The Disappearance of Technology: Toward an Ecological Model of Literacy

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Diverse voices have outlined the advantages or disadvantages of technology as they have emerged within classrooms, businesses, communities, and families. Enthusiasts vaunt technological changes, which they contend can effect a more equitable distribution of power. They invoke issues such as empowerment, equality, access, speed, efficiency, liberation, and the development of a global community in support of a pro-technology agenda. As an example, Rheingold's (1993) account of the growth of electronic communication in the Bay Area is framed in terms such as grassroots groupminds and new electronic villages, terms that call forth the potential of new technologies to support a renewal of community. Going further, some proponents promote a form of technological determinism in which new tools or media alone are seen as bringing about a better world.

More cautious observers warn that technologies can be used to reinscribe existing inequitable power relations. They see technology implicated in the loss of jobs, and poor working conditions (see Mikulecky & Kirkley, chap. 18, this volume), surveillance, and regimentation, and caution us about censorship and unequal access. They note that even well-intentioned tools can be used to forward an antidemocratic agenda and that some new technologies support abuses by their very design. Ellul (1980) sees the overall process of technicizing society as "the end of man [humanity]." Technology, he says, "disintegrates and

tends to eliminate bit by bit anything that is not technicizable" (p. 203). The result goes far beyond the subordination of humanity to technology.

Thus, we are often faced with a choice between a typically positive, technological determinism and a more negative, social determinism (Bromley, 1997; Bruce, 1993). Rather than conceptualizing the debate via these mutually exclusive and equally deterministic structures, we examine how prevailing ideologies construct the meaning of technologies in different situations. In fact, when technology is used to accomplish specific goals, for certain individuals, in a particular setting, it can be used to liberate or oppress. That is why situated studies of how literacy technologies are used in classrooms, workplaces, or homes and reveal more about these issues than do analyses of technologies or social relations alone (Bowker, Star, Turner, & Gasser, 1997).

We tend to think of technology as a set of tools to perform a specific function. These tools are often portrayed as mechanistic, exterior, autonomous, and concrete devices that accomplish tasks and create products. We do not generally think of them as intimately entwined with social and biological lives. But literacy technologies, such as pen and paper, index cards, computer databases, word processors, networks, e-mail, and hypertext, are also ideological tools; they are designed, accessed, interpreted, and used to further purposes that embody social values. More than mechanistic, they are organic, because they merge with our social, physical, and psychological beings. Thus, we need to look more closely at how technologies are realized in given settings. We may find that technological tools can be so embedded in the living process that their status as technologies disappears.

The Disappearance of Technology

As technologies embed themselves in everyday discourse and activity, a curious thing happens. The more we look, the more they slip into the background. Despite our attention, we lose sight of the way they give shape to our daily lives. This disappearance effect is evident when we consider whether a technology empowers people to do things that would be difficult, or even impossible otherwise.

Consider for example, the telephone. As it comes into use, it is initially considered a novelty that permits new and interesting, but hardly necessary actions. Later, as it is used more widely, the actions it affords move from novelty to habit, the tool becomes commonplace. Soon it is treated as part of daily activity. We might say, "I talked to my friend today," without feeling any need to mention that the telephone was a necessary tool for that conversation to occur. Through this process, we move from looking at the technology as an addition to life to looking at life through that technology. The embedding of the technology in the matrix of our lives makes it invisible. In fact, the greater its integration into daily practices, the less it is seen as a technology at all.

Thus, writing is no longer viewed as a technology; instead, only its newest manifestations take on that role. Each literacy technique-quills, movable type, ballpoint pens, typewriters-passes through phases of technology to tool, from unfamiliar to familiar, and from visible to invisible. Already, word processing, once a new technology, is now considered to be just the way people write. Web page writing conceived as a new technology ability today, will not be so in a few years.

Further, as a tool becomes embedded in social practices, our conception of the ability required for an individual to use that tool changes as well. In the early stages of use, disability is counted as a flaw in the tool: We say that poor design of the technology makes it difficult to use. Later, the disability becomes an attribute of the user, not the tool. We say that the user needs more training, or worse, is incapable of using the tool. Once the status of the tool as technology has fully merged into daily practice, the disability to use it becomes an essential attribute of certain people.

For example, stairs are an architectural technology that empower people to move easily from one floor of a building to another, floors themselves being a technology to increase the ratio of floor space to land and building surface area. But ordinarily, we do not consider floors, or even stairs, as technologies; their ubiquity makes them invisible. Operating invisibly, stairs empower some just as surely as they disempower others.

People who use wheelchairs can move easily within a single floor, but they become disabled by the presence of stairs. The stairs construct wheelchair-ness as a disability. Even if one insists on characterizing wheelchair-ness as a brute fact, a fixed property of the individual, the consequences of that fact are radically altered by the architectural technology. Consider how the addition of elevators to a building reconstructs wheelchair-ness as a minor disability. The important point is that the ambient technologies can alternately able or disable an individual many times in the course of a single day.

This process is one of the crucial ways in which all literacy technologies-slate tablets, typewriters, word processors, networks, computer interfaces, databases, the Web-are ideologically embedded. Effective use of the dominant reading and writing technologies then becomes the defining characteristic for new forms of literacy (Bruce, 1995). Lack of such ability can be conceived as an inherent disability, located in the individual, which might or might not be alleviated through various measures, such as providing more time, easier texts, skill training, tutoring, help features, donations of equipment, and so forth.

But if we recognize that these tools are constructed, we begin to see how design choices create ability and disability. Lack of English fluency, for example, has now been constructed as a literacy disability with respect to the Web, because so much of the Web content and even the Web software tools are in English. Not owning or being able to use a computer is constructed as a disability for attaining

a college education. A competent writer may be locked out of an editing job for lack of desktop publishing skills. Thus, new literacy abilities, and consequently, disabilities are continually reconstructed. In this sense, discussion about participation in any literate society must be referenced to that society's current and emerging literacy technologies.

One implication of this is a lack of choice. We cannot simply choose our tools (i.e., to write longhand, use a typewriter, a word processor, or e-mail) in order to be literate participants. Instead, the technology chooses us; it marks us as full, marginal, or nonparticipating. Haas (1996) makes a similar point in her call to consider the materiality of literacy, how its various manifestations over time have always been linked to specific bodily and physical realizations. An obvious implication is that teachers of literacy must consider how new technologies help to reconstruct reading and writing processes for their students.

Students and parents increasingly expect convenient access, explicit instructions, and the use of computer technology in the classroom. Similarly, teachers expect students to have computers at home. Thus, computer use is becoming an integral aspect of academic achievement. The promise of learning more through new technologies is becoming a premise, a requisite for success. A danger is that the mere presence of computers may signal that all is well when little has actually changed in the reading and writing ecology.

The disappearance of technology is more than a metaphor. We cannot see most microprocessors because they are now hidden in artifacts such as telephones, fax machines, cars, dishwashers, and even athletic equipment. Such hidden microprocessors have been called embedded systems because they are not obvious in these devices and their function may be invisible to the user. Thus, the infrastructure of the larger world is becoming infused everywhere with software. Soon, General Motors will sell more microprocessors than IBM, because microprocessors will control speed, navigation, braking, suspension, climate, and airbags (Fiddler, 1996).

Embedded systems may entail a loss of control in one sense. Fewer people will be able to fix their own cars or any number of household appliances. They will need to rely more on experts, and they will need to pay for that expertise. On the other hand, these systems can create a more user-friendly world, what some have called "soft technology" (Norman, 1993). Their overall effect will depend on the social conditions and power relations that surround their use.

Similarly, literacy tools are becoming embedded systems. For an increasing number of people, writing means typing on a personal computer, reading means browsing a newspaper on the Internet, and researching means accessing a library database via modem. If a computer hard drive crashes while using today's literacy tools, most people will need to rely on an expert to fix it. Literacy today is becoming dependent on embedded systems that are invisible to the user.

One implication of this embedded technology is that we need to look more carefully at how technology is affecting our lives even when we cannot see it directly. Literacy means not just reading and writing texts, but "reading" the world, and the technological artifacts within it.

An Ecological Model for Literacy Technologies

Awareness of how technologies merge with daily practices leads us to view technology and literacy as constituent parts of life, elements of an ecological system (see also Bromley, 1997; Latour, 1988; Law, 1991). This viewpoint gives us a basis for understanding the interpenetration among machines, humans, and the natural world. Lemke (chap. 17, this volume) has a similar conception of literacy, which he describes as part of an ecosocial system:

> Literacies cannot be adequately analyzed just as what individuals do. We must understand them as part of the larger systems of practices that hold a society together . . . if we think the word society means only people, then we need another term, one that, like ecosystem, includes the total environment: machines, buildings, cables, satellites, bedrock, sewers, farms, insect life, bacteria. (p. x)

Thus, literacies, and the technologies of literacy, can only be understood in relation to larger systems of practices. Most technologies become so enmeshed in daily experience that they disappear; that is, they are no longer seen as technologies. They become the ordinary; in order to see them, we must make the familiar strange. As T. S. Eliot (1943, p. 59) in "Little Gidding" expressed it,

> And the end of all our exploring
> Will be to arrive where we started
> And know the place for the first time

Eliot's words resonate for us as literacy educators because we have the responsibility to make the familiar strange-not only to rethink the uses of technologies, but also to know it again for the first time as we consider where our students may be starting. We must recall what it is like to be a novice or to be less privileged. We need to critically examine what has become commonplace, normalized, and even invisible. In some cases, we may need to depend on our students to navigate the voyage because they may be more expert.

A question often arises in the technology debates: Do we use technology, or does technology use us? Idhe (1990) rejects both alternatives, and instead sees people as living within a technologically textured ecosystem. The relations between humans and technology are both sensory and contextual. Because kinesthetic perception is always part of the process of using technology, we can imagine our bodies as extended through artifacts, forming hybrids. Idhe says a technology is not simply a tool, but an artifact with intentionality. In Latour's

(1988) terms, technologies are actors in social systems, as are texts, maps, physical spaces, and artifacts of all kinds.

If we assume that technology is necessarily embedded in cultural practices, it is only one step further to see people as caught within not just specific technologies, but in "technology," a process Heidegger (1977) calls enframing. He argues that we must understand technology as an activity that surrounds us, as in his famous assertion, "everywhere we remain unfree and chained to technology, whether we passionately affirm or deny it" (p. 311). The essence of technology lies in the way it "comes forth" or reveals itself in human activity. Heidegger wants us to understand technology as an inescapable part of our social world and ultimately, of our basic values. The crucial question then becomes: What is the essence of technology? He warns us that we may perceive all entities in the life world, in the ecology, as a "standing reserve," simply as resources to serve technology. Technology provides a way to order, and then, more ominously, the way to be ordered.

Social Relations and Technologies

People write social relations through the languages of technology, constructing hierarchies and fields of inclusion or exclusion through silicon chips, wires, and video displays. The sentences we write with technologies describe our social life, as surely as the cave paintings of Lascaux or the Mayan calendar tell tales of earlier social worlds. However, technologies also serve to prescribe, to turn social intentions into tangible realities. Latour (1991) encapsulates this point as, "technology is society made durable" (p. 103).

How can this be? How is it that a plastic box full of electronic components can tell the tale of social relations? According to Selfe and Selfe (1994), interface designs are geopolitical borders, a sort of cultural contact zone. They encourage English teachers and students to critique its politics. Such a critique might start with their observation that standard "computer interfaces do not . . . provide direct evidence of different cultures and races that make up the American social complex, nor do they show much evidence of different linguistic groups or groups of differing economic status" (p. 486). They argue that these interfaces, with desktop metaphors, Eurocentric icons, and English language defaults, are markers of capitalism and class privilege. A corporate ideology becomes its primary orientation, which promotes the commodification of information. Information as commodity then translates into big business for commercial networks. Selfe and Selfe also propose that the interface maps the kind of knowledge imbued with hierarchical values characteristic of Western patriarchal cultures rather than knowledge as bricolage-a more intuitive, associative, organic, and perhaps feminine process. The interface, then, is a political. ideological and epistemic borderland where we in fact "write our lives" with technology.

We need to disentangle this complex in order to see how ideology is woven through it. In the sections that follow, we explore how technologies function as ideological tools, focusing on four intertwined themes. First we examine how ideology influences the design of technologies. Second, we examine the distribution of technologies, including questions of access. Third, we consider ideological aspects of using technology. Finally, we look at how we interpret the effects of technologies.

Design of Technologies

One arena for ideology to operate in is the design of technologies. New information technologies are often designed to forward democratic ideals through interaction, collaboration, and sharing of information. A familiar example is local area networks that allow multiple users to share folders as part of their collaborative work. Shareware and groupware programs (such as the synchronous [1] program InterChange) allow real-time conversations among multiple users for collaborative writing (Bruce, Peyton, & Batson, 1993). Such programs can facilitate equal access as they are designed to give voice to many participants. As Beach and Lundell (chap. 6, this volume) show, computer-mediated communication can "create an engaging dialogic forum for social literacy practices" (p. xx).

In a similar spirit, the Internet, what McChesney (1995) calls "society's central nervous system" (p. 14), with its millions of users, can foster new relationships and even build new communities based on shared interests and information (Rheingold, 1993; Spender, 1995). These relationships and communities can be far-reaching, relatively inexpensive, and increasingly multilingual, multicultural, and global (see Garner & Gillingham, chap. 13, this volume). In principle, the weblike design of literacy technologies can offer a more equitable distribution of information than any technology we have previously known.

At the same time, both hardware and software design can disrupt the democratic process and the community-building ideals. For example, InterChange does not erase power hierarchies. Users of these programs still understand who has the authority to initiate, lead, direct, and silence discussions. Furthermore, the texts are controlled by a teacher, administrator, or technologist who can easily monitor students' exchanges without their knowledge or permission. Similarly, within corporations, groupware has become attractive to managers in part because it furthers their ability to monitor and control employees.

Other authors have voiced concern about how epistemology is embedded in the design. Could it be that militaristic ways of knowing and masculine desire are buried in the design of certain technologies? Sofia (in press), drawing on insights from psychoanalysis and semiotics, suggests that the design of the contemporary computer recalls its militaristic male-centered history, a history that has helped further a view of the computer as fetish, which in turn may exclude

females' attitudes. As she explains:

> Computers seem to embody the very essence of rationality, working as they do with principles of digital code and processing, and formal logic. Educationalists who believed technologies were neutral . . . were surprised by the rapidity with which patterns of masculine domination and female exclusion emerged with the introduction of computing in schools.

Sofia (in press) claims that computer technology, with its connection to one subgenre of science fiction fantasy, with its attendant notions of control and domination, speaks especially to adolescent males. Militarism, formal logic, and science fiction contribute to what is largely a male computer culture, which some females may find uninviting. The result is that computer culture reproduces negative attitudes toward computer use among women. To offset this trend, Sofia recommends that feminists appropriate computers in their own way, rejecting the "informatics of domination," fetishism of the "androcentric science fiction culture," and fantasies of the computer as "second self."

It is important to be careful here: The notion that interfaces or digital codes enforce any one set of values teeters toward the technocentric view, beyond which the tool determines social practice. Nevertheless, the discussion of gendered technologies points to yet one more way that ideology can be embedded in the design of technology.

Distribution of Technologies

A second arena for ideology to operate through technology is that of distribution and access. Consider the case of people who are blind or visually impaired: With older technologies of text, many individuals accommodate to dominant literacy practices, for example, by using Braille or audiotape. New technologies pose a new array of opportunities but also the need for new accommodations. To a certain extent, the wide availability of Internet resources and technology such as speech generation and recognition promise greater access than ever before. However, reliance on graphical interfaces, the abandonment of support for older technologies, and limitations in access time or training can exclude the same individuals from the global information community. Thus, the deployment of computers and how they are used bears on the degree to which visual impairment functions as literacy disability.

In a similar fashion, people in other groups find their access to literacy limited in new ways. Technology, of course, is not free and it is no surprise that those with the most money have the best technology if they want it; those within the lower socioeconomic brackets, as well as racial minorities and females, have less access than other groups (Sutton, 1991).[2] Access is thus partial, restricted, and stratified. With so much rapid change so quickly, new hardware and software are

quickly developing to meet consumers' needs. Even technophiles have difficulty keeping up with the trends. To have access to technology, people have to be aware of it, have the means to purchase it, and have the knowledge to use it. Awareness, means, and knowledge can be restricted and privileged. For many, the promise of technology is still remote; for others it is a premise-something that is a normal and already invisible part of everyday life.

Research by Michaels, Cazden, and Bruce (1985) supports the theory that unequal access to technology operates at many levels: "As is so often the case with new technologies, computer use is more apt to reinforce existing patterns rather than change them" (p. 36). In schools, for example, there are inequalities in the ratios of computers to students in software usage and in classroom use. Even when schools have computers, poorer schools often have less sophisticated software. Use may be limited to drill-and-practice software rather than to the Internet and to the problem solving that is more likely to be emphasized in affluent schools. Even when adequate hardware and software are available, schools may implement the technology in ways that further exacerbate inequality; for example, by limiting access to students who are pulled out of regular classes.

In higher education, access to technology can also accentuate economic difference: Many schools now require students to purchase computers. The University of Illinois Law School now requires new students to have a computers. [3] Associate Dean Colombo explained that "for lawyering in the twenty-first century, law students are just going to have to have computer skills-a wide variety of them" (Wurth, 1996, p. A-1). Besides using computerized databases to do legal research, the students may also use document assembly programs, e-mail, and the Web when they are finally hired by a law firm. Also, the law school is hoping that students will receive more one-on-one attention with their law instructors through e-mail communication and electronic exercises.

For those students who can barely afford law school, the addition of the requirement to purchase a computer can be a burden. Thus, the requirement illustrates the presumption that those without technical expertise and the means to afford technology will probably not succeed as lawyers in the 21st century. Thus, computers now delimit the potential for academic success, even before a student considers applying to law school.

As information technologies merge with communications technologies, what can be done with a computer now depends on the quality of network connections. New computers are quickly linked into local area networks and the Internet within organizations and at least to some extent through the telephone in homes and schools. With an inexpensive connection, a user can transmit and receive ordinary text albeit at a slow rate. Faster connections allow the transmission of audio, pictures, and video. This means that "being on the Internet" varies tremendously depending on the kind of network connection one has. Those with

faster connections can gather and transmit more information, and in short, do more with their computers. As information becomes increasingly accessible for some but not all citizens, network speed becomes an index of power in society.

Table 16.1 Network Speed, Media, and Users

Type	*Speed*	*Text in 1 Minute*	*Other Media in 1 Minute*	*Typical Users*
14.4 modem	14.4 kb/s	25 pages	1 black-and-white diagram	School
2B.8 modem	28.8 kb/s	50 pages	1 color picture	Home
56 modem	56 kb/s	130 pages	Audio, compressed, small window video	
ISDN-64	64 kb/s	1 book (150 pages)		Consultant
ISDN-128	128 kb/s	2 books	10 pictures	Small business, some homes, magnet schools
T1	1.54 mb/s	12 books		Medium-size business
Cable modem	10-30 mb/s	16-48 books		Major corporations

In the 21st century, computer literacy means not only being familiar and comfortable with computers, but also having access to information. Network speed therefore becomes an indicator of literacy practices, just as the possession of a quill pen once was. As Table 16.1 shows, more powerful affiliations have access to more information. [4] The more access they have to information, the more powerful they become within an information-based economy. In this sense, then, power relations are reinforced rather than equalized.

One could think of network access as being analogous to having a membership card for a huge library. The 3,000 times difference in speed means that some members have access to thousands of books, as well as graphics, audio, video, and large data sets; it is as if these members have carte blanche to the Library of Congress. Others, however, are restricted to a limited number of plain text materials; it is as if these members can only go to a community bookmobile. Differences in access become even more significant to the extent that graphics, audio, video, virtual reality, and other media become standard means for representation. Thus, different network speeds differentially construct ability. Again, power relations are shaped both by the technologies and by the existing structures that support social stratification.

An interesting side to the power achieved through network speed is that those privileged social actors, living with an accelerated consciousness (i.e., faster is better) in a product-centered society, may increasingly experience a deteriorating quality of life. Dobrzynski (1996) writes that many American corporate workers are burdened by an excess of e-mail and voice mail messages. Corporate downsizing has meant a loss of support staff, so corporate workers deal directly with communications overflow. Some employees go in early, stay late, or use their weekends to respond to e-mail correspondence. It could also be true that high-technology companies are experiencing more communication, but at a lower level of quality and a higher level of irrelevance. Discussions about retirement surprise parties and theater tickets are flirting for employees' attention, whereas more pressing issues such as market reports and plans for product demonstrations may be overlooked, or at least deferred. Because workers are not talking to each other face to face as much any more, management will need to worry about possible misunderstandings and trivial or recreational material comingling with the important.

Rifkin (1995) thinks that the word karoshi will be more than a Japanese cultural phenomenon. The term describes a person's emotional and physical breakdown caused by high-tech stress. In a post-Fordist, state-of-the-art workplace, Rifkin imagines, it will soon be a global, cultural condition. This new kind of stress, which may even change workers' biorhythms as they try to calibrate their biology with computer response time, can lead to chronic fatigue and even a fatal breakdown. Karoshi is a clear example of how the technology merges with not only our social, but also our physical beings. Of course, for some employees, the inclusion of more recreational discourse within the workplace and new modes of interaction may mark an improved quality of life. Thus, the same effect may be positive or negative depending on one's perspective, a theme we return to later in this chapter.

Another consideration is that, with respect to access to the Internet which has so much information and so many users, we need to perhaps stop asking what is wrong with texts (a tenet of critical thinking), but rather, what is right with them? Which texts are useful? How do we know? Whose ideas are salvageable? Why? Because much of the information on the Internet is unrefereed, and increasingly commodified, the Internet raises new questions about authority and access to unbiased information. In serious academic journals, for example, the manuscripts are carefully reviewed and the journals themselves are typically free of blatantly commercial advertising, although they may have invitations to subscribe to other journals or professional organizations. The Internet, however, has characteristics of both shopping malls and academic journals (Bruce, 1995; Burbules & Bruce, 1995). Will it evolve into an international coffee shop or a high-tech billboard? Will it foster more global dialogue or more corporate monologue? What do we want it to be? How does it fit in with our democratic ideals? Where do we fit in the process?

McChesney (1995) urges concerned Internet users to fight for the kind of information system that guarantees noncommercial access. If not, he warns, cyberspace could be transformed into a giant marketplace:

> The contours of the emerging communications battle are unclear, but most business observers expect a flurry of competition followed by the establishment of a stable oligopoly dominated by a handful of enormous firms. What is clear is that the communications highway will not be devoted to reducing inequality or misery in our society. In fact, without any policies to counteract the market, the new technologies will probably create a world of information have's and have-not's, thereby exacerbating our society's already considerable social and economic inequality. (p. 17)

The distribution of high-tech communications information is unequal in a stratified society. Who will guarantee that it will not be constrained by corporate leaders? What kind of policy should ensure that nonprofit, noncommercial, and reliable information has equal access?

Use of Technologies

Regardless of how a technology is designed and distributed, the use people make of it becomes a third arena in which ideology can operate. In some cases, the use is for democratic ideals, perhaps to invite student collaboration and more equitable participation. Or, teachers may encourage students to expand their horizons through electronic chats with students from other communities (see Garner & Gillingham, chap. 13, this volume). These changes in schools can also encounter stiff resistance as Neilsen (chap. 8, this volume) documents. Moreover, technology used for censorship, surveillance, and control, countering the very ideals it can promote.

Recently the spirit of the global community has taken an inward turn, as more people are recognizing ways in which technology can be used to gather information surreptitiously. There is an increased demand for cryptography software. Those with greater technological control, especially government agencies and big corporations, can be interlopers, controllers, and censors. Large companies now establish firewalls to separate their information from the public. Some countries, notably Singapore and China, have discussed creating firewalls between their entire countries and the rest of the world.

Computer systems cannot guarantee privacy, and the amount of personal information in databases is disturbing. An interested party can all too easily access information about a person's credit history, spending habits, insurance claims, and health history. This information, or misinformation, can make one vulnerable to credit card fraud, restricted health insurance, and bothersome marketing ploys. Using MapQuest, one can find the address of nearly anyone in

the United States, including a map and directions to their house. If you carry a mobile phone, your whereabouts are tracked continually and stored in a telephone company database, even when you are not talking on the phone. What do potential abuses of technology say about our right to privacy in a democratic society? The information age has ushered in a redefinition of public and private space which we are only beginning to understand.

And what of the right to free speech? According to Browning (1996), the Internet is learning to censor itself. The Platform for Internet Content Selection (PICS), developed by the WWW Consortium, is trying to resolve the moral issues that lie at the core of regulating information on the Net. As Browning puts it, "PICS promises to create a do-it-yourself censorship that will allow everybody both freedom to speak and freedom not to listen" (p. 38). The goal of the rating system is to allay government responsibility for censorship. Instead, users can access self-rating schemes, such as SafeSurf, which allow them to find out information about a website's violence, nudity, sex, and language content. Thus, PICS would provide users with "a vast interlinked system of reference, recommendation and reputation" (Browning, 1996, p. 38). The rating system would necessarily be ideological: How much, and to what degree, are violence, nudity, sex, and foul language acceptable? To what extent does banning so-called immoral content coincidentally ban sites that promote political issues such as gay and lesbian rights or destruction of landmines? How are the categories defined? The creators of the systems such as SafeSurf will devise algorithms based on their own set of values.

What has been referred to as "Netwars" is another way that ideology penetrates the use of technologies. For example, America Online, a commercial service, does not provide access to most White nationalist news groups. Although the popular service is trying to promote tolerance and equality, a democratic ideal, it also limits freedom of speech, another democratic ideal. Ideological Netwars thus summon a whole set of issues about defining democracy in cyberspace.

Interpretation of the Effects of Technologies

A fourth arena for the operation of ideology through technology is the way we interpret its effects. For example, a company's downsizing that becomes possible by reliance on more technology is frightening if you are a worker who could be displaced by a machine. However, if you are a corporate director seeking greater efficiency, you would welcome the same technology. If you are a literature student who needs to find a Shakespeare quote quickly, you could find it easily on the Web. However, from your instructor's point of view, this easy access could be negative if the use of quotes was supposed to be an indicator of deep reading.

One can interpret the technologically based changes in the economy in similar ways. Automation in the context of corporate restructuring is leading to a

decrease in human labor, especially in the manufacturing and service sectors (see Mikulecky & Kirkley, chap. 18, this volume). For large, technologically advanced companies, the profit margin increases as production becomes more efficient. However, two negative aspects accompany this greater efficiency. The first is increased unemployment, with workers displaced by automated systems in both manufacturing (e.g., rubber, mining, electronics, textiles) and service sectors (e.g., bank tellers, secretaries). The second aspect, a corollary of the first, is that unemployed or underemployed people cannot contribute much to the economic growth that these products promise. According to Rifkin (1995), the two problems indicate a growing dual, or cleaving, economy for the 21st century. The cleaving, Rifkin warns, will occur both nationally and globally. The first economy, the utopian one, will be made up of highly trained, well-educated knowledge workers in an information-based economy. The second economy, for the reserve of other workers, will be struggling with unemployment, part-time work, and jobs left in the service sector, such as waitressing, construction, automotive maintenance, painting, and so forth.

Thus we find two economies and a growing chasm between them. As Rifkin (1995) suggests, "Ironically, the closer we seem to come to the technological fruition of the utopian dream, the more dystopian the future seems" (p. 56). Literacy no longer means just reading and writing to secure a decent job, even one that does not require much of either. Literacy means reading the technological world, including the relation of technologies to these dual economies.

Conclusion

Despite many differences in conceptions, various scholars (Connell, 1996; Heidegger. 1977; Idhe, 1990; Latour, 1993) have pointed to a consensus regarding the study of technology: The more we examine technology, the less we find it useful to focus on its technical attributes per se, and the more we see the need to understand the ways in which ideology is embedded within it. To understand what a technology means, we must examine how it is designed, interpreted, employed, constructed, and reconstructed through value-laden daily practices. Following this line of argument, the concept of situated evaluation has been proposed to evaluate changes as new technologies are adopted (Bruce, Peyton, & Batson, 1993; Bruce & Rubin, 1993).

A social setting produces an ideological matrix that includes both laudable and deplorable realizations of technology. What does this mean for the transformation of literacy in coming years? The ecological model suggests understanding literacy technologies as embedded throughout social practices, often in invisible ways. There is as much reason to be cautious as to be celebratory. Although it is clear that technology can enhance literacy by providing motivation, access to information, new worlds to students, faster communication, and real-time

communication with peers, using technology in educational settings requires continuing critical analysis.

The 21st century occasions new ways of conceiving and teaching about literacy. Because of the increasing generation of information through new recent technology, teachers need to consider, perhaps more than ever, how they will teach students to select and critique texts, especially those on the Web. Additionally, literacy teachers need to be ready to handle a wide range of student familiarity and ability with writing and researching technologies. They need to recognize that a computer is a tool, but also a symbol that indexes privilege (Bromley & Apple, in press; Stuckey, 1991). Teachers will need to assess how technologies relate to students' positions in the dual economies, thus expanding the meaning of critical literacy (Muspratt, Luke, & Freebody, 1997) to encompass new means of representation. They may also need to revise their conception of text, as students learn how to read and write hypertexts, graphs, charts, mathematical equations, pictorial models, and even virtual realities.

An important part of literacy education now is to consider a range of options for learning, including a wide range of technologies. One-on-one conferencing and peer editing are still fine ways to teach college writing. This can be done via e-mail or through office visits and peer editing workshops, and in different settings. Reading exercises that celebrate multiple interpretations can be done with or without computer assistance. An ecological model of literacy helps us to visualize the whole, and to see a range of options as part of the whole, neither dismissing nor naively accepting technology wholesale.

Finally, researchers need to do more situated studies that detail the complexities of literacy within an ecological model, and to see how ideology operates within situations where literacy, technology, and humans interact. We may then approach a more rounded understanding of how technologies can either promote or forestall equality.

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Notes

1. Synchronous programs support real-time conversation in written form, unlike email, which is usually used asynchronously.
2. Based on a review of research on equity and computers in the schools throughout the eighties in K-12 classrooms.
3. Other law schools such as the University of Richmond, Stanford, Duke, New

Mexico, and Oregon have similar requirements.

4. Some of the numbers in the table are approximate. For example, cable modems are shared among users, so the actual transmission rates can be much lower than 30 mb/s. Also, different types of data compression, image size and so on markedly affect how much can be transmitted: there is a clear trade-off between document quality and quantity. Nevertheless, the general pattern shown in these examples still holds: Common transmission rates vary by several orders of magnitude and that has qualitative consequences.

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