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Publisher's Note

The publisher has gone to great lengths to ensure the quality of this reprint
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This book is dedicated to my father

Franklin Charles Haas

and to the memory of

Richard C. Deus

1915-1982

- Part I: Writing Technology and the Construction of Literacy
- Reading On-Line
 - Materiality and Meaning: The Ethics of Computer Technology as Writing
 - Technology as Writing: Planning
 - Two Forms and Materiality: Literary Discourse Representations of Text
- Part II: The Social and Cultural Construction of Literacy
- Tools
 - Social Cognition, or Scientific Truth in Non-Scientific Discourse: Design Decisions in the Evolution of a User Interface
 - Constructing Technology Through Discourse and Discursive Change

- Part III: Conclusion and Future Research
- Handwriting Technology
 - Typewriting Technology

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THE TECHNOLOGY QUESTION

The relationship between writing and the material world is both inextricable and profound. Indeed, writing is language made material. Through writing, the physical, time-and-space world of tools and artifacts is joined to the symbolic world of language. The materiality of writing is both the central fact of literacy and its central puzzle. This materiality is the central fact of literacy because writing gains its power—as a cognitive process, as a cultural practice, and even as a metaphor—by linking these two powerful systems: the material realm of time and space with the quintessentially human act of language. The materiality of literacy is also a central puzzle, and I call this puzzle “The Technology Question.” What does it mean for language to become material? That is, what is the effect of writing and other material literacy technologies on human thinking and human culture? By naming this question one of technology, I underscore what I see as the inexplicable relationship between technology and materiality: Writing is made material through the use of technologies, and writing is technological in the sense and to the extent that it is material. Human beings have used and continue to use technologies (e.g., sticks on sand, pen and ink on parchment, #2 pencil on legal pad, cursor on monitor) to bring language to material life. Writing technologies are material not only in and of themselves, but also because they allow for the creation of the material artifacts that are named by the noun writing.

In this chapter I argue that the materiality of writing, although often overlooked, is actually at the heart of a number of current controversies within literacy studies, and that this materiality must be acknowledged to fully appreciate the nature of literate acts. Further, understanding writing as inextricably based in the material world can provide a theoretical basis from which to argue about the most recent iteration of the Technology Question: What is the nature of computer technologies, and what is their impact on writing?

I am using the term material to mean having mass or matter and occupying physical space. The implements of writing—pens, pencils, keyboards—have mass, as do written products. Even pixelated screen images, although they may not seem material in the same way as do marks chiseled on a clay tablet, depend upon several kinds of material apparatus both for creation and for perception and use (e.g., input devices, monitors, electrical systems, and semiconductor chips). Because this analysis extends beyond what is conventionally seen as the domain of Marxist or neo-Marxist examinations of technology, I have tried to avoid Marxist terminology. However, I do take from Marx and Engels' historical materialism (1846) the notion that the material world matters; that is, that the materially-based conduct of human activities has profound implications for the development of human culture and the shape of human consciousness. Further, my use of the word material is not meant to invoke conventional binary distinctions like material/immaterial, physical/mental, body/mind. Rather, texts written or read are at once material and immaterial, and writers and readers engage one another in realms that are both physical and mental. Indeed, as I explore in the final chapter of this volume, overcoming the culture-cognition impasse in writing scholarship will require refiguring writing, in all its complexity, as of the body *and* of the mind.

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. Writers sit in well-appointed desks in offices, or they slouch in less well-appointed ones in classrooms. Sometimes writers forego a desk altogether, preferring a kitchen table, or a lap, or the dashboard of a car. Writers use stubby pencils or felt-tip pens, cheap ball-points or lap-top computers; often writers use a number of these material implements in tandem. Writers compose speeches on backs of envelopes, make lists on scraps of paper, write essays in spiral notebooks, and compose lab reports or love letters on word processors. Indeed, an observer from another culture might be surprised by how much time people in Western society spend typing on keyboards, or—more surprisingly, perhaps—how much personal, intellectual, economic, and even physical work gets done with pen or pencil in hand. In short, such a visitor would be astonished to see how engaged individuals within Western culture are with the material tools of literacy.

But the materiality of writing, or the materiality of language that is writing, also remains a central puzzle within literacy studies. The Technology Question is present in debates about the nature of oral and written language, in controver-

sies over the relationship between speech and writing, and in discourse about the political and educational implications of that relationship. The Technology Question, unresolved, lurks in discussions about the nature of writing, from Plato to Derrida to the pages of contemporary journals, where scholars argue about writing's relationship to knowledge, to truth, and to power. The Technology Question is evident—indeed, is often begged—in arguments that computer technologies will revolutionize communication, education, and business, or that computers will bring about a wholesale transformation of human thinking and human culture.

In the next sections I review three instances of the Technology Question within literacy studies—one philosophical, one historical, and one sociopsychological. First, the philosophical debate between Plato and Derrida on the nature of writing illustrates the stakes of the Technology Question. That is, both of these philosophers recognized that determining the nature of writing is not an idle or superficial exercise, that at a very real level, questions of writing are questions of truth, knowledge, and power. A second set of scholars who have examined the Technology Question, historians Eric Havelock, Walter Ong, and Jack Goody and Ian Watt, provide empirically-based investigations of the Technology Question, particularly as it concerns the rise of literacy in ancient Greece. Third, the work of Lev Vygotsky and, later, Sylvia Scribner and Michael Cole provide a corrective to some of the dichotomization of speech and writing, and the confusion of cultural and cognitive effects, that are present in the work of Ong, Havelock, and Goody and Watt.

These three examples of scholarship on the Technology Question also illustrate that it is present in a wide range of issues within literacy studies, although its presence is often latent. While all three of the bodies of work examined here are concerned in an essential way with the Technology Question, each is less than explicit about that concern. Indeed, despite the fact that the material tools and artifacts are inherently bound up in acts of writing, there has been scant explicit and detailed attention focused on this materiality in contemporary discussions of writing. Opening the Technology Question up to detailed and systematic examination would lead to a richer and more complete picture of the complex act of writing. It would also help to adjudicate conflicting claims about computer technologies for writing (i.e., whether computers' effects will be humanizing or dehumanizing, democratizing or totalizing, etc.). Further, addressing the Technology Question is vital to understanding the nature of computer technologies for literacy, their power in shaping literate acts, and people's relationship to them.

Finally, the three bodies of work reviewed here illustrate a further dilemma implicit in the Technology Question: Are the changes that writing evokes changes at the level of culture or at the level of individual cognition? If the changes occur at both levels, what is the relationship between them? How can and do technologies, including writing, impact both cognitively and culturally? This returns, of course, to the cognitive/cultural impasse in writing studies more generally: What is the relationship between writing as a cognitive act and writing as a cultural practice? Exploring the Technology Question can provide a way into—and possibly a way out of—this dilemma. This issue is discussed more extensively in chapter 9 (this volume).

THE TECHNOLOGY QUESTION IN PHILOSOPHY

As scholars from Eric Havelock to Jay Bolter have argued, writing is a technology; that is, it is a set of materially embodied symbolic tools that humans use for the goal-directed accomplishment of work—work that is communicative, economic, or intellectual, or, more likely, work that is all of these at once. As a technology, writing extends human beings' ability to communicate with others across space and through time; writing as a technology makes possible literature and history, law and government as we understand them, and certain kinds of philosophy—although writing also makes possible bureaucracies, tax audits, acts of libel, junk mail, and so on.

Philosophers have understood that the union of the physical world of the body with language—the symbolic system that is the highest act of mind—is profound, but they have not agreed on its implications. Plato (1973) and Derrida (1981), sitting at two ends of a 2500 year span of Western philosophy, provide the most pointed example of the philosophical arguments about the Technology Question. Both Plato and Derrida recognize the stakes of the Technology Question: They reorganize that writing is inherently bound up with issues of truth, knowledge, and ultimately power.

In Plato's *Phaedrus* (1973), Socrates denounces writing at length. He argues that writing is a shadow, a derivative of "living and animate speech" and therefore at a further remove from true knowledge than is speech. Note that Plato is primarily concerned with the psychological aspects of writing's impact: Writing gives the illusion of wisdom while in fact fostering forgetfulness. Further, writing, unlike speech, can neither answer queries put to it nor distinguish between "suitable and unsuitable readers." Writing is compared to

a child who needs its parent (speech) to defend it, and the very best that might be said about writing is that it can provide a pastime for wise men who are past their prime (sect. 275-76).

Clearly, Plato is highly ambivalent about writing. Earlier in this dialog, Socrates calls the manuscript Phaedrus hides under his cloak the "actual speech" of Lysias and entreats Phaedrus to show it to him (sect. 228). And, of course, Plato himself was a writer of many texts. For present purposes, it is not important to establish precisely where Plato stands *vis à vis* writing; rather, he is provided as an early theorist who recognizes the significance of the Technology Question and devotes considerable attention to it, despite the fact that his approach may not be, in the final analysis, completely consistent.

Through the cumulative power of these multiple indictments of writing, Plato tried to close the book, as it were, on the Technology Question. He failed, of course, because Derrida, twenty-five centuries later, is still arguing with Plato over the nature of writing. Derrida's larger goal is the critique of Western metaphysics (Johnson, 1981), and in "Plato's Pharmacy" (1981) he takes on a central part of this project, deconstructing Plato, "the father of *logos*." For Derrida, Phadrus is the "inaugural gesture" (p. 128) of Western philosophy, and in his reading of it Derrida turns Plato on his ear. For Derrida, writing is not ancillary or secondary or derived, but is always already there. The dichotomy that Plato sets up¹ between speech and writing already presupposes the technological system that makes it possible—writing. According to Derrida, Plato has to have writing in order to attack writing: He (like Rousseau and Saussure) wants to put writing "out of the question" (p. 158), yet to do so, he must borrow both the medium of writing and its analytical/theoretical system. Further, although Plato sees writing as absence, the "supplement of a supplement" (p. 109), the writing itself gets away from him, "endlessly vanish[ing] through concealed doorways" (p. 128). Because what writing supplements (i.e., speech) turns out to also be a supplement or an absence, Plato can define and defend, speech only through writing. Jasper Neel (1988) paraphrases Derrida: "Whatever is supposed to precede and inform writing, whatever is supposed to escape play or be primary or be present in its own right always turns out to operate just like writing. Writing, in other words, created the West, not the other way around" (p. 118).

Is writing an aid to memory, or is it a dangerous, shadowy illusion of wisdom? Is writing a drug that dulls the memory, or merely a pastime? Is writing the *pharmakon* (drug/remedy), or is it the *pharmakos* (scapegoat)? Is

Lerid-
repose
Plato

writing a supplement to philosophical truth, or does it in fact make philosophy possible? These questions, debated across the centuries by Plato and Derrida, are all variants of the Technology Question: What is the nature of language made material, what is the nature of writing? And what, as a consequence of writing, happens to human thinking and human culture?

For Plato, the effects of writing are most directly psychological: The material implements and artifacts of writing are a psychological crutch, and a tainted one at that, given its remove from true knowledge. Plato's critique of writing is built on firm distinctions between speech and writing, and this distinction is mirrored in the material/immaterial split in Western philosophy that is often traced to Plato. Derrida's response to Plato's psychological concerns, on the other hand, occurs mostly at the level of writing as system. He wants to deconstruct Platonic binaries—particularly here speech and writing, but also body/soul and immaterial/material. To do so he addresses not Plato's psychological concerns but rather how writing works as a cultural system. The stakes in this debate about the Technology Question are huge for both Plato and Derrida: Maintaining a distinction between speech and writing is absolutely imperative for Plato, both politically and philosophically. If, on the other hand, Derrida can deconstruct Plato's duality of speech/writing, one of the most powerful of the Platonic binaries, he is well on his way to cracking the Platonic system as a whole.

I use the argument between Plato and Derrida about writing to illustrate that the Technology Question is a long-standing one with profound implications, politically and philosophically, as Plato and Derrida both understood. Further, the dichotomization of speech and writing that Plato insisted upon (and that Derrida attempted to deconstruct) remains a common theme in other discussions of the Technology Question. This is illustrated—again returning to Plato's Athens—as the historical scholarship on the advent of western literacy is examined.

THE TECHNOLOGY QUESTION IN HISTORIES OF ANCIENT GREECE

A second, quite different body of work concerns the historical analysis of changes wrought by writing on preliterate civilizations. Literary theorist Walter Ong, classicist Eric Havelock, and anthropologist Jack Goody each engage the Technology Question in their comparative historical analyses of ancient Greece

pre- and part-literacy. Each of these scholars is interested in exploring the implications of materially supported alphabetic systems on Greek culture and Greek thought. These scholars' work is vital to examinations of the Technology Question because they take many of the notions, explicit and implicit, in the treatises by Plato and Derrida and explore them through empirical observations of cultural systems and textual artifacts. While these scholars' methodologies are significantly different from one another, there are important parallels in their claims and conclusions.

Ong's (1982) book, *Orality and Literacy: The Technologizing of the Word*, is wide ranging and demonstrates an impressive familiarity with work in diverse fields, from ethnographic anthropology to semiotic theory. Using ancient Greece as an exemplar, Ong examines the nature of thinking and being in primary oral cultures, cultures that are so radically different from Western culture, that Ong admitted his success in this venture can only be partial. Ong acknowledged that his comparisons are of extreme cases: contemporary Western cultures that are "hyperliterate" and primary oral cultures that do not exist except in isolated ways today.

For Ong, writing transforms human consciousness by moving language from an aural realm, where it unfolds across time, to a visual realm, where it takes on a primarily spatial quality. According to Ong (1982), the sense of sight isolates individuals outside and at a distance from what is seen; similarly, sight-based language (written or printed texts) fosters contemplation, analysis, and critique. The sound-based temporal world of speech is totalizing; it "pours into" and "envelopes" (p. 72) the listener, and its centralizing and unifying character shape thought culture. Therefore, writing, what Ong calls "the most monumentous of all human technological inventions," translates sound into space and so "transforms the human life world" (p. 85).

Ong elevates the Greek alphabet above other scripts and syllabaries, claiming that it alone has the simplicity for truly widespread use and widespread effects. For instance, the Chinese system, in contrast to the modern alphabet, is cumbersome and elitist, and Ong claimed that it will "no doubt" soon be obsolete, replaced by the Roman alphabet.² Ong is at his best when he examines the paradoxes of literacy: Writing has been closely associated with death, as in the notion of a lifeless written text, but this lifeless object can also be perpetually "resurrected into limitless living contexts" (p. 81); or the idea that writing, because it is artificial, alienates us from the natural world and therefore heightens our humanity. Writing, which is neither natural nor inevitable, is

nonetheless a supreme achievement of humankind because “artificiality is natural to humans” (p. 82).

Ong's apparent purpose—suggested by key terms like “consciousness” and “ways of thinking”—was to examine the cognitive effects of literacy, and indeed he has been most often read that way (Brandt, 1990; Heim, 1987). Despite this ostensible focus, however, Ong readily moves from cognitive claims to cultural ones and back again. In the most widely read part of the book (i.e., chapter 3, “Some Psychodynamics of Orality”), many of the characteristics Ong outlines describe patterns of thinking—aggregative, additive, copious—but others seem to be used to describe primary oral cultures, such as traditionalist and homeostatic. In any case, Ong is not interested in examining in any detail the actual relationship between individual and cultural changes wrought by writing, or the mechanisms by which one kind of change mediates another.

Classicist Eric Havelock, with his focus on cultural effects, provides a complementary perspective to Ong's. In a career spanning more than thirty years, Havelock (1986) has attempted to treat what he calls the “oral-literate problem” (p. ix) in the context of Greek philosophy, literature, and politics. Whereas Ong's book is far-reaching and eclectic, synthesizing a great deal of diverse prior research, Havelock uses more primary source material to make a narrower argument, but one that is similar in kind to Ong's. Specifically, Ong discusses literacy and writing generally, whereas Havelock's (1982) thesis is it was the invention of the Greek alphabet per se—specifically the addition of vowels to the Semitic writing system, allowing a more accurate sound to sight correspondence—that constituted the “literate revolution in ancient Greece.” Indeed, Ong's argument in *Orality and Literacy* is based in important ways on Havelock's primary research; Havelock, in turn, specifically acknowledges the intellectual debts he owes to Ong's *Orality and Literacy*.

Havelock (1986) insists that primary orality is well nigh impossible for our literate minds to conceptualize because “all our terminologies and the metaphors involved are drawn from an experience that is literate and which we take for granted” (p. 63). In “The Preliteracy of the Greeks,” Havelock (1976/1977) synthesizes a great deal of his previous research and lays out a series of nine conclusions about literacy (and preliteracy) in ancient Greece. Most of Havelock's conclusions deal with cultural causes and implications of literacy: that the development of the Greek alphabet (approximately 700 BCE) constituted a monumental and unique event in the history of human culture; that

classical Greek culture, however, preceded literacy; and that nonliterate cultures are not necessarily primitive. Havelock does venture into the realm of the psychological in his discussion of how oral cultures remember, and here he postulates that poetry functions as the mediating mechanism between psychological imprinting and shared cultural memory. However, Havelock stops short of explicating how the literacy skills of *individuals*—primarily traders and craftspersons in ancient Greece—actually translate in a revolution at the *cultural* level.

For anthropologist Jack Goody and his collaborator, literary critic Ian Watt (1968), “the notion of representing a sound by a graphic symbol is itself so stupefying a leap of the imagination that what is remarkable is not so much that it happened relatively late in human history, but rather that it ever happened at all” (p. 9). While Goody and Watt are careful to complicate the literate–preliterate distinction—problematizing, for instance, how literate societies are classified (p. 3)—their ultimate goal is to explicate differences between literate and nonliterate cultures. Hence, they argue against an existing paradigm within anthropology that would deny that a crucial distinction between literate and nonliterate cultures exists. They label such an approach “diffuse relativism and sentimental egalitarianism” (p. 26). Goody and Watt use the case of the rise of literacy in ancient Greece to illustrate how researchers might approach studying specific instances of differences in literacy in other, more contemporary cultures.

Like Ong and Havelock, Goody and Watt identify the development of writing with changes in the space and time dimensions of language use. In the seamless temporality of oral societies, the past and the present remain continuous: Parts of the cultural tradition that are not relevant are forgotten or transformed to maintain homeostasis. In a culture with writing, according to Goody and Watt, there is a disjunction between past and present. Literate cultures understand that the past is past and that it is distinct from the present. And in the tensions that develop between present and past, Goody and Watt claim, literate cultures develop a sense of history, a notion of historical and cultural difference, and the ability to distinguish between error and truth—a distinction that leads to skepticism.

Although history and skepticism are results of changing relationships with time, logical analysis, for Goody and Watt, grows out of the spatialization of language. When powerful concepts like *good*, *truth*, and *justice* are “given physical reality” (17) through writing, they can become objects of analysis. The

actual physical reality of these words, in turn, leads to the development of systematic methods for thinking, or logic.³ Goody and Watt contrast the development of logic in literate cultures to the maintenance of “consistency” (p. 16) in traditional ones. In the face-to-face interactions of the preliterate culture, logical inconsistencies, and the criticism thereof, are overlooked, adjusted, or forgotten.

Like Ong and Havelock, Goody and Watt discuss the implications of the development of writing on both a cultural and a psychological level. The alphabet made writing and reading easy to acquire on an individual level; this, in turn, had important political ramifications for the culture at large. Similarly, the sheer amount of written materials in written cultures means that no one individual can ever participate fully in the total cultural tradition. This leads both to alienation on the part of the individual and to social stratification for the culture at large.

Despite their differences in background and methodology, there are striking similarities in the works of these historical scholars. The example of ancient Greece functions as an exemplar of the cultural and cognitive power of literacy; at times, this example takes on the power of metaphor—or even myth. Ong, Havelock, and Goody all explain writing as time made spatial. In other words, writing turns time into space. In addition, each of them contrasts the decontextualization of the spatial form (writing) with the contextual richness of the temporal form (speech). In a sense, then, Ong, Goody, and Havelock align themselves with Plato’s Socrates in seeing writing as once-removed, a derivative of speech or “supplement,” in Derrida’s terms. However, while Plato can be read as lamenting that writing strips language of its dynamic qualities, Ong, Goody and Watt, and Havelock tend, in varying degrees, to celebrate the abstractness and precision that they believe writing—unencumbered with temporal detail—allows.

For present purposes, the engagement of these historians of Greek literacy with the Technology Question illustrates two important points. First, in emphasizing the time and space dimensions of written language, Ong, Havelock, and Goody and Watt are emphasizing the materiality of written language because, in many ways, what defines material is that it exists in space and time (i.e., having mass and therefore retaining a degree of physical permanence over time). Of course, these scholars are not explicit about their focus on materiality—certainly they do not use that term—but in stressing the spatialization and temporalization of language that writing allows, or rather demands, Ong,

Havelock, and Goody and Watt are in fact defining written language by its links to the material world.

Second, although these scholars each examine both cultural and individual implications of literacy, none of them explicates how, or by what means, the individual translates into the cultural, or vice versa. For a way into understanding the relationship between cultural changes and cognitive changes brought about by technology, I turn now to another group of scholars who have addressed the Technology Question in somewhat different terms.

THE TECHNOLOGY QUESTION IN SOCIO-PSYCHOLOGICAL THEORY

A third group of scholars who have explored the Technology Question can be loosely categorized as sociopsychological theorists. This line of work—beginning with Lev Vygotsky in the 1920s and extending through Sylvia Scribner and Michael Cole in the early 1980s to contemporary neo-Vygotskians such as Jean Lave—has examined the relationship between cultural systems, including but not limited to writing, and individual thinking or consciousness. Vygotsky and Scribner and Cole address literacy directly, whereas Lave deals with mathematics as a cultural system. As I describe below, Vygotskian theory and neo-Vygotskian approaches like that of Scribner and Cole and Lave provide the potentially most useful basis for exploring the Technology Question.

In general, the work of Vygotsky and his followers adds to an examination of the Technology Question in two ways: First, each of these scholars is trying to directly address how culture and cognition mutually construct one another. This move is important because technologies are cultural artifacts that are used by individuals; any theory of technology must be able to account for the relationship between cultural and individual manifestations of technology’s effects. Further, the attempt to understand the relationship between culture and cognition is useful in discussing the Technology Question because, as we have seen, philosophical and historical approaches have tended either to sharply separate cultural and cognitive effects (Derrida and Plato) or confuse them (Ong, Havelock). Second, the research of this group of scholars helps to call into question the notion that writing and speech, or literacy and illiteracy (or, analogously, print and computers), are mutually distinctive phenomena. Vygotsky’s genetic-historical method, and the empirical research of Scribner

and Cole that is built on it, complicate our understanding of technologies and suggest that a sharp dichotomization may be tempting, but is historically inaccurate and pragmatically suspect.

Russian theorist Lev Vygotsky was interested—as were Ong, Goody, and Havelock, among others—in how graphic symbol systems structure human thinking, but he was more explicit than these later scholars in hypothesizing about how this restructuring might take place. For Vygotsky, symbol systems or signs were cultural systems—human-made artifacts and symbols that carried cultural value even as they were put to use by individuals within a culture. Two concepts from Vygotsky—the notion of mediational means and the genetic-historical method—are useful in approaching the Technology Question.

Technological Mediation

Vygotsky was part of a vital intellectual atmosphere in Russia after the Revolution, and he apparently took seriously the notion of developing a psychology based on Marxist principles (see Wertsch, 1985; Kozulin, 1990, downplays the Marxist influence). In addition, Vygotsky was profoundly influenced by Engels' historical materialism as it is laid out in *Dialectics of Nature* (1948). Engels postulated that, in labor, humans interact with nature via material tools. These material tools mediate human encounters with the environment, and, in so doing, transform not only the environment but the humans who use them as well. Vygotsky (1981a) brilliantly extended the concept of tool use to include sign systems, including writing, and he referred to such sign systems metaphorically as "psychological tools." For Engels, labor and the instruments of labor create humans, to the extent that the human hand is as much a product of labor as it is an implement of it. Similarly, for Vygotsky, semiotic signs or psychological tools are the mediational means by which higher psychological functions develop—and therefore the means by which the unique human quality of consciousness is brought into being. Further, psychological tools carry cultural power and cultural history, but they are always instantiated in specific ways in actual use. Human development, then—with development understood as both psychological growth and historical/cultural change—occurs through the creation and use of psychological tools. Although Vygotsky (1986) devotes a great deal of theoretical and empirical attention to speech as a psychological tool, he also includes materially based or materially supported systems like writing, numeric analysis, maps and diagrams, and even works of art as psychological tools (1981b).

The example of speech illustrates several of these tenets of the Vygotskian theory of psychological tools: A child learning spoken language from a parent is engaged in a very individually focused act. However, the language that he or she is learning is not arbitrary or "made up" but is rather the product of her culture. Similarly, the effect of language learning is psychologically profound for the child; Vygotsky (1981a) claimed that such socially supported and culturally sanctioned learning had the capacity to radically transform individual thinking. Once the child has language, then, he or she is able not just to reason about objects and actions in the world, but to communicate about them. He or she is able to use language to modify others', and eventually his or her own, behavior. In this way, individual use of psychological tools feeds back into social activity and the larger cultural system of which it is a part (1986).

Although the example of speech suggests something about psychological tools in individual development (ontogeny), Vygotsky (1966) also saw psychological tools working culturally and historically over time. Casting lots, finger counting, and tying knots as an aid to memory are all ways in which humans historically used materially based objects in the world to support mental activities that have since become internalized: decision-making, arithmetic, and recollection, respectively. As these examples suggest—and as Witte (1992) convincingly argues—Vygotsky's conception of thought extends beyond the purely linguistic. While language learning and use was central for Vygotsky, his interest in both art (1971) and mathematics (1981b) suggests that he was attempting to construct a broad and inclusive theory of psychology.

Despite the fact that Vygotsky was interested in both individual and cultural development, he was not advocating a simple recapitulationist or parallelist model of the relationship between individual and cultural growth; that is, individuals do not recapitulate their culture's development, nor do cultures develop in parallel to the individuals within them. Such a position can be read as implicitly racist, but a close reading of Vygotsky reveals that he was aware of such an interpretation of his work and explicitly argued against it (e.g., Vygotsky, 1966). Further, the complexity of cultural change via tools is underscored by the fact that the "same" cultural tools can be used by different societies in different times to greatly different effects (Scribner, 1985; Scribner & Cole, 1981).

What Vygotsky's notion of mediational means brings to our examination of the Technology Question, then, is this: Tools and signs can have a profound impact on both individual mental functioning and cultural change. Although

effects in these two areas are related in complex ways, they are not simply reducible to one another. Further, Vygotsky's concept of psychological tools mediating development (both cultural and individual) suggests that the effects of technological change (e.g., computerization) on writing are profound, but certainly not unitary, easily predicted, immediate, or consistent across contexts.

The extension of Vygotsky that I would like to make is one that is in keeping with the general spirit of his work and underscores the profundity of the Technology Question in writing and the import of technological change in writing tools. Specifically, Vygotsky does not stress the materiality of writing. That is, he tends to describe writing (and other sign systems) *metaphorically* as psychological tools. But writing is the powerful system that it is precisely because it combines the psychological power of the semiotic system of language with the material means to reproduce and disseminate that semiotic system.

For Vygotsky, writing as a sign system, a psychological tool, is analogous to a hoe, a material tool. The hoe mediates my interaction with the physical world in the conduct of my labor of gardening, and the physical world of the garden is transformed, or at least that is my goal. Analogously, writing mediates my interaction with the social world—and is the means of transformation not only of others (when I persuade through my writing) but also of myself (when I learn from it). But what this simple analogy overlooks—and what makes writing even more powerful—is that writing is, or relies on, technological systems as well as sign systems. That is, the hoe is a material tool that except in special circumstances we would not use as a sign or a symbol. But writing is unlike the hoe in that it is material as well as psychological.

Writing has the potential for even more profound transformations of humans because it operates on both of these levels—both its psychological (semiotic) aspect and its material-technological aspect have the potential to transform. Extending Vygotsky's work with psychological tools in this way is useful in understanding why current changes in the material circumstances (i.e., technological tools and contexts) of writing have such a powerful potential and why the Technology Question is of such vital import. In general, Vygotsky's notion of mediation is important in addressing contemporary issues of computer technology and writing because it provides a theoretical basis from which to predict that technology can have real and important, if complex, effects on writing.

The Historical–Genetic Method

The applicability of technological mediation to the Technology Question seems clear: Technology matters, for it can bring about important changes individually and culturally. However, the notion of mediation in and of itself can invite a kind of technological determinism: It can imply that technological change inevitably and straightforwardly leads to cultural or individual change. In countering such determinism, a second Vygotskian concept is useful—that of the historical–genetic method. While certain concepts from Vygotsky have been popular in the educational literature for decades, recently Vygotsky's methodology has attracted the attention of scholars (e.g., Cole, forthcoming).

Because of the influence of Marx, Vygotsky consistently attempted to place psychological phenomena into their historical context. Vygotsky used the term "genetic" in the general sense of "origin" or "antecedents" rather than in the more specific sense as the study of genes or genetics. For him, to study a phenomenon meant to study the history of that phenomenon (Vygotsky, 1981b) and that historical study, in turn, meant studying the phenomenon undergoing change or in process (Vygotsky, 1978). The word *historical* can be broadly interpreted in Vygotskian theory to include: general evolutionary history of the species, the history of individual societies, the history of individuals within a given society, and the history or development of particular psychological systems. As Scribner (1985) points out, this historical analysis can happen at any of several levels, and the integrated psychology Vygotsky was working toward would have attempted to integrate all of these into a single theory of development, broadly defined.

The last of these understandings of history—that of the history of psychological systems—is the one that is the most uniquely Vygotskian, and the one which can be extended and made most useful for examining technology. Understanding 20th-century literacy means understanding the technologies that support it—since without the technologies, literate acts would be profoundly different. Vygotsky's theory of mediation helps us to see tools, signs, and technologies as spatially and culturally distributed systems that function to augment human psychological processing. Viewed in this way, then, technologies—in particular, literacy technologies—are themselves complex systems that might fruitfully be studied genetically, in the Vygotskian sense. What would this kind of historical–genetic study of technology mean, and what gains would it offer? These questions are addressed in more detail in the following

chapters (see chapters 6 and 8, this volume). Briefly, a historical–genetic study of literacy technologies would entail looking at technology in process, both in process of use and process of development, and in transition. It would entail examining not only the transformative power of tools on consciousness, but also how the tools themselves get made, and how they get transformed. It would entail reconfiguring what at first may seem brand new technologies as extensions and modifications—albeit sometimes radical ones—of previous technologies, and it would entail studying the phenomenon of technology as a history of that phenomenon.

Taking such a complex historical view of current technologies relieves us of the bind of technological determinism: When the history of a given technology—writing, print, computers—is reconstructed in all its complexity, we can see that a straightforward narrative of technological advance or historical “ruptures” due to technology is not viable (see chapter 8, this volume). When we observe technology in use, we see that, although technological effects are very real, they can be small, subtle, even paradoxical (see chapter 4, this volume). And when we watch technology being developed, we can see that the shape of current technologies is not a given, but rather is the result of complex decision making, economic concerns, politics, and not a little serendipity (see chapter 6, this volume). In short, a historical–genetic approach to technology makes it difficult to continue to posit computers, or any technology, as amorphous, omnipotent agents of change, suggesting instead that a given technology’s effects may be varied, elaborate, complicated, and far from immediate. Equally important, a historical–genetic approach to technology opens up a space both for the study of technology and for the active “writing” of it that technological determinism and instrumentalism obscures. I shall return at the close of this chapter to a more thorough discussion of the opening of spaces to discuss, to study, and to write technology.

Neo-Vygotskian Approaches to the Technology Question

Neo-Vygotskians Scribner and Cole (1981) and Lave (1988; 1993) enrich theoretical approaches to the Technology Question through their respective developments of the notion of “practice.” Drawing on Vygotsky, other Soviet activity theorists (Davydov & Markova, 1983; Leont’ev, 1978; Wertsch, 1981), as well as Bourdieu (1977) and de Certeau (1985), these scholars place practice in a central position in their theories. In the theories of both Scribner and Cole,

and Lave, practice ties together thinking and acting human beings with their cultural, material, political contexts and is therefore a way to integrate agent, action, and world. In exploring the Technology Question, the notion of practice is useful because when literacy is examined in practice, it is seen as intrinsically tied to technology—to tools, implements, and artifacts. A practice account of literacy acknowledges these material tools and technologies; in fact, it would see them as central. But—again as a counter to technological determinism—a practice account would also posit technology as only one of a complex of factors that impinge on thinking and doing in context.

Psychologists Scribner and Cole (1981) developed their practice account of literacy after intense study of the literacy of the Vai in West Africa. Their seven-year project in Liberia was an attempt to systematically examine the cognitive effects of different writing systems. If Scribner and Cole’s goal had been to find general, large scale effects of literacy, the study would have been a failure. However, their study is remarkable not only for its thoroughness, but also because it is the first to find real, substantial effects for literacy, at least in some contexts and under some conditions.

Scribner and Cole’s practice theory adds a level of complexity to the dichotomization of writing and speech by earlier scholars of the Technology Question, like Havelock and Ong. Arguing against the idea that writing is decontextualized speech and against the “great divide” theories of earlier scholars, Scribner and Cole claim that the practice of literacy is itself deeply contextualized. (A similar argument is made in another vein by Brandt, 1990.) That is, the spatial and temporal contexts of writing may be different than those of speech, but they are no less important. Indeed, individual members of a literate culture, even those who are not actually literate, understand the altered conceptions of space and time that written language requires. In studies where literates and nonliterates were asked to dictate letters of instruction, the nonliterates understood the differing information requirements for readers who were distant to the writer, or who were unfamiliar with the physical context of the task. Scribner and Cole found that nonliterates understood, at least in a limited way, how the practice of literacy transforms space and time dimensions for language users. (Heath, 1983, also documented the complex relationships between literacy and nonliteracy in her studies of communities in the United States.)

In general, Scribner and Cole’s (1981) work argues against writing as “merely” decontextualized speech, argues against the sharp dichotomization of

technological systems, and argues against great divide theories of technological change. Their work also remains the most complete, long-term study of the effects of literacy. Their results, which show real if subtle effects for writing, suggest—as Vygotsky hypothesized—that technology (in this case, writing) matters.

Unlike Scribner and Cole, Jean Lave (1988, 1993) does not address issues of literacy *per se*. Rather, her work has examined the learning and use of mathematical concepts in everyday life, but her notion of *everyday activity* is one of the most developed accounts of practice in the psychological literature, and her treatment of technology is both complex and subtle and quite applicable to the general understanding of the Technology Question in literacy studies. Indeed, math and literacy share a number of similarities, among them a sort of dual status in the culture at large. At one level, both math and writing exist as subjects for learning in school and objects for academic study; at another level, both exist popularly and actually in the real world as everyday math and reading and writing. The latter form of both math and writing tends to be denigrated in relationship to its academic counterpart (see Lave & Wenger, 1991, especially chapter 5.)

Various technologies are implicated in the everyday practice of mathematics in all of the settings Lave (1988) examined: cooking, supermarket shopping, Weight Watchers meetings. The well-practiced use of these technologies—scales, calculators, even human fingers—is what constitute everyday mathematical competence; this kind of competence is no different in kind than the competence of experts in various domains who must master the use of tools (i.e., engineers, navigators). Lave and Wenger (1991) also acknowledge that technologies carry with them a complex history of use and adaptation that always impinges as well on the practice of those who use the technology. In general, Lave places technologies and artifacts at a central, pivotal position between the individual and the cultural practice within which that individual operates. I return to Lave and her notion of everyday practice in the following chapter.

CULTURAL MYTHS AND A SPACE FOR TECHNOLOGY STUDIES

This review of scholarship in three quite distinct realms of literacy study suggests that the issues surrounding writing technology are pervasive, pro-

found—and far from settled. However, in each of these bodies of scholarship—philosophy, history, and sociopsychological theory—the Technology Question remains for the most part latent. That is, this scholarship does not directly address technology as technology; rather, technology is posited as important (to varying degrees) but is not itself examined in any systematic way. Although not all scholarship within literacy studies needs to focus on technology, leaving the Technology Question latent is a problem in so far as what is latent is often overlooked. Technology is implicated in every literate act, and to ignore this implication is to remain confused about the essential relationship of writing to technology, and about our relationship—as writers, as teachers, as scholars—to both of them.

One danger in keeping this vital aspect of literacy (i.e., technology) latent in our discussions and in our research is that this latency allows or even invites an instrumental view of technology. Such an instrumentalist view sees technology as merely a tool—a neutral and transparent means to produce written language, which is somehow imagined to exist independent of that means. The last decade of work in cultural studies of scientific and other discourses suggests that writing—also a technology—is not transparent, that it carries beliefs and value systems within it, and that to treat written language as if it were neutral or transparent has severe political, theoretical, and practical consequences. (Examination of the “myth” of autonomous text is beyond the scope of this discussion, but see Cazden, 1989; Farr, 1993; Geisler, 1994; Haas, 1994; Haas & Flower, 1988; Nystrand, 1987.) An instrumental view of technology carries with it all the dangers of an autonomous theory of language. When text is seen as autonomous, it is viewed either as nonproblematic and neutral, a view that tends to exclude it from scrutiny and so leave the ideologies and value systems inherent in it unexamined. Or, it is viewed as powerful, above reproach, and beyond questioning, a view that ignores that written language is the product of human motive and serves human purposes; this view creates a situation in which the language “consumer” can be duped, manipulated, or misled.

Similar dangers lie in the instrumental view of technology. In a previous essay (Haas & Neuwirth, 1993), three interconnected cultural “myths” about technology within literacy studies were detailed. These myths obstruct both a true understanding of writing technologies and an active involvement with them: the transparent technology assumption, the all-powerful technology assumption, and the assumption that technology is not our job.⁴ These myths

about technology place literacy teachers and scholars in a subordinate position to technology, removing them from the realm of technology development and critique and setting them in positions to be merely receivers of technology. Chapter 2 examines two of these myths (transparent technology and all-powerful technology) in some detail, and Chapter 7 shows how these myths are operating not just in literacy studies generally, but even within the specialized literature about technology. Here, I outline the scope of the two myths and suggest that they are an inherent danger in keeping the Technology Question latent in scholarship on literacy.

Like the autonomous text myth, the assumption that technology is transparent posits a kind of distortionless window, through which essential acts of reading, writing, and thinking are conducted. The "technology is transparent" myth sees writing as writing, its essential nature unaffected by the mode of production and presentation. The most serious drawback to the transparent technology assumption is that it encourages an overly positive, whole-hearted acceptance of computer technology without any consideration of possible negative effects of that technology. Viewing technology as transparent encourages a belief that writers can use computer technology without being shaped by it, and therefore discourages any examination of how technology shapes discourse and how it, in turn, is shaped by discourse.

A second cultural myth operating within literacy studies is the assumption that technology is all-powerful and self-determining. In this view, computer technologies will have far-reaching and profound effects, effects that will be almost wholly positive and always inevitable. In this view, we must simply stand back and watch as the computer revolution remakes literacy, language, and culture. When the "technology is all-powerful" myth is operational, individual practices and motives, as well as cultural habits and beliefs, take a subordinate position to technology, which is seen as determining itself. Together, these myths, which are really two sides of the instrumentalist view of technology, contribute to a division of labor in which scholars in the humanities and many of the social sciences believe that "technology is not our job," whereas scholars in other, more technical domains believe that "technology is our *only* job." As I suggest in Chapter 2, Technology Studies will require that each of these groups rethink this faulty view of division of labor.

The goal of this book's first section (chapters 1 and 2) of this book is to open up a space within literacy studies for the examination of the Technology Question. Such an examination will entail looking *at*, rather than *through*, the

literacy technologies we use every day. This will be difficult, and indeed not always practical. In the conduct of most work it is important to be able to treat technology transparently; after all, we have classes to teach, books to write, bills to pay, and children to raise. Looking self-consciously at every technology would be paralyzing. However, I believe that opening a space for the discussion of technological issues within the mainstream of literacy studies is crucial. Such a space would make possible the active engagement of scholars of literacy in questions of technological use and development—an engagement that is now precluded by cultural myths of transparent and all-powerful technology. As Chapter 6 illustrates, technologies are not created in a vacuum; they do not emerge, full blown, from the head of IBM. Just as language carries ideology within it, so too does technology.

The Technology Question, as it is argued in philosophy, historical studies, and educational theory and practice, is still open to debate, and I believe this is all to the good for those of us interested in the theory and practice of writing. The stakes in this debate are huge (as Plato long ago recognized). Literacy scholars need to do more than merely observe as the discourses of our culture "make" technology and as that technology, in turn, remakes discourse.

FOOTNOTES

¹Jasper Neel (1988) notes that Derrida reads the *Phaedrus* "straight," i.e., for Derrida's deconstructive reading to "work," Socrates must always and simply "speak" for Plato. Derrida therefore cannot acknowledge all the irony or "play" that is present in the dialogue.

²Ong's worry about the 40,000-character Chinese typewriter overlooks the possibility of a word processor that—like the human hand—can construct the characters. Like many scholars of western literacy, Ong evidences a latent bias against Asian writing systems. The tenor of *Orality and Literacy*, like that of Havelock (discussed later), is that the Greek alphabet alone leads to logic, philosophy, and higher culture. Although the case to be made for alphabetic systems is strong, it is not clear cut, and Ong's tendency to credit Western (alphabetic) societies alone with advanced culture and thinking is clearly suspect.

³It is important to note that, to support their claims in this section, Goody and Watt rely not on empirical or primary evidence, but on the writings of Plato—a move that is somewhat problematic, given Plato's strong beliefs about writing.

⁴The following section is drawn from my published collaboration with Neuirth, as well as from many conversations we have had about these issues; I am indebted to her for both.

CHAPTER 2

TECHNOLOGY STUDIES

The previous chapter argued for the materiality of literacy and set up the Technology Question as essentially a question about the materiality of literacy: What is the nature of material language (writing)? What are its implications? And what happens when the material forms of literacy change? This chapter examines what kinds of systematic inquiry will be necessary in order to address the contemporary version of the Technology Question: What are the implications of computer-based writing tools for the processes and practices of literacy?

The materiality of writing becomes profoundly obvious when technologies change—when writers move from the heft of the manuscript and the feel of a new Blackfeet pencil, to the bright, wired-up, whirring box and clicking keyboard on the desk. During the 1980s many people made this move, from producing texts with pencils, pens, and/or typewriters, to producing them with computers. Much of the research reported in Part 2 of this volume had its beginnings then, when people were interested in telling their own stories of the move from older technologies to newer ones, and were willing to share those stories with me. In interviews I conducted for almost ten years, beginning in the early 1980s, writers told of their experiences of making the move from one set of material tools to another, profoundly different one. When writers exchange one set of material tools for another—or, more accurately, when they add another set of literacy tools to their repertoires—aspects of writing are foregrounded that may not have been noticed before, including the writer's physical relationship to texts and the tools of text production. For example, many writers I interviewed mentioned tactile and visual changes in their understandings of and interactions with texts on computer screens. These writers often sensed that these changes had implications both for the form,

structure, and quality of written texts and for the shape of their own writing processes (see chapter 4, this volume; see also Haas, 1989c, and Haas & Hayes, 1986).

Both popular and scholarly treatments of writing with computers throughout the 1980s and into the 1990s have stressed the profound differences in writing and written texts that computer technologies have engendered. But a general sense that writing is different with computers is not the same as a clear articulation and careful examination of those differences and their implications. Teasing out when and how technology changes writing, when it does not, and the implications of both is one of the challenges of an enterprise I call Technology Studies: a concerted, focused attempt to examine technologies of writing—historically, theoretically, empirically, and practically. This chapter sketches out what this enterprise might look like, what its tenets and scope might be, and the tasks it might undertake. I hope it can serve as a catalyst, a way into discussions of the complex relationship between writing, in all its cultural and cognitive complexity, and the material technologies that make writing possible.

We are currently at an historical moment that is ideal for this kind of critical inquiry about technology. Computer-based literacy technologies are still new enough that writers notice them. That is, many writers can articulate the advantages and disadvantages of computer technologies and can make conscious decisions to work around these technologies by employing the more traditional technologies of pen or paper at certain junctures in the writing process. Contrast this kind of conscious “noticing” and self-management of technology with the transparency of older technologies, such as the alphabet, the directionality of printed text, or paper. Although these older technologies certainly have shortcomings, most writers can neither articulate these shortcomings nor make choices to work around them. As users and consumers, people prefer their technologies transparent: They do not like to have to think about the features of their word processors any more than they like to think about shifting gears in an automobile, and they prefer to look through a given technology to the task at hand. In the conduct of inquiry about technology, however, scholars are wise to strive to look at the technology itself, rather than through it. Technology Studies should be an enterprise in which scholars consciously and studiously attend to the technology itself—its shape, scope, and history—as well as to its various consequences. Indeed, it is only by examining a technology's scope, shape, and history—by looking at rather than through it—that its consequences can be truly judged.

In the remainder of this chapter, I define the scope and general tenets of Technology Studies. I also examine what I see as two critical barriers to Technology Studies: cultural myths about the nature of technology and a lack of theoretical grounding for examinations of the contemporary iterations of the Technology Question.

THE ENTERPRISE OF TECHNOLOGY STUDIES

What happens when the material forms of literacy change? For example, what happens when students chart General Lee's offensive into Pennsylvania in 1863 through hypermedia, rather than tracing it on a map in a book? What happens when workers share information through e-mail, rather than around the water-cooler, or when scholars conduct research via the InterNet, rather than by traipsing through dark and dusty library stacks? And what happens when those scholars produce on-line rather than paper documents? An initial response to these questions might be that these familiar literacy activities are radically remade in new, computer-supported environments, and indeed this has been the response from both scholars and the popular press. Certainly, anyone (including most readers of this book) who has made the move from writing with print-based materials to computer-based ones can attest to the sense of newness and difference that attends this move. However, serious inquiry about technology requires an unpacking of just what this sense of newness and difference entails. One of the central projects lying ahead for Technology Studies is to move from a general belief that writing is different when writers use computers to a clear articulation and careful examination of those differences.

One way to begin such an examination is to address specific questions about technology. Doing so underscores that writing is at once *individual*, an act of mind; *cultural*, an historically based practice; and *material*, inherently dependent on physical, space-and-time artifacts. For instance, take the example of a scholar producing an article or monograph. Certainly such an activity is an individual one, particularly in the humanities, where scholars usually work alone to produce "original" contributions to knowledge. Whether searching for obscure texts via the InterNet or laboring over the prose of an introductory chapter, the scholar's activity is, in many ways, a solitary work of the mind. However, simultaneously, the scholar's writing activities are inherently cultural, beginning with the institutions and disciplines within which he or she functions. These institutions both shape the scholar's contributions and have

the power to give them sanction (or not). Even the scholar's "original" ideas are in some ways the product of a certain cultural and historical milieu. At the same time, each step along the way—from cruising the InterNet for information to polishing final prose—is dependent in complex and vital ways on material technologies. Perhaps the most obvious examples to contemporary observers are the monitor, keyboard, chips and circuits of the machine that support both the search for other texts and the production of the scholar's own. But more than likely, this writer's processes are also supported by pens, pencils, paper, print volumes, and maybe even his or her secretary's typewriter. In short, this act of writing—like all others—is a complex of individual thoughts, cultural practices and beliefs, and physical, material technologies. And understanding this act of writing—or any other—requires that we address it in all its cognitive, cultural, and material complexity. And this in turn will require scholars trained in diverse disciplines to work together.

Technology Studies Crosses Disciplines

In order to examine the Technology Question as it is manifest in particular, contemporary acts of writing, the complex and symbiotic relationship between culture, cognition, and technology needs to be examined. This is the ultimate goal of Technology Studies—to understand how material technologies both constrain and enable acts of mind, on the one hand, and how cultures produce, adapt and are affected by material technologies, on the other hand. Obviously, such a project will require as well that we address the relationship between a material culture and materially supported cognitive acts. The complexity of such a project may seem overwhelming, given the ubiquitousness and power of reading and writing in our culture; the coordination of mental, physical, and affective efforts that writing requires of individuals; and the diversity of literacy technologies themselves.

This task is both more and less daunting because it is clearly, of necessity, an interdisciplinary one. It is less daunting because no one researcher would be responsible for exploring all aspects of technology and literacy. Clearly, examining how culture, thinking, and technology constitute one another in and through writing will cross a number of disciplinary boundaries and require specialists with an ecumenical spirit able to use a range of methodological approaches to study technology. Historians can pursue questions about the evolution of writing technologies and trace their impact over time; cognitive

psychologists can examine people's in-time use of literacy technologies, and the relationship between the material objects and cognitive processes of writing, while social psychologists and organizational behaviorists can examine technology-in-use in a variety of group, organizational, and institutional settings; critical theorists might explore the relationship between power and technology development, both contemporarily and historically; educational researchers could study how technologies change, and are changed by, the classrooms and other real-world learning settings into which they are imported; rhetoricians could examine the arguments made about technology, or the assumptions about technology that operate in given cultural contexts; computer scientists can work to refine and develop tools to meet communication needs in a variety of organizational contexts; and linguists could explore changes in language use that accompany technology development and technology use. Of course, none of these research projects in and of themselves sound particularly new; such efforts are already underway in a number of places, and have been for some time.

What would make the enterprise of Technology Studies new is also one of the things that would make it daunting: active collaboration, frequent communication, and professional interaction across disciplinary and institutional lines. Opening up channels for collaboration and communication between researchers in divergent areas is notoriously difficult, even (or perhaps especially) in academic institutions. But understanding the symbiotic relationship between writing—in all its forms as cultural practice, social interaction, and cognitive process—and the material technologies by which writing is accomplished (from clay tablet to laptop) will require not just scholars from a range of disciplines pursuing related questions, but, at the very least, a conscious attempt to learn about and take into account what other scholars do. That is, the historian looking at large-scale technological change over time would benefit from understanding the sociolinguist's fine-grained look at language use; the critical theorist examining cultural constructs of technology has much to learn from the rhetorician's analysis of technological argument; and the psychologist looking at individuals' interactions with material technologies is reminded—through work in history, rhetoric, and critical theory—of the larger place of both technology and literacy in our culture. And just as the computer scientist who works to develop new literacy technologies needs to understand what the educational researcher does about technology in use, or what the critical theorist does about the cultural uses of technology, humanistic scholars from all disciplines need to understand a bit of what the computer scientist knows: how computers work and how they are made to work.

Ideally, however, those involved in pursuing questions within Technology Studies would collaborate across traditional boundaries in actual hands-on intellectual projects that would need and use the diverse skills and knowledge of computer scientists, linguists, historians, designers, rhetoricians, engineers, psychologists, and critical theorists. It is probably in these circumstances—where scholars from diverse disciplines work together on common projects—that Technology Studies has the greatest chance of taking hold. In fact, some of the best contemporary work in Technology Studies is coming from research sites—including U.S. and European universities and corporate research centers—with just such interdisciplinary teams in place: Stockholm's Royal Institute of Technology (KTH), where, housed in the Division of Computer Science, psychologists, communications theorists, and computer scientists are working to develop computer writing tools that mimic the three dimensionality of traditional writing technologies (Eklundh, Fatton, & Tomberger, *in press*); Rensselaer Polytechnic Institute, where rhetorician Cheryl Geisler and computer scientist Edwin Rogers are collaborating with engineering students and corporate sponsors to develop and build a computerized collaborating writing and design workspace for engineering students (Rogers, et al, 1994); Bellcore, where psychologists Dennis Egan and Tom Landauer and computer scientist Joel Remde have developed a hypertext system that is theoretically and practically based, using what they call "formative design-evaluation," in which empirical studies and design constitute an iterative series (Landauer, Egan, Remde, Lesk, Lochbaum & Ketchum, 1994); Carnegie Mellon University, where rhetoricians David Kaufer and Christine Neuwirth are working with colleagues in computer science, social science, and graphic design on projects aimed at understanding collaborative on-line writing and developing systems to support that writing (Neuwirth, Kaufer, Chandhok, & Morris, *in press*); the Laboratory of Comparative Human Cognition at the University of California at San Diego, where psychologist Michael Cole and his colleagues—applied linguists and educational psychologists, as well as community workers and public school teachers and administrators—are studying how technology systems and children change one another (Cole, *in press*). This list is, of necessity, partial; but these research teams—working across disciplinary, institutional, and even national boundaries—are exemplary because they bring together scholars from a range of disciplines, pursuing vital questions about technology and literacy, and disseminating their results widely to academic, industrial, government, and educational forums.

This kind of collaboration, communication, and interaction across disciplinary lines will be difficult to bring to fruition. Technology Studies will require cross-disciplinary presses and journals (e.g., Lawrence Erlbaum Associates' technology series and the Society for Literature and Science's new journal *Configurations*) and on-line groups for discussion and argument, as well as forums—conferences, meetings, symposia—in which scholars can meet face to face. It will also require some loosening of the institutional structures that impede active collaboration between individuals in different departments and colleges, and between industry and academia. But initially and primarily, researchers working in the diverse areas of Technology Studies must make their own audience as they attempt to reach—or, more accurately, construct—readers who share the larger goals of understanding technology and literacy in all its forms. This volume is one attempt to create such an audience: I hope that the book can speak to my colleagues in computer science as well as in English; to scholars in the human sciences of rhetoric, linguistics, cultural studies, and history, as well as those in the more empirical disciplines of organizational theory, cognitive and social psychology, and education.

One of the tenets, then, of Technology Studies is that it should be consciously and studiously interdisciplinary. Consequently, Technology Studies cannot and should not shy away from, on the one hand, normative studies of value and policy, or on the other, practical studies of development and use. Scholars from critical theory, rhetoric, and education—disciplines that traditionally deal in the murky areas of human values and policy—bring an interest and expertise in addressing questions like the following: What should technology look like? How should technology be used? Who should technology serve? Ideally, these questions could also be taken up by computer scientists and psychologists, who have traditionally been more interested in questions of implementation and use: Does this machine work? What happens when people use it? How does it augment human processing capacities? How can we make it better? An awareness of these kinds of nuts and bolts issues about real, working systems must also undergird the scholarship of researchers considering policy and value questions. Discussions of value and policy are hollow if those conducting them do not have some experience with development and implementation of actual technologies, and technology development is bankrupt if it is not grounded in theory, history, and the thoughtful consideration of consequences. Attempts to understand the relationship between technology and

literacy, thinking and culture, are doomed if those conducting them focus too narrowly on one kind of question, or exclude out of hand particular methods.

Technology Studies Focuses on Technology Itself

Another tenet of the interdisciplinary enterprise of Technology Studies would be a continual focusing and refocusing on the technology, a looking at, rather than through, technology. Technology *itself*—rather than merely technology's consequences—must become an object of inquiry. Of course there is interest in technology's consequences, because computers, like other technologies before them, are powerful tools for accomplishing purposeful acts and shaping cultural practice. People are only interested in tools, after all, because those tools can do something for them.

However, theoretical or empirical attempts to understand technological consequences, without attending as well to the shape of the technology itself, stand little chance of success. For instance, empirical studies aimed at understanding the effect of "the computer" on writing in classrooms, or in corporations, must begin with an awareness that "the" computer does not exist; rather, it is instantiated in vastly different ways through use by people in classrooms, homes, offices, and corporations. At the very least, these people use all kinds of computers, and it would be reasonable to expect quite different effects if writers were sharing a few obsolete personal computers running simple word processing programs than if they were using high-powered networked workstations with integrated video, audio, and graphics. In either case, generalizing from one situation to the other would be risky. Empirical studies of technology should look at technology, attending to the range of hardware and software that writers use, as well as the physical setting in which they use it: Is the equipment new, old, or obsolete? Is the machine networked or stand alone? How fast does the machine respond to user input? How is text displayed? Is the system easy to learn? What editing and formatting features are available? How much access do writers have to computers? Is printing available? What are the ergonomics of the workplace (i.e., is it comfortable, well lit, and free of glare, smoke, and excess noise)?

Further, the place of computers in a particular sociocultural setting, the history of computers in that setting, and individuals' feelings and beliefs about technology will all affect what "the computer" is taken to be in any given case. Therefore, reflective, speculative, and theoretical essays must also move

beyond using the general term *computers*, or even more broadly, *technology*, as a placeholder that assumes the role of causal agent, without being specified in any clear way. The work of Richard Lanham, one of the most articulate technology scholars within the humanities, illustrates how vague the terms remain in discussions of technology's cultural impact. Lanham (1989), a technological optimist, heralds technology's remaking of reading and writing, and of literature and literary study, but the causal agent in this remaking is sometimes the personal computer, sometimes digitization, sometimes desktop publishing. Certainly all these forms of computer technology are related, but Technology Studies would seek to delineate that relationship and, more generally, to systematically explore (through historical studies, feature analysis, or theoretical inquiries) how particular aspects of computers, particular kinds of computers, and particular uses of computers engender particular cultural effects.

Both instantiations of the *looking through technology* phenomenon (empirical and theoretical) are tied to the myth of technological transparency—the notion that a computer is a computer is a computer. They are also linked to a related myth about technology in our culture—that it is all-powerful, and in the next section, I examine these two myths. As long as “the computer” remains unspecified, under specified, or too variously specified, attempts to understand the complex, symbiotic relationship between writing and technology will remain disjoint, or even contradictory. Rather, Technology Studies must focus in an exacting way on technology itself. This is not meant to suggest that inquiries should be limited to studies of the black (or gray, or white) box that sits on the desk. Rather, if technology is to be understood, it must be examined broadly, in all its cultural, historical, and material manifestation. Indeed, if technology is understood, as Heidegger (1977) would have it, as a complex of processes, objects, needs, and uses, then the scope of Technology Studies can be broad indeed: studies of the processes of development of literacy technologies, the social and cultural events that utilize those technologies, the institutional and individual uses to which technology is put, as well as careful examination of the actual objects called computers.

TECHNOLOGICAL MYTHS THAT IMPEDE TECHNOLOGY STUDIES

As I suggest earlier, there are a number of institutional impediments to the conduct of Technology Studies, particularly boundaries between and within cultural institutions, including academic disciplines. Much of contemporary society is structured through division of labor and the making of and deference to experts. Certainly these institutional structures have benefits, including a certain economy of effort and training and a sharing of large amounts of information and knowledge that is beyond the ken of any individual. The conduct of Technology Studies, however, will require working through and across existing borders between disciplines, or at least make those borders a bit more fluid. As difficult as institutional structures may be to overcome, however, there are several implicit beliefs about technology that also provide impediment to the conduct of Technology Studies. These cultural myths, or assumptions, about technology are particularly insidious because they lurk, unexamined, in thinking about and definitions of technology and they color both how problems of technology are delineated and what strategies are brought to bear in their solution. More specifically, these assumptions place us—as scholars, as teachers, and as users—in a subordinate position to technology. That is, these myths or habits of thinking take people out of the realm of technology development, technological critique, and technological inquiry and set them in positions to be merely receivers or consumers of technology (for a more elaborate discussion of these myths, see Haas & Neuwirth, 1994).

The two myths treated here are closely related: One asserts that technology is transparent, whereas the other asserts that technology is all-powerful. While seemingly disparate, these two assumptions actually share an instrumental view of technology. That is, accepting these assumptions means believing that writing and technology are somehow separate and distinct entities, and that they exist independently of one another. This instrumental view of technology is of course connected to beliefs about the nature of institutional and disciplinary boundaries: When technology is seen instrumentally, it is possible to believe that technology is the province only of technologists, experts from another domain, whose job it is to “do” technology, whatever that might mean. And the work of humanists, educators, or cultural critics is seen to be the study of discourse, or learning, or culture as it exists independently from technology. I would argue instead that understanding writing, culture, or technology are—in the late 20th century, as always—part and parcel of the same scholarly

the late 20th century, as always—part and parcel of the same scholarly enterprise. Or that they should be.

The Transparent Technology Myth

The myth that technology is transparent posits that technology is a kind of distortionless window: Writing is not changed in any substantive way by the transparent medium through which it passes. In this view, writing is writing is writing, unchanged and unaffected by the mode of production and presentation. The essential processes of literacy are universal and unchanging: Writers and readers simply exchange their pens for word processors, transfer their books to hypertext, replace their face-to-face conversations with computer conferences, and continue to produce texts and construct meanings in the ways they always have. One variant of the transparent technology assumption acknowledges that writing is different with computers, but limits that difference to an increase in efficiency. That is, this version of the transparent technology myth holds that writers can compose, revise, edit, and produce texts more quickly and with less effort with computers; therefore, using computers increases writers' efficiency, but makes no profound difference in how writing gets done. The belief that technology is a "win" because it increases efficiency is obviously problematic: The very metaphor of *efficiency* equates literacy acts with production acts, a somewhat suspect equation (Olson, 1987).

The transparent technology myth views technology merely as a means of textual production. Writing, in its essential nature, is somehow imagined to exist independently of and uninfluenced by that means. As I argue in chapter 1, however, writing is in its very essence technological, because writing has never and cannot exist separate from material technologies. The danger of the transparent technology assumption, of course, is that when it is operative there is no need for inquiry about technology: If technology is "immaterial," so to speak, there is little need to study it at all. But believing that technology is transparent does not in fact make it so, and does not preclude technology having powerful effects on literacy, effects that we are not prepared to examine or understand if we are operating with a belief that technology does not matter.

The Technology Is All-Powerful Myth

The counterpart to the transparent technology myth is the assumption that technology is all-powerful. In this view, computer technologies are self-determining: They will have far-reaching and profound—but essentially one-way—effects. New technologies for literacy are such a powerful force that simply introducing them to writers will change literacy acts in the most profound of ways, supplanting completely the existing pen and book technologies, according to the all-powerful technology myth. This myth imbues computer technology with a number of qualities, among them that computers are unique and that they are active, independent agents of change. One can see this myth operating in largely celebratory popular accounts of technological change, but it is also operative in some scholarly work as well. Chapter 7 (this volume) presents a detailed rhetorical analysis of some of the claims made about technology within English studies; these claims often implicitly invoke the myths of "transparent" or "all-powerful" technology.

There are several dangers to the technology is all-powerful myth. First, the technology is all-powerful myth errs by placing individual uses and motives, and cultural habits and beliefs, in a subordinate position to technology which determines its own uses and effects. Like the technology is transparent stance, this myth essentially compels us to remain noncritical and nonparticipatory. The belief that technology determines itself and its own uses and effects removes the space where both the development and critique of technology occur. If technology determines its own shape and use, there is little need for an enterprise like Technology Studies.

Further, the myth suggests that the theory and practice of literacy will have to be rebuilt from the ground up: Existing theories, practices, and rhetorics will be useless in the new age of this unique literacy tool, the computer. Consequently, scholarship influenced by this myth is given a kind of *carte blanche*, a freedom from accounting for technology by any existing theory or knowledge, as it looks for strong, unitary, one-way, and often only positive effects for technology, or seeks to celebrate the newness and uniqueness of computer technologies. Scholarship, then, becomes a justification for technology, rather than serious inquiry about technology.

For Technology Studies to be a viable and useful scholarly enterprise, the myths of transparent and all-powerful technology must be overcome. There are several correctives to these myths. The first is a thorough grounding in the

histories of other technologies, which, as I argue in chapter 8 (this volume), provides a strong counter to the tendency to read history as a series of technological revolutions. The long and complex history of print, for instance, illustrates that technology is neither transparent (i.e., print had and continues to have real consequences) nor all-powerful because those consequences are the result not of the printing press as a unitary object but are rather the result of a complex of technological, cultural, and historical factors.

Another corrective to these myths is to acknowledge that technologies' effects depend on how they are culturally represented and how people reason about them. That is, technologies are made through our thinking and talking about them, and through our use of them (see chapters 6 and 7, this volume). Therefore, technologies are not static—certainly not static enough to be unequivocally transparent or all-powerful. Rather, they are modified subtly and constantly by the uses to which they are put, and by the discourse that accompanies those uses. Technologies continue to evolve, not just because of technological breakthroughs but because their contexts of use, and their users, continue to shape them. For example, any effect of computer networks on writing processes is a result of a complex interaction between the technology itself and the teachers and students actively using the networks to achieve their goals (Neuwirth, Palmquist, Cochran, Gillespie, Hartman, & Hajduk, 1994). In short, recognizing the dynamic nature of technologies, the ways in which technologies are constructed and used, and the complicated history of technological advance can help counter overly simplistic myths about technology.

A THEORETICAL GROUNDING FOR TECHNOLOGY STUDIES

To what theories of writing or literacy might scholars interested in technology look for the underpinnings of technology study? What theories of writing will help us look carefully at, rather than through, the material technologies of literacy? What theories of writing might help us examine the relationship between cultural tools and cognitive activity? Despite the ubiquitousness of the tools and artifacts of literacy in contemporary culture and the rapid change in writing tools that the last decade has witnessed, surprisingly few theorists of writing have specifically addressed technological questions, and even fewer have attempted to deal with the broader issue of the material nature of writing.

Hence, another impediment to the enterprise of Technology Studies is a dearth of theory that can undergird attempts to examine the relationship

between technology and literacy. The lack of coherent theory is due to two related problems: the tendency of writing and discourse theorists to fall victim to the dual myths of transparent and all-powerful technology, and the inability of literacy studies broadly conceived to deal with materiality, particularly the embodied materiality of writing.

Even the best examples of Technology Studies cannot bridge the gap between technology's role in shaping individuals' writing processes or practices and the larger cultural impact of technology that constitutes historical-cultural change. That is, studies of technology tend to focus either on the fine-detailed, real-time processes of technology development, learning, or use; or they examine the broad sweep of change at the cultural and historical level. Seldom, if ever, is this question addressed: How do we get from one to the other? How do we move from discussions of technology's role in thinking to discussions of its role in culture, and back again? This situation, of course, mirrors a larger gap in current understanding: the murky, always-assumed, but never specified relationship between writing as cognitive process and writing as cultural practice, and the relation of both to the material world. Indeed, as chapter 9 (this volume) suggests, Technology Studies may provide a highly specified and materially present instantiation of the cultural–cognitive impasse. At the end of this section I examine the work of scholars studying what I call "embodied practice"; this scholarship may provide a promising beginning for a theoretical accounting of the materiality of literacy and a theoretical grounding for technology studies.

First, however, I briefly examine three bodies of theory that have influenced recent writing research and pedagogy in important ways: cognitive theories of writing, classical rhetorical theory, and postmodern theory. Although an extended critique of these theories is not attempted here, I do want to suggest how each of them has avoided or oversimplified the Technology Question, and why I therefore find them less than useful in addressing questions of technology and literacy. Classical rhetorical theory and cognitive theory have either ignored or only indirectly treated questions of technology; in effect, for much of these two bodies of theory, technology is transparent. A number of scholars have drawn on postmodern critical theory to discuss technology, but these treatments tend to treat technology as all-powerful; they fall prey to the inherent technological determinism of postmodernism.