA 2002: 17).

5. *Race/ethnicity.* Rates of Internet use are greater for Asian-Americans and non-Hispanic whites (about 60 percent for each) than for non-Hispanic blacks (40 percent) and persons of Hispanic origin (just under 32 percent) (NTIA 2002: 21). Variation among these groups in income and education explains much of the difference, but even among those similar in educational attainment or income level, fewer African-Americans than whites use the Internet (Hoffman et al. 2001; Lenhart et al. 2003).

6. *Age*. Rates of Internet use rise rapidly from age 3 to a peak around age 15, when nearly 80 percent of Americans are online; decline to around 65 percent at age 25; then descend gently to just below 60 percent by age 55. At that point, rates decline rapidly with age (NTIA 2002:13).

7. *Gender*. In early surveys men used the Internet at higher rates than women, but by 2001 women and men were equally likely to be online (Losh 2003). From late teens to the late 40s, women are *more* likely than men to use the Internet; men acquire an increasing edge after age 55 (NTIA 2002: 14).

8. *Family structure*. Families with children in the home are more likely to have computers and the Internet than are families without children (NTIA 2002: 14).

These patterns of inequality are similar to those observed in other countries. In Switzerland, for example, in 2000, 69 percent of university graduates but only 19 percent of high school graduates were on line, and similar advantages were found for persons with high incomes, the young, and men (with the gender gap notably greater than in the U.S.) (Bonfadelli 2002: 75; and see De Haan 2003 on the Netherlands; Heil 2002 on the U.K. and Germany; and McLaren and Zappala 2002 on Australia).

**Persistent Disagreement**

The availability of high-quality data has failed to dampen a hot debate over whether socioeconomic and racial divisions warrant government action. During the Clinton administration, the Commerce Department advanced an ambitious set of programs aimed at wiring schools, libraries, government offices, and community centers throughout the country. The Bush administration has alternately treated the "digital divide" as something that was never a problem [Bush's FCC Chair likened it to the "Mercedes divide"] or a problem that has been solved [The NTIA's 2002 report on Internet access is triumphantly titled *A Nation Online*]. Almost everyone agrees that the CPS data are reliable. But disagreement on how to interpret the trends persists, centering on four questions:

1. *What do we mean by "access"?* If we mean the being able to get online in some fashion at some location, then inequality is much diminished. If "access" means using graphically complex Web sites from one's home, differences among groups remain substantial.

2. ***Which** "digital divide"?* Some intergroup differences that were large at the onset of the digital revolution have diminished or disappeared. Others have persisted.

3. *How should we measure the difference*? It is simple to find measures that convey whatever impression an advocate prefers. But some measures are better than others.

4. *How should we interpret trends*? Can we count on the market to provide extensive service at some point in the future (and how extensive, and how soon, are extensive and soon enough); or will current inequalities are likely to persist indefinitely.

**What do we mean by access?**

The original literal sense of "access" has gradually been replaced by a set of more concrete operational definitions. Different definitions yield somewhat different conclusions about inequality. We compare digital divides based on three increasingly demanding definitions of access: using the Internet anywhere; using the Internet at one's place of residence; and using the Internet at home through a high-speed connection. (The second criterion is meaningful because most people can surf more freely and spontaneously at home than at the office or in a public library. High-speed connections enable people to

access streaming media or graphically complex Web sites.) For each criterion, Table 1 provides access rates for two contrasting groups and a measure of inequality, the ratio of the odds of access for the more and less privileged groups.[4]

Table 1: Different Criteria of Access Yield Different Estimates of Inequality
(Data on Americans 18 and Older from 2001 Current Population Survey)

| | Use Internet | Use Internet At Home | Use Internet at Home Hi-Speed |
|---|---|---|---|
| Black | 39.09 | 26.21 | 5.57 |
| Non-Black | 57.89 | 46.54 | 10.87 |
| Non-Black/Black Odds ratio | 2.111 | 2.451 | 2.068 |
| Women | 56.33 | 44.23 | 9.71 |
| Men | 55.84 | 45.03 | 11.09 |
| Male/Female Odds Ratio | 0.970 | 1.033 | 1.160 |
| High-School Degree | 54.61 | 42.71 | 9.53 |
| College Graduate | 83.39 | 68.90 | 16.69 |
| BA/HS Odds ratio | 4.173 | 2.972 | 1.903 |
| Income $20-29,999 | 40.02 | 28.04 | 4.79 |
| Income >$67,500 | 68.24 | 57.01 | 14.91 |
| Greater/Lesser Odds ratio | 3.220 | 2.991 | 3.484 |
| Age 18-25 | 67.62 | 50.00 | 11.57 |
| Age >55 | 30.96 | 25.30 | 5.98 |
| Younger/Older Odds ratio | 4.657 | 2.952 | 1.837 |

Three features of this table deserve note. First, different criteria yield different estimates of inequality. For example, the disadvantage of people over 55 relative to the young (18-25) is greater with respect to using the Internet anywhere than it is with respect to using the Internet at home and, especially, having a high-speed home connection. (The difference reflects the fact that older people have higher incomes, more stable residences, and fewer other places to go online than the young.) Similarly, in 2001 women surpassed men in rates of Internet use; but men were still ahead in access to the Internet at home, especially through high speed connections.

Second, different criteria yield different impression for different intergroup comparisons. Inequality with respect to age and educational attainment (comparing college graduates to high-school graduates) is greatest for Internet use anywhere. Racial inequality, however, is greatest for at-home

access, and income inequality (people with family incomes of $67,500 or more compared to those with incomes between $20,000 and $30,000) is greatest for high-speed connections at home.

Third, it follows that the size of intergroup "divides" depends on how one defines "access." Inequality in Internet access anywhere between college and high school graduates dwarfs inequality between blacks and non-blacks; but racial inequality is slightly greater for access to high-speed connections at home. By the same token, the age and education "divides" exceed inequality between income groups in use of the Internet at all; but income inequality slightly exceeds that associated with age and educational attainment for use of the Internet in one's home.

### ***Which* divide?**

In the few years that the Internet has been widely available, it has diffused widely. Some inequalities in access have already closed. Other gaps persist, however. (See figures 1 through 4.[5]) Differences in rates of Internet use between men and women essentially disappeared between 1994 and 2001. (This descriptive conclusion is confirmed by Ono and Zavodny's [2003] logistic regression analyses with controls for income, age, educational attainment and marital status.) Age remains strongly associated with Internet use, but the disadvantage of persons in their 50s and 60s has diminished. Regional differences and urban/rural differences also have declined (on the latter, see Bikson and Panis [1999]).

By contrast the absolute gap between Asian-Americans and Euro-Americans on one side, and African-Americans and Native Americans on the other, increased (though the ratio of the more privileged to less privileged groups' rates declined) (see also Hoffman et al. 2001). Most absolute differences based on educational attainment and income fanned out in the early years of rapid penetration, then remained stable (or in the case of differences among the topmost categories declined) thereafter. Policy analysts particularly interested in disparities based on gender, age, or place of residence are likely to find reasons for cheer in the Internet's trajectory, whereas analysts especially concerned about racial or socioeconomic inequality will be far less satisfied .

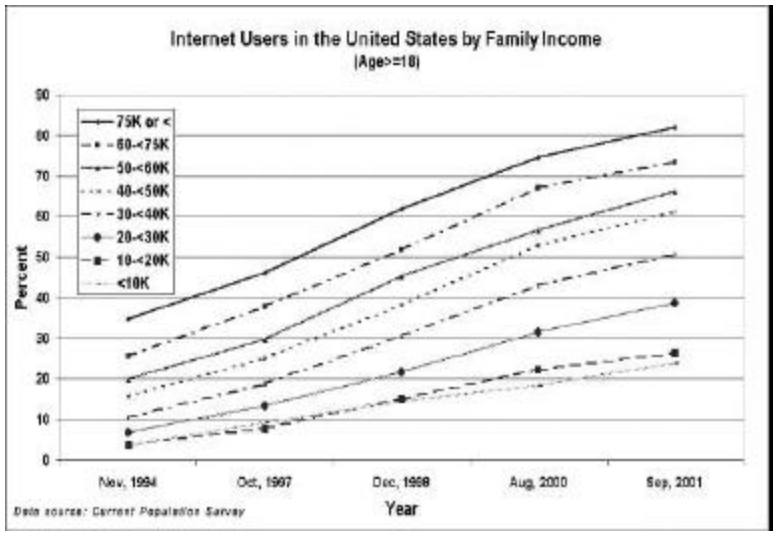


*Figure 1*

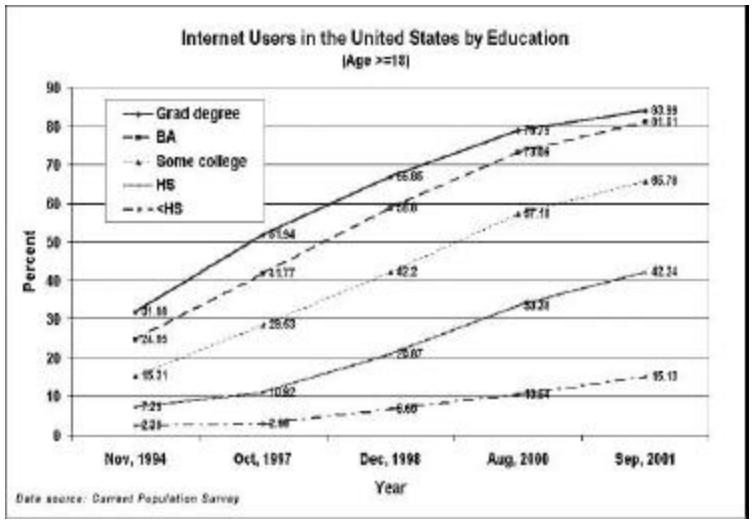


*Figure 2*

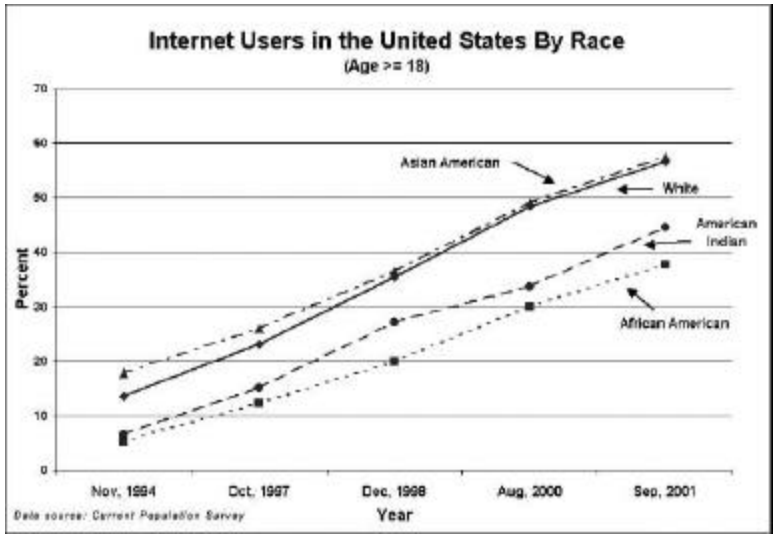


*Figure 3*

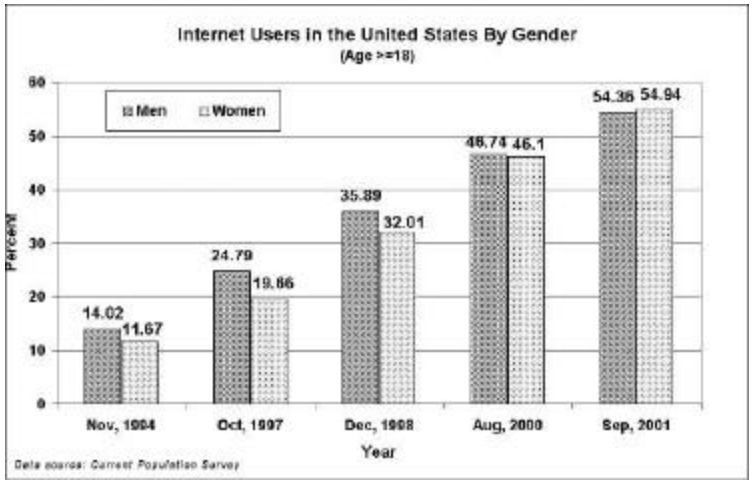


*Figure 4*

### *Which measures?*

Interpretation of trend data is complicated by the fact that different measures of inequality yield diametrically different results. Observers measure over-time change in intergroup inequality in Internet use in many ways: absolute percentage differences; the ratio of the proportion online in the advantaged group to the proportion online in the less advantaged group; the ratio of the proportion off-line in the less advantaged group to the proportion off-line in the more advantaged group; the odds ratios of adoption (or nonadoption) between two groups; and, for forms of inequality that can be expressed ordinally, pseudo-gini coefficients expressing deviation from equality in the distribution of Internet users across income (or educational) strata. Some measure relative rates of change: ratios in the rate of increase of the less adventaged to the more advantaged group; or ratios of the rate of decrease of nonuse of the more advantaged to the less advantaged use (both expressed as change in either absolute rates or in odds ratios).

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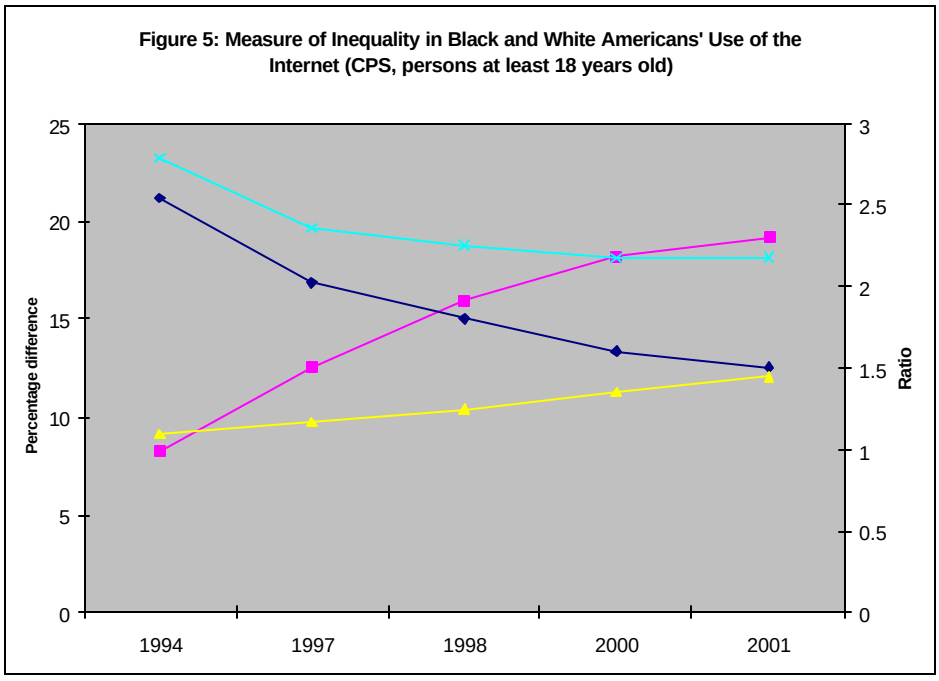


*Light blue (top) line: Ratio of white odds of use to black odds of use (right y axis)*
*Dark blue: Ratio of white to black rates of use (right y axis)*
*Maroon: Absolute difference between white and black rates of use (left y axis)*
*Yellow line: Ratio of black to white rates of nonuse (right y axis)*

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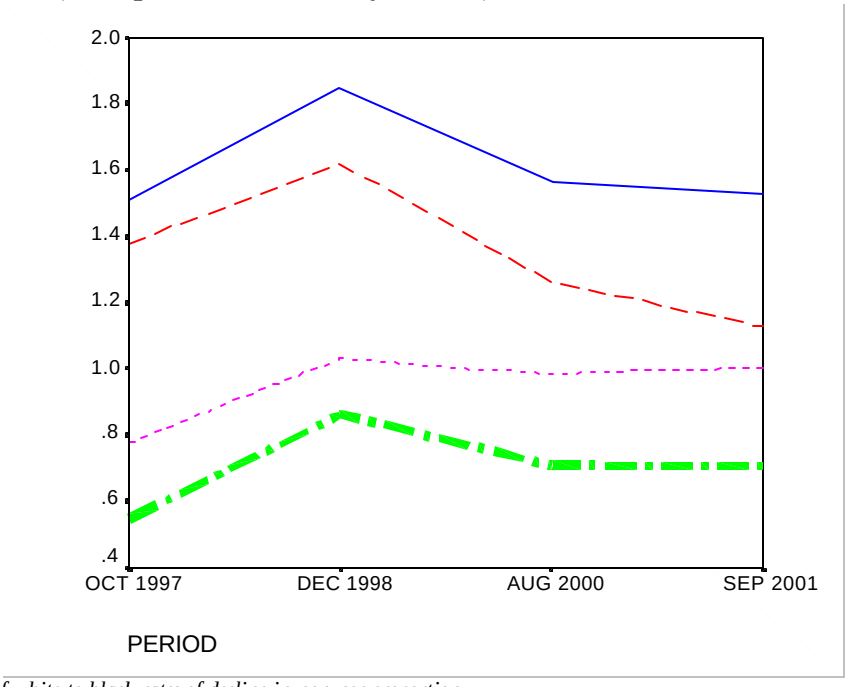
Figures 5 and 6 use CPS data to illustrate why this proliferation of measures is problematic, using a single type of inequality, that between blacks and whites age 18 or older. Figure 5 compares the shares of each

group online between 1994 and 2001. Pointers with pride can emphasize a steady decline in the ratio of the percentage of white Americans online to the percentage of black Americans online. Viewers with alarm may note that the absolute percentage difference between whites and blacks has increased slightly and that the ratio of the percentage of African-Americans who are off-line to the percentage of whites who are off-line has risen steadily. In fact the online and off-line ratios are mirror images, for as the proportion of Internet users has increased from a very low base, the percentage of nonusers has declined from a very high base. Other things equal, groups that start at a disadvantage will increase their percentage of those online while constituting an ever larger share (proportionately) of the disenfranchised.

**Figure 6: Measures of Inequality in Rate of Change in Black and White Americans' Use of the Internet (CPS, persons at least 18 years old)**




*Blue (top) line: Ratio of white to black rates of decline in nonuser proportion*
*Red line (second from top): Ratio of white to black absolute change in percentage on-line*
*Maroon line (third from top): Ratio of white to black increase in odds of using the Internet measured as interperiod odds ratios*
*Green (bottom) line: Ratio of white to black rates of increase in on-line proportion*

We see the same thing if we compare rates of change (Figure 6). Whether inequality seems to be worsening or improving varies from measure to measure. Optimists may note that rates of percentage increase in the proportion online have been greater for blacks than for whites. Pessimists can point out

that rates of absolute percentage increase for whites have outpaced those for blacks and that whites reduced their offline numbers at a higher rate than blacks throughout this period.

Martin (2003) argues that there is something wrong with measures that yield opposite conclusions depending on whether one measures the proportion of two groups online or the complement of that proportion (intergroup ratios of use/nonuse rates or rates of change in use/nonuse, as well as quasi-gini coefficients for forms of inequality that can be represented ordinally); and he offers an attractive solution. Odds ratio do not have this problem, he notes: they are the same whether one focuses upon the proportion of two groups who are users or the proportions that have been left behind. We include odds ratios in both figure 5 (the ratio of the odds that a white American is online to the odds that a black American is online) and in figure 6 (the ratio of interperiod changes in odds for whites to changes in odds for blacks). Both demonstrate that the white advantage declined notably between 1994 and 1997 and remained stable or grew slightly from 1997 to 2001.

To understand mechanisms that produce inequality it is helpful to identify advantages and disadvantages that accrue to people as a consequence of their race (or gender or income) independent of other salient characteristics that travel in tandem with race (or gender or income). A good measure of a characteristic's net contribution to inequality in Internet use is its coefficient in a logistic regression equation with statistical controls for other things associated with going on-line. One study that employed this technique, using CPS household data from 1994 to 2000, found that the net effects of education, race and, to a lesser extent, income increased over this period (Leigh and Atkinson 2001). Another, using CPS data from 1993 and 1997, found constant income effects but increasing education effects on use of Internet services, as well as growing net differences between African-Americans and non-Hispanic whites (Bikson and Panis 1999). A study of Internet use in fourteen European countries (Norris 2001) found growing effects of education, income, and occupation from 1996 to 1999. Such studies indicate that inequality grew modestly during the first years of diffusion.[6]

**Interpreting the trends**

Leigh and Atkinson (2001) argued that changing differences between groups in rates of Internet use simply reflect the position of those groups on an S-shaped diffusion curve that will culminate in full access for everyone. Groups that have reached the point of rapid ascent at the curve's mid-section will always appear to be outpacing groups that are still in the take-off stage. When the latter achieve take-off and the former reach the "top" of the S where rapid growth yields to slower increases, the less advantaged groups will appear to be catching up (Norris 2001: 30-31).

This is a crucial analytic insight. But *can* we assume that different groups are merely at different points on the same curve? Perhaps the most important question facing policy makers is whether disadvantaged groups are simply a few paces behind or, by contrast, are becoming marooned as the rest of the world moves ahead. If the former is true, we can count on time to bridge the divide;if the *trajectories* are different, public policy must play a larger role to reduce inequality (Leigh and Atkinson 2001).

*Alternative theoretical frameworks.* One can make a good theoretical case for either scenario. (Liberals, who set policy in the Clinton administration, tend to take the latter stance, whereas conservatives, like those in the Bush administration, embrace the former.) The case for the optimistic scenario goes like this: In its rapid diffusion, the Internet is traversing the path of such communication technologies as radio and television. At first, access is restricted to an elite defined by wealth, institutional location, or both; but increasing penetration reduces gaps between rich and poor, urban and rural, old and young, the well educated and the unschooled (Compaine 2001).

Peter Blau's insights (1977) explain why purely structural factors may ensure that inequality in access declines with diffusion. The first people to gain access to a new technology usually occupy privileged positions on several dimensions – for example, income, white-collar work, educational level, race, rural residence, and gender. But many fewer people are privileged on all dimensions than on each. (For example, there are a lot more white-collar employees than there are high-income, white, male, urban-dwelling, college-trained white-collar workers.) As penetration grows, access cascades beyond multiply privileged groups to people who are privileged in some ways but disadvantaged in others; the latter, in

turn, become conduits to others with whom they share less privileged characteristics. For example, when a rural Latino white-collar worker gains Internet access at her workplace, she may use the skills she acquires to help blue-collar family members go online, thus reducing inequality between Hispanic and non-Hispanic Americans, and between urban and rural dwellers.[7]

An equally strong case can be made for the opposite scenario. When we examine technology diffusion, a distinction emerges between products and services. Even expensive products often reach high penetration levels when economies of scale reduce their prices (television sets, VCRs, and computers) or less expensive secondary markets emerge (automobiles and refrigerators) or both. By contrast, the diffusion of services that entail continuing expense has been slower, bumpier and less complete (Schement 2003). As critical as telephone service would seem to be (especially to residents of rural areas), telephone penetration grew slowly and actually declined (markedly among farm families) during the Great Depression (Fischer 1992). Despite federal efforts -telephone service did not penetrate 90 percent of households until the 1970s, and remains much less than that in inner-city neighborhoods (Schement and 1999; Mueller and Schement 2001).

*Evidence on both sides.* Evidence, as well as theory, can be mustered on behalf of both optimistic and pessimistic points of view. Four arguments favor the former. First, as we have seen, some "divides" (gender, region, age, rural/urban) have already diminished. The trajectory of other gaps depends on the measures one uses, but Internet use has undeniably expanded among all groups, so straightline extrapolation (until recently at least) has suggested eventual convergence.

Second, surveys indicate that despite slowing growth after 2000, the market for Internet services is far from saturated. A spring 2000 survey by the Pew Center reported 41 percent of Americans who did *not* use the Internet intended to do so (Lenhart 2000: 2); two years later 44 percent of nonusers predicted they would do so. If they did (and if those who said they probably or definitely would not go online did not), the proportion of Internet users would rise above 70 percent.

Third, non-users' expectations are strongly correlated with age. In the Pew survey, 65 percent of nonusers 50 years old or younger expected to go online, compared to just 36 percent of nonusers over 50,

suggesting that generational succession will send Internet usage rates even higher. Based on these cohort differences, the author predicts that "in a generation, Internet penetration will reach the levels enjoyed by the telephone…and the television" (Lenhart 2000). Finally, late adopters come from less privileged backgrounds than Internet pioneers. In both 1998 and 2000, surveys found that new users had lower incomes and less education than Americans who had been online longer (Horrigan 2000a; Cummings and Kraut 2000; Howard et al. 2001; Katz et al. 2001).

Evidence in favor of the pessimistic scenario is equally strong. Inequality by race, income, and educational attainment has diminished little, if at all: Americans with few years of education and low incomes were still less likely to be online in 2001 as Americans with the most education and the highest incomes had been in 1994. Moreover, one can discount those divides that *have* been bridged as special cases: place of residence became less important because networks were built out and the technology became more flexible; women and the elderly are usually slower technology adopters than men and the young, but both groups ordinarily catch up.

Second, high diffusion rate of the 1990s represented *not* a "natural" trajectory, but rather the success of federal and state initiatives to encourage the Internet's rapid evolution and broad availability; and the special benefits to the Internet of an extraordinary economic bubble (the eponymous "boom" of the late 1990s). The reversal of both public policy and macroeconomic fortune after 2000 has already belied projections made as recently as 1999 that income inequality in use of Internet services would vanish by 2001 (Bikson and Panis 1999); and in 2001 that household Internet access would reach 90 percent by 2003 (Leigh and Atkins 2001:6). Instead, diffusion slowed as the bubble popped (Lenhart et al. 2003). If curves plateau at or near 2001 rates, existing levels of inequality could be locked in for decades.

Third, although newer adopters are of lower socioeconomic status than long-time users, they may not *stay* online. In particular, loss of income during hard times may make consumers less able to pay ongoing monthly connection fees. Many people adopt the technology only to give it up later, and these Internet drop-outs come disproportionately from groups with lower probabilities of going online in the first place. In surveys undertaken between 1995 and 2000, Katz and colleagues (Katz and Aspden 1997;

Katz and Rice 2002) found that approximately 20 percent of those who had ever used the Internet no longer did so. In fall 2001, 3.3 percent of CPS households reported that they had discontinued Internet service (NTIA 2002: 77). Analyses prepared for this chapter reveal that about 10 percent of General Social Survey (GSS) respondents who used the Internet in spring 2000 no longer did so when they were reinterviewed eighteen months later. A 2002 study (Lenhart et al. 2003: 21) reports that 7 percent of U.S. adults are *former* Internet users, and between 27 and 44 percent of *current users* have gone offline for extended periods after becoming users.[8] They conclude that "the road to Internet use is so paved with bumps and turnarounds" (*ibid:* 3) that the binary division of the population between "online" and the "off-line" is misleading.

**The digital divide: A research agenda**

Because the diffusion process is at a relatively early stage, monitoring change through ongoing data collection remains a critical priority. The NTIA's research program of CPS surveys remains the most important source of information, though studies with richer sets of covariates (like the GSS) or more focused questions (like the Pew Center's surveys) are important complements.

We must also fill significant gaps in analysis of data already collected. First, as we have seen, trend studies have suffered from a babble of competing measures and definitions of Internet access. Descriptive research employing reliable measures to describe change over time in (several definitions of) access would be a valuable baseline contribution. Second, we know relatively little about differences between predictors of access at work, home, or other locations, or about the extent to which members of less privileged groups rely either on workplace connections or on community settings to go online. Different factors influence access at different locations (the unemployed, for example, cannot go online at work), with implications for intergroup inequality. We know even less about access through interfaces other than computers or television screens (in the U.S., at least), like cell phones, personal digital assistants (PDAs), and various hybrids of the two.

Third, we know very little about social-network processes that culminate in adoption. Because the Internet is characterized by *network externalities* (*i.e.*, its value increases with the number of people using it), an important predictor of adoption should be the number of one's friends, relatives, or business contacts who are already online. (Internet users are twice as likely as nonusers to report that most people they know use the Internet; and just 4 percent of users compared to 27 percent of nonusers report that none or very few of their acquaintances go online [Lenhart 2003:28].) Research on computers indicates that families whose friends and neighbors own and use computers are more likely than otherwise similar people to purchase a first computer themselves [Goolsbee and Klenow 2000].) Adoption within networks is probably marked by tipping points atr which using e-mail or instant messaging becomes essential for full participation. Thus aggregate diffusion curves may reflect local lumpiness (rapid takeoffs within and cascades across relatively small network regions, along with limited diffusion among other networks), making patterns of intergroup inequality dependent upon network dynamics that we understand poorly.

Fourth, the little research on the influence of institutional affiliations in inducing people to go online suggests that the topic warrants more attention. One study reported that 30 percent of Hispanics take up the Internet through school (almost twice the proportion for non-Hispanic whites and blacks), whereas 43 percent of African-Americans first go online at work (a substantially higher proportion than whites or, especially, Hispanics) (Spooner and Rainey 2001: 8). The imbrication of school and workplace with information-seeking trajectories – and how that differs for different kinds of people – is an important research priority.

Fifth, we must learn more about Internet dropouts and about the extent to which differential persistence exacerbate inequality. Understanding the etiology of dis-adoption – the roles of weak network externalities, institutional disaffiliation (job loss, termination of schooling, reduction in discretionary income) is an important step. And it may be useful to model changes in intergroup inequality as product of group-specific adoption and abandonment rates.

Finally, how do public policy and macroeconomic conditions affect diffusion rates and equality of access? State-level analyses that explore relationships between these outcomes and state policies and

federal investments, while controlling for macroeconomic conditions and population composition, represent a promising approach.

## How Does Online Inequality Compare to Inequality in the Use of Other Media?

In order to understand the Internet's implications for equality of access to information, we must examine comparative evidence on access to and use of other communication media. Even if people with lots of money or education have privileged access to information online, whether or not an increasing role for the Internet exacerbates or ameliorates information inequality depends on whether access to and use of other media is more or less equally distributed. Socioeconomic status is ordinarily associated with access to communication media, and, among those with access, with getting information (see Verba, Schlozman and Brady 1995 for evidence from the political domain); it would be headline news if the Internet were an exception. As Norris (2001:12) argued "The interesting question is not whether there will be *absolute* social inequalities in Internet access [but] … whether *relative* inequalities in Internet use will be similar to disparities in the penetration rates of older communication technologies.

How might the Internet compare to mundane communications technologies like newspapers, magazines, the daily press, or even face-to-face conversation? Most online information is a free good. Economic theory tells us that if price elasticity is >0, free information will be consumed at a faster rate than costly information, especially by people with little discretionary income. Thus, for those who have access to it, the Internet should to make the distribution of information more equal. Yet this argument requires qualification in a number of ways. First, many competing information sources (network television news, interpersonal communication by telephone, daily newspapers) are either free or inexpensive. Second, online information is a "free good" only in so far as the user's time is without value. If lower-status Internet users take longer to find information (because their search skills are poorer, their connections slower, or their domain knowledge less), then the Internet could be a more "expensive" form of information than the newspaper, television, or a phone call to a friend. If going online requires you to drive to the library or risk getting in trouble if the boss catches you surfing, it may be more expensive still. Third,

because of the vast amount of information online, the Internet may be most attractive to those whose demand for information is highest (in many domains, high-SES users). Others may be satisfied by more limited media. Bonfadelli (2002) argues that the heterogeneity and depth of Internet-based information (in comparison to the relative homogeneity of material in newspapers or news broadcasts) is likely to exacerbate information inequality. In other words, one can plausibly hypothesize that the Internet will lead to a more egalitarian distribution of information; *or* that it will reinforce or even exacerbate the usual inequalities.

We must distinguish analytically between *access* and *use* in this regard. With respect to "access," we may ask what would happen (holding constant the way people distribute attention across media) if information *producers* took information currently transmitted by newspaper, television, or word of mouth and began distributing it through the Internet instead. For example, to what extent would low-income parents be hurt or helped if public schools used local newspapers less and Web sites more to distribute information about class assignments, policy changes, and extracurricular activities? With respect to use, the question is (given the current allocation of information across media), how would inequality be affected if information *consumers* shifted their attention from one medium to another? For example, would low-income parents learn more or less about their kids' schools if they spent more time online and less time reading the newspaper or talking with neighbors?

We know of only four studies that address such questions directly. Norris (2001: 90), using 1999 Eurobarometer data, found remarkably similar predictors of scores on a "new media index" (computer, CD-rom, modem, and Internet) and an "old media index" (VCR, Fax, satellite TV, cable TV, Teletext, and Videotext) in several European countries. Chang (2003) used data from the 1998 Survey of Consumer Finances to investigate the impact of education, race, and other factors on where people get financial information. Education was more strongly associated with use of the Internet than with use of any other source of information; wealth (but not income) was significantly predictive of Internet use as well (but less so than of contact with financial professionals). African-Americans favored financial professionals and advertisements over the Internet. Young people preferred the Internet and eschewed

financial professionals, the elderly did the opposite. In a study of health-information–seeking, Pandey, Hart, and Tiwary (2002) found that income and education significantly predicted Internet use. Compared to information sought from a doctor or in the newspaper, the Web was the only medium stratified by socio-economic status. In a study of use of media for political news, Bimber (2003) reported that African-Americans were less underrepresented among Internet users than among newspaper readers; and that young people were disproportionately likely to seek information online.

For this chapter, we analyzed data from the 2000 and 2002 General Social Surveys, which contained domain-specific questions about information-seeking in the areas of health (2000 and 2002), politics (2000), and jobs (2002). Respondents were first asked if they had "looked for information" at all during the past year; those who replied affirmatively were then asked if they employed each of several sources of information.[9] Therefore we can explore variation in search behaviors among people for whom we know that the knowledge domain is salient.

Here we focus on the association between median family income and use of each source of information. Comparison of median incomes (reported in dollar ranges, to which we assigned values at the midpoint) indicates that respondents who sought information at all about healthcare or political candidates were financially better off than those who did not (see Table 2). (No difference was evident for job information.) Table 3 describes the search behavior of respondents who sought information in each

TABLE 2
MEDIAN INCOME OF RESPONDENTS
WHO DID AND DID NOT SEARCH FOR INFORMATION

| | Health Info (2000) | Health Info (2002) | Political Info (2000) | Employment Info (2002) |
|---|---|---|---|---|
| Sought Information | 37500 | 45000 | 45000 | 37500 |
| Did not seek information | 32500 | 32500 | 32500 | 37500 |

domain. The results are striking: In each case, people who sought information on the Internet had notably higher incomes than people who searched through other means. The difference was least for employment information ($37,500 compared to $32,500), but the Internet was the *only* source for which users had

higher incomes than nonusers. The income advantage of those who sought political information online was greater than for any other source but general-interest magazines (both $55,000 for users and $37,500 for nonusers). The differences were most marked in healthcare, where the Web users' income advantage was far greater than that for any other information source.

TABLE 3: MEDIAN FAMILY INCOME OF RESPONDENTS WHO DID AND DID NOT USE SPECIFIC MEDIA FOR INFORMATION (RESPONDENTS WHO SOUGHT SUCH INFORMATION FROM ANY SOURCE ONLY)

PANEL A: HEALTH INFORMATION SEARCH (2000)

| | Doctor or Nurse | Friend or Relative | WWW | Magazine (Health) | Magazine (General) | TV/Radio | Newspaper |
|---|---|---|---|---|---|---|---|
| Yes | 37500 | 45000 | 55000 | 37500 | 37500 | 32500 | 37500 |
| No | 35000 | 37500 | 27500 | 37500 | 37500 | 45000 | 41250 |

PANEL B: HEALTH INFORMATION SEARCH (2002)

| | Doctor or Nurse | Friend or Relative | WWW | Magazine (Health) | Magazine (General) | TV/Radio | Newspaper |
|---|---|---|---|---|---|---|---|
| Yes | 45000 | 45000 | 55000 | 37500 | 37500 | 37500 | 37500 |
| No | 45000 | 37500 | 32500 | 45000 | 45000 | 45000 | 45000 |

PANEL C: POLITICAL INFORMATION SEARCH (2000)

| | Newspaper | TV/Radio | Magazine (General) | Friend or Relative | Political Campaign | WWW | Magzine (Political) |
|---|---|---|---|---|---|---|---|
| Yes | 45000 | 45000 | 55000 | 45000 | 45000 | 55000 | 45000 |
| No | 37500 | 55000 | 37500 | 37500 | 45000 | 37500 | 45000 |

PANEL D: EMPLOYMENT INFORMATION SEARCH (2002)

| | Newspaper | Friend or Relative (non-coworker) | Outside Contact | WWW | Co-Worker | Publication | Counseling Service | TV/Radio |
|---|---|---|---|---|---|---|---|---|
| Yes | 37500 | 37500 | 37500 | 37500 | 37500 | 37500 | 32500 | 25625 |
| No | 45000 | 45000 | 37500 | 32500 | 37500 | 37500 | 37500 | 37500 |

To summarize, the little evidence we have is equivocal with respect to socioeconomic inequality in use of different media, but suggests that for some purposes at least, information would be more unequally distributed in a world in which the Internet played a greater role and other media a correspondingly smaller one. Insofar as we can judge from available studies, the level of socioeconomic inequality in access to information online is no less, and is probably greater, than the degree of inequality in access to information through other media.

**Comparing Media Sources: A Research Agenda**

Three issues must be addressed. First: *What is the quality of the information that people get from difference sources?* If the information that people get off of the Internet is markedly inferior to the information they get from other sources, then any advantage that higher-SES users have in employing that medium is a poor advantage indeed. In addition to generic differences in information quality among media, researchers should address differences associated with socioeconomic status in the quality of the information that users actually retrieve. If low-income Internet users obtain less reliable information from more poorly designed sites that their higher-income counterparts, but are getting the same information when they read the newspaper or watch the evening news, the Internet may reinforce information inequality in ways that are not apparent from simple measures of use.

Second: *To what extent do differences in search behaviors reflect limitations on access vs. differences among people who already have access?* To what extent do differences like the ones documented above reflect greater inequality in access to the Internet than to other sources of information and to what extent do they reflect socioeconomic differences in what people do on line? If everyone had easy and autonomous access to the Internet would differences diminish? Or do users of different socioeconomic backgrounds have different patterns of information-seeking behavior independent of medium?

Third: *Among people who seek information online, to what extent is such search a complement to or a substitute for other kinds of information-seeking activities*. If the Internet is used only to complement more conventional information sources, it represents an incremental benefit for users. If it replaces other sources, depending on the quality of the information people find there, it may represent a net decline or increase in utility. Early studies of Internet users (Althaus and Tewksbury 2000; Bromley and Bowles 1995; and Stempel et al. 2000) reported that Web use did not limit use of other media but more recent studies indicate that Internet users watch less broadcast television than others (Waldfogel 2002). Such studies have not yet focused on use of media to acquire specific types of information. nor have they explored differences in substitution patterns for different kinds of users.

## Beyond the Digital Divide: Inequality Online

Such questions take us away from the "digital divide" and call attention to socioeconomic inequality among people who already go online. Research on access is still important because it documents an significant social change and establishes a baseline for evaluating progress towards the policy goal of universal service. At the same time, as Internet access has reached the point that almost every American can find a connection at a public library (Schement 2003), the key research questions about distributional issues have changed.[10] The pressing question now is less `who can find a network connection from which to log on?,' than `what are people doing, and what are they *able* to do, when they go online.' Moving beyond a binary view of access to a more detailed conception of inequality of technological opportunity involves four steps: Identifying critical dimensions of inequality; documenting differences among groups; explaining the antecedents of inequality on these dimensions; and modeling the relationship among different forms of inequality and between these and critical outcomes. In pursuing these questions, students of the Internet can draw both on prior studies of culture, information, and social inequality and on a more directly relevant tradition of research on the "knowledge gap" hypothesis.

### Culture and information in the stratification order

Sociologists have long studied inequality in access to cultural and information goods (DiMaggio 2001). Such work has addressed not only formal education, long a staple of research on social inequality, but also command of prestigious types of cultural knowledge (Bourdieu and Passeron 1977), linguistic abilities (Bernstein 1977), cognitive styles (Kohn and Schooler 1982), and access to technology (Attewell and Battle 1999). Lessons from this research tradition are applicable to research on inequality in access to and use of the Internet.

One generalization that emerges from this work is what we call the *differentiation principle*. At first, scarce information services are often relatively undifferentiated. As they become more available, they also become more differentiated in character, as the relatively privileged seek advantage by accumulating types that are more richly rewarded in marital or labor markets. The type case here is

education: As access to high school became nearly universal, increasing proportions of children from upper and middle-class families began attending college. With the onset of mass higher education, college training was further differentiated into selective private institutions and several tiers of less selective and less costly public institutions (Brint 1998; Collins 1979, Karabel and Astin 1975).[11] Such differentiation created new forms of inequality within the ranks of the college educated, alongside the old kind of inequality between those with and without college educations.

Similar patterns are visible in other cultural and informational goods. Bourdieu (1984) emphasizes the ways in which elite groups with high levels of cultural capital but relatively few financial resources develop elaborate forms of cultural distinction, compared to the solidly classical tastes of traditional business elites. In the sphere of information technology, hand-held communication devices have been differentiated, as the old stationary telephone has evolved into cellular telephones, personal digital assistants, wireless Internet devices, and varied combinations thereof. We anticipate that high rates of Internet penetration will increase the salience of new kinds of inequality *among Internet users* that affect the extent to which they reap benefits from going online.

**The "Knowledge Gap" hypothesis**

Research on inequality in use of earlier communications technologies establishes a precedent. According to the "knowledge gap" hypothesis (Tichenor, Donohue and Olien 1970), people of high socioeconomic status are always advantaged in exploiting new sources of information. Because of their privileged social locations, they find out about them first; and because of their high incomes they can afford to access them while they are new. Moreover, schooling provides an initial cognitive advantage that enables the well educated to process new information more effectively, so that their returns to investments in knowledge will be higher. As a consequence, not only do the socioeconomically advantaged learn more than others, but the gap is destined to grow ever larger due to their advantage in access to new sources of information.

Empirical tests of the knowledge-gap hypothesis have provided mixed support. A review of more than twenty studies with over-time data reported that, consistent with the theory, knowledge gaps on

issues often increase when media attention is greatest and narrow when coverage declines (Gaziano 1997). Studies that control for media exposure have also reported that readers or viewers with more prior knowledge of a topic are better able to assimilate new information (Viswanath and Finnegan 1996). Public-health studies, however, suggest that information campaigns on salient medical issues initially expand inequality in knowledge but ultimately reduce it (Viswanath and Finnegan 1996). Indeed, there is some evidence that when information is widely available and consumers are strongly motivated to learn, media exposure can *reduce* knowledge gaps over time (Ettema et al. 1983).

Tichenor et al. (1970) hypothesized that knowledge gaps would be smaller for highly salient knowledge domains in relatively small communities, and some studies have supported this view (Viswanath et al. 2000). Insofar as this is the case, the Internet's ability to create compact online communities of interest in which status differences among members are relatively invisible may enable rapid learning among users at all levels of SES who find their way to specialized Web sites, especially sites that include an interactive component. (If high-SES people are more likely to access such resources, however, the Internet's interactivity and anonymity might actually exacerbate inequality.)

The lesson of "knowledge gap" research for students of the Internet is that "access" is never enough to ensure productive use. Students of the "knowledge gap" call attention, first, to individual differences (often associated with education) in motivation, salience, and skill; and, second, to the social context of information consumption (for example, the availability of opportunities to discuss new information with peers) as explanations of unequal impact. Similar factors likely shape the extent to which different kinds of people benefit from the Internet's availability (Bonfadelli 2002).

**Dimensions of inequality online**

We call attention to five broad forms of inequality. The first is variation in the *technical means* (hardware, software, and connections) by which people access the Internet. The second is variation in the extent to which people exercise *autonomy* in using the Web –- for example whether they access it from work or home, whether their use is monitored or unmonitored, and whether they must compete with other

users for time online. The third is inequality in the *skill* that people bring to their use of the medium. The fourth is inequality in the *social support* on which Internet users can draw. The fifth is variation in the *purposes* for which people use the technology. We view each type of inequality as likely to shape significantly the experience that users have online, the uses to which they can put the Internet and the satisfactions they draw from it, and their returns to Internet use in the form of such outcomes as earnings or political efficacy.

*Inequality in technical apparatus*. Kling (1998) distinguished between technological and social access, calling attention to the importance of "the physical availability of suitable equipment, including computers of adequate speed and equipped with appropriate software for a given activity." How does *inequality in the adequacy of hardware, software, and connections* limit the ways in which different kinds of users can employ the Internet? As bandwidth increases and more Web sites require late-model browsers to display java applications, sophisticated graphics, or streaming video, to what extent can users without access to expensive systems access the full range of Internet content?

Among Internet users, the same factors that are associated with being online in the first place (income, educational attainment, race, and metropolitan residence) predict having high-speed connections (Horrigan and Rainie 2002: 10; Mossberger et al. 2003). Research suggests that inferior technical apparatus reduces the benefits users can gain from the Internet directly and indirectly. First, users with slow connections and obsolete software or hardware are simply unable to access many sites. Second, because their online experience is less gratifying, they go online less and acquire fewer information-retrieval skills. Horrigan and Rainie (2002) report that, after controlling for experience and demographic variation, broadband users search for information more widely, engage in a broader range of activities, and more often produce their own Web content than users without high-speed connections. Similarly, Davison and Cotton (2003) report that broadband users spend more time on-line and are more likely to use on-line business and consumer services and recreational sites .[12]

*Inequality in autonomy of use*. How much control do people exercise over their Internet use? An important aspect of this dimension is location of access (Bimber 2000): whether people go online at home

or at work, school, libraries, or community centers. If access is outside the home, how much flexibility does the user have in determining the hours at which she or he can go online? How far does the user have to travel? To what extent do regulations, time limits, filtering software or monitoring arrangements limit use? If access is at work, what uses are permitted (and how does this vary with organizational role), what kinds of filtering or monitoring systems are in place, and how stringently are rules enforced (O'Mahoney and Barley 1999)? (In 2001, 63 percent of large employers monitored their employees Internet connections and 47 percent stored and reviewed their e-mail communications (American Management Association 2001].) If access is at home, to what extent is autonomy limited by the actions of other family members or the policies of the Internet Service Provider (ISP) (Lessig 1999)? Does in-home access have different effects on educational or occupational outcomes than access from other locations? Of people who have access at work, what predicts the degree of autonomy they possess in determining *how* they use the technology?

We have seen that educational attainment, income, and race are all associated with having Internet access at home. We hypothesize that, where individuals have access to the Internet at work, the autonomy with which they can exercise that access is associated with their organizational rank and functional position. Finally, we expect that among people with access to the Internet, the greater the autonomy of use, the greater the benefits the user derives.

*Inequality in skill*. Kling (1998) pointed to the importance of inequality in users' possession of "know-how, a mix of professional knowledge, economic resources, and technical skills, to use technologies in ways that enhance professional practices and social life." Wilson (2000) refers to inequality in "cognitive access": the extent to which users are trained to find and evaluate the information they seek. Internet users vary in their possession of at least four kinds of relevant knowledge: recipe knowledge about how to log on, conduct searches, and download information; non-domain-specific background knowledge (e,g, of Boolean logic for designing search algorithms); integrative knowledge about the way the Web operates that helps them navigate better; and technical knowledge about software, hardware, and networks necessary for troubleshooting problems or ensuring that one stays up to date (e.g. by

downloading patches and plug-ins). Taken together, these four kinds of knowledge constitute what we might (after sociolinguists' notion of "communicative competence" [Hymes 1974]) call "digital competence": the capacity to respond pragmatically and intuitively to challenges and opportunities in a manner that exploits the Internet's potential and avoids frustration (Hargittai 2002).

We know very little about what explains inequality in the competence needed to find information online. Evolution in Web site construction and growth in the volume of information has required new skills for the technology's efficient use. Flashy software implemented with little attention to human factors renders many sites accessible only to sophisticated users with state-of-the-art hardware and software and sophisticated navigation skills (Hargittai 2003b). Moreover, limitations in search technology – most search engines index no more than a small percentage of all content online (Lawrence and Giles 1999) – render it difficult for the average user to find many sites.

Despite a growing literature on Web-site usability issues (much of it from library science and social informatics), we know little about how and why skill is related to personal characteristics. A few researchers have examined self-reports of skill, and found that users with less formal education are less confident in their abilities (Bonfadelli 2002). We also know that women are less confident in their online skills than men; and that self-assessments predict performance poorly (Hargittai 2003a).

Hargittai (2003a) is unique in that the author subjected a random sample of residents of a socially heterogeneous New Jersey county to extensive testing, including surveys, open-ended interviews, and, most important, observations, while they attempted to locate several kinds of material online (using computers and browsers similar to those they ordinarily employed). Hargittai found that skill (defined, first, as the ability to complete a task and, second, how much time people spent on the task) was only modestly associated with demographic measures (and associated in different ways for different tasks); relatively weakly associated with off-line domain familiarity; and more strongly related to autonomy of use and the amount of time subjects spent online in a typical week.

A study of online sessions of a sample of new users (Neuman et al. 1996) demonstrated that emotional impact – whether users felt frustrated or gratified at the session's end --- was a function of their

success in attaining their objectives. We infer from this that Internet competence is related to the satisfaction users derive from the experience, the extent to which they find it stressful or rewarding, and therefore, the extent to which they persist in Internet use and acquire additional skills.

*Inequality in the availability of social support.* Based on these observations, we might expect inequality in competence to deepen inexorably, as skillful users find the Internet rewarding and acquire greater skill; and less able users grow frustrated and turn away. Yet we know that most new users do gain competence and persist. We suspect that this is the case because novices draw on *social support* from more experienced users when they need help. Such support has become more important as the technology has penetrated new sectors of the population. Anecdotal evidence suggests that early Web users were embedded in dense networks of technically sophisticated peers. By contrast, more recent recruits are often less sophisticated and more isolated (Kiesler et al. 2001). Kim and Jung (2002), in a study of East Asian youth, found strong effects of social support (from both family and friends) on the breadth and extent of on-line activity.

We hypothesize that three kinds of support increase users' motivation to go online and their digital competence: technical assistance from persons employed to provide it (for example, workplace support staff, customer support staff, librarians, and teachers); technical assistance from friends and family members ; and emotional reinforcement from friends and family in the form of commiseration when things go wrong and positive interest when things go right. We further hypothesize that social support influences returns to Internet access, however these are measured.

*Variation in use*. How do income, education, and other factors influence *the purposes for which one uses the Internet*? From the standpoint of the contribution of technology use to socioeconomic life chances, not all uses are equal. The Internet prophets who foresaw that the Web would empower citizens, increase social capital, and enhance equality of opportunity probably did not have gambling or pornography sites in mind when they made these predictions. We place high priority on examining determinants of different kinds of use, especially distinguishing among uses that increase economic welfare (*e.g.*, skill-enhancement, learning about employment opportunities, consumer information, or

education) or political or social capital (using the Internet to follow the news, gather information relevant to electoral decision-making, learn about public issues, engage in civic dialogue, or take part in social-movement activities), versus those that are primarily recreational.

The variety of uses to which one puts the Internet is likely to reflect the number of hours one spends online. We have no cumulative data on the latter, but surveys have asked how many hours respondents are online *now* and how many years they have been online, and both measures are associated with variety of use. Moreover, among Internet users, those with more education began to use the Internet earlier and go online more frequently (at least in the early stages of diffusion) than less educated users (Bonfadelli 2002: 77). In the U.S., women with Internet access went online less frequently than otherwise similar men (Bimber 2000).

Evidence that users from more privileged backgrounds are more likely to use the Internet to get ahead and equip themselves to participate in community affairs or politics is beginning to accumulate. DiMaggio and Hargittai (2002) report that among respondents to the 2000 GSS, education, income, and vocabulary test scores have strong effects on "capital-enhancing" uses of the Internet but much weaker (or negative) effects on recreational use. Bonfadelli (2002) found that, among Swiss Internet users, education was positively associated with using the Web for information and services, but negatively associated with using it for entertainment.

DiMaggio and Hargittai (2002) did not find significant effects of race, net controls (see also Alvarez 2003). Spooner and Rainey (2000) found that African-American Internet users are more likely than their white counterparts to use the Web for education and job-hunting. NTIA (1998, 2000) reports that lower-income and less-educated Internet users are more likely than wealthy users to use the Internet to find jobs, a result that may reflect exclusion from the informal social networks through which information about the most desirable jobs to be distributed (Lin 2000). Egalitarians should find such results encouraging. Yet relatively early adopters in groups with lower levels of adoption may be atypical in ways that make generalization unwise (see Bourdieu and Passeron 1977 on "overselection").

Note that in distinguishing among uses in this way, we do not suggest that recreational Internet activities are without value – only that both public policy and students of inequality place a higher priority on equality of economic opportunity and civic engagement than on sociability and the pursuit of happiness. Researchers interested in social inequality and social policy should distinguish between online activities likely to cultivate the former and those primarily devoted to the latter.

**Research agenda: Modeling digital inequality**

With well over half of U.S. adults online, we must supplement research on the digital divide with studies of inequality within the online population. The research agenda is long, comprising each form of inequality described above, as well as integration of the parts into a comprehensive model.

The most important lesson of this section is that "Internet use" is far less likely to have strong or consistent effects (or antecedents) if we measure it as a single entity than if we distinguish among different types of Internet use and examine their causes and consequences separately. Among the differences that may matter most are how one goes online, what one goes online to do (*e.g.*, e-mail versus Web-surfing), and, when one does use the Web, what kinds of sites one tries to access and how one goes about searching for them (Anderson and Tracey 2001; Hargittai 2003a).

Priorities for the study of inequality in access to advanced technology are both methodological and substantive. Many aspects of Internet technology are unfamiliar to less sophisticated users, who may be unable to answer questions about connection speeds or processing power. Work on question design could improve data quality considerably. Substantively, we need to move beyond cross-sectional research to ensure that differences associated with connection speed or hardware quality do not simply reflect selection effects (i.e., the greater likelihood that heavy and sophisticated users will invest in more expensive technology).

With respect to autonomy, the big question is how *where* one goes online affects *what* one does there. Within the home, which family members use Internet connections the most, for what purposes, and why? On the job, we know that workplace Internet monitoring is widespread; but we know very little

about the purposes of autonomy and surveillance (whether employers aim to enforce broad prohibitions against time-wasting surfing, or whether they target only employee behaviors [sexual harassment or fraud, for example] for which they bear vicarious liability); about differences among employees in different job classifications in monitoring or regulation of workplace Web use ; or about how monitoring influences employee behavior.

Measurement is the most difficult challenge for students of skill. Hargittai's (2003a) observational approach is effective, but most researchers will find the cost prohibitive for large-scale data gathering. We need survey-ready proxies for search skill, troubleshooting ability and recipe knowledge, but the quest for such measures is complicated by the fact that the technology generates new forms of skill (or makes old ones obsolete) as fast as researchers can validate their measures. If suitable measures *can* be found, the next step is to understand the mechanisms that produce variations in skill and the consequences of such variation for persistence and productivity of Internet use.

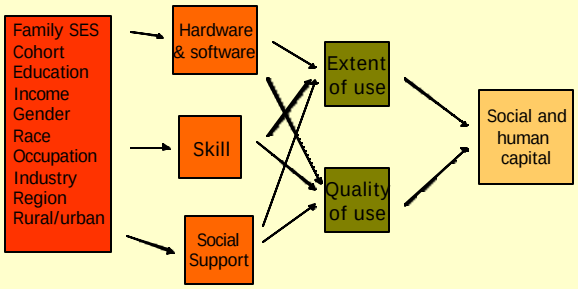
Better data on social support, especially data that distinguish between problem-solving assistance and affective support, is a high priority. Such data would make it possible to explore how social relationships enhance skill development and reduce frustration and, in so doing, increase the extent and productivity of Internet use.

Surveys increasingly ask Internet users about the kinds of sites they visit and about frequency of behavior. What most surveys do *not* tell us is *why* people fail to use the Internet for particular purposes --- *e.g.*, whether Internet users who never visit political sites get their political news from other media or simply are indifferent to political information in any form. An important priority, then, is to ask respondents about information-seeking offline to provide context for interpreting their online behavior. A long-term priority is to go beyond self-reports by exploiting "clickstream" data --- detailed records (collected by market researchers) of the sites that individual Web users visit (Goldfarb 2002). Employing clickstream data presents many challenges --- gathering information about respondents' demographic traits and social attitudes without violating their privacy, classifying sites by topical domain, providing functional codes (*e.g.*, shopping, playing games, gathering information) for particular visits based on information

about the pages accessed, deducing when multiple users are employing the same account – that will require collaboration between social scientists and computer scientists. At the same time, because click-stream data are both behavioral and extremely detailed, they can answer questions (for example, what kinds of users access the highest quality information, or the extent to which users avoid or seek out sites that challenge their political views or aesthetic preferences) that survey data can only begin to address.

Taken together, the hypotheses set out in this section aggregate to a model of the influence of technological inequality on individual life chances that applies to the Internet and generalizes beyond it (see Figure 7). As we conceive the process, demographic and situational factors affect quality of technical apparatus, autonomy of use, skill, and social support at the individual level. These in turn influence the efficacy with which Web users employ the medium (both directly, by making it easier to achieve the users' objectives) and indirectly (by enhancing learning and satisfaction, which in turn enhance persistence, efficacy, and volume and breadth of use). Ultimately, in this model, increases in human capital (including educational attainment), social capital (includeing political agency) and earnings are direct functions of the efficacy, intensity, and purposes of use, and indirect consequences (through these mediating variables) of apparatus quality, autonomy, skill, and support. These latter relationships are sufficiently important that we devote the next section to them alone.

Figure 7: Impact of Internet Access on Life Chances



## Does Internet Use Matter?

In one way, we know that Internet access matters. It matters keenly to the millions of people who rely on the Internet for e-mail, news and other forms of information and entertainment. The high-school and college students for whom instant messaging has replaced the telephone, the operatives in the Jesse Ventura or Howard Dean campaigns who used the Web to get their dark-horse candidates into the race, members of dispersed or stigmatized communities who can find one another online, and all the people who report having met spouses online (and the many more who hope to find them there) could not be convinced that the new medium is anything less than transformative.

From the standpoint of both public policy and social science, however, this question has a narrower meaning: Are people who have access to the Internet any better off – especially with respect to economic welfare (education, jobs, earnings) or social participation (political participation, community engagement , or receipt of government services and other public goods) than they would be without the Internet? If the answer is "no," then the case for public intervention is far less compelling than if it is "yes."

The knowledge-gap hypothesis discussed earlier raises a second question: Do returns to technology vary by socioeconomic status, race, place of residence, or gender? Are higher-status users more effective at converting access into information and information into occupational advantage or social influence than less privileged users? Does the low cost of information online level the playing field or does online inequality reproduce existing patterns of inequality? Few studies have assessed the Internet's impact on individual economic welfare or occupational mobility. But research on the effects of computer use on earnings, quality of worklife and school achievement offers valuable lessons to those who would undertake similar research on the Internet.

### Do Technical Skills Enhance Earnings?

Using CPS data from the late 1980s, Krueger (1993) reported that workers who used computers on the job earned 10 to 15 percent more than their otherwise similar peers. Based on these analyses, he argued

that the expansion in computer use in the 1980s accounted for one third to one half of the increase in the rate of return to education during that time. Using German data, DiNardo and Pischke (1997) likewise found significant wage differentials associated with computer use --- but also with on-the-job use of calculators, telephones and pencils. They argued that Krueger's results reflected selection effects rather than real returns to computer use, as computers had simply become part of the armamentarium of office work.

Entorf and Kramarz (1997) and Entorf, Gollac and Kramarz (1999) replicated the earlier results cross-sectionally in France, but their panel analyses indicated that workers who became computer users experienced no immediate wage increase. Rather the earnings pay-off appeared to come with experience. Even then it was modest -– just 2 percent after two to three years. The authors concluded that the difference between this estimate and the 15 to 20 percent differences found in cross-sectional studies reflected selection effects: when employers implement new technologies, they choose their best workers (who are already the highest paid) to use them. Similarly, Chennells and Reenen (1997), assuming that "high wages signal high workforce quality and that this quality enables new technologies to be adopted at lower costs" (599), found in the U.K. that although computers were first introduced into high-wage work settings, their introduction had little effect on blue-collar wages (see also Hughes & Lowe [2000]).

We found only one study of Internet users' wages, Goss and Phillips' (2002) study of the effects of Internet use on workers' wages in the U.S. manufacturing sector. They reported significant returns to Internet use: 13.5 percent, with a range by industry from 4.9 to 16.4 percent. Internet users received greater wage premiums in low-tech industries, a result the authors attribute to the more recent introduction of the technology in the latter and possible selectivity bias.

It is clear, then, that people who use computers at work earn more, but there is much debate about why this is the case. Autor, Katz and Krueger (1998) studied aggregate changes in the relative supply and wages of workers by education from 1940 to 1996. Finding strong and persistent growth in relative demand favoring college graduates, they conclude that rapid skill upgrading within detailed industries accounted for most of the growth in demand for educated workers since 1970, and that upgrading was most extensive in the most computer-intensive industries (1169). They conclude that such "skill-biased

technological change" goes a long way toward explaining growing wage inequality in recent decades. In response, Card and DiNardo (2002) contend that most of the rise in wage inequality between 1980 and 2000 occurred between 1980 and 1986, whereas the pace of technological innovation (based on growth in the size of the IT sector, the pace of Internet development, and aggregate productivity growth) was greatest in the 1990s.[13] They argue that new technologies always entail short-term premiums for workers with the skills to use and maintain them, as long as the latter remain relatively scarce. Consistent with Braverman (1974) and Spenner (1983), as reviewed earlier, once such skilled workers become more plentiful and the work is routinized, wage premiums decline.

A uniquely comprehensive study of the effects of technological change at the establishment level followed a major retooling of a food-processing plant that dramatically increased the skill level of the workforce (Fernandez 2001). Despite increased task complexity, mean and median wages for hourly workers remained unchanged during the three years of the study. Moreover, wage inequality (overall and between white and minority workers) increased markedly, with declining wages for those below the median and more positions for well-paid maintenance mechanics and electricians.

**Do Technical Skills Enhance Quality of Worklife?**

Technology may change the qualitative experience of work, as well as influencing earnings. Castells (2001) argues that technological change is central to a broader transformation in work for both manual workers and for "self-programmable" labor ("which must be able to reprogram itself in skills, knowledge, and thinking, according to changing tasks in an evolving business environment" [91]). Although he rejects technological determinism, Castells argues that "work flexibility, variable employment patterns, diversity of working conditions, and individualization of labor relations are systematic features of e-business. From this core of the new economy, flexible labor practices tend to diffuse into the entire labor market…" (96). These hypotheses clearly merit sustained empirical examination as technological change unfolds.

What do we know about the impact of computerization on quality of worklife? Based on CPS data, Freeman (2002) reports that computerization and use of the Internet are associated with longer hours

as well as higher wages. Using the 1992 Employment in Britain Survey, Gallie (1996) reported that managers in technically advanced work settings adopted more consultative styles of interaction with manual workers (a result that could reflect changes in ideology or worker training, as well as technological imperatives). Fernandez (2001) found that technological change resulted in greater task complexity across several skill dimensions. Whereas 17 percent of workers used computers before the renovation, 90.2 percent did afterwards. Furthermore (contrary to the "deskilling" thesis), management expected workers to have a more complete knowledge of the production process and to be able to accomplish a wider variety of tasks. Fernandez emphasizes that "organizational and human resources factors were seen as integral part of the plant retooling" from the start: Workers were reorganized into teams and managers were encouraged to view themselves as coaches rather than bosses. It seems likely, then, that changes in the labor process and quality of work life reflected changes in managerial ideology as well as technology.

Some ethnographic studies suggest that implementation of new technologies make workers who can use them more autonomous, and may lead to a redistribution of power as well. Barley (1990) found that the introduction of computerized scanning technologies into hospital radiology units enhanced the relative standing and power of technicians, whose skills became indispensable to newly deferential physicians. Studying change in a large insurance firm, Lewin and Orleans (2000) reported that managers became less coercive and more consultative in dealing with computer specialists, who operated with considerable autonomy. Such findings support Weber's observation that technological change invariably challenges the viability of status structures based on social honor. One can imagine (although research has not documented it) that during transitional moments, young employees with strong Internet skills may move to the center of informal workplace networks and, in so doing, attain more influence and respect than their job descriptions would imply.

We must avoid broad generalizations about the effects of the Internet or even computerization on organizational design and workers' experience. The most thorough review of the literature on organizational effects of digital technology found little support for expectations about network effects and reported that many much-anticipated effects (*e.g.*, tele-commuting) were still relatively rare (O'Mahony and Bar-

ley 1999). The most notable examples of change reflect the application of specialized computer networks to specific kinds of work, such as the disintermediating impact of cellular communications on relations between central command structures and fieldworkers in industries as diverse as trucking and the U.S. military (Nagarajan et al. 2000; Fountain 2001).

**Does Technology Improve School Performance?**

Attewell and Battle (1999) found that computer use at home was significantly related to children's reading and mathematics test scores. (As with cross-sectional wage studies, it may be that computer use proxies a bundle of unmeasured resources that are available in computerized households.) This study is one of few that address the question of whether returns to technology vary in a manner that reinforces or challenges existing inequalities. The authors report that the former was the case, with higher returns for boys, whites, and children from families of higher socioeconomic status. Focusing on home use, Attewell et al. (2003) report that young home-computer users derive modest but significant sociocognitive benefits, but that these effects reverse among the heaviest users.

In a review of the literature on computers, schooling, and educational inequality, Attewell (2001) concluded that the context in which technology is introduced makes a big difference. For example, he notes that research has demonstrated positive effects on test scores of home computer use but *negative* effects of using school computers. Other studies from the 1990s found that low-income and minority students used computers at school more than middle-class and white students, but that their teachers were less qualified and schools used computer labs as a form of baby-sitting. Similarly, Bolt and Crawford (2000) reported that after public schools surged online in the late 1990s, staffing and teacher training lagged far behind, rendering the technologies educationally ineffective. Indeed, only one third of teachers described themselves as well prepared to incorporate computers or the Internet into their lesson plans (cited in Goolsbee and Guryan 2002). The only study to investigate the impact of school-level Internet service (as opposed to computer use in general) found no impact of subsidies for Internet adoption on test scores measured at the school level. The focus on subsidies (rather than adoption by both subsidized and

unsubsidized districts), however, means that the results cannot be generalized (Goolsbee and Guryan 2002).

**Does Technology Reduce Inequality in the Sphere of Consumption?**

Scott-Morton et al. (2001; 2003) reported that consumers who bought automobiles over the Internet received a significant discount, with benefits especially great for African-Americans. Similarly, Waldfogel and Chen (2003) report that Internet shoppers who use comparison sites (especially those with reliability ratings) patronize highly branded sellers less --- a sure sign that they are paying lower prices. Brown and Goolsbee (2002) find effects on insurance prices, but note that when the number of consumers using online price comparison sites reaches critical mass, non-users free ride on their efforts

The long-term effects of such processes on inequality are unclear. On the one hand, if more well educated and higher-income people are more likely to be online (which they are) and more sophisticated in their navigational skills (which they may be), the Internet could increase inequality by elevating the difference between the prices that rich and poor pay for the same goods. On the other hand, price disparities already exist for many goods, so that low-income persons who *do* use the Internet effectively will benefit more than their high-income counterparts. And in markets where many persons compare prices online, costs may decline for everyone.

**Does Technology Enhance Political Influence and Community Engagement?**

There is extensive evidence on the impact of the Internet on political participation and civic engagement based both on surveys and on quasi-experimental studies in which residential communities are wired and then investigated (Ishida and Isbister 2000). Although much of this work is beyond the scope of this chapter, we can summarize major findings succinctly.

First, despite fears to the contrary, Internet use does not lead to passivity or privatism. Internet users tend to consume more information offline than nonusers, and to be more active in other ways as well, and their online activities do not diminish their other efforts (Robinson et al. 2000). Shah et al. (2001) found that informational use of the Internet had a small but significant positive impact on

community participation, whereas recreational uses had no effect. (An influential experimental study found that Internet use led to social withdrawal but only in the short term;a follow-up showed that the negative effects dissipated relatively quickly [Kraut et al. 1998; 2002].) Second, Internet use does not *cause* people to become socially or politically involved. Rather it makes it easier for people who are already engaged in community activities and political affairs to become even more so (Bimber 2003). Third, Internet use simultaneously increases local *and* long-distance communication, serving as a complementary channel (rather than a substitute) to face-to-face interaction (Hampton and Wellman 2000; Katz et al. 2001; Kavanaugh and Patterson 2001). Wellman (2001) refers to this phenomenon as "glocalization."

The big question, about which we know rather little, is whether Internet use exacerbates inequality in political engagement and social participation. High status people are more likely to be on-line, and probably use the Internet to influence the world around them more than others because they were more politically involved *before* they went online. On the other hand, Internet use may have a larger *net* effect on the behavior of socially and politically engaged users with fewer resources, for whom the advantages the Internet affords may be correspondingly more important.[14]

**Effects of Internet Use: Research Agenda**

Scholars and policy makers interested in whether and under what conditions Internet use helps people get ahead stand before a gulf of ignorance, partially concealed by a fog of speculation. Dispelling the fog is essential for policy analysts, for if Internet has no positive effects (or if the effects are positive only for the already privileged), then egalitarian arguments for public investment are weakened. (Not all are, of course: If government insists on interacting with citizens online, and if citizens must have Internet access to fulfill the obligations of citizenship or to get public services to which they are entitled, this in itself would create a compelling rationale for universal service.)

Research on the impact of computer use on earnings can teach us important lessons. First, panel data is essential. Even with panel data, selection effects are difficult to distinguish from genuine impacts;

cross-sectional data in this area defy interpretation. Second, selection effects aside, it is unlikely that Internet use will be associated with positive individual-level economic outcomes in large national samples. The mechanisms that connect skills to rewards are profoundly local, reflecting specific conditions of labor supply and demand and specific task requirements in particular industries. If there are positive effects of Internet use, we will need to disaggregate to find them.

Third, research on inequality online suggests that we are unlikely to find effects of global (and especially binary) measures of Internet access or use. Variation in how extensively people use the Internet, their ability to find the resources they need, and why they choose to go online are substantial and likely to be related to the payoffs users receive.

Fourth, research on Internet effects should routinely address the question of differential returns based on users' educational attainment, income, gender, or race – i.e., the question of whether the Internet's benefits tend to ameliorate or reinforce existing patterns of inequality. In so doing, one should distinguish between two types of inequality-reinforcing mechanisms: those that reflect differences in how, where, to what extent, how skillfully, and for what purposes different kinds of people go online; and those that reflect discrimination, labor-market position, or other factors that alter returns to people whose Internet use is equivalent in quantity and quality.

Fifth, research on the effects of Internet use on consumption and on political and social participation should likewise explore the extent to which Internet use reinforces or counteracts intergroup inequalities. We also need to learn more about the extent to which the movement of government services online is associated with declines in off-line service, and on the effects of such shifts on persons in low-income (and low-Internet-use) communities (see Fountain 2001).

## Social Organization of Technological Inequality

The "Internet" is a protean family of technologies and services that interacting efforts of profit-seeking firms, government agencies and nongovernmental organizations are rapidly reshaping. Patterns of inequality can be understood as the aggregate consequences of individual choice only if those choices are

themselves viewed as functions of decision contexts shaped by political and strategic decisions of state and corporations. Digital inequality reflects not just differences in individual resources, but also the ways in which economic and political factors make such differences matter. Understanding the relationship between economic inequality and inequality of access to information requires research into the predictors of inequality at the level of communities, organizations, local states, and national societies. There is a growing literature on inequality among nation-states (Hargittai 1999; Norris 2001; Kiiski and Phjola 2002; Guillen and Suarez 2002), but only suggestive evidence about factors influencing patterns of inequality over time within the United States and the other advanced industrial societies.

**Government policies and Internet adoption**

The Clinton/Gore administration championed the Internet and used the power of the federal government to encourage its growth. The Internet's rapid diffusion in the U.S. during the late 1990s was almost certainly influenced by a wide range of federal policies: the privatization of the Internet early in the decade; the decision to exempt online sales from federal tax; Commerce Department grants for projects that brought new communication technologies to low-income communities; and the federal "E-rate" policy of subsidizing investments in Internet technology by public schools and libraries. Internet connectivity in U.S. public schools jumped from 3 percent in 1994 to 63 percent in 1999 (U.S. Department of Education 2000), and library connectivity rose to over 90 percent (Schement 2003). Research suggests that (in California at least) schools in low-income and minority communities were most responsive to the subsidies (Goolsbee and Guryan 202).

Such policies influence patterns of inequality in access. Public schools appear to be doing much to democratize access to computers; but they have been less successful in ameliorating inequality in access to the Internet. Just over one third of African-Americans between the ages of 10 and 17 reported using the Internet in school, compared to almost 58 percent of whites in that age range (NTIA 2002*:* 49-51). Youth from high-income families are also considerably more likely to use the Internet at school than are there low-income peers. We have no way of knowing whether these differences reflect differences in

resources among schools with different student-body compositions; differences between schools in their ability to productively employ resources that they have; or variation in access among students within online schools. Authors of one early review (Bikson and Panis 1999: 23) concluded that equalizing Internet resources at school had little effect on inequality in Internet use because students gained skills and experience by having computers available at home. By contrast, the availability of the Internet at public libraries enhances access for less privileged groups: African-Americans and people with low incomes are more likely to use the Internet in libraries than are whites and people with family incomes greater than $50,000 (NTIA 2002: 41).

Government's impact extends through law as well as subsidy. The importance of financial inequality in limiting Internet access depends, for example, on regulatory and legislative decisions that expand definitions of "intellectual property" (and constrict the definition of "fair use") in ways that enable Internet firms to substitute pay-information services for free-information services. The fact that the government issues accessibility standards for electronic and information technology with which all government Web sites have to comply (Access Board 2000) also exemplifies how institutional measures can contribute to the degree to which sites are accessible to users with different needs and resources. Government's own use of the Internet is also consequential: the capacity of different kinds of Americans to gain access to information about government services, for example, will depend upon the extent to which government agencies and political institutions make information available, the form in which they present the information, the strategies they use to promote their sites, and the manner in which they interact with different types of users (Fountain 2001).

Local governments have also invested in the Internet, to a greater extent in Europe than in the U.S. Van Winden (2001) notes that several European cities, including Manchester in the United Kingdom and Rotterdam and the Hague in the Netherlands, viewed new communications technologies as "a catalyst for new social cohesion" and dedicated significant resources to providing citizens with the infrastructure to create virtual communities and to participate more actively in local politics. Van Winden argues that such programs failed to achieve either social integration (subcultural groups tended to interact

online among themselves) or broader political participation (as new opportunities were exploited predominantly by already active and privileged citizens).

**The impact of business strategies**

Corporate strategies, as modified by government regulation and consumer response, also systematically influence individual-level incentives and constraints that produce inequality of access to technology (Neuman, McKnight, & Solomon 1998). The extent to which differences in the quality of hardware, connections, or software shape one's effective access to the full range of information on the Web, for example, is in part a product of how businesses and other organizations design their Web sites, and whether they provide "low-graphics" or "text-only" options for users with less advanced equipment. Companies that produce browers and ISPs responsible for the software used to access the Internet also influence people's ability to navigate the Web.

Institutions also shape access through decisions about investments in network infrastructure. For example, Internet connectivity in rural America was initially limited by weak telecommunications infrastructure investment. As a result, rural areas have had less competition among ISPs, higher rates, and fewer households online (Strover 1999). By contrast, the superior availability of infrastructure in urban areas is responsible for relatively rapid penetration of high-speed Internet access in inner-city public libraries, a development that has increased access for the low-income and minority communities that many such libraries serve (Bertot & McClure 1998).

Content creators can only reach large audiences if online gatekeepers (Web services that categorized links and search facilities to other sites) channel users to them (Hargittai 2000). During the 1990s, entrepreneurs developed comprehensive and strongly branded "portals" (Websites containing search engines, category guides, and shopping and information services) to match users and content. Internet traffic is highly concentrated: 80 percent of "hits" (successful efforts to contact a site) go to just .5 percent of Websites. By 1999, "portal sites" accounted for one in four of the most visited destinations (Waxman 2000a, 2000b). The search engines such sites feature are often biased in their rankings of sites in re-

sponse to user queries (Introna & Nissenbaum 2000). Web destinations that portal sites display prominently or that search engines rank high are likely to monopolize the attention of all but the most sophisticated Internet users. Most Internet searchers "satisfice," trading off comprehensive coverage in order to minimize search costs. An analysis of almost one billion queries on the Altavista search engine revealed that 77 percent of sessions included but one query and 85 percent of users viewed only the first screen of search results (Silverstein et al 1998). If Castells (1996) is right in his prediction that that Internet users will soon divide into "two distinct populations, the interacting and the interacted," then understanding the economic and political economic determinants of this process will be an essential to understanding and explaining digital inequality.

Indeed, many media companies envision a media convergence in which the Internet essentially becomes a means of transmitting movies, recorded music, and television programming --- in effect, cable television on steroids.[15] Insofar as this agenda is realized, the predictors and effects of Internet connectivity are likely to change markedly from what researchers discovered in the late 1990s and early 2000s. For example, if Internet users become more like television viewers, their relatively high levels of social and community engagement may not survive the transition to broadband,

Wilson (2000) has called attention to another dimension of inequality between social and linguistic groups: the availability of suitable content. This, in turn, is related to barriers to entry (especially the skills and time required to mount a Web site and the capital necessary to promote it and keep it current). Relatively little empirical research bears on the availability of culturally and linguistically specific Internet content of different kinds (except to document the dominant position of English as the language of the Web [OECD 1997]), and even less on the impact of availability on Web use by non-English-speaking or other minority communities.

**Institutional effects on Digital Inequality: A Research Agenda**

In effect, the challenge here is to understand measures of inequality in access to and use of technology as the explananda, and institutional arrangements – both government policies and business practices – as the

independent variables. Whereas most of the research proposed in previous sections of this chapter has focused upon individual and household behavior. in this section the goal is to understand the impact of policy regimes and industrial organization (broadly defined) on *patterns* of inequality. The trick is to navigate between the Scylla of quantitative analyses of policy outcomes one-intervention-at-a-time, which are almost certain to demonstrate negligible effects; and the Charybdis of undisciplined case studies, which too often reveal the results for which the author hopes.

We may get some leverage on public-sector policies by exploring variations in Internet use at the state level as a function of differences in state-government subsidies and other policies (and in federal expenditures within states) aimed at encouraging more equal Internet use. A useful first step would be to inventory state-level policies and to identify significant variants thereof.

Cross-national research is useful, as well, although understanding the interaction of policy and business strategy in different nation-states is a daunting challenge probably best undertaken by teams of scholars from different countries. The advantage of cross-national designs is that public policies, technological infrastructures, and industrial organization vary so markedly across national borders, with dramatic consequences for the ways in which people access the Internet (for example, the balance between PCs and hand-held devices, which is often related to investments in cable and telephone infrastructures). Historical factors, like France's early attempt to create a subsidized national teletext system through its postal service, and details of telephone service charges (*e.g.*, whether local calls are cross-subsidized by business and long-distance charges, as in the U.S., or relatively expensive, as in the U.K.) may also be consequential.

With respect to private-sector strategies, perhaps the initial priority is simply to map the terrain and identify those strategic decisions (and interactions among them) that are most likely to influence inequality in access to the Internet in the future. Given the rapidity of change, monitoring the strategies of and relationships among Internet Service Providers, content providers, and other participants in the Internet industry would represent a useful step.

## Conclusion

The "digital divide" paradigm served researchers and policy makers well during the opening years of Internet diffusion. Even though we know relatively little about the net effects of Internet access on educational attainment, labor-market success and life-course outcomes, the fact that public services and government information are increasingly migrating to the Internet makes access an important topic from the standpoint of public policy.Now that more than half of Americans now go online, we should pursue a more differentiated approach to understanding the Internet's implications for social and economic inequality --- one that focuses upon the extent and causes of different returns to Internet use for different kinds of users. In particular, it is crucial to move beyond description and projection to understand the mechanisms, consequences and institutional context of inequality in access to the Internet and use of the services it offers.

This paper sets out the following research agenda:

1. Expand the focus of research from the "digital divide" between "haves" and "have-nots" (or between users and non-users) to the full range of *digital inequality* in equipment, autonomy, skill, support, and scope of use among people who are already online.

2. Compare inequality in access to and use of the Internet for significant purposes to inequality in access to use of other media for the same purposes.

3. Develop and test models of the social processes that engender or ameliorate inequality by mediating the relationship between individuals' social identities and their access to and use of new technologies.

4. Extend such models to the relationship between the use of these technologies and valued individual-level outcomes, and investigate variations in rates of return to technology use for different subgroups within the population.

5. Supplement individual-level research with analysis of institutional factors that shape and modify the relationships between individual characteristics and individual outcomes.

This agenda requires more intensive analyses of existing resources, more surveys of Internet users and non-users to address an expanded menu of topics, and improvements in survey design. Students of digital inequality will also need to expand their methodological armory to include observational designs, analyses of clickstream data, analyses of link patterns among Web sites, ethnographies of use, cross-national comparisons, experimental survey designs, and political-economic research on industrial organization and regulatory issues.

This is a large agenda, but not impossibly so. The digital revolution is the first major technological change that has occurred *after* the emergence of federal social science funding and the expansion of research universities in the 1960s. As such, it represents a challenge to the social sciences (in collaboration with colleagues in computer science and engineering) to demonstrate their ability to understand and anticipate the consequences of technological changes as they are taking place. Properly conducted, such work can serve as an example for social scientists concerned with the effects of biotechnology and other technological revolutions that are sure to come.

Indeed, the research we call for here is one front in what should be a larger effort to understand the causes and impacts of inequality in access to and use of information of many kinds. Information figures crucially in the generation of inequality in advanced industrial societies in myriad ways: it shapes our childrens' ability to succeed in school and compete for access to higher education; its quality determines the returns on our financial investments; it even influences our ability to avoid illness and extend our lives. Currently, research on informational inequality is severely balkanized: educational researchers study the determinants and influence of test scores; a few economists and economic sociologists investigate where people get information about investment opportunities and labor markets; public-health researchers analyze the determinants of knowledge about wellness and the health-care system; and political scientists study sources of political information. We suggest, at the very least, that (1) Information is a centrally important determinant of life chances, inequality in access to and use of information is a systematic source of social inequality, and cumulative patterns of disadvantage in access to different types of information may have cumulative consequences; (2) Scholars working in currently autarchic

research areas that share a focus on the relationship between information and inequality in life-course outcomes may have a lot to learn from one another; and (3) Similar questions and analytic strategies – *e.g.*, a focus on institution ecologies, rather than single sources of information; the study of information-seeking careers, with attention both to changes in information-gathering behavior over the life course and to the implication of such behavior in one domain on later behavior in others; and analyses of variation not simply in knowledge but in returns to investment in strategies of knowledge acquisition -- may be useful across domains. These considerations constitute not the conclusion of this chapter, however, but the introduction to a different chapter, the production of which is a collective project for another day.

References

Abbate J. 1999. *Inventing the Internet.* Cambridge, MA: MIT Press.

Access Board. 2000. Electronic and Information Technology Accessibility Standards. http://www.access-board.gov/sec508/508standards.htm.

Althaus, Scott L, and David Tewksbury. 2000. "Patterns of Internet and Traditional News Media Use in a Networked Community." *Political Communication* 17:21-45.

Alvarez, Anthony Steven. 2003. "Behavioral and Environmental Correlates of Digital Inequality." *IT&Society 1(5): 97-140. http://www.stanford.edu/group/siqss/itandsociety/v01i05/v01i05a06.pdf*

American Management Association. 2001. "2001 AMA Survey: Workplace Monitoring and Surveillance: Summary of Key Findings." http://www.amanet.org/research/summ.htm. Last accessed August 8, 2003.

Anderson, Ben and K. Tracey. 2001. "Digital Living: The Impact (or Otherwise) of the Internet on Everyday Life." *American Behavioral Scientist* 45: 456-475.

Anderson R. H., T.K. Bikson, S.A. Law, and B.M. Mitchell. 1995. *Universal Access to E-Mail - Feasibility and Societal Implications*. Santa Monica, CA: RAND.

Attewell, Paul. 2001. "The First and Second Digital Divides." *Sociology of Education* 74:252-259.

Attewell, Paul and Juan Battle. 1999. "Home computers and School performance." *The Information Society* 15: 1-10.

Attewell, Paul, Belkis Suzao-Garcia, and Juan Battle. 2003. "Computers and Young Children: Social Benefit or Social Problem?" *Social Forces* 82: 275-94.

Autor, David H., Lawrence F. Katz and Alan B. Krueger. 1998. "Computing Inequality: Have Computers Changed the Labor Market?" *The Quarterly Journal of Ecnomics* 113:1169-213.

Barley, Stephen R. 1990. "The Alignment of Technology and Structure Through Roles and Networks," *Administrative Science Quarterly* 35: 61-103.

Benton Foundation 1998. *Losing Ground Bit by Bit: Low-Income Communities in the Information Age.* Washington DC: Benton Foundation and National Urban League.

Bernstein, Basil. 1977. *Class, Codes and Control,* vol. 3. London: Routledge & Kegan Paul.

Bertot JC, McClure CR. 1998. *The 1998 National Survey of U.S. Public Library Outlet Internet Connectivity: Final Report*. Washington: American Library Association and National Commission on Libraries and Information Science.

Bikson, Tora K., and Constantijn W. A. Panis. 1999. *Citizens, Computers, and Connectivity: A Review of Trends*. Santa Monica, California: Rand Corporation. http://www.rand.org/publications/MR/-MR1109/. Last accessed Aug. 26, 2003.

Bimber, Bruce. 2000. The Gender Gap on the Internet. *Social Science Quarterly*. 81: 868-876.

Bimber, Bruce. 2003. *Information and American Democracy: Technology in the Evolution of Politcial Power*. New York: Cambridge University Press.

Blau, Peter M. 1977. *Inequality and Heterogeneity: A Primitive Theory of Social Structure*. New York: Free Press.

Blau, Peter M. and Otis Dudley Duncan. 1967. *The American Occupational Structure*. New York: Wiley.

Bolt D and R. Crawford. 2000. *Digital Divide: Computers and Our Children's Future*. NY: TV Books.

Bonfadelli, Heinz. 2002. "The Internet and Knowledge Gaps: A Theoretical and Empirical Investigation." *European Journal of Communication* 17: 65-84.

Bourdieu, Pierre. 1984. *Distinction*. Cambridge, Massachusetts: Harvard University Press.

Bourdieu, Pierre and Jean-Claude Passeron. 1977. *Reproduction in Education, Society, and Culture*. Beverly Hills: Sage Publications.

Braverman, Harry. 1974. *Labor and Monopoly Capital.* New York: Monthly Review Press.

Bromley, Rebekah V. and Dorothy Bowles. 1995. "Impact of Internet on Use of Traditional News Media." *Newspaper Research Journal* 16.

Brint, Steven. 1984. "`New Class' and Cumulative Trend Explanations of Liberal Political Attitudes of Professionals." *American Journal of Sociology* 90: 30-71.

Brint, Steven G. 1998. *Schools and Societies*. Pine Forge Press.

Brown, Jeffrey R. and Austan Goolsbee. "Does the Internet Make Markets More Competitive? Evidence from the Life Insurance Industry," *Journal of Political Economy* 110: 481-507.

Bucy, Erik P. 2000. "Social Access to the Internet." *Press/Politics* 5: 50-61.

Card, David and John E. DiNardo. 2002. "Skill-Biased Technological Change and Rising Wage Inequality: Some Problems and Puzzles." *Journal of Labor Economics* 20:733-783

Castells, Manuel. 1996. *The Rise of the Network Society. Vol. 1 of The Information Age: Economy, Society and Culture*. Boston: Blackwell.

Castells, Manuel. 2001. *Internet Galaxy: Reflections on the Internet, Business and Society*. New York: Oxford University Press.

Chang, Mariko Lin. 2003. "With a Little Help from my Friends (and my Financial Planner): How Socioeconomic Status and Race Influence the Search for Financial Information." Paper presented at the session on Culture and Economy at the 2003 annual meeting of the American Sociological Association in Atlanta, Georgia.

Chennells, Lucy and John Van Reenen. 1997. "Technical Change and Earnings in British Establishments." *Economica* 64:587-604.

Collins, Randall. 1979. *The Credential Society: An Historical Sociology of Education*. NY: Academic Press.

Compaine, B. 2000. "Re-Examining the Digital Divide." Paper Presented at the 28th Telecommunications Policy Research Conference in Alexandria, VA. September 23-25.

Compaigne, Benjamin M. 2001. "Information Gaps: Myth or Reality? Pp. 105-18 in *The Digital Divide: Facing a Crisis or Creating a Myth*, ed. Benjamin M. Compaigne. Cambridge, Massachusetts: MIT Press.

Cummings, Jonathon N., Robert Kraut. 2000. "Domesticating Computers and the Internet." Manuscript, Carnegie Mellon University.

Davison, Elizabeth and Shelia R. Cotton. 2003. "Connection Discrepancies: Unmasking Further Layers of the Digital Divide." *First Monday* 8, 3. http://firstmonday.org/issues/issue8_3/davison-/index.html. Last accessed Sept. 1, 2003.

DeHaan, Jos. 2003. "IT and Social Inequality in the Netherlands." *IT&Society* 1: 27-45. http://www.stanford.edu/group/siqss/itandsociety/v01i04/v01i04a04.pdf

DiMaggio, Paul. 2001. "Social Stratification, Life-Style, Social Cognition, and Social Participation." Pp. 542-52 in *Social Stratification in Sociological Perspective*, 2nd edition, edited by David Grusky. Boulder, Colorado: Westview Press.

DiMaggio, Paul and Eszter Hargittai. 2002. "From the Digital Divide to Digital Inequality." Presentation at the annual meetings of the American Sociological Association in Chicago, August 2001.

DiNardo, John E and Jorn-Steffen Pischke. 1997. "The Returns to Computer Use Revisited: Have Pencils Changed the Wage Structure Too?" *The Quarterly Journal of Economics* 20:291-303.

Entorf, Horst and Francis Kramarz. 1997. "Does Unmeasured Ability Explain the Higher Wages of New Technology Workers?" *European Economic Review* 41:1489-1509.

Entorf, Horst, Michel Gollac, and Francis Kramarz. 1999. "New Technologies, Wages, and Worker .Selection." *Journal of Labor Economics* 17: 464-491.

Ettema, James S., James W. Brown and Russell V. Luepker. 1983. "Knowledge Gap Effects in a Health Information Campaign." *Public Opinion Quarterly* 47: 516-27.

Fernandez, Roberto M. 2001. "Skill-Based Technological Change And Wage Inequality: Evidence Form A Plant Retooling." *American Journal of Sociology* 107: 273-320.

Fischer, Claude S. 1992. *America Calling: A Social History of the Telephone to 1940*. Berkeley: University of California Press.

Fountain, Jane. 2001. *The Virtual State: The Politics of Digital Government.* Washington, D.C.: The Brookings Institution.

Freeman, Richard B. 2002. "The Labour Market in the New Information Economy." *Oxford Review of Economic Policy* 18:288-305.

Gallie, Duncan. 1996. "New Technology And The Class Structure: The Blue-Collar/White-Collar Divide Revisited." *British Journal of Sociology* 47:447-473.

Galor, Oded and Daniel Tsiddon. 1997. "Technological Progress, Mobility and Economic Growth." *American Economic Review* 87: 363-82.

Gaziano, Cecilie. 1997. "Forecast 2000: Widening Knowledge Gaps." *Journalism and Mass Communications quarterly* 74: 237-64.

Goldfarb, Avi. 2002. "Analyzing Website Choice Using Clickstream Data." Pp. 209-230 in *Advances in Applied Microeconomics v. 11: The Economics of the Internet and E-Cmmerce*, ed. Michael R. Baye. London: Elsevier Science Ltd.

Goolsbee, Austan and Jonathan Guryan. 2002. "The Impact of Internet Subsidies on Public Schools." Working Paper. Cambridge, Massachusetts: National Bureau of Economic Research.

Goolsbee, Austan and Peter J. Klenow. 2002. "Evidence on Learning and Network Externalities in the Diffusion of Home Computers." *Journal of Law and Economics* 45:317-344. http://gsbwww.uchicago.edu/fac/austan.goolsbee/research/computer.pdf. Last accessed Aug. 29, 2003.

Goss, Ernest P. and Joseph M. Phillips. 2002. "How Information Technology Affects Wages: Evidence Using Internet Usage As a Proxy for IT Skills." Journal of Labor Research 23 :463-474.

Gouldner, Alvin. 1979. *The Future of Intellectuals and the Rise of the New Class*. New York: Seabury Press.

Guillen, Mauro and Sandra Suarez. 2002. "The Political Economy of Internet Development: A Cross-National Time-Series Analysis." Working Paper. Philadelphia: The Wharton School, University of Pennsylvania.

Hall, Peter A. 1993. "Policy Paradigms, Social Learning and the State: The Case of Economic Policy-Making in Britain." *Comparative Politics* 27:275-96.

Heil, Alexander. 2002. *The Information Society in the United Kingdom and Germany: Chances, Risks and Challenges*. Master Thesis, University of Leipzig, British Studies. http://www.falling-through-the-net.de/analysis.pdf. Last accessed Sept. 1, 2003.

Hampton, Keith and Barry Wellman B. 2000. "Examining Community in the Digital Neighborhood: Early Results from Canada's Wired Suburb." Pp. 475-92 in *Digital Cities: Experiences, Tech-*

*nologies and Future Perspectives*, edited by T. Ishida and K. Isbister. Heidelberg, Germany: Springer-Verlag.

Hargittai, Eszter. 1999. "Weaving the Western Web: Explaining Differences in Internet Connectivity among OECD Countries." *Telecommunications Policy* 23: 701-18.

Hargittai, Eszter. 2000. "Open Portals or Closed Gates?: Channeling Content on the World Wide Web." *Poetics* 27: 233-53.

Hargittai, Eszter. 2002. "Second Level Digital Divide: Differences in People's Online Skills." *First Monday* 7, 4. http://www.firstmonday.dk/issues/issue7_4/hargittai/. Last accessed Sept. 1, 2003.

Hargittai, Eszter. 2003a. *How Wide a Web: Inequalities in Access to Information Online.* Ph.D. Dissertation, Sociology Department, Princeton University.

Hargittai, Eszter. 2003b. "Serving Citizens Needs: Minimizing Online Hurdlges to Accessing Government Information." *IT & Society* 1.

Hoffman, Donna L., Thomas P. Novak. 1998. Bridging the Racial Divide on the Internet. *Science*, April 17.

Hoffman, Donna L., Thomas P. Novak. 1999. Examining the Relationship of Race to Internet Access and Usage Over Time. Working Paper. Nashville, Tenn: eLab Manuscripts. Vanderbilt University. *The Digital Divide: Facing a Crisis or Creating a Myth?*, edited by Benjamin M. Compaine. Cambridge: Massachusetts: MIT Press.

Hoffman, Donna L., Thomas P. Novak and Ann E. Schlosser. 2001. "The Evolution of the Digital Divide: Examining the Relationship of Race to Internet Access and Usage over Time." Pp. 47-98 in *The Digital Divide: Facing a Crisis or Creating a Myth*, ed. Benjamin M. Compaigne. Cambridge, Massachusetts: MIT Press.

Horrigan, John. 2000a. *New Internet Users: What They do Online, What They Don't, and Implications for the `Net's' Future.* Pew Internet and American Life Project.

Horrigan, John. 2000b. *The Holidays Online: E-Mails and E-Greetings Outpace E-Commerce*. Washington, D.C.: Pew Internet and American Life Project.

Horrigan, John. 2003. Pew Internet Project Data Memo on High-Speed Internet adoption at home as of March 2003. May 2003. Washington, D.C.: Pew Internet and American Life Project.

Horrigan, John and Lee Rainey. 2002. "The Broadband Difference: How Online Americans' Behavior Changes with High-Speed Internet Connections at Home." Washington, D.C. : Pew Internet and American Life Project. http://www.pewinternet.org/reports/pdfs/PIP_Broadband_Report.pdf. Last accessed August 26, 2003.

Howard, Philip, Lee Rainie, and S. Jones. 2001. "Days and Nights on the Internet: The Impact of a Diffusing Technology." *American Behavioral Scientist* 45: 383-404.

Hughes, Karen D. and Graham S. Lowe. 2000. "Surveying the 'Post-Industrial' Landscape: Information Technologies and Labour Market Polarization in Canada." *The Canadian Review of Sociology and Anthropology* 37:29-53.

Hymes, Dell. 1974. *Foundations in Sociolinguistics: An Ethnographic Approach*. Philadelphia: University of Pennsylvania Press.

IntelliQuest. 1999. Intelliquest study shows 83 million U.S. Internet users and 56 million online shoppers. Press release, April 19. http://www.intelliquest.com/press/release78.asp.

Introna Luc and Helen Nissenbaum 2000. "Shaping the Web: Why The Politics Of Search Engines Matters." *The Information Society* 16.

Ishida, T. and K. Isbister, eds. 2000. *Digital Cities: Experiences, Technologies and Future Perspectives*.. Heidelberg, Germany: Springer-Verlag.

Karabel, Jerome and Alexander Astin. 1975. "Social Class, Academic Ability, and College `Quality.'" *Social Forces* 53: 381-98.

Katz, James E. and P. Aspden. 1997. "Motives, Hurdles and Dropouts." *Communications of the ACM* 40: 97-102.

Katz, James E. , Ronald Rice and Philip Aspden. 2001. "The Internet, 1995-2000: Access, Civic Inolvement and Social Interaction." *American Behavioral Scientist* 45: 405-19.

Kavanaugh, A.L. and S.J. Patterson, S.J. 2001. "The Impact of Community Computer Networks aon Social Capital and Community Involvement." *American Behavioral Scientist* 45:496-509.

Kelley, Maryellen R. 1990. "New Process Technology, Job Design, And Work Organization: A Contingency Model." *American Sociological Review* 55: 191-208

Kiesler, Sara, Bozena Adaniuk, Vicki Lundmark, Robert Kraut. 2001. "Troubles with the Internet: The Dynamics of Help at Home." *Human Computer Interaction*.

Kiiski, S. and M. Phjola. 2002. "Cross-Country Diffusion of the Internet." *Information Economics and Policy* 14: 297-310.

Kim, Y. and Joo-Young Jung. 2002. "Digital Divide In 90% Access: Multi-Dimensional Examination Of Adolescents' Internet Connectedness In Seoul, Singapore And Taipei." Pp. 219-47 in *A Study on the Digital Divide of the Youth*, ed. J. Hwang, Yu, J., and Lee, J. Seoul: Korea Institute for Youth Development.

Kling, Rob. 1998. "Technological and Social Access on Computing, Information and Communication Technologies." White Paper for Presidential Advisory Committee on High-Performance Computing and Communications, Information Technology, and the Next Generation Internet.

Kohn, Melvin L. and Carmi Schooler. 1982. "Job Conditions and Personality: A Longitudinal Assessment of Their Reciprocal Effects." *American Journal of Sociology* 87: 1257-86.

Kraut, Robert, M. Patterson, V. Lundmark, Sara Kiesler, T. Mukophadhyay, and W. Scherlis. 1998. "Internet Paradox: A Social Technology That Reduces Social Involvement And Psychological Well-Being?" *American Psychologist 53: 1011-31*.

Kraut, Robert, Sara Kiesler, B. Boneva., J. Cummings, V. Helgeson and A. Crawford. 2002. "Internet Paradox Revisited." *Journal of Social Issues* 58: 49-74.

Krueger, Alan B. 1993. "How Computers Have Changed The Wage Structure: Evidence From Micro Data." *Quarterly Journal of Economics* 108: 33-60.

Lawrence, S. and C.L.Giles. 1999. "Accessibility Of Information." On The Web. *Nature*. 400, 107-109.

Leigh, Andrew and Robert Atkinson. 2001. ”Clear Thinking on the Digital Divide.” Progressive Policy Institute, published online as pdf file, June 2001.

Leighton, Wayne A. 2001. “Broadband Deployment and the Digital Divide: A Primer.” *Policy Analysis* #410 (August 7). Washington: Cato Institute. http://www.cato.org/pubs/pas/pa410.pdf, last accessed Aug. 26, 2003.

Lenhart, Amanda. 2000. *Who’s Not on Line? 57 Percent of those Without Internet Access Say they do not Plan to Log On.* Washington, D.C.: Pew Internet and American Life Project.

Lenhart, Amanda, John Horrigan, Lee Rainie, Katherine Allen, Angie Boyce, Mary Madden and Erin O’Grady. 2003. “The Ever-Shifting Internet Population: A New Look at Internet ccess and the Digital Divide.” Washington, D.C.: Pew Internet and American Life Project.

Lessig, Lawrence 1999. *Code and Other Laws of Cyberspace*. New York: Basic Books.

Lewin, Clare and Myron Orleans. 2000. “The Class Situation Of Information Specialists: A Case Analysis.” *Sociological Research Online* 5: http://www/socresonline/org.uk/5/3/lewin.html.

Lin, Nan. 2000. *Social Capital.* New York: Cambridge University Press.

Losh, Susan Carol. 2003. “Gender and Eduational Digital Chasms in Computer and Interent Access and Use Over Time: 1983-2000.” *IT&Society* 1: 73-85. http://www.stanford.edu/group/siqss/itandsociety/v01i04/v01i04a06.pdf

Marsden, Peter V. 1987. "Core discussion networks of Americans." *American Sociological Review* 52:122-131.

Martin, Steven P. 2003. “Is the Digital Divide Really Closing? A Critique of Inequality Measurement in *A Nation Online*.” *IT& Society* 1, 4. http:www.ItandSocieyt.org. Last accessed June 12, 2003.

Marx, Karl. 1887 [1867]. *Capital: A Critical Analysis of Capitalist Production*. Translated by Samuel Moore and Edward Aveling. London: Sonnenschein, Lowrey.

Mossberger, Karen, Caroline J. Tolbert, and Mary Stansbury. 2003. *Virtual Inequality: Beyond the Digital Divide.* Washington, D.C.: Georgetown University Press.

Mueller, Milton L. and Jorge Reina Schement. 2001. "Universal Service from the Bottom Up: A Study of Telephone Penetration in Camden, New Jersey." Pp. 119-46 in *The Digital Divide: Facing a Crisis or Creating a Myth?,* edited by Benjamin M. Compaine. Cambridge: Massachusetts: MIT Press.

McLaren, Jennifer and Gianni Zappalà. 2002. "The 'Digital Divide' Among Financially Disadvantaged Families in Australia." *First Monday* 7, 11. http://firstmonday.org/issues/-issue7_11/mclaren/index.html. Last accessed Sept. 1, 2003.

Nagarajan, A. , J.L. Bander, and C.C. White. 2000. "Trucking." In *U.S. Industry in 2000: Studies in Competitive Performance*, ed. Board on Science, Technology and Economic Policy, National Research Council. Washington, D.C.: National Academy Press.

Neuman, W. Russell, S.R. O'Donnell SR, and S.M. Schneider. 1996. "The Web's Next Wave: A Field Study Of Internet Diffusion And Use Patterns." Manuscript, MIT Media Laboratory.

Neuman, W. Russell, Lee McKnight, and Richard Jay Solomon. 1998. *The Gordian Knot: Political Gridlock on the Information Highway.* Cambridge, Massachusetts: MIT Press.

NTIA (National Telecommunications and Information Administration). 1995. *Falling Through the Net: A Survey of the "Have Nots" in Rural and Urban America*. July. Washington, D.C.: U.S. Department of Commerce.

NTIA 1998. *Falling Through the Net II: New Data on the Digital Divide*. July. Washington, D.C.: U.S. Department of Commerce.

NTIA 1999. *Falling Through the Net: Defining the Digital Divide*. November. Washington, D.C.: U.S. Department of Commerce.

NTIA 2000. *Falling Through the Net: Toward Digital Inclusion*. October. Washington, D.C.: U.S. Department of Commerce.

NTIA 2002. *A Nation Online: How Americans Are Expanding their Use of the Internet.* February. Washington, D.C.: U.S. Department of Commerce.

Neuman W. Russell, L.W. McKnight and R.J. Solomon. 1998 *The Gordian Knot: Political Gridlock on the Information Highway*. Cambridge: MIT Press.

Neuman, W. Russell, S.R. O'Donnell and S.M. Schneider. 1996. "The Web's Next Wave: A Field Study of Internet Diffusion and Use Patterns." Manuscript. Cambridge, Massachusetts: M.I.T. Media Lab.

Norris, Pippa. 2001. *Digital Divide? Civic Engagement, Information Poverty and the Internet in Democratic Societies*. NY: Cambridge Univ. Press.

OECD (Organization for Economic Cooperation and Development) 1997. Webcasting And Convergence: Policy Implications. Paris: OECD. (http://www. oecd.org/ dsti/sti/it/ cm/prod/ e_97-221.htm)

Olien, Clarice, George Donohue, and Phillip Tichenor. 1983. "Structure, Communication and Social Power: Evolution of the Knowledge Gap Hypothesis." Pp. 455-61 in *Mass Communication Review Yearbook*, edited by E. Wartella, D.C. Whitney, and S. Windahl. Beverly Hills, California: Sage.

O'Mahony, Siobhan and Steven R. Barley. 1999. "Do Digital Telecommunications Affect Work And Organization? The State Of Our Knowledge." *Research in Organizational Behavior* 21: 125-61.

Ono, Hiroshi and Madeline Zavodny. 2003. "Gender and the Internet." *Social Science Quarterly* 84: 111-21.

Pandey, Sanjay K., John J. Hart, and Sheela Tiwary. 2002. "Women's Health and the Internet: Understanding Emerging Trends and Implications." *Social Science & Medicine* 56:179-91.

Pew Center for the People and the Press. 1995. *Technology in the American household*. Washington, D.C. http://www.people-press.org/tech.htm.

Pew Internet and American Life Project. 2000. *Tracking Online Life: How Women Use the Internet to Cultivate Relationships with Family and Friends*. Washington, D.C.

Robinson, John P., Meyer Kestnbaum, Alan Neustadtl, and Anthony Alvarez. 2000. "Mass Media Use and Social Life among Internet Users." *Social Science Computer Review* 18: 490-501.

Schement, Jorge Reina and Scott C. Forbes. 1999. "Approaching the Net: Toward Global Principles of Universal Service." http:/www.benton.org/policy/schement/ptc99/ home.html, last accessed Nov. 16, 2001.

Schement, Jorge Reina. 2003. "Measuring What Jefferson Knew and DeTocqueville Saw: Libraries as Bridges across the Digital Divide." *IT&Society* 1, 11pp.

Scott-Morton, Fiona, Florian Zettelmeyer and Jorge Silva-Risso. 2001. "Internet Car Retailing." *Journal of Industrial Economics* 49: 501-19.

Scott-Morton, Fiona, Florian Zettelmeyer and Jorge Silva-Risso. 2003. "Consumer Information and Discrimination: Does the Internet Affect the Pricing of New Cars to Women and Minorities." *Quantitative Marketing Economics* 1: 65-92.

Shah, Dhavan V., Jack M. McLeod and So-Hyang Yoon. 2001. "Communication, Context and Community: An Exploration of Print, Broadcast and Internet Influences." 28: 264-506.

Silverstein C, Henzinger M, Marais H, Moricz M. 1998. "Analysis of a very large AltaVista query log." *SRC Technical Note* 1998-014. October 26.

Spenner, Kenneth. 1983. "Deciphering Prometheus: Temporal Change In The Skill Level Of Work." *American Sociological Review* 48: 824-37.

Spooner, Tom, Lee Rainey. 2000. *African-Americans and the Internet.* Washington, D.C.: Pew Internet and American Life Project.

Stempel III, Guido H., Thomas Hargrove, and Joseph P. Bernt. 2000. "Relation of Growth of Use of the Internet to Changes in Media Use from 1995 to 1999." *Journalism and Mass Communication Quarterly* 77:71-79.

Strover, S. 1999. *Rural Internet Connectivity*. Columbia, MO: Rural Policy Research Institute.

Tichenor, Phillip, George Donohue, and Clarice Olien. 1970. "Mass Media Flow and Differential Growth of Knowledge." *Public Opinion Quarterly* 34: 159-70.

U.S. Dept. of Education. 2000. *Internet access in U.S. public schools and classrooms: 1994-1999. Stats in Brief*. National Center for Educational Statistics. February.

Van Winden, Willem. 2001. "The End of Social Exclusion? On Information Technology Policy as a Key to Social Inclusion in Large European Cities." *Regional Studies* 35:861-877.

Veblen, Thorstein, 1983 [1921]. *Engineers and the Price System.* New Brunswick, N.J.: Transaction Books.

Verba, Sidney, Kay Schlozman, and Henry E. Brady. 1995. *Voice and Equality: Civic Voluntarism in American Politics*. Cambridge, Massachusetts: Harvard University Press.

Viswanath, Kasisomayajula and John Finnegan. 1996. "The Knowledge Gap Hypothesis: Twenty-Five Years Later." Pp. 187-227 in *Communication Yearbook* (vol. 19), edited by Brant R. Burleson. Thousand Oaks, California: Sage Publications.

Viswanath, Kasisomayajula, Gerald M. Kosicki, Eric S. Fredin, and Eunkyung Park. 2000. "Local Community Ties, Community-Boundedness, and Local Public Affairs Knowledge Gaps." *Communication Research* 27: 27-50.

Waldfogel, Joel. 2002. "Consumer Substitution among Media." Working Paper, FCC Media Ownership Working Group, September. http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-226838A8.pdf. Last accessed August 29, 2003.

Waldfogel, Joel and Lu Chen. 2003. "Does Information Undermine Brand? Information Intermediary Use and Preference for Branded Web Retailers." Working Paper, Wharton School, University of Pennsylvania. http://bpp.wharton.upenn.edu/waldfogj/pdfs/Infoint.pdf/ Last accessed Aug. 29, 2003.

Waxman, J. 2000a. *The Old 80/20 Rule Take One on the Jaw. Internet Trends Report 1999 Review*. San Francisco: Alexa Research.

Waxman, J. 2000b. *Leading the Pack... Internet Trends Report 1999 Review*. San Francisco: Alexa Research.

Weber, Max. 1978 [1956]. "The Distribution Of Power Within The Political Community: Class, Status And Party." Pp. 926-40 in *Economy and Society*, ed. Guenther Roth and Claus Wittich. Berkeley: University of California Press.

Wellman, B. 2001. "Physical Place and Cyber Place: The Rise of Personalized Networking." *International Journal of Urban and Regional Research* 25:227-252.

Wilson Ernest J. 2000. *Closing the Digital Divide: An Initial Review. Briefing the President.* Washington: The Internet Policy Institute. May.http://www.internetpolicy.org/briefing/ErnestWilson0700.html.

## Endnotes

1 There may be a case for government action to increase equality in *returns to* Internet use; and if such programs succeeded, the case for action to increase equality of access would be strengthened. Even if Internet use does not help people get ahead economically, the case for government intervention would still be very strong if access to the Internet were to become necessary for access to government services and to a minimal level of social and political participation.

[2] Our focus throughout this paper is on the United States, although we believe the general framework is applicable to other economically advanced industrial societies.

3 Current Population Survey estimates tend to be more conservative than those from other studies. For example, a November/December 2000 survey by the Pew Internet and American Life project found 58 percent of a national sample online (Horrigan 2000b: 7).

[4] The odds ratio, $r_{jk}$, equals $(p_j/[1-p_j])/(p_k/[1-p_k])$, where $p_j$ is the probability that the more advantaged group has access and $p_k$ is the probability that the less advantaged group has access.

[5] These figures were produced by this paper's second author using CPS data. Comparable graphs for region, metropolitan residence, gender, and Hispanic ethnicity are available at *http://www.eszter.com/netuse.html.* Data for 1994 are on the presence of modems in the household. Data for subsequent years are on use of the Internet for any purpose.

[6] Unfortunately it is difficult to interpret these results with much confidence. The authors of the U.S. study chose a method (linear as opposed to logistic regression) that would tend to lead coefficients to become larger (other things equal) as the Internet's penetration increased. Te author of the European study describes her method as linear (OLS) regression in the text but as logistic regression in the notes to the table reporting results, complicating interpretation (Norris 2001: 86, 88).

[7] This line of reasoning must make two assumptions, for both of which there is much empirical supports: First, the parameters with respect to which advantage is accorded must be only moderately correlated with one another (Blau 1977); and, second, personal relationships must be characterized by bias towards homophily (i.e., people must tend to have friends who are similar to themselves) (Marsden 1987).

[8] The report states that 58 percent of adults are Internet users and that 17 percent of nonusers have been users in the past. We derive the 7 percent figure by multiplying the proportion of adults who are nonusers (1-.58) by .17.

[9] The text of the health item was "In the past year…have you looked for information about a health concern or medical problem? If Yes please tell me if you tried to find such health information from…[articles in a daily newspaper; articles in

a general-interest magazine; special health or medical magazine or newsletter; a doctor, nurse or other medical professional; friends or relatives; radio or television programs; the Internet or World Wide Web]." The text for the political item was "In the past two years…have you looked for information about the views or background of a candidate for political office? If YES please tell me if you tried to find such political information from… [articles in a daily newspaper; articles in general news magazines like TIME, NEWSWEEK, or U.S. News; special magazine or newsletter with particular policy interest or perspective; radio or television programs; friends or relatives; campaign materials from campaign worker or candidate; the Internet or World Wide Web]." The text for the jobs item was: "In the past year…have you searched for information about a new job or explored career opportunities? Please tell me how many times you tried to find such information? [Classified ads in a daily newspaper; classified ads in an industry or professional publication; a fellow worker or human resources staff member at your workplace – that is, where you were working when you were searching; business or work contacts outside your workplace – that is, outside where you were then working; friends outside of work or relatives; any job placement or career counseling service; radio or television program; information posted on the Internet]." (The job responses were binarized as "yes" or "no.") Note that respondents were asked these questions *before* being asked the series of items about their use of the Internet, so that they were *not* primed to think about the latter.

[10] Some policy analysts have argued that once most members of a society are able to log on to the Internet, the "digital divide" will have been overcome and equality of access to the benefits of the Internet, at least for those who want them, will have been achieved. Drawing on the history of telephone access, Compaine (2000) argues against legislation to ensure universal access because, he maintains, the combination of market forces and government programs currently in place are achieving that goal already. We question whether the telephone is the right analogy. For one thing, the view of telephone access as a binary good – a good for which the critical distinction is simply whether one has it or not – is only appropriate to the last quarter of the 20th century. In the early and middle years of telephony, service varied in quality, some Americans connected through party lines (and were thus unable to use the technology for confidential communication) whereas others had individual connections, and long-distance service rates were discriminatory (Fischer 1992). In the first part of the 21st century, the rise of cell phones, palm pilots, and other devices that blur the distinction between telephones and computers are re-differentiating telephone access. By the same token, the ability to log on to the Internet differs from the ability to pick up a receiver and find a dial tone in that the range of uses to which one can put the Internet, and the extent to which many of these uses depend on the quality of connections and equipment, user know-how, and social support, are far greater than was the case for the telephone even a decade ago.

[11] The precise nature of the hierarchy varied from country to country. For example, in the U.K., the contrast between the elite universities and the newer "red brick" universities was particularly striking. In the U.S., distinctions were graduated, with elite public research universities rivaling elite privates, but with much growth channeled to less selective public institutions, especially two-year colleges.

[12] Horrigan and Rainey (2002) note that causality is probably reciprocal in that investing in broadband is most attractive to users who use the Internet for a diverse set of purposes, a supposition strengthened by a subsequent report (Horrigan 2003) on users who plan to switch to broadband. Although Davison and Cotton (2003) do not explore the possibility, their findings suggest that broadband adopters may constitute two groups, one business-oriented and one driven by recreational enthusiasms.

[13] Card and DiNardo's critique of the Skill-Biased Technological Change (SBTC) Hypothesis rests in part on comparison of changes in intergroup inequality among groups with varying degrees of technology use. They note that the racial wage gap declined sharply during the 1970s and remained stable during the 1980s while overall earnings inequality was rising, even though the SBTC hypothesis would predict that a group that (like African-Americans) was less likely to use computers at work would see its relative position decline substantially during this period. They also contend that the SBTC hypothesis cannot explain "the fall in the relative wages of younger versus older workers, the fall in the relative wages of computer science and engineering graduates, the greater widening of wage inequality among FTFY (full-time, full-year employment) men than among broader groups of workers, and the failure of industry wage differences to expand over the 1980s" (772).

[14] Shah et al. (2001) report that the positive effects of Internet use on community engagement are stronger for young users, for whom the medium is a central part of life, a difference that would tend to increase equality of participation.

[15] On October 4, 2002, CBS Marketwatch (a financial news subscription service) ran an item headed "AOL takes new cue from cable TV." AOL, the reader may recall, purchased media conglomerate Time Warner during the Internet stock boom, but synergy eluded its management, AOL lost subscribers, and the share price of the merged company (AOL Time Warner) fell precipitously. In fall 2002, AOL CEO Jonathan Miller announced a new strategy. AOL, he promised, "will offer a regular schedule of day-parted programming" appealing to subscriber interests, with more than 40 "shows" on such topics as finance, health, and education. According to Marketwatch, Miller also promised "more entertainment programming, and more and better live chats…" In other words, having failed to commercialize successfully the Internet as it developed before 2002, AOL's business strategy would be to turn the Internet into cable television.