

CHANGING TECHNOLOGIES, CHANGING LITERACY COMMUNITIES?

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ABSTRACT

Many people who write about information technology draw a parallel between the introduction of the printing press in 15th century Europe and the introduction of the computer. The parallel is based on the notion that technological revolutions entail rapid and far-reaching social change that is the inevitable result of the introduction of a major new technology. In this view, changes in the technologies of literacy affect literacy practices and communities: The transformation from an oral culture to a literate one reshaped consciousness; the introduction of alphabetic writing in Ancient Greece transformed Greek thought; the invention of the printing press moved the power of scholar-priests to more democratic institutions and promoted individualism, nationalism, and secularism. Scholars thus claim that the introduction of the computer will inevitably result in a different social consciousness of what literacy is and how it functions in individuals and society. This common view does not reflect the realities of history. Technologies themselves did not cause changes such as the Reformation. Changes result from mutually influencing social and technological factors: New technologies like the printing press merely facilitated changes already beginning to take place.

The uses of literacy are various. As a technology, it gives its possessors potential power; as a stock of cultural knowledge within a given tradition, literacy can constrain or liberate, instruct or entertain, discipline or disaffect people. Princeton historian Lawrence Stone once remarked that if you teach a man to read the Bible, he may also read pornography or seditious literature. Put another way, if a man teaches a woman to read so that she may know her place, she may learn that she deserves his. These are the Janus faces of literacy (Kaestle, 1991, p. 27).

In 1986, the *Wall Street Journal* carried an advertisement that proclaimed, "In 1455 Gutenberg brought the miracle of printing to the civilized world ... 531 years later, Apple brings it to the civilized desktop" (February 21, 1986, pp. 11-13). One might condemn Apple's hubris were it not for the fact that many people who write about information technology draw a parallel between the introduction of the printing press in Europe in the middle of the 15th century and the introduction of the computer in the late 20th century. The parallel is based on the notion that technological revolutions entail rapid and far-reaching social change that is the inevitable result of the introduction of a major new literacy technology.

Attributing cognitive and sociocultural change to new literacy technologies did not begin with the introduction of the printing press but is documented in Ancient Greece and Medieval England, where the technologies being introduced were alphabetic writing and literacy respectively. Literacy is a technology as Kaestle argues above, one that converts thought into records, as Goody (1977) proposed when he claimed literacy is the technology of the intellect.

Whether it is in discussions about Ancient Greece or about 20th century computer technology, many scholars and others separate into two usually opposing camps: those who fear the new technology, fearing it will negatively change life as they know it, and those who extol the virtues of the new technology, believing it will create new, beneficial ways of knowing and interacting. Both sides ultimately argue over issues of power and control (even if those arguments are not voiced explicitly)--over form, authorship, distribution of knowledge, and the very construction of knowledge itself. What both supporters and opponents of a particular technology generally hold in common is the view that the technology is prior,

causal, and neutral. Pool (1977), for example, writing about the introduction of the telephone, claimed that technology, as well as changing how we do things, changes the way we think about things and ultimately about the way we think. While historical data do show that the introduction of different literacy technologies involves some similar phenomena--evolving and supporting technologies, resistance, fervent promotion, a belief in its inevitability, and potential for control of liberation--the underlying premise that the technology causes a "revolution" is not supported by historical data. Hence, today we need to be very careful about drawing analogies between the possible effects of information technology and those of previous literacy technologies. Instead, researchers and commentators should examine the sociocultural milieu into which information technology is introduced to see how the technology amplifies certain characteristics (or not).

Within the field of literacy studies, several researchers working from a more anthropological perspective have demonstrated that literacy is a socio-cultural phenomenon that reflects a community's values; they have shown that literacy is not a set of skills, whose absence or presence in individuals or communities automatically leads to particular outcomes (see, e.g., Heath, 1983; Scribner & Cole, 1981; and Street, 1984, who studied communities as diverse as the Piedmont Carolinas, the Vai in Liberia, and Iran, respectively). Even Goody himself, a major proponent of "the consequences of literacy" (1972) noted in his discussion of the introduction of Semitic literacy that "there was ... a strong tendency for writing to be used as a help to memory rather than as an autonomous and independent mode of communication; and under such conditions its influence tended towards the consolidation of the existing cultural tradition" (p. 326). Similarly, several scholars writing on technology have advocated a position of "technorealism" (Shapiro, 1999, p. 1), that is, a "middle ground between techno-utopianism and neo-Luddism" (Technorealism, 1998). The following examination of the introduction of earlier literacy technologies dispels the myth of technological determinism (see also Nunberg, 1996, for a collection of essays, most of which argue against technological determinism) and provides the historical context for arguing that computer technology is not an autonomous technology that in and of itself will change the way we think, create greater democracy, or concentrate wealth and power among a privileged élite. Rather, the real tension lies in who will steer this revolution. The computer revolution will be what *we* make of it.

ORAL LITERACY AND ALPHABETIC LITERACY

Early Greece

The basis for Western literacy was the invention of alphabetic writing by the Greeks. Around 1100 B.C. the [Phoenicians](#) invented a syllabary, a writing system representing spoken syllables. It is conjectured that the impetus for the Phoenician invention was probably commerce. Since they were primarily a mercantile culture, this breakthrough facilitated record-keeping of trade. The Greeks, building on the syllabary, developed alphabetic writing where the written symbols represent meaningful sounds (phonemes) of the language. Interestingly, Plato, one of the first great writers in Western culture, vigorously condemned writing (in writing). Both Plato and his teacher Socrates argued that literacy would change the way people think, would destroy memory, shift power, and consequently negatively affect the social order. Socrates feared literacy would promote the appearance of wisdom among writers who merely had information (Plato, p. 323). Plato was especially concerned, not just with the cognitive effects of writing, but also with the social effects--what writers would perpetrate and what people would do with the written information they read. Both cognitive and social effects, he argued, would alter the social status quo and could give power to those without the wisdom to rule. In the *Phaedrus*, for example, Socrates says,

The fact is that this invention [writing] will produce forgetfulness in the souls of those who have learned it. They will not need to exercise their memories, being able to rely on what is written ... And once a thing is put in writing, the composition, whatever it may be, drifts all over the place, getting into the hand not only of those who understand it, but equally of those who have no business with it. (Hamilton & Cairns, 1989, pp. 520-521).

Indeed, Plato even argued vociferously against certain forms of oral discourse, what he considered nondialogic forms of oratory used by politicians, rhetoricians, and epic poets, who, he felt, swayed the public through their dramatic use of language. For Plato, only what we today call "the Socratic method" forced the speaker to think more critically about his or her ideas. When the listener asks for clarification, the speaker is compelled to reconsider his own ideas and try to see the world from another's perspective. Knowledge then is only what one can "reflectively defend in face-to-face dialogue with someone else" (Gee, 1996, p. 27). Holding the floor in a monologue, in contrast, leads to valuing the form of the discourse over the content and leads to reduced interaction between speaker and hearer. For both Socrates and Plato, writing, even more than monologic oratory, reduces even more the immediate engagement of speaker/hearer, hence their concern that writing leads to writers appearing to have wisdom when they really have only information, not knowledge.

Proponents of the view that literacy technology causes cognitive and social effects (e.g., Goody & Watt, 1968; Havelock, 1963) claim that the introduction of alphabetic literacy in Ancient Greece changed the way people thought, allowing for logical analysis and procedures. More recent studies of Ancient Greece (e.g., Lentz, 1989) show how the existing technology of orality existed side by side with the new technology of literacy, each enriching the other. Although in post-Homeric Greece many people knew how to read and write the alphabetic script, communication was still mostly oral. Public oral discourse was the primary means for the development and distribution of knowledge. Such studies also show how the characteristics of logical thought which were claimed to be the result of literacy, were in fact precursors to its introduction. Writing merely amplified this already existing way of thinking.

Medieval England

The use of alphabetic literacy in Medieval England to record legal and business transactions illustrates and supports the view that the technology of writing is both influenced by and influences social practices, rather than the unidirectional view that technology causes particular effects. The introduction of written records did not create a more efficient system, but rather solidified power in the hands of the scholar-priests and royal bureaucracies (Clanchy, 1993), even though those literate schoolmen became more numerous. In addition to the more extensive use of written records, a new literacy technology was introduced--tally sticks--to provide a more permanent record of financial transactions. The tally sticks of the Royal Exchequer were held as public documents at the Palace of Westminster in London. Initially adopted by the church and monarchy in the 12th century, they were used by private accountants in the 13th century, as reading and writing were more widely used by the general population. From the 13th century, the public had become used to written records for business. At the same time writing was taking hold for business, the Lollards, English dissidents and precursors of the Reformation, spread their heretical doctrines to the common man through print in the vernacular, rather than in the scholarly, priestly Latin. As Pattison (1982) points out, "The spread of reading and writing skills had created a market for books, and the economic systems of the late Middle Ages predisposed industrious businessmen like [Caxton](#) and [Gutenberg](#) to fill a need where they saw one" (p. 99) (see [next section](#)). In his exhaustive study of literacy in Medieval England, Clanchy (1993) demonstrates that writing was of immense importance at the time (even without anything like universal literacy) and that its use was "...sufficiently vigorous to sustain the mass production of printing" (Clanchy, 1983, p. 8). Clanchy's thesis

is that a print community was the result, not just of the technology, but of a thousand years of development of a "vigorous literate culture" (p. 8).

THE INTRODUCTION OF THE PRINTING PRESS

As with the introduction of alphabetic literacy in Ancient Greece, the introduction of the printing press has been considered a transformer of society. In two large volumes, Eisenstein (1979), a social historian, relates the effect of the printing press on Europe, claiming that, by mechanizing human memory, the printing press made food for thought more abundant, allowing cognitive energy to be used more efficiently--it could be used for thinking instead of rote memorization. Print, she says, provided us with fixed forms of reference, ways of categorizing, indexing, and making ideas permanent. Two qualities distinguish the press from handwriting: the capacity to duplicate texts in large numbers and the capacity to fix and preserve texts and images over centuries. According to McCorduck, a writer on computer technology, "mechanical printing acted as an artificial memory (as did writing,) but now the memory, a communal treasure, was greatly enlarged" (McCorduck, 1985, p. 34). The common view is that the invention of printing removed the power from the scholar-priests, replacing them with more democratic institutions. Many historians and populist writers claim that, because printed books were cheap and easily reproducible and therefore widely available, what began as a local quarrel between Martin Luther and his church was transformed into the Protestant Reformation. The claim is that the Reformation was possible because the *Bible* could be in the hands of the common people who no longer had to rely on the priests to interpret it for them. Similarly, the period in Europe referred to as the Enlightenment, with its ideas of individualism and nationalism, is attributed to the introduction of the printing press. McLuhan (1962), for example, who popularized this view of the printing press, credited it with the rise of science, industry, logic, capitalism, nationalism, and rationalism.

While such scholars and thinkers of the time and since have extolled the virtues of the advent of print, others have condemned it. Indeed, at the time, those who had control over written knowledge feared printing would weaken memory, the mind, and the spirit, and thus, their power. Pope Alexander VI, for example, declared,

It will be necessary to maintain full control over the printers so that they may be prevented from bringing into print writings which are antagonistic to the Catholic faith or which are likely to cause trouble to believers. (quoted in McCorduck, 1985, p. 23)

Johannes Trithemius, abbot of Sponheim, opposed print because he feared its impermanence, that paper would last but a short time, whereas parchment could last for a thousand years (see Clanchy, 1983). For Trithemius, the lasting nature of texts was vital because for Medieval clergy and scribes, the texts were divine, the word of God.

This common view of the Gutenberg revolution does not, however, reflect the realities of history. The technology itself did not cause the Reformation or the Enlightenment. Certainly there was immediate print production: In the 50 years after 1450, between 10,000 and 15,000 different titles were produced; legal codes were printed; vernacular Bibles were produced. However, print did not impinge on most people's lives and was not nearly as pervasive as some have claimed. For example, only about 200 copies of the Gutenberg Bible were ever produced (Cook, 1990). It was equally a product of the élite as were the earlier Bibles that were hand-scribed by priests and monks. Not only was it not distributed to the common people, but even if it had been, they could not have read it because well over 90% of the European population could not read (Pattison, 1982). Literacy was the province of the clergy, scholars, and some aristocrats--all men. In fact, even literacy among the aristocracy was very limited because they employed scribes. "Far from being revolutionary, Gutenberg's efforts reflected established social, religious, and economical (sic) institutions of his day" (Cook, 1990, p. 32). Even the Gutenberg Bibles themselves were not revolutionary; they were identical in form and function to scribal manuscripts, with the same thick

letter forms, ligatures, and abbreviations, the same page layout, and even the same elaborate hand-drawn illuminations. In other words, the new technology initially changed the means of production only. Indeed, for long after the introduction of the printing press, scholars continued to copy texts by hand, often copying printed texts, either because such texts were readily available or because the scribe chose to excerpt only certain parts of a text or texts, thereby creating his own anthology--an activity similar to, but also very different from, instructors photocopying selected texts and patching together their own anthology!

The mass literacy campaigns of the German Protestant Reformers created a "significant population of readers that could take advantage of the pictures and texts that the printing press made available to them" (Tyner, 1998, p. 19). Even so, it was not until the end of the 18th century that illiteracy began to decline to near 50%, mostly as a result of the need for reading and writing at work, especially in trades that needed to keep records. It was only then that print culture became pervasive, being used for common articles like theater tickets, marriage licenses, and indentures (Kernan, 1989). The printing press merely facilitated changes already beginning to take place in Europe, especially a heightened sense of individuality and personality, of nationalism and secularism. These social changes, along with changes in supporting technologies over several centuries, brought about mass literacy in Europe--not the advent of the printing press. The printing press was not a necessary or sufficient condition. Its introduction in turn depended on technological advances in metallurgy. The widespread distribution of books available to the "common man" depended on supporting technologies that lowered production costs of books, including the cheap production of paper (produced from wood pulp), the invention of steam power, and the rolling press. Even more important were later social changes such as the introduction of public schooling and changes in work from agrarian to industrial (Cook, 1990; Tyner, 1998).

These opposing views of the technology of literacy as liberating or controlling can be seen since the advent of the printing press. Two centuries later, the 18th century philosopher, John Locke worried about what books might contain. He feared that, by being immutable, the information in them would be taken as knowledge, as truth. In the same vein, Diderot (1755) echoes Plato's fear the effects writing would have on learning and wisdom:

[T]he number of books will grow continually ... [readers] will not do very much reading, but will instead devote themselves to investigations which will be new, or which they will believe to be new (for if we are even now ignorant of a part of what is contained in so many volumes ... they will know still less of what is contained in those same books, augmented as they be by a hundred--a thousand--times as many more) ... And eventually the world of learning--our world--may drown in books (pp. 234-235).

A 1795 tract claims that excessive reading will cause "colds, headaches, . . . arthritis, hemorrhoids, asthma ... migraines, epilepsy, hypochondria, and, melancholy" (Darnton, 1986, p. 16). As Cipolla related in his 1969 work, "Literacy and Development in the West," during the British parliamentary debate over the 1807 bill for universal elementary education, the president of the Royal Society worried that

[G]iving education to the labouring classes of the poor ... would in effect be found to be prejudicial to their morals and happiness; it would teach them to despise their lot in life, instead of making them good servants in agriculture, and other laborious employment to which their rank in society had destined them; instead of teaching them subordination, it would render them factious and refractory, as was evident on the manufacturing countries; it would enable them to read seditious pamphlets, vicious books, and publications against Christianity; it would render them insolent. (Oxenham, 1980, p. 68)

Proponents of universal literacy over the several centuries since the introduction of the printing press have claimed it brings both individual and social advancement, in fact using the same arguments as those who (as quoted above) have feared universal literacy. Such advancement includes the ability for abstract

thought, political democracy, social equity, lowered crime rates, wealth, and productivity, to name a few. Since literacy holds such promise for human progress, governments and others decry what they call the "literacy crisis" in Western societies (see, e.g., Hirsch, 1987; Kozol, 1985) and promoted the UNESCO Experimental World Literacy Campaigns. The former are often "disguised talk about other matters, a way of avoiding less acceptable social concerns" (Gee, 1996, p. 22), while the latter were largely unsuccessful because the literacy functions they taught did not meet the needs of the learners.

In his examination of literacy in 19th century Canada, Graff (1979) challenges what he calls the "literacy myth" that claims that literacy leads to both personal and social economic advancement. He shows that literacy by itself did not determine either occupation or wealth, whereas class and ethnic origin did. One such example is 18th century Sweden, which achieved almost universal literacy for both men and women before any other Western country. Yet, Sweden did not exhibit modernization, social equality, or the economic growth attributed to literacy. Sweden's literacy was in fact restricted to reading, taught in the home and supervised by the local clergy through regular compulsory examinations. The goal was for all people to read the Bible and other religious tracts for themselves, but not to interpret them for themselves (Graff, 1987).

In discussing the history of individual authorship of books and censorship, Hesse (1996) shows how the notion of "freedom of the press" blossomed with Condorcet in late 18th century France, only to be abandoned as a "free" press led to the mass production of seditious writings during the French Revolution. As a result, this dreamer of knowledge for all through a liberating printing press actually initiated legislation to censor writing by asserting ownership rights to authors and thereby assuring their accountability. Interestingly, later regimes freed full-length books (as opposed to pamphlets, etc.) from prepublication censorship because, taking a longer time to be produced, they were free from the immediate impact of newspapers or pamphlets. These regulations and deregulations, Hesse argues, were not a result of any intrinsic characteristics of printing, "but rather of sociopolitical choices, embodied in legal and institutional policies that ensured the realization of that cultural ideal" (i.e., of individualism and private property; 1996, p. 28).

THE INFORMATION AGE

Many of the anticipated social effects of earlier technology are paralleled in the skeptical and enthusiastic prognoses for computer-based literacy. Even while advocating an historical understanding and critical approach before lamenting the literacy crisis caused by electronic media, Kernan (1989, p. 172) talks "of the inevitability of such changes and their extensive effects on social and individual, as well as technological, life." Yet, if we take a critical historical perspective, we can see that technology is not the cause of social or cognitive changes, but rather amplifies values and beliefs that a particular society currently holds. One example demonstrating that the interaction between a computer technology and current sociocultural practices is complex and not one-way, is how in education, computer technology has facilitated trends already present in pedagogical theory--collaboration (or cooperative learning) as a means of learning, a focus on process rather than product of learning, a view of writing as social, reader-response theory, and the teacher as mentor-coach rather than purveyor of received knowledge. To illustrate, Batson and Bass (1996) briefly examine several disciplines where the instructional foci of collaboration and process were already in place before the use of computers (or some of their attendant technologies such as the Web) in education. In particular, "[i]n the composition field, those teachers who use network-based classrooms have been able to implement collaborative and process theory in a compatible marriage of theory and technology. Indeed, this is the critical point: information technologies did not create the composition field's emphasis on process, they merely enabled it more extensively than before" (p. 45).

To illustrate this point further, I will discuss in some detail commerce on the Internet, whether computer-based literacy changes society's and individuals' "ways of knowing," and the issue of information control and distribution, all phenomena paralleled in previous literacy technologies.

Commerce

Computer-mediated communication grew out of simple, short messages (usually) sent from a programmer working on a dumb terminal to an operator working on a dumb terminal, requesting the operator to perform some function, mostly in proprietary companies. Soon, people logged on to the mainframe computer at the same time realized the potential of this feature for sending immediate messages to anyone logged onto the same computer. Next followed the ability to transfer data files, which were stored until the user logged on. From this came the exchange of longer, "store-and-forward" communication messages. What people did with the technology was turn features designed to facilitate work tasks into a communication medium. So, too, with the development of the Internet, which grew out of the U.S. Department of Defense's Advanced Research Projects Agency network (ARPANET), a distributed network connecting defense research institutions. The goal of ARPANET was to both improve information sharing and ensure, in the face of an attack, that not all the Defense Department's work was stored in one place (see Hafner & Lyon, 1996, for a history of the Internet).

Just as the early syllabary of the Phoenicians was a means of increasing commerce and making it more efficient, the Internet was initially seen as an opportunity for commercial enterprise. Yet Prodigy, one of the first on-line commercial enterprises was never successful in commerce. Instead, America On Line (AOL), a service which initially was primarily a communication tool, signed up millions of subscribers. In the past several years, however, "dot com" and e-commerce have captured popular imagination. Indeed, [CyberAtlas](#), a site I refer to extensively below and in other publications, began in 1996 as a reliable source of data about Internet usage; after being purchased by internet.com in 1998, the Web site now "provides readers with valuable statistics and Web marketing information" (CyberAtlas, 2000a). A quick look through the archives shows that the data are now being directed in the service of commerce. Despite this apparent ubiquitousness of e-commerce, it is not yet profitable in terms of sales. One of the largest e-commerce businesses, Amazon.com, has still to make a profit even though buyers of its stock make profits through trading stocks. While the National Retail Federation has shown increases in Internet purchases, such purchases are still a small percentage of total retail sales in the US. Indeed, three very recent articles (CyberAtlas, 2000a, 2000b, 2000c) based on research studies show that [customers are looking for more than better retail distribution services](#), that [banks in both the US and UK are having a hard time convincing customers to pay bills online](#), and [in both the US and Europe e-business is still in its infant stages](#). Currently, most e-commerce is among e-commerce businesses, not between businesses and consumers because "Taking *relationships* [italics added] online requires more than technical ability" as the Bristol Group's Executive Vice President states concerning their study of Internet business in the US, Canada, Ireland, and the UK ([E-commerce may be hazardous to your wealth](#), 2000, p. 1).

While commerce (or defense) may be the driving impetus for literacy technologies, computer technology, like earlier technologies, has been coopted as a means of communication because

We do not write and read [or use computers] primarily in order to ensure this nation's employers can count on a competent, competitive workforce. We write and read in order to know each other's responses, to connect ourselves more fully with the human world, and to strengthen the habit of truth-telling in our midst. (De Mott, 1990, p. 6)

Thus, the Internet is used largely for communication through e-mail, newsgroups, bulletin boards, and Instant Messaging, all of which in some way are modeled on existing forms of communication. Indeed, as users more and more saw computers, not as "computing" machines, but as communication vehicles, they

developed new types of communication such as MUDs, MOOs, groupware, and personal Web pages. Now that the computer's communication role is established, we see a focus on the content of that communication: Software companies are joining forces with entertainment companies, or communications companies are joining up with educational multimedia companies. Just as earlier inventions did not cause any specific outcomes, so too, computer technology does not of itself cause specific developments around the technology. Alexander Graham Bell would likely not be surprised by the technology of the telephone, but he would be surprised by the social customs surrounding it--the protocols of voice mail, the ubiquitousness of telemarketing, or the use of a telephone number as identification (in, for example, catalog ordering). So, too, Alan Turing and Charles Babbage would not be surprised by the speed of computing or probably even by the microchip. But, they would be surprised that their "computing" machines are the sites for communities that meet and communicate via listservs, MOOs, and MUDs.

Ways of Knowing

Just as Plato opposed the introduction of alphabetic literacy because it might change our ways of knowing, commentators today oppose computer-based literacy, using many of the same arguments as those used for the introduction of previous literacy technologies. Echoing Plato, Greene (1983, p. 6C) worries that in e-mail, "[a]ll the personality and humanity that show up in letters disappear on computer screens ... all the warmth and wisdom are translated into those frigid, uniform, green characters." Ong (1982) agrees with Plato and extends the condemnation to computers: "Writing is passive, out of it, in an unreal, unnatural world. So are computers" (p. 79). Proponents of computer-based literacy, on the other hand, talk of its power to alter ways of knowing and ways of thinking about the world.

This so-called information age is misnamed, according to several scholars (e.g., Drucker, 1999; Hamming, 1997; Shapiro, 1999; Shenk, 1997). Like the writers Plato decried, we could have the appearance of knowing (that is, have information), without the wisdom to understand or use it. The title of my own book, *Knowledge Machines: Language and information in a technological society* (1995) reflects this concern that information is not knowledge, that we might drown in phosphorus dots on a screen and spend our time *investigating* rather than *reading* and developing knowledge and wisdom (cf., Diderot, 1755). Anyone who is on a listserv or who has tried to surf the Web can attest to the volume of information, the variable quality of that information, and the myriad pathways for retrieving information. To use the Web for retrieval of information requires developing new skills--navigating skills and discriminating skills.

The Web, a hypertext overlaid on the Internet, branches in directions determined by the Webmasters of its Web pages. Just as one person's neural networks are different from another's because of their differing life experiences, so too, the hyperlinks on a Web site may parallel one person's knowledge system, but not another's. Even search engines reflect the choices of the programmers. Yet, this web-like structure mirrors the two types of information structure represented in printed books: the table of contents for the hierarchical structure and the index for the associative structure. In hypertext, however, these structures are not always transparent to the reader. Additionally, many links dead end, ending either in an "orphaned" site or one that takes us outside the tree we initially started with. So, even after hours of surfing, we may not find a site with the information we want. Even when we find the information, it may not be usable. For example, in searching the Web for sites on Gutenberg and Caxton to use as hyperlinks in this paper, I came across several interesting sites--written by elementary school children for school projects. While this was a fascinating result, I was not sufficiently convinced by the authority of the writers to want to include them in a scholarly article. In searching for statistical data on Internet usage for a different paper, I found myself at two sites in languages I do not speak--Hungarian and Italian. The data about Internet usage reported on those sites may or may not have been useful. I have no way of telling. Over centuries of the social uses of printed books, societies have developed ways of authenticating,

validating, and sieving information, contrary to what Pope Alexander VI or the President of the Royal Society feared. Books and journal articles are reviewed before publication, edited by skilled professional editors, and referred to and commented on by reviewers or in citations. Thus, we mostly protect ourselves from charlatans posing as writers or researchers. In the short time we have been mining the Internet for information, we have not established protocols for efficiently retrieving or validating information, of separating the "infojunk" (Dertouzos, 1997) from useful information.

Literacy in an electronic medium is not tied to text; it may include images, sounds, and actions. Multimedia is just that. In claiming that the privileged position of printed text is ending and discussing how computers allow knowledge to be represented visually (such as through simulations or virtual realities), McCorduck states that

we have not had much choice until now because text, whether the best representation for certain purposes or not, has dominated our intellectual lives until now. The computer is changing this In the computer, we have fashioned for ourselves a means of taking advantage of *all* [italics added] our biological capacities to learn and to know, and to seek and find new knowledge; and this is--someday--how we *will* know. (1994, p. 259)

However, rather than being overwhelmed by the visual, writing in multi-media coopts the visual as part of the text. "Multi-media texts are not therefore the death of writing" (Bolter, 1989, p. 139). Indeed, because of the potential of multimedia, McCorduck has claimed that "we will know many different ways. The primacy of text is over, though text is hardly dead" (1994, p. 255). Kress (1998) and Bolter (1996), however, point out that although text has dominated in Western societies, other media have always co-existed with text. Scribal manuscripts were illustrated with elaborate illumination of letters; medieval churches told stories on stained glass; printed books used a variety of fonts and formatting structures (in fact the early printed books tried to replicate the elaborate illuminations of the scribal texts); rebus books have been popular for centuries; science books have been illustrated with drawings; newspapers and magazines use a variety of textual elements (see for example Bolter's analysis of *USA Today*, 1996). Thus multimedia, with its use of visuals, is an extension of previous attempts to blend the visual with text. "The breakout of the visual has more scope in computer-controlled multimedia than in print" (Bolter, 1996, p. 261); the computer amplifies a socio-cultural value of imagery and appeal to the senses.

Control of Information

A recurring theme during the introduction of earlier technologies is on one hand the fear that the technology will cause a shift in power, a shift in who controls the flow and content of information. The enthusiasts, on the other hand, advocated the new technologies precisely because they would provide social equity. Just as Pope Alexander VI feared the Catholic Church would lose control of information (and ultimately people's ways of knowing as discussed above), today skeptics fear a change in the distribution of power, while enthusiasts look to computer technology to liberate the masses as the printing press supposedly did. For example, a recent best seller, Shapiro's *The Control Revolution* (1999) is subtitled, "How the Internet is putting individuals in charge and changing the world we know." While this many-to-many technology may have the potential to empower, it also has the potential to maintain the status quo or replace one hierarchy with another, depending on who has access to the technology and who controls both information content and information flow.

Elsewhere, I have written extensively about the unequal access to information technology (Murray, 1999). Within the US, the digital divide falls along lines of ethnicity, age, gender, wealth and domicile (whether rural, urban or suburban). Outside the US, the divide follows lines of wealth and industrialization. Sites of empowerment do exist. During the Cultural Revolution in China, students e-mailed the news of the

Tiananmen Square massacre around the world; Serbian democracy activists broadcast on the Internet, in defiance of their government; Kosovo safe-haven refugees in Australia became computer literate almost overnight to keep in contact with family and friends around the world; individuals from their homes trade stocks and make (or lose) fortunes. But, we must not take for granted the extension of such empowerment. Just as the Reformation was aided by the printing press, it took a Martin Luther (and others) to shape the technology to achieve their goal of the Bible being available to all, which, as we saw previously, still took centuries to achieve.

Access is not sufficient. Even those with the technical access may not be able to find and use the information they require (as discussed previously); they may lose data through crashes and viruses. Computer technology is still an unstable environment. More importantly, access depends on who controls information content and its flow. Just as those with power feared individual access to the new literacy technologies of the past, so too, do they today. Powerful corporations, especially software gatekeepers like Microsoft, continue to try to control both content and flow. They try to achieve both through mergers and alliances with entertainment corporations with TV, radio, and newspaper outlets throughout the country. Dotcom companies collect data, cross reference it and sell it, removing our right to privacy. We have no tested laws that govern intellectual property rights on the Internet; journals such as this one rely on the basic honesty of other scholars that they will not copy and plagiarize. Information content and distribution was also controlled using earlier technologies. While the process of publication described above assured quality, it too acted as a gatekeeper, especially for nascent authors unable to afford a literary agent or for fledgling scholars, not yet socialized into the academic style of writing. But, just as this exercise of power was a socio-cultural phenomenon in previous eras, so it is today.

CONCLUSION

While it is clear from an historical analysis of earlier literacy technologies that the technology does not cause social or religious revolutions, it is also clear that the introduction of any technology is not neutral, whether the technology is a literacy technology or not. "The computer [or any other technology] is not just a tool; it is an extension of the environment in which we think and communicate" (Costanzo, 1992, p. 21). All tools carry social meaning, reflecting social values and practices. Their social meaning, however, is only evident in their use. When the telephone was first introduced, for example, people did not see it as anything more than a machine. Over time, however, it has become a cultural artifact, a way of communicating, with its own conventions for polite interaction, including opening sequences, turn-taking, and closing sequences. Societies adapt new literacy technologies to fit their value systems and practices so that any new medium becomes another part of the web of communication (see Murray, 1991). For example, e-mail as a technological tool has not been a replacement for the interoffice memo, using a different delivery system. Instead, users have adapted a range of forms and functions from other communication media (Williams, 1999) so that e-mail has become an additional mode in people's linguistic repertoire from which to choose (see Murray, 1988, for a discussion of medium and mode as choice).

Technology is not neutral, but nor is it inevitable, as many have proclaimed (see Nardi & O'Day, 1999, for a discussion of the rhetoric of inevitability). Technological determinism masks the need for educators and other consumers of technology to engage in discussions of the ethics and social responsibilities involved in its use. Because traditionally our education has depended mightily on the printed word, many educators have been easily seduced into believing that the future of education must entail computer literacy, even though no one can seem to agree on just what we mean by this term. Do we need computer literacy to drive a car (which now has several computers in it) or to do word processing or to use a bank automatic teller machine? Yet we read comments such as "computer literacy is "now as basic as the need

to read, write, and solve mathematical problems" (Bitter & Camuse, 1984, p. 262). As educators, we need to address the questions Andries van Dam raised back in 1985:

This is one of the great intellectual challenges of the century. Are we going to wait until the manufacturers give us what *they* want to give us? Or are we going to take hold of this technology and shape it for our needs as we see them? (quoted in McCorduck, 1985, p. 232)

The introduction of writing did not replace oral communication; the advent of print did not replace writing; electronic communication has not replaced print. Each exists as part of the complex of communication forms available for human beings to use, depending on the context of the communicative event. However, the uses of the different media have changed as new ones have been introduced. Hand-written signatures remained important after the advent of print and today are still the primary means of authentication. However, electronic forms of authentication are being developed--digital fingerprints and encryption keys. Despite the media and political cries about the decline of literacy in Western societies, more books are being produced than ever before (see, e.g., Benton Foundation, 1996). Specific outcomes of computer-based literacy are neither inevitable nor ideologically neutral: individual empowerment is as likely as top-down control; e-commerce may or may not dominate; information may or may not be turned into knowledge and wisdom; intellectual property may or may not be protected. As educators, we need to use both a critical and an historical lens as we discuss or adopt technologies in our lives and in our classrooms. Without such an understanding, we will abdicate the power over how to use the technology to others. "[W]hatever influences machines may have on human beings, are determined not so much by impartial technologies as by the ideological climate that produced them" (Costanzo, 1992, pp. 19-20). We need to understand that ideological climate and, from understanding, help (re)create it.

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