

On the Relationship Between Old and New Technologies

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The author argues for complicating current views of writing technology, specifically views of the relationship between old and new literacy technologies. Using a Vygotskian theory and a grounded theory methodology, the author explores the uses of old and new technologies of three contemporary work sites to ground claims that (a) competing visions of what technology is and what it can do are operative in contemporary workplaces, (b) multiple literacy technologies are copresent in the conduct of work, and (c) more advanced literacy technologies are not necessarily the most powerful within work cultures. The case studies are also interpreted through the lens of Bijker's theory of sociotechnical change.

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In her 1998 address to the Conference on College Composition and Communication, Cynthia Selfe admonished the field of composition studies to “pay attention to technology” (Selfe, 1999). She claimed that the field’s inattention to important questions about literacy technologies may make it an unwitting contributor to a national technological agenda that may reproduce, possibly in even more powerful forms, existing trends that perpetuate inequities in the educational system. This inattention, Selfe suggested, may be partly due to a sometimes uncoded yet powerful bifurcation that exists, within composition, between those who use, study, and/or advocate for technology and those who tend to treat matters of technology with “glazed eyes,” if not “complete indifference.” This leads, Selfe argued, to the professional isolation of teachers who use and scholars who study technology, an isolation exacerbated by the discipline’s “general distrust of the machine and [its] preference for the nontechnological.” Selfe’s call no doubt struck a chord with teachers and scholars of computer writing who have come to appreciate that technology is not transparent but rather imbued—as are all cultural artifacts—with history and with values.

During the past two decades, the subfield of computers and writing has grown and developed a rich conception of technology through hands-on work with computers in

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classrooms and through active scholarship. In the decade to come, we will need to share that rich conception with those who, in Selfe's words, prefer the nontechnological. We must succeed in complicating the kind of simplistic view of technology that allows the bulk of the field to dismiss it. To be more precise, overly simple views of technology can allow most of the field to ignore important technological issues (both theoretical and applied) and can lead to the isolation of, or even professional penalties for, those scholars who work with and study technology. Further, overly simple views of technology may lead to the bracketing of difficult questions—about technological development and equitable access, to name just two—that responsible scholarship demands we address. Overly simple views of technology in the classroom may lead to a silencing of students who resist technology and a flattening of the different effects, both good and ill, that technology can have on individuals and groups. I have argued elsewhere (Haas, 1996; Haas & Neuwirth, 1994) that such a complicating move may be a necessary first step if we are to construct an historically sensitive, empirically driven theoretical account of literacy technologies. In this article, I explore one aspect of this more complicated view of technology—a rethinking of the relation between old and new technologies.

As I illustrate later, the relationship between old and new technologies is complex and often fraught in practice, and it is one that deserves a rich theoretical accounting. Such an accounting would go beyond oversimplified, bifurcated models of technological development. Oversimplified views of technology can take many forms, including what I call the *simple replacement model*, which assumes that old and new technologies are clearly differentiated from one another, both theoretically and in practice, and that new technologies simply replace older, obsolete technologies. A second oversimplified view is what I call the *straightforward progress model*, a new-is-better view in which new technologies are more advanced and therefore more efficient, more powerful, or both. These oversimplified, bifurcated models of the relationship between old and new technologies are just as wrong-headed as is the bifurcation between technologists and nontechnologists identified by Selfe. Further, these overly simple models perpetuate inaccurate cultural narratives about technology; that is, stories of simple technological progress and stories of encroaching technological menace privilege different technologies (new and old respectively). But, both kinds of narrative are based on the premise that old and new technologies are separate, distinct, mutually exclusive, and easily differentiated.

My purpose in this article is to complicate oversimplified, bifurcated models of the relationship between old and new technologies, drawing on recent research on technologically-based literacy practices in workplaces. I first show how my work on technology has been influenced by the work of Vygotsky and how Vygotskian concepts can allow for a complicating of the overly simple models of the relationship between old and new technologies. I then present three observations about the relationship between old and new technology, at least as that relationship is enacted in the contemporary workplaces I have studied, and I ground these observations in brief case study accounts drawn from specific work sites. To explicate the workplace examples, I turn to the work of Wiebe E. Bijker (1995), a Dutch historian of technology, and his theory of sociotechnical change. Bijker's work is particularly interesting for those scholars interested in computers and literacy due to his expressed purpose of combining "empirical work with theoretical reflection in order to strengthen the link between academic [study] and socially relevant action" (pp. 289–290). I use several of Bijker's concepts—specifically, *non-linearity*, *contingency*

and/or constraint, interpretive flexibility, and power—to suggest fruitful ways to begin thinking theoretically about the relationship between old and new technologies.

Contemporarily, the split between old and new technologies tends to manifest itself as a split between, on the one hand, books, print, and physically present texts and, on the other hand, computer-generated and/or computer-delivered texts. One sees evidence of the split both in the popular press and in academic circles, including English Studies. Indeed, English Studies may be even more likely than other disciplines to buy this bifurcated model, as it allows that enterprise's object of study—the printed book—to remain seemingly nontechnological. However, literacy practiced via print is no less technological than is literacy practiced via electronics (see Haas, 1996). However, the technological base of printed artifacts has become virtually transparent in our culture due to both their ubiquity and a long history of use. Thus, books can *appear* to be nontechnological. Similarly, a subdiscipline like composition studies can align itself with nontechnological printed books and/or hard-copy student texts and can thereby exclude technology from its concerns in the way Selfe so cogently described.

Interestingly, blind spots to the technological nature of ubiquitous literacy tools and practices are not unique to our age. In "The Duplicity of the Pen," Meredith McGill (1997) recounted the story of Edgar Allen Poe's "MS Found in a Bottle." Poe apparently exploited cultural ambivalence about print technology to win a literary prize from the *Baltimore Saturday Visitor*. Specifically, Poe hand-wrote his text in Roman characters to mimic the printed book, a device the contest judges apparently found both novel and intriguing. However, sensing a potential backlash against Poe's implicit embrace of the technology of printing, his editors depicted him in subsequent advertisements and brochures with a quill in hand. The quill pen is, of course, also a technology, although its technological nature takes different material forms from the printing or hand presses of Poe's day. McGill's account of this incident about Poe's writing career illustrates two important points. First, cultural ambivalence and confusion over the relationship between old and new technologies is not new; what may be new is merely the specific technologies about which we worry.¹ Second, it suggests the contemporary collapse of two quite different technologies, handwriting and mechanical printing, into a single category called print was not yet prevalent in the nineteenth-century world of letters.

STUDYING TECHNOLOGY HISTORICALLY

Before moving to the presentation of the workplace-based case studies, I briefly review two important concepts from the work of Soviet semiotician Lev Vygotsky (drawing primarily on Vygotsky, 1981a, 1981b, 1986). These two concepts—mediational means and the historical-genetic method—have provided the theoretical grounding for my work on technologies and the practice of work. Specifically, the notion of mediational means has led me to examine literacy not as a distinct phenomenon, but as always embedded in larger human practices, including work. In addition, the notion of a historical-genetic method situates such studies in and across time—that is, historically. Both concepts are compatible as well with the grounded theory approach of Barney Glaser and Anselm

¹Note how the technologies celebrated as revolutionary in writing studies have changed in just two decades from word processing, to desktop publishing, to email, to hypertext, to the Internet.

Strauss (1967), which has provided the methodological base for my analysis of data. As I discuss briefly, the concepts of mediational means and historical-genetic method also provide counters to a simplistic bifurcated model of the old-new technology relation.

Mediational Means²

For Vygotsky, symbol systems, signs, and artifacts were cultural systems—human-made artifacts and tools that carried cultural value even as they were put to use by individuals within a culture. Vygotsky was profoundly influenced by Engels (1948), whose historical materialism is laid out in *Dialectics of Nature*. In that work, Engels postulated that, through 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 the tools as well. Vygotsky extended this notion of tools to include sign systems, and he referred to these sign systems as psychological tools. For Engels, the human hand is as much a product of labor as an instrument of it, and for Vygotsky, semiotic sign and *psychological tools* are the mediational means by which higher thinking develops. These psychological tools carry cultural power and cultural history, but they are always instantiated in specific ways in actual use. Because literacy technologies are mediational, they stand in a central position within the conduct of literacy, mediating in a sense between the individual actor and the cultural and historical milieu within which that actor works.

Vygotsky's (1986, 1981a) notion of technological mediation calls into question models of technological change such as the simple replacement model in which one technology is simply replaced with another. Such a simple replacement would be extremely unlikely because the mediational means—that is, the technology—is tied inextricably to social and cultural structures, on the one hand, and individual goals and practices on the other. In short, technological change cannot be a simple replacement of one technology with another—nor even an historical rupture between technologies—because technology is anchored so closely both to individual histories and to cultural practices.

Historical-Genetic Method

This second Vygotskian (1981b) notion has also been useful in examining literacy technologies historically. Because of his Marxist roots, Vygotsky consistently attempted to place the phenomena he studied into an historical context. He used the term *genetic*—in the general sense of origin or antecedent—to suggest that to study a phenomena or artifact, one must study the history or origins of that phenomena or artifact. Vygotsky apparently meant this genetic study to happen on several levels. To understand the conceptual thinking in the adult, one has to come to grips with the development of conceptual thinking in the child. And, to appreciate the meaning of culturally sanctioned behaviors, one needs to examine the history of those behaviors. I have extended Vygotsky's

²Significant portions of this section and the following subsection are drawn from my 1996 book, *Writing Technology: Studies on the Materiality of Literacy*, Chapter 1, "The Technology Question." See that volume (especially Chapters 1, 8, and 9) for more a more complete treatment of Vygotsky's work.

historical-genetic method to include technology: Understanding twentieth-century literacy means understanding the multiple technologies that support it, have supported it, and continue to support it. Further, we can take the long view and look for similarities as well as differences across time, even though similarities are sometimes more difficult to see: It is easy to see, for instance, that an advanced computer workstation is different from pen and ink manuscript technology, but there may also be important similarities across these two systems. A Vygotskian approach to the study of technology, then, suggests (a) that multiple technologies for literacy exist, (b) that their history-of-use is complex and overlapping, and (c) that technology's uses are tied intrinsically to other human activities. A Vygotskian view of technology clearly makes a simple model, such as the straightforward progress model, difficult to sustain because past behaviors, practices, and tools are deeply embedded in present ones.

LITERACY TECHNOLOGIES AND THE PRACTICE OF WORK

In this section, I present three abbreviated case studies of technology and the practice of work. Data, including textual artifacts, extensive field notes, interviews, and audio recordings of conversations and meetings, were collected over 16 to 28 months and analyzed using a grounded theory approach.³ This research has been supported by the Center for Research on Workplace Literacy (CRWL) at Kent State University, and a great deal of it has been conducted in collaboration with my colleagues there.⁴ In our research, conducted at ten separate workplace sites over a two-and-a-half-year period, we have seen how old and new technologies coexist in complex and interesting ways as literacy is practiced in the world of work. Specifically, this research supports three specific observations:

1. Competing visions of what technology is and what it can do are operative in contemporary workplaces.
2. Multiple literacy technologies are copresent in the conduct of work.
3. Advanced literacy technologies are not necessarily the most powerful within work cultures.

³In analyzing data collected at each site (which included structured and unstructured interviews, observational field notes, and textual artifacts), I used a grounded theory approach, a qualitative, field-based methodology developed initially by Glaser and Strauss to study the work of medical professionals (Glaser & Strauss, 1967; Strauss, 1987). Haas and Witte (1999) described modifications of this method for studying workplace literacy. The goal of the grounded theory approach, and of our modification of it, is the development of a theory inductively derived from systematic study—over time—of a specific human activity or practice. Theoretical categories, which emerge from data, are dimensionalized through recurring comparison with one another. The researcher then returns to existing data or gathers more data in an attempt to build a powerful theory of the phenomenon under study, but one that is grounded to data in specific and identifiable ways. Data, analysis, and theory are reciprocally related to one another, and the researcher engages in data collection, analysis, and theory-building iteratively.

⁴Although our research on workplace literacy in its early stages, some CRWL-sponsored projects have been reported in Dunmire (1997), Greenwood (1997), Haas (1997a, 1997b, in press), Haas and Witte (1999), and Witte (1998a, 1998b, 1999).

Taken together, the case studies below instantiate these observations and provide details about how to understand the relation between old and new technologies in the practice of twentieth-century work. Further, as I will point out in the presentation of each case study, the complexities of the multiple-determined work activities described below provide concrete counterexamples to oversimplified models of technological change.

Case One: Collaboration Across Engineering Workplace Sites

One of the CRWL sponsored projects began as a study of a single city engineer, formally trained as a civil engineer and his work to manage the utilities and infrastructure of Ashton,⁵ a small city in northeast Ohio. To properly understand the work of the city engineer, whom I will call Dan, it was important to examine the ways in which his work activities were tied to the work of other city employees: the city manager, the city council, and the citizens; his staff, including an assistant engineer, an administrative assistant, and utilities personnel; and the numerous consulting engineers the city employed to design and oversee utilities and roadwork construction within the city. The work activities mediated by literacy technologies in the case of Dan are made more complex because the individuals involved in that work are distributed across a wide geographical area. The assistant engineer and administrative assistant occupied offices adjoining Dan's office, but the utilities personnel are housed about six blocks away. The city manager (Dan's direct supervisor) occupies an office in the lower floor of the converted firehouse that serves as the Ashton Town Hall. The city council members, as nonpaid, elected officials, do not have offices in the Town Hall, conducting their council-related work at bimonthly city council meetings and, presumably, at other sites between meetings. The consulting engineering firms with which Dan works most closely are located in adjoining, larger cities: one is about 20 miles to the south and another is about 30 miles north.

Dan's work activities are made possible by a variety of mediation means or literacy technologies. These include a myriad of print-linguistic documents, ranging from a brief, printed memo to a coworker, to the bound, 200-page city *Master Water Plan*, to the highly formalized city council agendas. There are handwritten notes and documents, email messages, and faxed versions of any and all the above. Of course, because Dan is an engineer and because he employs engineers, a great deal of his work is conducted through the creation, revision, and utilization of maps, drawings, sketches, and plans—all texts that employ a variety of graphic sign systems, although many of them also contain print-linguistic signs. Indeed, Dan acknowledges that these graphic texts in fact “*are my work.*” Interestingly, although the city has a bound *Master Water Plan*, both Dan and the consulting engineers who produced the plan told me that the “real” city water plan is a two-by-three foot map of the city, depicting the city's water system in some detail. This map is frequently updated because the water plan is not a “fixed” entity, as the presence of the bound water plan document suggests, but rather in constant flux. Of course, oral communication is also important in the conduct of Dan's work, and this includes dyadic conversations, various kinds and sizes of staff meetings, open public hearings and council meetings, and phone conversations.

⁵In all case studies, individual and institution names have been changed to retain anonymity.

A brief example here serves to illustrate both the importance of literacy in Dan's daily work and the complexity of relationships between that work and the variety of technologies that mediate it. Plans for the construction of an extension to an existing water main on the southeastern part of the city began with the awarding of the planning contract to Flynn and Peters (F&P), a consulting engineering firm the city often employs.⁶ In this case, consulting engineering firms made semi-formal oral presentations, with accompanying hard copy texts, to Dan and the city manager; the city council then awarded the contract to F&P, upon Dan's oral recommendation at an open city council meeting. Work on the water main extension began in earnest during a meeting attended by Dan and his assistant city engineer and three engineers from F&P in which pencil notations were made by all present on several copies of existing maps of the city. Handwritten pages of notes were also made by all present. The F&P engineers then took their notes and sketches back to their offices in the neighboring city, where they produced to-scale, detailed specifications and drawings of the work to be done. These specifications and drawings were then delivered to Dan, who made penciled notes on them, discussed them with his staff and with the city manager, and called the consulting engineers several times before deciding that another meeting was in order.

At least three distinct versions of the specifications and drawings were produced by the F&P engineers (using a sophisticated computer-assisted design system) with face-to-face meetings, phone conversations, written (and faxed) memos, and faxed or hand-delivered copies with penciled notations exchanged between each version. Once Dan had approved a final version of the plans, an even more detailed set of drawings and specifications was then produced by the consulting engineers for use by their field engineers. According to one of the consulting engineers, Dan probably wouldn't see these more detailed specifications: "There really isn't a need—besides, he already knows what's in them." The process described thus far—a very small part of the upgrading of the city's water system scheduled to take 18 months—took about 10 days. About four weeks later, a "bid opening" took place at which the contract for the extension was awarded to a subcontracted construction company.

Although Dan and his collaborators use a variety of literacy and other communications technologies—and although to an outside observer it might not always be clear why one technology is employed in a particular situation—there seems to be little disagreement or even overt negotiation about what form communication will take in a given case. When queried about the implicit agreement that, at one point, a face-to-face meeting was necessary, one of the F&P engineers told me, "Well, it just seemed obvious." And, in another situation, when asked about a memo written and faxed after a series of phone calls, Dan responded, "Yes, he [the consulting engineer from F&P] probably knows I'll send this. We just had a lot of [phone] conversations—some of this needs to get written down." In short, there was a great deal of common ground, or common understandings, about technology—and about the appropriateness of specific technologies to specific

⁶I did not observe the process of the awarding of this contract directly because my research at this site began after the contract had been awarded to Flynn and Peters. However, I did sit in on numerous subsequent meetings involving Dan and the F&P engineers, I shadowed both Dan and one of the F&P engineers throughout this period, and I conducted numerous interviews with Dan and with two F&P engineers.

tasks—between Dan, his staff, and the F&P engineers, although this common ground seemed not to be articulated.

This brief example suggests ways in which an oversimplified replacement model of technological change falls short. Indeed, as Vygotsky's work would predict, diverse technologies—or mediational means—coexist and may even reinforce one another. Virtually every drawing produced by the AUTOCAD system becomes a mediational means for furthering face-to-face conversation, and these conversations become the basis for more written notes. Often this process leads to yet another set of drawings. Further, the various technological artifacts and systems may in fact mediate quite different activities: The AUTOCAD system mediates the production of drawings that match, in some ways, the goals of the engineers. The printed drawings mediate—and complicate—the face-to-face meetings of the engineers. The handwritten notes mediate both the encounters between engineers and the revisions of specifications and drawings to more accurately reflect the city's needs. In any case, it is hard to see how any of the new technologies in this case could simply replace the older ones.

Case Two: A City Manager's "Vision"⁷

Although there appeared to be a good deal of agreement about the use of literacy technologies in Dan's office, this second example of workplace technologies in use—drawn from offices in the same city government—shows that common understandings of technology are not always present. John Smitherman is the City Manager for the City of Ashton and the administrator to whom Dan reports. When John began as City Manager of Ashton, he brought with him a vision, in his words, about how technology might transform the work of the city government. He had recently come from another city—somewhat larger and considerably less affluent—where electronic communications set up to link employees of the city with elected officials had met with some success. John believed Ashton's city government could benefit in many ways from the implementation of electronic communication (essentially, a Web-based email system). The manager, his staff, and city council could all be "accessible via email" to Ashton's citizens; communication within Town Hall would be more efficient; links to the Internet would be "good PR," providing a ready source for information about Ashton, its history and current events to citizens and outsiders as well. But, John's vision was not realized, at least during his tenure as city manager, because it was not shared by other key players in Ashton. Competing visions of technology were also operative, and although none of these competing visions about electronic communication has yet won out, they have in effect neutralized one another.

Although there were probably any number of competing visions of electronic communication held by individuals in Ashton's city government offices, two specific examples (garnered through interviews) are provided by Elena, John's administrative assistant, and Justin, the Assistant City Manager. Elena has been employed in the Ashton city government for over ten years. Her current title is Administrative Assistant, but she is in effect the office manager of Town Hall. She is an articulate, highly professional woman in her

⁷Some of the interviews at this site were conducted by Kerrie Haskamp Farkas.

early 40s, whose warm and efficient manner makes her well-suited to her job tasks, which require constant interaction with city employees, elected officials, and citizens.

Elana's vision of electronic communications technology might be characterized as *a solution without a problem*.⁸ For Elana, the system of communication in place in Ashton (which, in her characterization, consisted of a combination of printed and handwritten texts, a great deal of face-to-face and phone conversation, and published notices and minutes) was effective and efficient. She was not sure what advantages would accrue from the installation of an electronic communications system.⁹ Simply put, Elana did not see any problems with the current system, a system (as she described it) in which (a) citizens were free to write or call the city offices as they wished, (b) information (e.g., council agendas and minutes, ordinances, and legislation) was photocopied and distributed efficiently, (c) the newspaper published the required notices of meetings and hearings (albeit not always in a timely way), and (d) staff members met and talked on the phone with one another many times per week.

Another city employee, Justin, is one of two assistant city managers and is responsible for operations. The other assistant city manager, Stella, was responsible for communications, although according to Justin, there was considerable overlap in their duties and their tasks were often assigned on an *ad hoc* basis.¹⁰ Justin, who holds both a B.S. in urban geography and an M.B.A., is only a few years away from early retirement, a prospect to which he is clearly looking forward. Justin's view of electronic communications technologies for Ashton can be characterized as *pie-in-the-sky*. It is not that Justin isn't savvy about technology or its uses because clearly he is. Rather, he seems to think that in the context of the city of Ashton—specifically the political context—the idea simply would not find popular support.

To be more specific, several years ago, a merger took place between the Village of Ashton (the central part of the existing city, located around a village green and containing historical old homes, some dating from the late eighteenth-century) and Ashton Township, containing suburban and commercial areas that had built up around the Village proper. As a result of the merger, the Village (now called the City of Ashton) increased its tax base significantly (because areas of residential and industrial development lay outside the previous bounds of Ashton), and residents of the Township area benefited through increased city services. But, despite these apparent advantages, many residents of the former village—often called “old villagers”—were not happy with the merger. Justin believed these segments of the population still held considerable power, and the inclusionary benefits of the new communications technologies (which, in John's view, would increase access to city officials for everyone) did not in fact match the political interests of the old villagers. In essence, then, while Justin may not have viewed electronic

⁸The italicized characterizations of technology in this section are my representations; they do not reflect the actual words of the participants.

⁹I should note that Elana was quite diplomatic in her views, never directly criticizing John's ideas about electronic communication.

¹⁰Obviously, given that Stella was the Assistant City Manager for Communications, it would have been beneficial to listen to her views on John's plans for electronic communication. Unfortunately, Stella resigned her position shortly after I began this interview study.

communication technologies themselves as *pie-in-the-sky*, he did believe that John's vision was unrealistic in the current political context of Ashton.

This case study of John Smitherman's failed vision of technological change illustrates the importance of individuals' conceptions of technologies and shows how, even in an organization that works rather well and among workers who work closely with one another, profound disjunctions about what technology *is* are present. But, this example also provides some concrete counters to the model of straightforward progress in technological change. For Elana, new isn't better: She sees no increased efficiency with the new technologies and because efficiency is one of her prime goals and one of the means by which her work is judged, she resists the implementation of those technologies. In short, for a technology to be better it must be better in the context of specific work activities. Further, Justin's concerns suggest how Vygotsky's (1981a) notion of historical genetic method may be at work here. Justin understands the history of Ashton—and hence the history of the work activities there—in a way that John, as a relative newcomer, may not. Justin's more complex understanding of the city and of its work leads to his skepticism that the new communications technologies will be either welcomed or used. In effect, Justin is skeptical of John's model of straightforward progress.

Case Three: Textual Artifacts in an Urban Abortion Clinic

My third illustration of technology-in-use at work sites comes from a very different kind of workplace. For 16 months, I conducted field research at an abortion clinic in a northeast Ohio city. Although I will not present a detailed account of the study in this article,¹¹ I do want to suggest how old and new technologies coexist at this worksite and how artifacts are used in the work of clinic personnel. Because I was interested initially in the role of texts in the work of the clinic, I began by cataloging all the written, printed, and electronic texts used on a regular basis in the clinic. From this set of documents several categories emerged. For example, the documents could be categorized by *formal features* (e.g., brochures, forms, charts, signs), by *source* (e.g., clinic staff, patient, American Medical Association, county court), by "*use*" (e.g., convey information, gather information, restrict movement, indicate acceptance, provide record, etc.), by *means of production* (e.g., handwritten, professionally printed, photocopied, typewriter or computer-generated, etc.), by *accessibility* (e.g., available to everyone, available to staff and patients, available to staff only, etc.), by *actions* taken upon it (e.g., read, signed, and filed; not read, but signed; written, read, and filed; written but not read; distributed and read; distributed and discarded, etc.), by *location* (e.g., posted on walls of waiting rooms, offices, or hallways; stacked on desks, counters, or shelves; filed in drawers or in hanging files, etc.), and by *distribution* (used only by clinic staff, distributed to patients, submitted to county and state health departments, etc.).

Two documents—the "blue sheet" attached to patient files and a pamphlet on fetal development produced by the State of Ohio—provide interesting contrasts in *means of production, use, and distribution*. The blue sheet, as it is referred to by staff members, is a half-page information sheet, used by clinic personnel, primarily medical assistants and nurses, but also physicians. It consists of words or abbreviations calling for various pieces

¹¹Further detail on this study is presented in Haas (in press).

of information (e.g., “name,” “DOB” [date of birth], “LMP” [date of first day of last menstrual period]) followed by spaces or lines where the information is eventually added, by pen or pencil, at various points in the care of the patient. Originally produced on a typewriter, it has been photocopied and placed in easily accessible locations. Stacks of the blue sheets are located on shelves in the nurses’ station, near the front window, and near the phone where most incoming calls are taken. The blue sheet is filled in by hand by clinic personnel and is attached to the outside of the patient’s chart with large clips.

The completion of the blue sheet typically proceeds like this: When an initial call is received from a potential patient (or, less frequently, when a patient walks into the clinic), the medical assistant or nurse on duty uses this sheet to record important information about the patient: name, date of birth, date of last menstrual period, history of previous pregnancies. Later, after the initial visit, notation is made on the blue sheet by clinic personnel confirming identity and age of the patient.¹² After the pregnancy test, the blue sheet is used to record the date and results of that test. Then scheduled dates for counseling (mandated by the state) are noted on the blue sheet, as is a notion for the completion of that counseling later. Results of other tests, such as blood work, are also recorded by hand on the blue sheet. The date for the scheduled procedure and information about the procedure and follow-up care are noted on the blue sheet (as well as on the chart itself) at other periods during the patient’s care. After patient files are no longer active (i.e., when the procedure and follow-up counseling and care are complete, or if the woman decides not to terminate her pregnancy), the blue sheet is then placed inside the patient chart and filed.

Despite its humble appearance, the blue sheet is an important and powerful document. Its importance is evidenced in several ways. On the rare occasion when a blue sheet is not attached to a patient chart, staff members will stop work, query one another, search through the chart and on desks and tables in an attempt to locate the misplaced blue sheet. If the sheet is not found, a new one will be constructed before care of the patient resumes. The importance of the blue sheet can also be seen by noting the number of other documents to which it is attached. The blue sheet is attached, literally, to the chart and to the test results and other medical information within the chart. It is also attached, through use, to many other diverse documents, including the patient’s drivers license or state ID card, counseling materials (some generated in-house, others coming from the state), forms on medical procedures submitted to state and county health departments, and forms submitted to the state reporting information on the demographics of the women served by the clinic. Further, the blue sheet’s importance is underscored by noting the number of people who use it: Every clinic worker who interacts with the patient, from medical assistant to physician, reads or at least skims the blue sheet many times and most workers also write on it as well.

Coincidentally, the pamphlet on fetal development produced by the state is the same color of blue as the blue sheet and its dimensions are the same (5 1/2 inches × 8 1/2 inches), but the similarities between the two documents end there. The glossy, 20-page pamphlet was professionally printed on heavy stock paper, with a separate cover, and

¹²Occasionally, according to clinic staff, women attempt to obtain care using a false name and, more frequently, women under the age of 18 attempt to obtain care without parental or court permission by giving a false age.

contains six full-color photographs of fetal development. Unlike the humble appearance of the blue sheet, the pamphlet is embossed with the seal of the State of Ohio Department of Health, and the names of the Governor and the State Director of Health appear on the front of the pamphlet, as if to suggest that the pamphlet was authored by these officials. The bulk of the document, 12 pages, is devoted to tracing fetal development from Day 1 of conception through Week 38, and the photos accompanying the text describing Day 1 and Weeks 6, 8, 12, 16, and 20. Following the section on fetal development are sections on adoption, birth control options, and “the father’s duty.”

The State of Ohio-produced pamphlet is ostensibly meant to provide information to women about to undergo abortions. But, the information presented is not about the abortion procedure *per se*; in fact, there is only one sentence in the pamphlet that even mentions the procedure itself: “The law requires your doctor to tell you about the nature and physical and emotional risks of both the abortion procedure and carrying a child to term.” Rather, the information presented is about fetal development or what in fact will happen if the woman *does not* undergo the abortion procedure. Like many of the regulations workers at this clinic must follow, this one may be intended to dissuade women from going through with their scheduled abortions. From this view, the purpose of the pamphlet is political, not informational.

This pamphlet is by far the most advanced mediating artifact in use at the clinic, at least in terms of means of production. Its full color photographs, glossy paper, and professional design make it stand out from virtually every other document I examined at the clinic. Most of the forms and other documents that mediate work in this clinic on a daily basis are simple and produced in-house. Despite its appearance (and despite what was probably the intent of its producers), the document is not used or distributed by women in the clinic in ways that enforce its intended power. Specifically, laws regulating abortion in the State of Ohio require that every woman who comes to the clinic receive this pamphlet on fetal development once her pregnancy is confirmed. And, the workers I observed follow the letter of this law: The pamphlet is clipped together with other informational materials and distributed to women to read in the waiting room when they come for counseling two weeks before the scheduled abortion procedure. However, the *manner* in which the pamphlet is distributed and the way that clinic staff talk about these materials in some ways undermines what is probably the intent of the law: to cause women to rethink their decisions to terminate their pregnancies. Specifically, the pamphlet is clipped underneath a packet of informational material given to women to read in the waiting room, but many women never make it to the bottom of this pile of informational material. In addition, when given the information, women are usually told “you can read it, or keep it, or return it here.” Most women return the packet—often having read little or none of it. During my observations in the waiting room, I noted that few women do more than glance at the pamphlet—more than half the women didn’t even open it. Indeed, one of the medical assistants believes that less than one in five patients takes the pamphlet with her. In short, this rather sophisticated (for this context) document is distributed in a manner keeping with the law, but for all intents and purposes the pamphlet is not used.

This example of literacy in context illustrates how complex is the relationship between old and new technologies, at least in the practice of everyday work at this site. Specifically, the means of production of the blue sheet is old, a typewriter and photocopy machine, while the means of production of the fetal development pamphlet is quite

up-to-date and far beyond the sophistication of production systems in the clinic. However, while the pamphlet seems peripheral to the work of the clinic, the blue sheet is profoundly tied to all patient care provided at the clinic—indeed, sometimes work comes to a halt if the blue sheet cannot be found. Contrary to the “straightforward progress model,” here the humble old technology of the blue sheet contributes both efficiency and power within this work context.

BIJKER’S THEORY OF SOCIOTECHNICAL CHANGE

I have used three workplace examples and a Vygotskian theoretical framework to suggest how oversimplified models, such as the replacement model and the straightforward progress model, fall short as explanations of the relationship between old and new literacy technologies. In this section, I turn to the work of Dutch philosopher of technology, Bijker (1995), as a means for interpreting these case studies and of suggesting some other, more complex and more empirically valid ways of viewing the relationship between old and new technologies. In *Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Technological Change*, Bijker (1995) traced the history of three disparate but ubiquitous twentieth-century technologies—the modern bicycle, the synthetic plastic Bakelite, and the fluorescent lamp. He used extended examples from these cases to posit a set of interrelated conceptual categories. Because, as his subtitle suggests, Bijker was concerned with technological change, several of his theoretical categories are useful in attempting to understand the relationship of old and new technologies.¹³ In this section, I briefly treat four concepts from Bijker’s work—*non-linearity*, *contingency/constraint*, *interpretive flexibility*, and *power*—and suggest how they can help us understand the case studies of technology-in-use in the practice of work, previously described.

Non-Linearity in Technological Development and Change

For Bijker (1995), non-linearity was a critical and basic concept, what he called a “guidepost” in “the journey” to integrate real-world and academic studies of technology (p. 6). Bijker argued that technological development and change is best understood as multidimensional, and multifaceted—a web that is built in fits and starts, and cannot be properly understood in hindsight. Bijker, quoting Ferguson (1974), claimed that

too easily, linear models result in reading an implicit teleology into the material, suggesting that “the whole history of technological development had followed an orderly or rational path, as though today’s world was the precise goal toward which all decisions, made since the beginning of history, were consciously directed. (p. 7)

For example, in Bijker’s examination of the history of the safety bicycle, one sees how arbitrary is a designator such as “the first modern bicycle.” This label is often used in connection with Lawson’s *bicyclette* of 1879 because at a surface level, it resembled contemporary bicycles, with its two relatively similarly-sized wheels and rear-chain drive.

¹³The way Bijker (1995) theorizes on technological development, use, and change is highly complex and nuanced. A full, integrated treatment of Bijker’s theory as a whole and its implications for studies of technology and literacy would be a worthwhile enterprise, but such an enterprise is clearly beyond the scope of the present article.

However, the bicyclette was a complete commercial failure. Others (the Star, the Geared Facile) were much more widely accepted and popular, but—due to superficial surface resemblances and the push for linear accounts—it is Lawson’s that is often labeled as “the first.” Because other bicycles (the Star, the Geared Facile) do not fit a simple linear scheme, they are often written off in histories of the bicycle.

Once we recognize the nonlinearity of technological development, rival technologies may be copresent at any given moment—as indeed they were in the development of the bicycle. Once we discard the requirement that technological change be linear, we can see that rival technologies, or at least different configurations of technologies, must certainly coexist. Only a Whiggish account of technology—that is, one that “presents history as uninterrupted progress, implying that the present state of affairs follows necessarily from the previous” (Bijker, 1995, p. 45)—would accept or even expect that a single technology necessarily have to dominate at any historical moment.

An illustration of Bijker’s (1995) notion of non-linearity is furnished in the account of Dan’s distanced interactions with the engineering consulting firm of Flynn and Peters. Here, a variety of old and new technologies are copresent: sophisticated CAD-generated maps, penciled notations, hand-written notes, informal memos, face-to-face conversations interlaced with phone conversations and taped messages. In this context, the various communication technologies not only coexist, but also reinforce one another. Further, these old and new technologies coexist and are used in a way that makes sense to the participants in the work event—that is, Dan and the F&P engineers. Similarly, although the high-tech, glossy pamphlet is produced by systems much newer than those used to produce the blue sheet, it is by means of this older technology that work gets done at the clinic.

THE ROLE OF CONTINGENCY AND CONSTRAINT IN THE USE OF LITERACY TECHNOLOGIES

Bijker (1995) introduced the terms *contingent* and *constraint* as a way to begin to understand the dual nature of technology as at once constant and changing; that is, there is a sense in which “technology is always changing,” and yet this cannot in fact literally be true, or technologies would be unusable. Some aspects of technologies must remain constant, or users would have no frame of reference or history of experience by which to understand them or use them. The new laptop just delivered to my office in fact has a standard QWERTY keyboard, a “constant” (at least so far) in most computer-based literacy technologies. Yet, technology does change: Some of the software I used just two years ago is now obsolete (much to the chagrin of administrators) and the 9600 baud modem I once thought so fast is of little use when I want to access the Internet.

To partially account for technology’s constant yet changing nature, Bijker (1995) posited the twin principles of contingency and constraint: Contingency refers to the “strategies of actors” and acknowledges human agency; constraint refers to the “structures by which [actors] are bound” (p. 15) and acknowledges the limits of that agency. More specifically, according to Bijker, decisions about technology are always partial and contingent—there might have been (and there may yet be) another choice. Yet, decisions about technology, whether in development or in use, are not boundless: they are constrained by the historical, material, and cultural circumstances surrounding them. Witness

60 years' worth of attempts—unsuccessful so far—to unseat the QWERTY keyboard as the standard for keyboard design. In Vygotskian terms, these attempts are constrained by a history in which this design is tied to a myriad of cultural artifacts and individual histories. Other technological change can be constrained by material or economic circumstances.

Again, Dan's work with the Flynn and Peters engineers provides a concrete instantiation of these concepts in the practice of work. Presumably, the official *Master Water Plan*, which exists in a bound, hard copy format, might have had its existence in another form—as, say, an online document or in map form only. Indeed, an online version would have accommodated the frequent changes necessary to update the document, and a supplemental map version was in fact useful to the engineers, as we have seen. And, yet, the requirements of a city government—the need for codified documents and plans in a “city that runs on paper,” in the words of City Manager John Smitherman—in fact constrained the form the *Master Water Plan* could take. Similarly, Dan seemed to be making independent choices of media for his interactions with the F&P engineers, using face-to-face or phone conversations in some cases, faxed or delivered documents in other cases, email messages or penciled notes in still others. However, that certain means of communication seemed obvious in particular situations and that there was a kind of tacit agreement about those means suggests they were also constrained.

Similarly, John's vision for electronic communications linking the various participants in Ashton's city government—manager's office, city council, citizens—was constrained by the political realities Justin articulated as well as by the power of the *status quo* and the institutional practices articulated by Elana that have a history of practical results. Yet, the failure of John's vision is also what Bijker (1995) would call contingent: Although John is no longer Ashton's City Manager, and even though the electronic communications he advocated are not yet in wide use, we have no way of knowing whether in fact a vision similar to John's may yet be realized—under the guidance of a new city manager or if and when certain current constraints are lifted.

Interpretive Flexibility of Technologies

A third concept from Bijker's (1995) theory of sociotechnical change, interpretive flexibility, posited that a given technology or technological artifact can have simultaneously held and equally valid interpretations at any given historical juncture. That is, for different relevant social groups the technology can literally *be* different things. Bijker illustrated the concepts of relevant social group and interpretive flexibility in his accounting of the “Ordinary,” an unusually (for us) tall bicycle with a large front wheel, popular in the late 1870s. Bijker deconstructed this single artifact into two separate ones—the Unsafe Bicycle and the Macho Bicycle—claiming that “although these two artifacts were hidden within one contraption of metal, wood, and rubber, they were not less real for that” (p. 76). Specifically, for one social group of nonusers of the Ordinary (consisting of women, children, older adults) the Ordinary was an Unsafe Bicycle because it was difficult to mount, risky to handle, and often resulted in falls and injuries. But, for another relevant social group of users, young, athletic, often upper-class men, the Ordinary was a Macho Bicycle. Indeed, the very qualities—riskiness and difficulty—that were a drawback for nonusers were in fact what made the Ordinary attractive to those who used it,

because, for these men, the point of riding was to show off one's daring and one's athletic prowess. So, for the nonusers, the Ordinary was a "nonworking" artifact, but for its young male riders, it worked very well indeed. Like Bruno Latour (1987), Bijker insisted that "the 'working' and 'nonworking' of an artifact are socially constructed assignments, rather than intrinsic properties of the artifact" (p. 75).

We can see the principle of interpretive flexibility in the contrary visions of networked communication in the city government of Ashton. The networked communication system that John envisioned for Ashton works in a technical sense, and indeed most of the hardware and software have been in place for some time. For Elana it is a nonworking system, partly because she has no context of use for it, but also because she has no felt need for its use in the conduct of her daily work practices. Similarly, if Justin's account is accurate, for some of the townspeople of Ashton, the networked communications system may not only be a nonworking system but a resisted system as well. Other examples come from our experiences as teachers of writing with computers. The concept of interpretive flexibility helps to explain how a word-processing system can be at once a powerful tool for desktop publishing and, for a different group of users, merely a fast typewriter. Similarly, the Internet can be a powerful system for accessing myriad information, but it can also be used to gather pornographic images, or to find lonely and vulnerable children.

Power as a Relational Concept in Technological Development and Use

Bijker (1995) pointed out that in studies of technology, and in the larger disciplines of economics, history, and sociology, the term *power* seldom has a precise meaning; this probably reflects the imprecision with which the concept is thought about within the larger culture. In both common usage and in studies of technology, the term can be used to refer to a quality, a relation, an outcome, or an agent. Bijker, following Giddens (1979), adopted an *interactionist* definition for power, as a "transformative capacity to harness the agency of others to comply with one's ends" (p. 262). Power, like technologies and technological artifacts, does not have a context-independent meaning or identity, but rather is constituted in specific interactions. That is, power is "relational—it is exercised rather than possessed" (p. 262). At a macro level, technologies and artifacts help to fix or reify certain structures, and can therefore be instruments of power; this is what Bijker called the *semiotic* aspect of power. But, at a micropolitical level, according to Bijker, a variety of everyday practices can shape or structure the actions of others. Clearly, in contemporary workplaces (like those with which I have been concerned here) these everyday practices are linked intrinsically to technologies and technological artifacts.

Abortion is a highly potent signifier and an extremely politicized practice in contemporary American culture, and there are many ways in which power figures into both the practice and the rhetoric of abortion.¹⁴ Here, I will use the interactionist definition of

¹⁴Both the term abortion and the medical practice of abortion are so politicized currently, it bears pointing out that through much of the nineteenth-century, abortion was apparently widely practiced and seldom had the significance with which it is contemporarily imbued. See Mohr (1978) on the history of abortion; see Condit (1990) on the rhetoric surrounding the practice; and see Luker (1984) on the medicalization of abortion in the late nineteenth-century.

power from Bijker (1995) to discuss the ways textual artifacts (produced via different modes of production) are used in the exercise of power within the abortion clinic. Specifically, Bijker's distinction between semiotic and micropolitical power helps to illuminate the differences, in effect, between the blue sheet and the fetal development pamphlet in the everyday work practices of clinic personnel. The blue sheet has semiotic power in that it provides a fixity of meaning about the patient. The blue sheet functions as a kind of "stand in" not only for the chart to which it is attached, but also for the patient herself. However, the blue sheet is also an instrument of micropolitical power in that it shapes and guides, as well as reflects, the work activity surrounding it. This power is most evident in the case of the misplaced blue sheet: Work could not proceed without the power embodied within the blue sheet.

The case of the fetal development pamphlet is even more interesting. Semiotically, we can see the pamphlet is an effort, on the part of the state, to fix the meaning of abortion and to fix this meaning specifically as an interruption of "normal" fetal development. The pamphlet does not attempt to explain abortion as a set of medical procedures (what will happen, what it will feel like, how long it will take, what recovery times to expect); clinic staff believe that this information about the abortion procedure is extremely important and have developed other means by which to convey it. Rather, what the pamphlet illustrates is what will happen if an individual woman changes her mind and does *not* proceed with the abortion. In this way, the state presumably attempts to fix the meaning of abortion as the interruption of fetal development, not as a medical procedure. But, an understanding of the power of the fetal development pamphlet at this macro level tells only half the story.

Power is also exercised micropolitically, as Bijker (1995) would say, through the daily actions of the clinic staff. The way the pamphlet is distributed in many cases seems to undermine the attempts by the state to exercise semiotic power, or to fix meaning. Seemingly trivial acts—like clipping the fetal development pamphlet underneath other informational materials—are examples of ways clinic staff exercise power. Further, by indicating to patients that the reading of the materials is optional (i.e., "you can keep it or read it or return it here"), workers are also exercising micropolitical power. Based on the small number of women I observed looking at the pamphlet and the small number of pamphlets kept by patients (according to staff reports), it seems that in this instance, in this local context, the micropolitical actions of clinic personnel effectively undermined the purpose of the pamphlet. In sum, Bijker's conception of power in the use of technological artifacts—as both structural semiotic power and local micropolitical power—helps us to see why, in this case at least, there is so little relation between the means of production and the power of a particular artifact in a given situation.

CONCLUSION

Through three case studies of contemporary workplaces and their use of technology, I have suggested that (a) competing views of old and new technologies exist in workplaces, (b) multiple literacy technologies are copresent in the conduct of work, and (c) more advanced technologies are not necessarily the powerful technologies in work sites. Theoretical concepts from Vygotsky (mediational means and historical genetic method) and from Bijker (1995) (non-linearity, contingency/constraint, interpretive flexibility, and power) may be useful in constructing complex accounts of the relationship of old and new

technologies. Although Bijker and Vygotsky were working in very different historical contexts, were coming from very different intellectual traditions, and were pursuing very different individual projects, there is much in their work that is compatible. Although he does not cite Vygotsky, it could be argued that Bijker's entire *Of Bicycles, Bakelite, and Bulbs* can be seen as an extended application of Vygotsky's historical genetic method. In addition, Bijker's conceptual apparatus, particularly the notions of contingency/constraint and power, presuppose something like a mediational function for technology. Although it is beyond the scope of the current article, an extended comparison between Bijker and Vygotsky and the Soviet activity theorists would be a worthwhile project.

I have argued here that a more complicated view of the relation of old and new technologies would provide a partial, but potentially powerful, counter to simplistic models of technology. New models of the relationship between old and new technologies—such as those suggested by Bijker's analysis of sociotechnological change—are necessary, I believe, if the field of composition studies is to adequately appreciate, understand, and use new literacy technologies. Such new models of technological development might help as well in attempts to make questions of technology less marginal within composition, within English Studies, and within the humanities.

There are, in fact, numerous historical examples to add credence to a more complex view of the relationship between old and new technologies. For instance, McGill's story about Poe may seem quaint in hindsight, but it suggests that tensions between old and new technologies are not themselves new, and that old and new technologies can be copresent in complicated and interesting ways. Further, new technologies may in fact be implicated in the evolution of old ones. Later in the same essay, McGill described how the penmanship mastery system of John Jenkins (published in 1791 as *The Art of Writing: Reduced to a Plain and Easy System, on a PLAN Entirely NEW*) was the first to reduce handwriting to a set of strokes, in essence a set of interchangeable strokes that mimicked the principle of moveable type, a technology just coming into widespread use for publications of mass distribution.

Another example is provided by Jeffrey Masten, Peter Stallybrass, and Nancy J. Vickers (1977) in their introduction to *Language Machines: Technologies of Literary and Cultural Production*. These authors identified a persistent contemporary myth, the myth of the linearity of the printed book. They argued that the work of recent historians of manuscript production and the book demonstrate "how narrow our assumption of the typicality of a certain kind of book and a certain kind of reading have been" (p. 5). In fact, Masten, Stallybrass, and Vickers argued that the production of the codex book was a radical subversion of the linearity of the scroll. That is, the codex allowed Christianity, literally, to "cut up" the linearity of the Judaic scroll so that a *discontinuous* practice of reading would be possible. The technology of the book (to use Masten, Stallybrass, and Vickers' example) allowed, for instance, for a reading of the Son's crucifixion to be superimposed upon the story of the sacrifice of Isaac. Discontinuous reading was also encouraged by the later numbering of biblical verses.

A study of a technology as the history of that technology (to paraphrase Vygotsky) would allow these kinds of complicated readings and encourage more nuanced and more interesting understandings about how old and new technologies coexist and influence one another in distinctly nonlinear ways. Only then might we begin to construct an understanding of literacy and technology that does justice to the richness of both.

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