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Writing as Technology

It is not difficult to recognize the printing press, the typewriter, and the Linotype machine as technologies. These industrial-age means of book production were complex and to a degree self-activating or self-directing. The mechanization of writing began in the 15th century with the letter press itself, which was the first text "processor," the first technology of writing to duplicate words en masse. (On the development of printing, see Steinberg, 1959.) In replacing the scribe who formed letters one at a time, the press registered several pages of text onto a large sheet of paper with each impersonal pull. As McLuhan recognized in *The Gutenberg Galaxy* (1972), "the invention of typography ... provid[ed] the first uniformly repeatable commodity, the first assembly line, and the first mass-production" (p. 124). Printing had the additional virtue that it could produce books that were nearly identical to the best manuscripts: the press rivaled handwriting in quality while far surpassing it in quantity. Elizabeth Eisenstein (1983) noted that "[t]he absence of any apparent change in product was combined with a complete change in methods of production, giving rise to the paradoxical combination of seeming continuity with radical change" (p. 20). This paradox made the mechanization of the word easier to accept, and scholars in the 15th century immediately saw the advantages of this new technology. Gradually, over several generations, printing did change the visual character of the written page, making the writing space technically cleaner and clearer. The book had taken on a different and more modern look by the late 18th century. In the 19th and 20th, steam and electric presses, and automatic typesetting brought further mechanization, further distancing the human controller from the printing process and defining an industrial age of print. The computer in turn adds new flexibility to the rapidity and efficiency of printing. The computer's capacity to adjust the text to each user's

needs, which is uncharacteristic of the classic industrial machine, derives from the unmechanical materials of electronic technology. The computer's central processor itself contains no gears or indeed any moving parts above the level of electrons, and even the mechanical components of a computer system, such as disk drives and printers, are characterized by rapid movement and fine control. The digital computer suggests a new definition of the machine, as a complex interrelation of logical as well as physical parts that, unlike the steam engine and the dynamo, processes information rather than producing power. If the printing press was the classic writing machine, the computer constitutes a technology of writing beyond mechanization, a postindustrial form of writing.

The medieval manuscript and ancient papyrus roll in turn represent technologies of writing before mechanization. These preindustrial technologies also required devices—pen and paper or parchment in the Middle Ages or reed pen and papyrus in the ancient world. Working from such raw materials as rags, animal skins, or plants to produce a finished book certainly required considerable technical knowledge. Still, the manuscripts were produced at the relatively slow pace of the scribe's hand, not the insistent rhythm of the machine, and we can see on each page the variations in size and shape of letters that indicate direct human production. The development of mechanical printing and now writing by computer has affected our view of these previous writing techniques. A medieval manuscript, rubricated and bound in leather, would perhaps have struck a Greek in Plato's time as a complicated and ingenious device. When we admire the manuscript as art, however, what we admire is the apparent negation of technology, the fact that the codex is not a printed book and therefore not the product of a machine.

There are good historical (as well as etymological) reasons, however, for broadening the definition of technology to include skills as well as machines. The Greek root of "technology" is *techne*, and for the Greeks a *techne* could be an art or a craft, "a set of rules, system or method of making or doing, whether of the useful arts, or of the fine arts" (Liddell & Scott, 1973, p. 1,785). In his dialogue the *Phaedrus*, Plato calls the alphabet itself a *techne*. He would also have called the ancient book composed of ink on papyrus a *techne*; even Homeric epic poetry was a *techne*, as was Greek tragedy. All the ancient arts and crafts had this in common: that the craftsman must develop a skill, a technical state of mind in using tools and materials. Ancient and modern writing are technologies in the sense that they are methods for arranging verbal ideas in a visual space. The writer always needs a surface on

which to make his or her marks and a tool with which to make them, and these materials become part of the contemporary definition of writing. Writing with quill and parchment is a different skill from writing with a printing press, which in turn differs from writing with a computer. However, all writing entails method, the intention of the writer to arrange verbal ideas in a space for later examination by a reader. In *Orality and Literacy* (1982) Walter Ong argued that writing is “interiorized” and that the process of interiorization makes it difficult for us to recognize writing itself as a technology (pp. 81–82).

Our technical relationship to the writing space is always with us as readers and writers. Literacy is, among other things, the realization that language can have a visual as well as an aural dimension, that one's words can be recorded and shown to others who are not present, perhaps not even alive, at the time of the recording. Literate people know that words can be placed in a visual space and have continued existence in that space. They always know this. Even when they are speaking, they know that their words can be written down. Students of culture as uncongenial as Walter Ong and Jacques Derrida have insisted that writing is a constant presence in our mental life. Cultures with a long tradition of literacy develop a standard literary language, so that men and women reveal their literacy when they are speaking as well as writing. Illiterates are denied access to that language, while those educated in the tradition tend to speak in a combination of colloquial and literary terms. They speak, as they write, in a variety of styles and levels, and they often structure their speech as they do their writing, talking in sentences and even paragraphs. They write in their mind as well as on paper or at a keyboard; indeed, they are writing whenever they think or verbalize in that methodical way characterized by writing.

There may be many such literacies at any given historical moment. A cultural elite may succeed in defining a high literacy, whose *techne* excludes various minorities. North American culture, for example, was relatively successful in maintaining such a high literacy until perhaps the Second World War: this *techne* was embodied in the literary canon that some traditionalists still wish to affirm as the basis for education. Minorities, however, may develop their own *technes*, their own internalized literacies. Spoken language can itself be a *techne*, for it can require method—most obviously in the varieties of oral poetry and storytelling that have been practiced for thousands of years and are still important today in much of the developing world. (On Homeric oral poetry, see Lord, 1968; Thomas, 1992, pp. 29–51. On the many other varieties of oral poetry, see Finnegan, 1977.) The oral

poet applies method to language in order to create verse forms and story structures, although in this case the structures must be able to be appreciated by listening rather than by reading. The oral poet is a writer, who writes exclusively in the minds of his or her audience.

Despite its apparent immediacy, however, oral poetry is no more natural than writing, just as writing with pen and paper is no more natural, no less technological, than writing on a computer screen. Although the computer is a more complicated and fragile device than a pen, we could not isolate ourselves from technology by reverting to older methods of writing. The production of today's pens and paper also require a sophisticated manufacturing process. Without electricity, industrial organization, and networks of transportation and distribution, we could not provide ourselves with adequate supplies of these simple writing materials. It is not the complexity of the devices that matters so much as the technical or literate frame of mind. Writing technologies are never external agents that invade and occupy the minds of their users. These technologies are natural or naturalized only in the sense that they are constituted by the interaction of physical materials and human practices. No technology, not even the apparently autonomous computer, can ever function as a writing space in the absence of human writers and readers. And what Walter Ong characterized as the literate mind is simply another name for the collective decisions shared among writers and readers about how to exploit their materials in order to communicate.

WRITING TECHNOLOGIES AND MATERIAL CULTURE

As Christina Haas (1996) puts it: “Writing is situated in the material world in a number of ways. It always occurs in a material setting, employs material tools, and results in material artifacts” (p. 4). Roger Chartier has made the argument repeatedly in his work on the history of the book:

“Whether they are in manuscript or in print, books are objects whose forms, if they cannot impose the sense of the texts that they bear, at least command the uses that can invest them and the appropriations to which they are susceptible. Works and discourses exist only when they become physical realities ... This means that ... keen attention should be paid to the technical, visual, and physical devices that organize the reading of writing when writing becomes a book” (Chartier, 1994, pp. viii–ix).

What Chartier says of books and manuscripts is certainly also true of digital technology (see also Duguid, 1996). The materiality of writing matters,

as much for electronic writing as for earlier forms. Electronic writing still requires our physical interactions with terrestrial materials—with the keyboard, the mouse, and the computer screen. Despite the dreams of cyberpunk authors and virtual reality enthusiasts, repetitive stress injuries should serve as a reminder that computers are physical entities. Electronic writing is always involved in material culture and in contemporary economics. Computers are tangible objects with aesthetic and social significance, and digital devices and software are objects of important economic exchange. A single software program, an operating system, has made one man perhaps the richest private citizen in the world, but more important has had a significant impact on economic activity throughout the developed world.

Electronic writing may also be virtual, yet all previous writing technologies were virtual as well, in the sense that they invited writers and readers to participate in an abstract space of signs. This virtual or conceptual writing space forms a continuum with the material space of writing: it is both a reflection of contemporary materials and techniques and an expression of our culture's ambitions for its writing. Just as new digital media refashion the material conditions of print and handwriting, so the computer's virtuality refashions the writing space of the printed book and the manuscript. The electronic writing space may seem to be severed from the material world in a way that the space of print was not. Enthusiasts for the electronic writing space often promote as revolutionary its dynamic and apparently autonomous character—the fact that Web pages and multimedia applications can act as well as react, redefining themselves in ways that neither the author nor the reader can necessarily predict in advance. Yet those actions and reactions are grounded in the physics and computer science of the technology and are the result of specific interventions on the part of human writers (or programmers) and readers (or users). Our literate culture is simply using the new tools provided by digital technology to reconfigure the relationship between the material practices of writing and the ideal of writing that these practices express. It remains as true for the computer as for earlier technologies that the materiality of writing “must be acknowledged to fully appreciate the nature of literate acts” (Haas, 1996, p. 3). (For a discussion of materiality and theories of language and writing in the 20th century, see Johanna Drucker's *The Visible Word*, 1994, particularly pp. 9–47.)

Chartier reminds us that writing never exists only in the abstract:

“Readers and hearers, in point of fact, are never confronted with abstract or ideal texts detached from all materiality; they manipulate or perceive objects and forms whose structures and modalities govern their reading (or their

hearing), thus the possible comprehension of the text read (or heard)” (Chartier, 1994, p. 3).

Each technology of writing involves different materials or different ways of deploying the writing materials, and these differences are significant. This is not to suggest, however, that the material conditions of writing determine in an exclusive fashion how a literate culture will read and write its texts. The relationship of the material techniques and the nature of writing—what Haas (1996) calls the Technology Question (pp. 3–23)—is far subtler and more interesting (see also Grusin, 1996). The very materiality of writing binds writing firmly to human practices and therefore to cultural choices. The technical and the cultural dimensions of writing are so intimately related that it is not useful to try to separate them: together they constitute writing as a technology. The technology of ancient writing is not only the papyrus, the ink, and the techniques of making book rolls; it is also the styles and genres of ancient writing and the social and political practices of ancient rhetoric. The technology of modern writing includes not only the techniques of printing, but also the practices of modern science and bureaucracy and the economic and social consequences of print literacy. If personal computers and palmtops, browsers and word processors, are part of our contemporary technology of writing, so are the uses to which we put this hardware and software. So too is the rhetoric of revolution or disaster that enthusiasts and critics weave around the digital hardware and software.

It is not a question of seeing writing as an external technological force that influences or changes cultural practice; instead, writing is always a part of culture. It is probably best to understand all technologies in this way: technologies do not determine the course of culture or society, because they are not separate agents that can act on culture from the outside. Yet the rhetoric of technological determinism remains common today. Popular writers often seem to suggest that technologies, especially digital information technologies, are agents in this sense. The World Wide Web, virtual reality, or computers are said to revolutionize our society, our economy, and even the way we think. More substantial writers such as McLuhan and Ong can also sound like technological determinists: McLuhan when in *Understanding Media* (1964) he explores media as “extensions of man”, and Ong when he claims in *Orality and Literacy* (1982) that writing restructures consciousness. The very title of Elizabeth Eisenstein's massive book on the age of print, *The Printing Press as an Agent of Change* (1979), suggests that she too is guilty of technological determinism. On the other hand, it is possible to understand print technology is an agent of change without insisting that

it works in isolation or in opposition to other aspects of culture. Even the Marxist sociologist of media, Raymond Williams, warned us to avoid economic or social determinism, just as we should avoid technological determinism (1975, pp. 130).

Individuals and whole cultures do mold techniques and devices to their own purposes, but the material properties of such techniques and devices also impose limitations on their possible uses. There are many things we cannot do with contemporary computers, even things that some would obviously like to do. For example, artificial intelligence has not provided us machines with the capacity to write stories or create fully autonomous graphic worlds, though many technophiles would like to have them. It also seems that a technique or device can render certain social constructions easier and or even possible. The hardware and software of the Internet made it possible to construct the World Wide Web. Our culture chose to turn the Web into a carnival of commercial and self-promotional Web sites, but that carnival would not be possible without the underlying hardware and software protocols. Yet even this way of putting it seems to create a false dichotomy between devices ("hard" technology) and social uses. Even in their brief period of development, the hardware and software of the Internet have clearly changed in response to social and economic pressures, and these social and economic pressures respond in turn to each new technical possibility. The open architecture of the World Wide Web allowed individuals to create sites and add them to the Web without the approval of any authority. This openness led to erotic Web sites, which in turn led to calls in the United States to block such sites because children might visit them. Some politicians wanted to censor these sites by law, and the ensuing struggle has also led to the development of software filters to allow parents to block certain sites. Wherever we start in such a chain of cause and effect, we can identify an interaction between technical qualities and social constructions—an interaction so intimate that it is hard to see where the technical ends and the social begins. When I speak of a technology of writing throughout this book, I will in general mean not just the hard technology, but the sum of the technical and social interactions that constitute a writing system. It is the contemporary technology of digital writing in this broad sense that we are trying to characterize.

In this characterization, the material properties remain significant. The properties of handwriting, of print, or of digital writing do each seem to favor certain kinds of expression and to prejudice others. The printed book favors linear writing; the computer makes associative linking easier. A technology,

as it has been culturally constructed, can predispose us toward a particular definition of "natural" writing. Thus, if a writer chooses to display fixed, linear prose on a computer screen, she is working "against the grain" of the technology, just as Lawrence Sterne in the 18th or the dadaists and other avant-gardes in the 20th century have worked against the medium of print to create highly associative prose. The very fact that such writers exploit the technology in other than its "natural" mode gives their work its significance. Even in these cases, however, we do not have to argue that linear writing is inherently natural to print. The linear character of print is the outcome of the constant interaction between the properties of the printed book and the decisions that Western authors and readers have made about how to exploit those properties. In other words, we can reject the attempt to isolate the technical from the social aspect of technologies of writing, but we can still examine how these techniques and materials have been deployed by writers and readers at various cultural moments. Linear writing is appropriate to print technology both because the printed page readily accommodates linear text and because our culture expects that printed prose should be linear. Other styles may be appropriate to digital technology, where software systems like the World Wide Web are both expressions of and influences on our changing attitudes toward writing.

ECONOMIES OF WRITING

Each culture and each period has had its own complex economy of writing, a dynamic relationship among materials, techniques, genres, and cultural attitudes and uses. The earliest economies flourished in Mesopotamia and in Egypt, where complex word-syllable scripts were recorded on stone, clay, or papyrus (see Gaur, 1984; Gelb, 1963; Jensen, 1969; Sampson, 1985). The ancient Greeks and Romans borrowed both the materials and the elements of their writing economy: the Greek alphabet was taken from the Phoenicians, and papyrus from Egypt served as the chief writing material for the Greeks and the Romans. The ancient book was a roll, consisting of sheets of papyrus glued together at the ends. The paged book or codex, which came into use in the 2nd and 3rd centuries A.D., opened a range of new possibilities for writing, by offering a space both more varied and more accessible than that of the roll (See Chartier, 1995, pp. 18–20; Reynolds & Wilson, 1978, pp. 30–32) (= > p. 78). The codex was put to more sophisticated use in the Western European economy of writing. In the Middle Ages parchment provided a more durable and more attractive writing surface than pa-

papyrus, which in any case became hard to obtain from Egypt. Paper was introduced from the Far East as a cheaper replacement for parchment in the later Middle Ages. Although not as tough as parchment, paper made from rags could be produced in greater quantities and could therefore supply a growing demand for reading materials (see Febvre & Martin, 1971, pp. 39–60. See also Gaur, 1984, pp. 44–47). With these new materials, medieval scribes slowly refashioned the writing space they had inherited from the ancients; they employed word division, punctuation, rubrication (decorated initial letters), headings, and letter styles to organize the text visually on the page. They began to insert critical notes and glosses into the margins of the text, sometimes in several layers. In some scholarly medieval codices, the page became a web of text and interpretation, tradition and innovation. Finally, the invention of printing in the 15th century initiated the modern economy of writing with its highly organized and standardized space. During each of these periods, there have been numerous secondary technologies as well: wax tablets, chalkboards, typewriters, stenographs, dictaphones, and so on—each fulfilling needs that could not be easily met by the dominant technology (see, for example, Rouse & Rouse, 1989).

When in the history of writing a new technology appears, it may supplement an established technology or replace it. Papyrus was replaced in the Middle Ages by parchment and paper. In the late 19th and early 20th centuries, the typewriter replaced handwriting for business communications. At the same time American society was beginning to accept women into the work force so that the change created secretarial jobs for young women, who took the place of male clerks (see Zuboff, *In the Age of the Smart Machine*, 1988, pp. 115–116). Now the word processor has replaced the typewriter. Whenever a dominant technology is challenged, there may be a major refashioning of the culture's writing space. The three dominant technologies since ancient times, the papyrus roll, the codex, and the printed book, each participated in the fashioning of a rather different writing space. When the codex replaced the roll, it refashioned the writing space from the still relatively oral space of ancient culture to the progressively more visual and less oral space of medieval writing. When the printed book supplanted and marginalized the codex, the writing space took on the qualities of linearity, replicability, and fixity that we have associated with the printed book. Electronic and digital technology are helping to refashion the writing space again. In the late age of print, this refashioning is not complete, and we are now experiencing the tensions and inconsistencies that come from attempts either to reconcile the two spaces of print and digital technology or definitively to replace the one with the other.

In its role as a great refashioner, electronic writing is reintroducing characteristics that have belonged to a variety of marginal techniques of the past. Electronic writing shares with the wax tablet or chalkboard the quality of rapid and easy change. It shares with the typewriter its keyboard (at least at present), its method of discrete selection of alphabetic elements, and its mechanical uniformity; with improvements in speech recognition, electronic writing systems can function like a tape recorder in taking input through a microphone. The computer can serve as a copier, a note pad, a calendar, or a teletype machine. In fact, it is hard to think of a marginal technology in the history of writing that the computer cannot imitate, just as it is hard to think of a dominant technology whose elements the computer does not borrow and reinterpret. Electronic writing may therefore participate in the restructuring of our whole economy of writing. Of greatest importance, however, is the way in which our literate culture is using the computer to refashion the printed book, which, as the most recent dominant technology, is the one most open to challenge.

REMEDICATION

In about the 8th century B.C., the Greeks began to refashion the space of oral mythology and heroic legend into the more precise and linear space of the papyrus roll (and stone or wooden inscription), a process that, according to Eric Havelock (1982), lasted hundreds of years. In late antiquity the shift from papyrus roll to codex refashioned the space again, making more effective use of the two-dimensional surface to deploy text. In Western Europe the shift from handwritten codex to printed book was another such refashioning, and the shift to electronic writing is yet another. We might call each such shift a "remediation," in the sense that a newer medium takes the place of an older one, borrowing and reorganizing the characteristics of writing in the older medium and reforming its cultural space. Writing on papyrus remediated oral communication by involving the eye as well as the ear and so giving the words a different claim to reality. The other shifts too blatantly or subtly changed the terms on which we as readers approach the text and its mode of representing the world. Remediation involves both homage and rivalry, for the new medium imitates some features of the older medium, but also makes an implicit or explicit claim to improve on the older one.

Remediation is a process of cultural competition between or among technologies. For centuries, the Greeks and Romans conceived of their technology of alphabetic writing on papyrus roll in a dialectic tension with the oral

tradition that writing only partly replaced. Ancient prose, even philosophy and history, was often highly rhetorical, as if the writing were still trying to imitate and improve on oral presentation. The shift from codex to papyrus roll was less problematic, with the result that the codex remediated the roll almost out of existence in a few centuries. In the Renaissance the printed book remediated the manuscript by appearing to provide the same visual space as the manuscript with the added benefits of mass production (= > p. 78). Over centuries, however, the printed book was a significant refashioning that defined a space in which fixity and accuracy were more highly prized than perhaps ever before.

Digital technology is turning out to be one of the more traumatic remediations in the history of Western writing. One reason is that digital technology changes the “look and feel” of writing and reading. A printed book could and did at first look like a manuscript, its appearance changing gradually over several decades. Chartier (1995) argues that the current shift from print to electronic technology, which he calls a revolution, entails a change greater than the one from manuscript to print:

“Our current revolution is obviously more extensive than Gutenberg’s. It modifies not only the technology for reproduction of the text, but even the materiality of the object that communicates the text to readers.... The substitution of screen for codex is a far more radical transformation because it changes methods of organization, structure, consultation, even the appearance of the written word.... The present revolution has only one precedent in the West: the substitution of the codex for the *volumen*—of the book composed of quires for the book in the form of a roll—during the first centuries of the Christian era” (pp. 15, 18).

Yet, until the 1980s, it was not apparent to most readers and writers that the computer was a writing technology at all. Before the advent of word processing on personal computers, our literate culture regarded computers as “number-crunching” tools for engineers or as electronic filing cabinets for bureaucratic data. In the past two decades, however, computers have been recognized not only as writing technologies, but as media for popular entertainment and expression, which we are using to refashion visual as well as verbal communication.

Remediation is not limited to technologies of writing. Richard Grusin and I have examined the ways in which new visual media, such as computer graphics, virtual reality, and the World Wide Web, define themselves by borrowing from, paying homage to, critiquing, and refashioning their predecessors, principally television, film, photography, and painting (Bolter &

Grusin, 1999). Computer games remediate film by styling themselves as “interactive movies”; virtual reality remediates film as well as perspective painting; digital photography remediates the analog photograph. The World Wide Web absorbs and refashions almost every previous visual and textual medium, including television, film, radio, and print. Furthermore, older media can remediate newer ones within the same media economy. Today, the traditional cinema is attempting to maintain its status by employing computer graphics in conventional linear films. And television is making such extensive use of new media that TV screens often look like pages from the World Wide Web. Remediation is a characteristic process not only for contemporary media, but for all visual media at least since the Renaissance with its invention of linear-perspective painting. Each medium seems to follow this pattern of borrowing and refashioning other media, and rivalry as well as homage seems always to be at work.

Furthermore, since the Renaissance, our culture has had two apparently contradictory expectations for its visual media. In one sense the goal of representation has been transparent presentation. The medium is supposed to function as a window through which the viewer can see the objects represented. That was in fact exactly how the artist and writer Leon Battista Alberti characterized linear-perspective painting in his treatise “On Painting”: as a window on the world (Alberti, 1972, p. 55). Western artists and audiences have generally treated perspective painting, photography, film, and now virtual reality and three-dimensional computer graphics as transparent media. On the other hand, artists and their audiences do not always want the medium to disappear; they often want to be made conscious of and even surrounded by media. Instead of transparency, they strive for *hypermediacy*, an intense awareness of and even reveling in the medium. Contemporary television, for example, is often hypermediated, although it can sometimes function as a transparent medium as well. Among new digital media, the World Wide Web is most often characterized by hypermediacy. The same medium can strive for transparency in one case and hypermediacy in another, and in general today we swing back and forth between a desire for transparent contact with the ostensibly real (unmediated) world and a fascination with the possibilities that media offer us. Because the number of old and new, analog and digital, media available to us today is very great, we live in an environment that is conducive to hypermediacy. Yet the desire for a transparent medium remains strong.

What all media and media forms have in common for our culture is the promise of immediacy. Transparent media promise to disappear and leave us

in contact with the unmediated world, although it is a promise that they can never entirely fulfill. Hypermediated media give up the attempt to present a world beyond themselves; instead, they offer themselves as immediate experiences. When one medium sets out to remediate another, it does so by claiming to do a better job. It can claim to be better at transparency. For example, virtual reality promises to be the ultimate transparent medium, better than painting or photography, because the viewer in virtual reality can actually step into the world viewed. Or the medium can promise a more elaborate hypermediacy, as World Wide Web sites do in combining painting, photography, graphic design, film, audio, and video into a sort of popular *Gesamtkunstwerk*. In either case the new medium is trying to convince us that it offers greater immediacy than its predecessors. Because our culture today is saturated with media, claims of greater immediacy are constantly being made, as new and older media vie for our attention.

The remediations of writing technologies are like those of visual media, particularly in the case of digital media where words and images combine and interact so freely (= > p. 47). Furthermore, throughout the 20th century, print has engaged in contests of remediation with photography, film, and television. All these visual technologies are still remediating print, while digital technologies are working their remediations too. The best way to understand electronic writing today is to see it as the remediation of printed text, with its claim to refashioning the presentation and status of alphabetic writing itself. The qualities that distinguish electronic writing from print, flexibility and interactivity, become the bases of the enthusiasts' claim that the computer can improve on the printed book. For the enthusiasts, these qualities can make the experience of reading sometimes more transparently real, sometimes more hypermediated, but always more immediate. As we shall see, to say that electronic writing is flexible and interactive is to say that it is hypertextual.

3

Hypertext and the Remediation of Print

If a decade ago the concept of hypertext was esoteric, today with the enormous success of the World Wide Web, the concept, if not the name, has become common cultural knowledge. A typical Web page consists of text and graphics like a page in a magazine or illustrated book. Unlike in a book or magazine, however, phrases in the text or portions of the graphics on the Web page can be "hot": clicking on them will bring up a new page. One page can be linked electronically to many others (Fig 3.1). In one sense this linking is simply the electronic equivalent of the footnote used in printed books for hundreds of years. Instead of looking to the bottom of the page or the end of the book, the reader positions the cursor, and the computer retrieves and displays the reference. There is this important difference, however: the second Web page can also contain linked phrases that in turn lead the reader to other pages. The process can continue indefinitely as the reader moves through a textual space that, in the case of the World Wide Web, can extend throughout the Internet. Although in a printed book it would be intolerably pedantic to write footnotes to footnotes, in the computer we have already come to regard this layered writing and reading as natural. Furthermore, the second page is not necessarily subordinate to the first. One linked phrase may lead the reader to a longer, more elaborate page. All the individual pages may be of equal importance in the whole text, which becomes a network of interconnected writings.

Such a network is called a hypertext, and it is the creation and presentation of such hypertextual structures that seem to constitute a new form of writing. We use the computer as hypertext to write with symbols that have both an intrinsic and extrinsic significance. That is, the symbols have a