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Gail E. Hawisher and Cynthia L. Selfe with Brittney Moraski and Melissa Pearson

Becoming Literate in the Information Age: Cultural Ecologies and the Literacies of Technology

In this article, we discuss the literacy narratives of coauthors Melissa Pearson and Brittney Moraski, who came to computers almost a generation apart. Our goal is to demonstrate the importance of situating literacies of technology—and literacies more generally—within specific cultural, material, educational, and familial contexts that influence, and are influenced by, their acquisition and development.

The increasing presence of personal computers in homes, workplaces, communities, and schools over the past twenty-five years has brought about dramatic changes in the ways people create and respond to information. In the United States, for example, the ability to read, compose, and communicate in computer environments—called variously technological, digital, or electronic literacy¹—has acquired increased importance not only as a basic job skill² but also, every bit as significant, as an essential component of literate activity.³ Today, if students cannot write to the screen—if they cannot design, author, analyze, and interpret material on the Web and in other digital environments they may be incapable of functioning effectively as literate citizens in a growing number of social spheres. The ability to write well—and to write well *with*

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computers and within digital environments—we believe will continue to play an increasingly important role in determining if students will be able to participate and succeed in school, work, and community.

Despite the growing importance of these new literacies, however, and despite statistical reports⁴ that document patterns of computer diffusion and use in U.S. homes, schools, and the culture at large, we have only begun to understand how people, both in and outside our classrooms, acquire and develop—or fail to acquire and develop—the literacies of technology. Over the years, we have learned from early studies with word processing that writers might compose differently with computers but probably not better (Hawisher,

"Research"); we have learned that online venues can assist in encouraging intellectual engagement (Cooper and Selfe) but that these online spaces are probably no more egalitarian than their face-to-face, classroom counterparts (Romano). Today, we hear an-

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ecdotes of students who demonstrate extraordinary abilities with the new technologies and those of students who know from first-hand experience of the difficulties family members face when it comes to developing electronic literacies. But while outstanding scholars from the U.S. and abroad, such as Deborah Brandt; Gunther Kress; Bertram Bruce; Robert Yagelski; Carmen Luke; James Paul Gee; Juliet Merrifield, Mary Beth Bingham, David Hemphill, and Kathleen P. Bennett deMarrais, have started to trace the historical, cultural, economic, political, and ideological factors affecting—or being affected by people's acquisition and development of literacy, in general, and digital literacies, more specifically, we still know less than we might about the relationship between digital and nondigital literacies.⁵

In this article, we discuss the literacy narratives of two participants, Melissa Pearson, an African American woman born on 25 August 1964 in Fort Jackson, South Carolina, into a middle-class Baptist family in the military, and Brittney Moraski, a white woman born on 28 August 1986 into a middle-class Catholic family in the rural Upper Peninsula of Michigan. These two stories are culled from a larger investigation of literate lives in the information age.⁶ Our hope is that these case studies will help readers appreciate the importance of situating literacies of technology—and literacies more generally within specific cultural, material, educational, and familial contexts that influence, and are influenced by, their acquisition and development. In foregrounding the significance of multiple contexts for electronic literacy efforts, we hint at the many related factors that shape, and are shaped by,

In foregrounding the significance of multiple contexts for electronic literacy efforts, we hint at the many related factors that shape, and are shaped by, people's adoption of computers as literacy tools and environments. people's adoption of computers as literacy tools and environments: social contexts; educational practices, values, and expectations; cultural and ideological formations like race, class, and gender; political and economic trends and events; family practices and experiences; and historical

and material conditions—among many, many other factors. We refer to these contexts as the *cultural ecology* of literacy and, with this term, we attempt to signal the complex web within which both humans and computer technologies coexist, and all communication takes place.

We believe five key themes emerge from a reading of these cases as set within their respective cultural ecologies, and we explicate each theme in later sections of this article:

- *Literacies have life spans.* These lifespans differ within particular patches⁷ of a cultural ecology.
- People can exert their own powerful agency in, around, and through digital literacies. In particular cultural ecologies, some individuals may even confound society's expectations regarding race, class, age, and gender.
- Schools are not the sole—and, often, not even the primary—gateways through which people gain access to and practice digital literacies.
 English composition teachers often have little connection to, and a limited understanding of, the range of literacy practices that happen in digital environments reached through other gateways.
- The specific conditions of access have a substantial effect on people's acquisition and development of digital literacy. Thus, access to computers—and to the literacies of technology—cannot be accurately represented as an isolated or monodimensional formation. Rather, access is best understood as part of a larger cultural ecology. Physical access to computers is necessary but insufficient for the acquisition and development of digital literacies.
- Families transmit literacy values and practices in multiple directions. Information about, and support of, literacy can flow both upstream

(from younger people to older people), and downstream (from older people to younger people), and across media (print to electronic environments or from electronic to print environments).

Some notes on method

In 1998, inspired by an outstanding talk Brandt gave at the University of Louisville's Thomas R. Watson Conference on her oral-history literacy project, we began a relatively large-scale study to identify how and why people in the U.S. acquired and developed (or, for various reasons, failed to acquire and develop) the literacies of technology between the years of 1978 and 2003. During that period, personal computers—as relatively cheap and durable, mass-produced and mass-marketed machines—became commercially available for the first time to many families, entered composition classrooms across the nation in large numbers, and were broadly accepted by many school-aged children as the composing tool of choice. Since that time, these machines have become so ubiquitous that their many effects are becoming increasingly invisible.⁸ Before our cultural memory of this important time faded entirely, we wanted to document the period during which these machines first found their way into—and altered—the fabric of our culture.

The larger project from which these case studies come consists of more than 350 literacy narratives from people who participated in life history interviews or completed online a technological literacy questionnaire. (See Appendix.) We recruited participants primarily through school settings, calling first on colleagues and students we knew from around the U.S. We also identified participants through the recommendations of these initial volunteers. As a result, the brothers, sisters, other relatives, and friends of the people we contacted also became part of our informant pool—secretaries, former domestic workers, graphic artists, technical communicators, factory workers, program directors, nurses, and managers, among just a few of their current and former occupations. At the time of their interviews people ranged in age from thirteen to sixty-nine and hailed from more than twenty-five different states from every section of the U.S. We have also invited participants whose stories we feature in our book (Selfe and Hawisher *Literate Lives*) to become coauthors of the published work that grows out of the investigation.⁹

We have chosen to focus on the stories of Melissa and Brittney because we think they provide an interesting pair of cultural tracings—albeit fragmentary and incomplete—of how personal computers found their way into the lives, homes, schools, and workplaces of some people within the U.S. during the period we are studying. For these two women, the introduction of personal computers, a relatively cheap and durable example of technology, was associated with periods of major social, educational, and technological change, times during which peoples' lives, and literacies, were altered in fundamental ways.¹⁰

Because these two women grew up under markedly different circumstances, we believe their cases will also help readers further appreciate the importance of situating technological literacy in specific cultural, material, educational, historical, and familial contexts—in particular, contexts characterized by varied levels of support (social, economic, educational, technological) for electronic-literacy efforts. As the work of Brian Street, James Gee, Harvey Graff, and Deborah Brandt reminds us, we can understand literacy as a set of practices and values *only* when we properly situate our studies within the context of a particular historical period, a particular cultural milieu, and a specific cluster of material conditions.

Finally, we feature these women and their stories because they resonate with parts of our own stories as women working in composition: the ways in which these women's lives are situated historically and culturally; their backgrounds and gender; the ways in which they have learned to use and cope with technology; the schools they have attended or in which they teach; their experiences as students; the teaching they have experienced; their relationships with family and friends; and the literacies they share with us.

Throughout this article, we also corroborate these two primary cases with references to the stories of other participants in our project: among them, Paula Boyd, born in Chicago, Illinois, in 1969; Nichole Brown, born in Greenville, South Carolina, in 1971; Damon Davis, born in Detroit, Michigan, in 1978; Josh Gardiner, born in Escanaba, Michigan, in 1987; Charles Jackson, born in Salt Lake City, Utah, in 1985; Karen Lunsford, born in Minot, North Dakota, in 1968; Mary Sheridan-Rabideau, born in Oak Lawn, Illinois, in 1967; and Dean Woodbeck, born in Vicksburg, Michigan, in 1956.¹¹

The cultural ecology of digital literacy in the 1960s and 1970s: the story of Melissa Pearson

When Melissa Pearson was growing in South Carolina during the 1960s, her African American family valued literacy both as a route to prosperity and as an intellectual practice. Her father's career in the U.S. Army, which began after he dropped out of high school and enlisted, influenced much of Melissa's childhood and, indeed, shaped much of her life. While in the armed services, her father completed high school and college, a trajectory that, as Melissa sees it, propelled the family into the Black middle class in the South:

When he finished college in the army, he was offered a chance to go to the officer's candidate board and took that. So, he moved from ... one class ... to another ... and this all took place when I was born or very, very early in my life.

Melissa's mother finished high school and then began studying nursing at Bennett College for Women, a historically black college. Her career, however, assumed second place to her husband's. As Melissa notes:

Um, my mother graduated from high school. I think it was the class of 1961. I remember this because the whole family has to celebrate her class reunion around Christmas time. I mean it's a whole community thing because it was the last all black high school in her town she is one of twelve children. Most of her siblings except for maybe herself and another sister all went to Bennett College which is a historically black college in South Carolina. And they either went into nursing school at Bennett or . . . teacher's training . . . So, um, I have a family full of educators.

But my mother dropped out of college in her sophomore year when she met my father and, um, became a military wife and so she worked as, she was going to school to be a nurse and she worked as a, um, CNA, a certified nurse's assistant, for a long time.

The military context of the family's life—as shaped by national and world events—influenced Melissa's literacy values and practices both directly and indirectly. In the decade leading up to her birth, Fidel Castro had become well ensconced in Cuba; the Soviet Union had launched Sputnik in 1957, established the administration of Nikita Khrushchev in 1958, and had shot down Gary Powers's U2 spy plane in 1960. In the U.S., during the years preceding Melissa's birth, citizens had elected John F. Kennedy to the office of President in 1960; Miami-based Cuban refugees had invaded the Bay of Pigs in 1961; and the Cuban missile crisis had unfolded in 1962. During the early years of the Cold War, people had begun building fallout shelters in their backyards and holding atomic bomb drills in public schools, and the nation's military was on high alert.

During this same tumultuous period, computers were in the process of becoming a major social force. Growing out of an alliance between the U.S. military effort and scientists after World War II, these machines changed rapidly after the first mainframe—dubbed ENIAC—was completed in 1945. That machine included 17,468 vacuum tubes, weighed 30 tons, took up approximately 1,000 feet of floor space, ran on 130–140 kW of electricity, and worked at a speed of 100 kHz. By 1951, UNIVAC I, the first commercially successful, general purpose computer, had been purchased by the United States Bureau of Census (White), and by 1958 (just five years before Melissa was born) the U.S. had established the Advanced Research Projects Agency in the Department of Defense (DARPA) to support the development of computer-based research (Kurzweil). This research remained primarily dependent on mainframe computers, which were large and expensive, but spin-off applications, which required an increasingly computer-savvy workforce, had begun to affect the curricula and literacy practices of universities and schools across the country (Castells, *The Information Age* series).

Most project participants who pursued higher education and who were over thirty years of age first encountered computers in college. By the 1970s, many research institutions had begun to teach computer programming as part of the effort to educate an increasingly savvy workforce. But the access that people had to computers was often far from ideal, and, frequently, the conditions of this access limited their enthusiasm for literacy practices in digital environments. As another study participant, Dean Woodbeck, eight years Melissa's senior, pointed out,

I had to take . . . Fortran [W]e had punch cards, and you would have to do a stack, and they had this, you know, there was this machine that had a keyboard that you typed on and it coded the punch card [with] whatever you were typing in

You could have 80 cards in your stack [and you] ran the stack through this reader, and then you went away for awhile because it didn't generate a printout right away. So you'd maybe go in the morning ... and run your program, [and] um, go to class, you know, [and] come back a couple hours later. Sometimes you came back the next day to see if the program ran or not and, there it was ... sitting in your mailbox. The program ... may have said "Error,"... and you'd have to do it over again So then you would have to go back to your punch cards and say, "OK, did I make a typo here?"

Or, you know, if you dropped them [the cards] and put them back together in the wrong order—everything had to be in a certain order—it [the computer] would just spit [the cards] back at you . . . Oh, I hated it . . .

As computers became smaller, faster, and more flexible during the 1960s, innovations associated with computer technology had leaked into the realm of popular culture, where they affected Melissa's life. By 1965, for instance, ComSat's Early Bird, the first television satellite, was put into orbit, and one of the first broadcasts to use this technology covered a 1966 protest march against the war in Vietnam (*The 1900*s). The Vietnam Conflict, of course, was a war in which Melissa's father fought on behalf of the U.S. Even in this context, however, Melissa's own personal understanding of computers, remained limited. As she explained,

[I remember] . . . my father saying something about how, um, war systems and things are managed on a computer, you know, and having some cognition about what that was although I couldn't picture what kind of computer I imagined someone sitting there with a cape [and a] keyboard . . . I guess.

The Cold War was far from the only threat facing the nation or the only macrolevel factor that affected Melissa's early literacy practices and values. In 1963, one year before she was born and the same year in which President John F. Kennedy was assassinated, a bomb killed four children at a Black church in Birmingham, Alabama, and 250,000 people listened to Reverend Martin Luther King, Jr., deliver his "I Have a Dream" speech in Washington, DC. Civil unrest followed—in Harlem, Philadelphia, Chicago, and Jacksonville. In summer 1964,

the year of Melissa's birth, Reverend King won the Nobel Peace Prize, and President Lyndon B. Johnson signed the Civil Rights Act. By 1966, when Melissa was two years old, Malcolm X had been assassinated, and Reverend King had led a five-day march in Selma, Alabama.

These events, too, had their direct and indirect effects on Melissa's literacy values and practices, and those of her family. Influenced by the national context of unrest and hoping to avoid the mayhem that marked early school desegregation efforts, Melissa's As Melissa entered and progressed through elementary school, for instance, computer technology had made it possible for families to view the broadcast of the first Super Bowl in 1967; the coverage of Reverend King's assassination in 1968; and Neil Armstrong's walk on the moon in 1969. The time into which Melissa had been born and within which she would grow up would continue to be characterized, to a great extent, by technological events like these, even though her personal access to computers, for various reasons, would take another twenty or so years.

mother enrolled her in an all-Black Montessori school in 1967 and an all-Black Catholic primary school in 1968. By this time, computers were assuming an increasing presence in the public sphere, in part because of their influence on mass media. As Melissa entered and progressed through elementary school, for instance, computer technology had made it possible for families to view the broadcast of the first Super Bowl in 1967; the coverage of Reverend King's assassination in 1968; and Neil Armstrong's walk on the moon in 1969 (*The 1900s*). The time into which Melissa had been born and within which she would grow up would continue to be characterized, to a great extent, by technological events like these, even though her personal access to computers, for various reasons, would take another twenty or so years.

During Melissa's childhood, the high value her family placed on literacy continued to affect her life and approach to education:

Well, um, my father . . . [was] always . . . reading all the time. You know, if I look back over the times in our lives, I can always see him stretched out with the paper or some kind of manual or some kind of book or something. I always remember him as a reader

Um, but my father's punishment . . . for me . . . when I was younger, I had to copy the dictionary If I got in trouble and was being irresponsible, I had to write a paper about responsibility . . . and privilege.

Um, my mother, my mother was like a romance novel reader right before she went to bed. That was her little thing. She would read these little Danielle Steele's or some kind of Harlequin [novel]....

In 1976, just one year before the first fully assembled microcomputers rolled off the production line and began trickling into U.S. schools, Melissa's father began a tour of overseas duty in Italy and Germany. Moving with her family, Melissa attended military-supported institutions during much of her junior high and high school years wherever her father was stationed. When asked about moving so much, both in the United States and in Europe, she says that she accepted her many moves throughout school "with a grain of salt—and that the transitions weren't so bad." Her main memory has to do with coming back from Germany to stateside schools in the South:

I just don't remember having too much stress [from moving]. The only thing I can remember is when I was in Germany, there was so much enrichment that went on outside the classroom that made you a lot smarter than you realized you were becoming. You know, you just got really savvy about some things and then when I came back to the States and I was confined to the classroom again, because I went to a civilian school for junior and senior year, I found it, I just got really edgy, you know, I got really bored—I really wanted the go-see kind of education again.

Melissa's family returned to the U.S. in 1980 where her father, now as a lieutenant colonel, was stationed in Fort Stewart, Georgia, and Melissa graduated from high school in 1983. She went on to attend the University of South Carolina and Georgia Southern University through her sophomore year in college and then joined the army herself in 1986. Although Melissa had benefited a great deal from her education outside the United States, neither the U.S. military schools of Europe nor the high schools and universities she attended at home provided her with access to the new microcomputers that were coming to populate U.S. schools. According to both government and private-sector reports published during this period,¹² as well as the narratives of many other participants in this project, the dispersion of the new technology was—and continues to be—unevenly aligned along the related axes of race and class in U.S. public schools. This inequity was to prove embarrassingly persistent, even into the 1990s (e.g., United States, *Falling*). Nichole Brown (another African Ameri-

can in this project) who came from a working class family and was educated in the South seven years after Melissa,

"A computer for me was something to be used by skilled people. And it was so far out of my grasp."

describes her own perception of this situation succinctly, "I thought ... [computers were] something that rich people and spoiled kids had. I knew that I would never have one. Not even a question."

Despite these inequities, the country had begun to realize that computer expertise, however defined and however unevenly distributed, was an important key to success in an increasingly technological culture. Melissa noted:

My first memory of a computer? A computer for me was something to be used by skilled people. And it was so far out of my grasp. It probably was not until I was well out of high school—I'm even thinking that it was after the army—yeah, it was when I worked in a bank. All I knew was how to flip it on, put my little password in, and do my own work.

Although Melissa's first experiences with computers occurred in the army as she came in contact with mainframe technology, she discounted them. These data entry efforts, as she explained, were limited by her understanding of the system with which she was interacting:

... it was something really quick. I punched [the data] in. I didn't cognitively think of the system, you know, the computer was like this whole other entity and you just put it [data] in there. If it was to like crash, I had no idea I probably didn't even know how to turn it on, you know, when I came into work it was on, you know.

But once Melissa started working with computers, she seemed to have no fear of plunging right in:

It wasn't until I wanted this temporary job and it required that I have data processing skills on a certain kind of computer. I lied. I lied. I made my résumé sound like I knew every computer program out there and hadn't even learned on it. I was writing stuff like Lotus, you know, and didn't even know what it meant. Excel, didn't even know what it meant. I'm like, yeah, I do it, I do it, you know. And so when I got the job—I did get the job, because, you know, I've got the gift I guess. I got the job and I remember that on the first orientation day I took the manual home to the computer and I read and I studied that thing all night and the next day I knew how to turn it on, I knew how to get into the program, I knew how to input information just from like familiarizing myself with that manual. And I had those people convinced. I had them convinced that I knew what I was doing on the computer. So that catapulted me into other jobs that required computer skill and I just, that's what I remember doing, getting the book. It all came with the book.

In the same way that Melissa, as a child, remembered her father learning from the army manuals that she watched him read, Melissa took on computers. She read the instruction manuals, educated herself through self-application packets, and "learned Excel, learned Lotus, learned Word, learned e-mail." Finally in the 1990s, Melissa bought a Packard Bell personal computer.

Computers—for Melissa and many other participants in our project denoted privilege; they were for important people, for government professionals, or for bank officials who handled money and important documents. From her father, Melissa also learned that computers required a particular kind of expertise and that they gave those who worked with them a certain kind of power over their own lives and those of others. Melissa's determination and middle-class status, reinforced daily by her life in the military, played a significant role in helping her enact agency in and around digital environments.

In 1989, Melissa married her husband, whom she met in the army, left nursing as a profession, and resigned her own post in the armed services. She maintained her connection with military life, however, as she moved from place to place with her husband who remained in the military until 1999. Outside the military, she found life, "a little crazy":

[Out of the army] I worked as a member services representative in the credit union for a while. That was okay except it really got on my nerves to work with civilians because there was no structure. You basically would do whatever you wanted to do. Whatever you wanted to do; nobody cares about your title or anything. And that drove me nuts a little while. Because I was [so] much a part of the military structure with my husband being in, my father being in, and it was just so engrained [in me] that I found the whole civilian working structure a little crazy. I moved back to the States and worked odd jobs, part-time things, until I became a paraprofessional in a middle school.

Her work in the middle school was sufficiently rewarding that it gave her the motivation to go back to school and finish her degrees, even though she had also become a mother and had borne two children during this time.

In 1996, Melissa first attended a community college (in the town where her husband's military career finally deposited them) and then went on to a four-year university in the same town, receiving her bachelor's and master's degrees in English from the University of Illinois, Urbana-Champaign. Funding for her master's degree was provided through a special Scholar's Fellowship from Parkland College that enabled Melissa to return to Parkland as a full-time faculty member in 2000. Since then she has gone on to accept a tenure-line faculty position with Midlands Technological College, an outstanding two-year college in Columbia, South Carolina.





Introduction

My Online Portfolio

Figure 1. Melissa's first Web authoring experience.

By the time of her interview in 2000, when Melissa was thirty-six, she had already become a Web author through her coursework at the University of Illinois and was teaching students in her college-level English classes the intricacies of word processing, page-layout software, online conferencing, and Web site development. By the time of her interview in 2000, when Melissa was thirty-six, she had already become a Web author through her coursework at the University of Illinois (see Figure 1) and was teaching students in her college-level English classes the intricacies of word processing, page-layout software, online conferencing, and Web site development. She had, in addition, bought her first car online, purchased CD-ROM books for her children,

and admitted to having little respect for businesses that lacked a serious Web presence. She also reported teaching her oldest child, Justin, to read on the computer:

During the time that he [Justin] was... almost two years old, I spent a lot of time on the computer that we had just gotten. And, you know, of course he's curious about what I'm doing, and he would come in and, um, I would just sit there and say, "This a 'j''—you know, we were talking about his name, JUSTIN. And eventually when he would see the letters go up on the screen he began to associate and ... pick them out and I'd say, "Point to 'j." He would point to a "j" and it would go up on the screen. And, um, you know, being two I didn't think that he ... could associate the actual keyboarding and the monitor. But, um, that was where he would go and pick out his letters: "Is this a 'c' right here?"—you know, that kind of thing.... Later on, I didn't quite do that with his brother ... They are 19 months apart, but, um, he had exposure through, uh, a daycare program where they had like a computer camp for little toddlers and stuff. So he had exposure that way and so they are constantly doing computer stuff at school ... They are just surrounded by computers...

Most recently, with her brother, Melissa has made business cards on her computer. She has also used her Web access to visit chat rooms, vote in Harris and Gallup polls, and cruise the Internet to learn more about issues like immigration, when the Elian Gonzalez case was in the news in 2000, and police violence, when Amadou Diallo was shot by police in New York in 1999. As she noted,

I have an opportunity to gaze into the political arena or the social arena on the World Wide Web and actually read it and internalize it. Not that I believe everything that's coming across it. But if I don't, if I get to one site, and I read it, and I go onto another site, I can at least contrast what the inconsistencies are. Melissa also noted that she wanted to help her mother start an e-business selling gift baskets over the Web and had plans to purchase her own domain name and create a Web site for this purpose. Her most recent decision, however, is to earn a doctorate with a focus on service learning, a specialty she has worked hard to develop in her master's degree research and community college teaching. With her growing confidence in online venues, she plans to earn this degree through a distance-learning program.

The cultural ecology of digital literacy in the 1980s and 1990s: the story of Brittney Moraski

Between 1964, when Melissa was born, and 1986, when Brittney was born, the first large-scale computer network, ARPANET, had been created; John Vittal had invented the first fully functional e-mail system; and Queen Elizabeth II had sent her first e-mail message. Also within this period of time, BITNET, a successor to ARPANET, had come into being, matured, and been linked to other computer networks that were emerging around the world. The network of networks that resulted from these connections—known as the Internet—had also started to expand at an exponential pace. By Brittney's first birthday, it connected more than 10,000 host computer; by her second birthday, more than 60,000 hosts; and by her third birthday, more than100,000 hosts. By the time Brittney was five years old, the computer code for the World Wide Web had been released, making it possible to create digital texts out of words, images, and sounds and to publish them on the Internet. By the time she was seven, the first graphical browser Mosaic, re-

leased at the University of Illinois, had begun to pique the public's interest in the Web.¹³ This rapid pace of technology change was about to accelerate rather than slow over the subsequent decade, generating effects that would

Although Brittney would attend both elementary and secondary school in the same small town where she was born, she knew at an early age that the digital world she would inherit placed a premium on computer-based literacies.

change the lives of Brittney's white, middle-class Catholic family in Michigan's rural Upper Peninsula. Although Brittney would attend both elementary and secondary school in the same small town where she was born, she knew at an early age that the digital world she would inherit placed a premium on computer-based literacies.

As with Melissa's parents, Brittney's mother and father were her first literacy teachers, and they held literacy practices in high esteem. Her mother, who had attended a year and a half of college, "always enjoyed reading," and her father, a sixth grade teacher who holds a master's degree in education, "constantly reads magazines on ultralight and powered parachute flying," in addition to daily newspapers. As Brittney notes, her parents

 \ldots never stressed the importance of education—it \ldots [was] unnecessary. \ldots Even in childhood, my brothers, sisters, and I \ldots instinctively understood the importance of education.

Unusually poised for a fifteen-year-old at the time of our initial interview, Brittney reported that she always had her "nose in a book" and—like Melissa and many of the other respondents in our study—attributed her love of reading and learning to her family's literacy practices and values:

[They were] . . . fantastic about reading to me. I was read to constantly, especially during car rides. Such diligence and attention from my family members has no doubt played a major role in the development of my intellectual facilities

[Now] I enjoy history, and I found *Robert Kennedy: His Life* by Evan Thomas to be a fantastic book. I've read many books on the Holocaust, including *Night* by Elie Wiesel and *The Diary of Anne Frank*. I'm beginning to become interested in classical literature (I loathed it before) and recently read *The Pearl* by John Steinbeck. I read the news articles on Yahoo! to stay current in world and national affairs and subscribe to *Time* magazine. I enjoy writing essays and research papers and love creating web sites.

Unlike Melissa, whose Web authoring began later in life and was the culmination of several years of computing, Brittney began to author Web sites as a child. Twenty years after Melissa's early school experiences, Web sites, research papers, and essays exist side by side for Brittney as natural companions. As thirteen-year-old Josh Gardiner, a contemporary of Brittney's, and another study participant, explained when we asked him to describe how centrally computers figured in his life and his ability to communicate with other people, "They rank right up there with air" (Interview, 11 June 2003).

The first computer that Brittney remembers in the house was her brother's, and it was on this machine that Brittney began her digital literacy practices when she was five:

My brother Garrett got a computer when I was young, and I remember that I had a dinosaur (my passion at the time) program in which I made a printout that read:

brittney ligh moraski is 5 years old. her sisters and brothers names are courtney and leslye and brittney garrett brett brandon dad [bob] mom [beth] mitzi is are best friend in the world.

Brittney also used a computer when she visited the home of a family friend, Mitzi Barra. As a result, by the time Brittney got to school, she had already associated computers with literacy, self-expression, and fun:

The increasingly close relationship between literacy and computer technology that helped shape Brittney's early reading and writing experiences at home (at a microlevel) reflected a similar linkage at school (at a medial level) and within the larger cultural ecology (at the macrolevel). By 1990, when Brittney was four years of age, the State of Michigan supported educational computing in K–12 school sites. During the same time period, the Michigan State Board of Education published a report, *Education: Where the Next Century Begins*, that called for the development of a five-year state technology plan that would help ensure citizens of "the necessary technological skills for employment" (Michigan).

As a result of these factors and others, when Brittney began second grade, in 1994, 68.4% of fourth-grade students, 82.3% of eighth-grade students, and 86.9% of eleventh-grade students nationwide were writing stories or papers on computers (United States, *Condition*), and 43% of fourth-grade teachers and 17% of eighth-grade teachers nationwide reported using computers to teach reading (Coley et al.). This rapid expansion of computer-based literacy efforts took place within a global context in which the World Bank and the United Nations had already established their own Web sites; Bulgaria, Turkey, Kazakhstan, Ghana, and Kenya had been connected to NSFNET; and the World Wide Web was growing exponentially (Zakon). It is little wonder that as Brittney grew up and progressed through the grade levels in school, she was keenly aware of the increasingly important role that computer-based exchanges were playing in the world and increasingly adept at communicating within digital environments.

At the microlevel of personal literacy practices and values, Brittney remembers developing her own digital literacy through a process of working and learning collaboratively in Mitzi's company.

I just dove into computers as a young child, and I used it, especially in word processing, often before many of my peers. I used Microsoft Works in fourth grade to create my graphs and papers for my science fair project. A huge amount of credit goes to the Barra's (Mitzi and her father) for my technological progression—they taught me everything. I would go over to Mitzi's house and together we would try (and try) to create the things necessary for my homework. It took us hours to learn how to create a graph in Works. I didn't have a computer of my own until I was a sixth grader, so the only time I used the computer was when I was at her house. Needless to say, I spent an extraordinary (and worthwhile) amount of time there throughout my childhood. Her (and her family's) help and support has been tremendous.

"I would go over to Mitzi's house and together we would try (and try) to create the things necessary for my homework. It took us hours to learn how to create a graph in Works. I didn't have a computer of my own until I was a sixth grader, so the only time I used the computer was when I was at her house." At home, Brittney rapidly became the technology expert. And—like Melissa and many people who came of age in a technological world—she passed her growing expertise upstream to her parents, teaching them how to send e-mail, connect to the Internet, and use Microsoft Money, a finance management program. By the time Brittney had

completed sixth grade in 1998 and had her own computer, she had begun to use the Internet daily, joining 57 million other U.S. citizens (Treese) and 147 million people globally (Paquet) who also had access to the Internet.¹⁴

Computers became a major part of Brittney's social life as well. As a sophisticated fifteen-year-old, she observed that computer-based literacy had become a means of extending the personal relationships of her friends:

My friends embrace technology because it allows them to communicate with their friends, makes homework assignments easier, and allows them to create cards and posters When my friends have crushes with certain guys ... the computer becomes an important flirting tool. Getting that guy on your instant-messenger list can result in conversations that may lead to "going out."

By the time that Brittney arrived at high school in 2001, she was thoroughly aware that she was a citizen of a nation dependent on computers and a world moving rapidly, if unevenly, toward technological connection. But not all of her contemporaries or near contemporaries shared the same level of access to computer technology that Brittney enjoyed. Other study participants and near contemporaries of Brittney, for instance—especially those raised in poverty, educated in schools with high populations of students of color, and lacking the material resources needed to purchase access to computers—had very different experiences. As Damon Davis, for example, an African American who was twenty-one when we first interviewed him in 2000, noted about his own childhood, ". . . [F]rom where I'm from, computers were not the big thing . . . No computer at home, uh, actually nobody I knew in the neighborhood had one." Despite inequities both within and outside of the United States (Castells), however, a snapshot of computer use taken at this point in history would show that computer use was growing rapidly in many parts of the world. More than 93 million Internet host systems had been registered, and the World Wide Web had reached a size well over a billion indexable pages (Zakon). Brittney was part of a generation that recognized that those nations with the healthiest economies, and the largest share of world markets, were also those with the highest investment in computer technologies. Within this historical context, Brittney was to become one of the estimated 605.6 million people worldwide who today have moved their communication activities online ("How Many Online?").

Before Brittney was sixteen, she was reading books on Web design, HTML coding, using programs like Photoshop, and enrolling in online distance education classes to supplement her education in a small, rural town. In junior high, as she noted, a great deal of her day was spent in online literacy activities, although she believed her outdated computer had cramped her style to some extent:

I have a moderately slow, nondescript PC computer. It has been jazzed up recently, however—one of Mitzi's brothers helped me to install a CD burner, more memory, and an additional hard drive.

... I spend a tremendous amount of time using a computer! ... I have the Internet at home, and I use it for a multitude of functions. I access my Spanish course online, send and receive emails, use Yahoo! Messenger to check news headlines and see how my stocks are doing, purchase stocks though ShareBuilder, buy books and CDs at Half.com or Amazon.com, use M-W.com to look up the definitions of words, chat with friends on ICQ, update the school's website, look up topics that interest me, download songs, search for scholarships or contests, learn more about the college admissions process and visit the sites of my preferred universities, look for upcoming camps or workshops, research for homework, and more, and more! One recent example of how I use my computer: We were asked at [my church group] to choose a patron saint and report on it the next week. Well, I used Yahoo! and Google to find sites that list patron saints, and pretty soon I was at catholic-forum.com, trying to find my "personal" saint. I eventually settled on St. Catherine of Alexandria, the patroness of wisdom, philosophers, scholars, and students, but I was tempted to choose St. Vitus, who guards against oversleeping!

Although Brittney used computers in school, her *preferred* gateway for such literacy activities was her own home or that of Mitzi. In these places, Brittney

"While my algebra teacher has a website that he uses to post homework, the art teacher at school gives PowerPoint presentations, and my health teacher had us take a computerized test to see if we were right or left brained, there is little use of dynamic technology in school, but I'm certain that this will change as the years progress. I think my personal initiative in understanding and utilizing computers will serve me better than what my school has taught me." could shape the conditions of her access to meet her specific needs and interests. In part this was true because Brittney's computer skills had quickly outstripped those of many of her teachers—particularly those who taught English. And, while Brittney was appreciative of those instructors who took the trouble to enter her digital world and tolerant of their initial efforts, she was also realistic about the time it would take for adults to catch on to the

dynamic technologies that were already a part of her life. She was brutally frank about the instruction she felt her school could offer students like her:

I appreciate [it] when my teachers embrace technology—I understand that it can be a scary thing. However, very few teachers use technology in the classroom. While my algebra teacher has a website that he uses to post homework, the art teacher at school gives PowerPoint presentations, and my health teacher had us take a computerized test to see if we were right or left brained, there is little use of dynamic technology in school, but I'm certain that this will change as the years progress.

I think my personal initiative in understanding and utilizing computers will serve me better than what my school has taught me. But that's really life in a nutshell. We do best at things we have a genuine interest in, not those that are spoon-fed to us.

Brittney's assessment of the educational system she inhabited was both accurate and incisive. Although her teachers were supportive of her computer-based learning activities and had even chosen her to attend a summer institute on computer-based communication, many of Brittney's online literacy practices remained invisible to the instructors with whom she worked daily. This was true, at least in part, because many of these online literacy activities fell outside the relatively narrow bandwidth of the conventional practices her teachers recognized as literate behavior.

None of Brittney's teachers, for instance, realized that her extensive exchanges in chat rooms helped to define her attitude toward face-to face conversations and her sophisticated ear for nuance in verbal exchanges. Similarly, Brittney's developing understanding of visual literacy was generally invisible to her high school teachers, as were her digital composing efforts that combined both alphabetic and visual elements. As a result, only Brittney herself knew how much her online activities—for instance, her growing understanding of visual design—had begun to contribute to the success of her conventional alphabetic assignments. She explained:

Lately, . . . I've realized that the aesthetic quality and layout of a website greatly determines its credibility and effectiveness . . . I think cleanliness, readable fonts, and professional-looking graphics are very important It is important to "read" graphics and understand the relationship between text and how it is displayed. (i.e. bold text = main idea, small text = footnote)

When I write conventional texts, I \ldots use visual layouts to contribute to the true message of my writing.

Given her situation, by the time she entered high school, Brittney had become quite adept at leading a double life in terms of her literacy practices and values. To please her teachers for most of her academic classes, she composed what she called "conventional" texts like the following book report entitled "Schindler's List" (see Figure 2). But to challenge herself and to engage in the literacy practices she knows will matter most to her when she graduates, she contributes to her school's Web site and designs visual PowerPoint texts like "Honduras 2001," about a social action project she undertook with members of her community (see Figure 3). Importantly, Brittney's experiences in this regard mirror those of a number of other young people in our project. Charles Jackson, for instance, an avid computer gamer when we interviewed him at the age of sixteen, also had what he considered to be limited computer-based instruction and access to computers in school. Charles considered home to be his primary gateway to the literacies that he would need to succeed in college and to prosper as a gaming entrepreneur. Although his school did acquire a computer lab when he was in the second grade, Charles had only minimal access to these machines and limited help from teachers in learning to use them. As he explains, when his instructors did integrate computers into their classroom work, they focused on conventional, alphabetic literacy:

I had about an hour a week [on the computers]. [And] if I was lucky I could [also] use them for 10 minutes before recess

The teachers helped me learn about computers, but I don't think they really knew what they were doing. They were new to computers like we were. They helped us out by encouraging us to use them and to help us learn to read and write with

Brittney Moraski February 13, 2002 English, Book Report

Schindler's List

Schindler's List, a novel by Thomas Keneally, prevails in its account of the Holocaust and Oskar Schindler's uncanny heroism. The novel fails, however, to convey the very human and personal suffering of European Jewry at the hands of the Nazis. Schindler's List presents a cut-anddry recitation of the tragedies of the Holocaust and does not leave the reader with a strong sense of personal loss at its conclusion. The author's use of complex and, at times, incorrect sentences detracts from the story and makes it difficult to read. The faults of the novel, however, disappear in Steven Spielberg's film adaptation of Schindler's List. The movie presents the horrors of the Holocaust visually, and most importantly, poignantly. While Spielberg's film captures an essence of the Holocaust that Keneally's words do not express, it is only when the movie and novel are used in concert that the history of the Holocaust is appropriately depicted.

While Schindler's List has considerable faults, it does present an amazing story. Keneally's cantankerous sentences may discredit the flow of the novel, but the lives of Oskar Schindler and the Schindlerjuden are so intriguing that the story itself remains captivating. Schindler, a Nazi Party member, used his clout and authority within the Reich to protect over a thousand Jews during the Holocaust. An important industrialist, Schindler contracted Jews, otherwise imprisoned in labor and death camps, to work in his factories under the guise that they were essential workers and that their efforts were necessary to keep up the production of German Army supplies. In his concentration camps, prisoners were cared for and fed. Schindler forbade SS guard beatings and executions of prisoners. While life in Schindler's camps was not easy, the Schindlerjuden (Schindler's Jews) considered them a paradise. People on Schindler's list had hope, and better yet, a guarantee of a future beyond the war.

While Keneally does an impressive job telling the *Schindlerjuden*'s story, his book lacks the emotional impact that most Holocaust literature possesses. Keneally's style of writing fails in describing the enormous tragedies of the Holocaust. Since a majority of the characters in *Schindler's List* survive the Nazi's Final Solution, their stories lack a certain amount of tragedy and devastation. Readers of the novel are not adequately exposed to the brutality and atrocities present throughout the Holocaust, and, consequently, are not left with a sense of personal grief or loss at the novel's end.

The film version of *Schindler's List*, directed by Steven Spielberg, debuted in 1993. The threehour video was a winner of seven Academy Awards, including Best Picture and Best Director, and was considered by many to be one of the greatest films of all time. Spielberg's video succeeds in its portrayal of the Holocaust because it uses imagery to make its impact. Spielberg's *Schindler's List* brings the chilling anti-Semitic jeers of village children and the brutality and sheer iniquity of SS guards to the screen. The palpable horror and grief in Jewish families becomes heart-wrenchingly real in the video, and history, however distant, supercedes time and exposes the physical agony of those affected by the Holocaust.

The whole of *Schindler's List* is more than the sum of a moving novel or a cinematic piece of art. Together, the novel and video complement each other, preserving a wide breadth of the Holocaust for future generations to learn and grow from. With the gravity of its subject matter, *Schindler's List*, as a novel and a movie, stands as a testimony, a written and visual witness, to what cannot be forgotten.

Figure 2. Brittney's print essay.

HAWISHER & SELFE / BECOMING LITERATE IN THE INFORMATION AGE



Figure 3: A visual composition that Brittney creates for a self-sponsored literacy task.

them \ldots . They taught us to use word processors and encyclopedias on computers \ldots .

I do a lot of computer coding. Mostly C++ stuff. I do a lot of writing for my games. I try to come up with ideas. I just sit down and try to come up with ideas. Often I will write down a plot or [try] different methods of coding to get a camera angle to work or a certain character to move, stuff like that.

Thus Charles engages a great deal in the kinds of analytical thinking often prized in schools, but most of this thinking and writing is done out of school, extracurricularly, in his role as a gamer.

What these narratives suggest to us

The narratives presented here comprise only a small portion of the story of how people and their families adapted their literacy values and practices to computer-supported environments from 1978 to 2003 in the United States. Although we cannot generalize from these personal narratives to larger populations, these life history interviews have helped us generate key themes that may provide rich direction for further study and exploration. Here we present some thoughts on those emerging themes, discussing them in relation to the narratives presented above and to those of other participants in our study.

The cultural ecology and lifespans of literacies

Almost without exception, the narratives suggest to us that literacies may accumulate more rapidly in the lives of some people when a culture is undergoing a particularly dramatic or radical transition, much as Brandt (*Literacy*) and Miles Myers have indicated. During such periods of macro-order change, people like Melissa and Brittney and many of the other participants learn to value and practice both past and present forms of literacy, often simultaneously. In our contemporary culture, for example, which is undergoing a complicated and messy transition from a modern world of superpower nations and manufacturing might to a postmodern world of global commerce and the rhizomatically organized exchange of digital information, change is both dramatic and rapid. Hence, it is no surprise that literacy scholars have noted multiple literacies emerging, accumulating, combining, and competing: among them, print and digital literacies (Deibert), conventional alphabetic literacies (Brandt, *Literacy*), visual literacies (Kress; George), and intertextual forms of media literacies (George and Shoos).

However the narratives we've presented here also indicate that new forms of literacy may not simply *accumulate* in specific cultural ecologies.¹⁵ Rather,

in the lives of individuals, groups, and communities in dif- ferent patches of an ecosystem and in ecosystems as a whole, literacies have *lifespans*. Specific literacies emerge; they overlap and compete with pre-existing forms; they accumulate, especially, perhaps, in periods of transition; they also eventually Specific literacies emerge; they overlap and compete with pre-existing forms; they accumulate, especially, perhaps, in periods of transition; they also eventually fade away. And, depending on the ecological conditions, some may fade faster than others.

fade away. And, depending on the ecological conditions, some may fade faster than others.

Examples of emerging, competing, and fading literacies are not difficult to find. All the participants we have mentioned in this particular article, for example, have adopted e-mail as their primary form of communication at a distance, and so, for them, the literacy involved in writing letters by hand is fading. The specific literacy practices associated with letters handwritten on paper fit well in a culture characterized by an educational system that provided constant practice in cursive writing, a corporate sector based primarily in the United States, and a relatively cheap and reliable postal service that hadn't been compromised by deliveries of anthrax in envelopes. E-mail, similarly, as a literacy practice fits remarkably well with the growth of electronic networks, global markets, and international financial systems.

Fit and the lifespans of particular literacies, of course, will vary among individuals, and communities, within regions and ecological patches. For Brittney, Charles, Damon, and Josh, for instance, literacies that are primarily alphabetic are fading; they have, as Kress notes, taken a "turn to the visual" ("English") and to the multimodal (Cope and Kalantzis). On the microlevel, these young people recognize the excellent fit between emerging digital literacies and the current cultural ecology. However, this same situation does not hold for other people of their age who occupy different ecological patches. Scholars such as Manuel Castells and Pippa Norris have pointed out that while some people (like Josh and Charles) have the opportunity to rely primarily on instant-messaging systems, e-mail, and chat rooms as they communicate with similarly equipped friends in Germany, Italy, or the Netherlands, a teen living in poverty in some parts of Nigeria or China, or on an under-resourced Native American reservation in the United States may not have the same opportunities to pursue such practices or may not be interested in doing so.¹⁶

Importantly, the overdetermined ecological relationships among literacies, social formations, and technological systems also emerge from the stories we have told. On the macro- and medial levels, the new literacies of Brittney, Charles, Damon, and Josh could not have flourished, indeed would not have been necessary, without the invention of the World Wide Web, fast Web browsers, and efficient Web search engines. Nor could they have existed without new kinds of hardware and software that supported both word and visual processing, multimodal design, and global communication. Similarly, these new literacies would not have experienced such widespread growth without the accompanying explosion of online communities that used chat rooms, experimented with digital photography, played games online, and designed Web sites—communities made up of people who shared the interests of some of the participants in this study. In addition, their interests were supported at one level or another-by parents and friends who were also convinced of the increasing value of digital literacies, the growing enthusiasm of educators who understood the communicative potential of technology, the technologizing of U.S. workplaces, the establishment of federal and state programs for technological literacy, the increasing investment in information services, the influence and growth of globalization and transnational finances, and many more factors at micro-, macro-, and medial levels. All of these factors-and othershave contributed to a cultural ecology in which technological literacy practices have been, and continue to be, valued.

Literacy, technology, and agency

The literacy narratives we have discussed here also indicate that people manage to exert their own very real and potent agency in, around, and through digital literacies, thus shaping the environment for their own literacy practices through actions that have effects at micro-, macro-, and medial levels of social operations. This understanding corroborates the work of Anthony Giddens who notes that people both shape and are shaped by the social systems within which they live in a complex duality of structuration—that "every competent member of every society" not only "knows a great deal about the institutions of that society" but also draws on this understanding of "structure, rules and resources" to make changes in the surrounding environment (71). Andrew Feenberg, too, contends that people can productively shape and influence technological systems in both their design and their use, even as these systems themselves shape and influence people's lives.

For us, it is comforting to see how people like Melissa, Brittney, and other participants in the study have succeeded to some extent in shaping the social and historical circumstances within which they live. Their actions—their decision to learn to compose, create, and communicate in computer environments; the ways they have shaped their own appropriate conditions of access to these environments; the steps they have taken to advance their knowledge and expertise within these environments; the significant literacy exchanges

they have undertaken with people outside their own culture, country, and age group, although often occurring in micro-level social environments (i.e., in families, in peer groups, in everyday contexts of living)—also extend beyond these environments to the medial level (e.g., workplaces, schools, organizations)

These people's sense of their own communicative agency in digital environments remains strong and persists, despite the discouraging computer experiences they have had and the poor reception their literacy efforts have sometimes received from teachers and parents.

and macrolevel (e.g., regional, national, multinational) contexts. These people's sense of their own communicative agency in digital environments remains strong and persists, despite the discouraging computer experiences they have had and the poor reception their literacy efforts have sometimes received from teachers and parents.

We do not want to indicate with this discussion, however, that people can always accomplish anything they want within the social structures they inhabit or that their actions are always effective in the ways they intend. Clearly, people are constrained by any number of influential factors: age, class, race, gender, handicap, experience, opportunity, and belief systems are among only a few such factors. A number of our participants, for example, most especially women, felt that their gender was not an asset to them as far as technological literacy was concerned, and several texts suggest the difficulties some women and girls face in electronic environments (e.g., Blair and Takayoshi; Cassell and Jenkins; Hawisher and Sullivan; Hawisher and Selfe "Teaching"). There continues to be strong support for the perception that boys are more likely to use computers extensively than girls and to excel in their use of them. Justine Cassell and Henry Jenkins note in From Barbie to Mortal Combat, for example, that "among secondary school-aged children (eleven to eighteen years), boys are at least three times more likely to use a computer at home, participate in computer-related clubs or activities at school, or attend a computer camp" (12). The literacy narratives generated from our study tend to substantiate Cassell and Jenkins's contentions.

Our study also suggests, however, that while some girls may participate *less* in computer activities, many *do* participate. When Paula Boyd, now 34, for example, was in junior high, she was a regular at the local mall and its video game arcade, despite the fact that her girlfriends preferred to hang out in the

mall proper rather than in the arcade. Brought up in a working class family, Paula has always felt comfortable around computers and serves as a role model today for many younger (and older) women in her work directing a learning center at Parkland Community College. Sixteen-year-old Brittney, similarly, seldom feels that being a girl hampers her in her pursuit of digital literacy. As long as she has the encouraging support of family, friends, teachers, and community, she is able to engage in the computer-based literacy practices she prizes. At the same time, however, she recognizes the complicated nature of gender differences and acknowledges that sometimes, because she is a girl, she feels "slightly, though not wholly, out-of-place" (personal communication, 2 February 2003). As an example, she notes the following:

Just recently I toured my area's intermediate school district vocational training program as part of a school trip, and I visited the PC tech dept. as part of the tour. From touring the class I could see that the students in the class were predominately male, and in some sense that was slightly intimidating. Still, the teacher who led the tour treated me (the only female in the group) equally and respectfully, and while I don't think my treatment in that class would be any different than the male students, I imagine that it would take me time to adjust to such a learning environment.

She goes on to tell us about the computer camps in which she participated, admitting that in all-male settings she's less likely to "show off" her computer expertise or admit that she doesn't understand something. She concludes, however-and everything we know about Brittney supports her conclusionthat "[her] gender may play some role in [her] experiences with technology, but it is not (nor never will be) influential enough to stop [her] from enrolling in a C++ course or, most importantly, venturing out of [her] comfort level to learn something new" (personal communication, 2 February 2003). We are confident that her high aspirations for excellence and her acts of literacy themselves will continue to thrive throughout her college years. But, at the same time, we do worry that other young women less confident about their capabilities in digital environments may have less success, and we are disheartened that the gender ratio in many computer settings remains so imbalanced. If the first decade of the twenty-first century is anything like the preceding decades, we must acknowledge that a chilly climate for women often extends to computer-based literacy environments today (Takayoshi; Kramarae; Hawisher and Selfe, "Teaching").

In addition, the actions people *do* undertake—because they take place within a complex cultural ecology—always have what Giddens calls "unin-

tended consequences" (56) that overflow the bounds of peoples' intentions. Melissa, for instance, went back to earn a college degree ostensibly to become qualified to teach in a middle school. During her undergraduate and graduate years, however, when she was already thirty years old and a wife and

"I'm INCLUDED in communities, rather than being on the margins doing what an African American woman might stereotypically do, which is often nothing related to technology if she is in Education or Liberal Arts."

mother, her easy access to, and particular facility with, the new technologies convinced her that she should follow a different route. As she put it in an e-mail message, the results of her efforts have been gratifying:

My interest now in computer literacy affords me access both socially and professionally. I'm INCLUDED in communities, rather than being on the margins doing what an African American woman might stereotypically do, which is often nothing related to technology if she is in Education or Liberal Arts. Reflecting on my earlier experiences, I'm certain that had I not lied, and then obtained the manual, and had I not been self-motivated in acquiring a computer of my own, my employability and mobility would have been drastically different. . . . (personal communication, 29 January 2003)

Certainly Melissa's persistence contributed to her success, but other factors in the cultural ecology contributed as well. She attended a community college that, at the time, was sponsoring an excellence program aimed at recruiting minority faculty members, and Melissa's qualifications made her a superb prospect. Without this opportunity, Melissa may never have become a college teacher, one who now regards her work with the new information technologies as a definite asset. Her welcoming relationship with computers also seems to fly in the face of society's common construction of how middle-class, adult women respond to the new information technologies. As noted, being a woman is customarily cast as an obstacle to acquiring the literacies of technology (e.g., Cassell and Jenkins; Jessup). But we hypothesize (based in part on our larger study) that the military culture, in which technology is just a part of everyday life for women as well as men (Katzenstein and Reppy), may work in women's favor as far as information technologies are concerned. Karen Lunsford, a white woman in our study four years younger than Melissa, has this to say about her early memories of computers as an air force dependent when she was 10 years old:

One of the earliest real computers that I remember was in, um, we were in Alabama, we were there for one year from 1978 to 1979. . . . And [my father] was taking courses of some sort, and he had a simulation computer that he brought home and it had a daisy wheel printer in it. It didn't have a screen. And I remember he brought it home, he linked it to the telephone and we were playing *Star Trek* on it.

For Karen and her sister, computer games rapidly became a family activity, and, often, with their emphasis on war and military maneuvers, the games themselves were merely an extension of Karen's immersion in a military culture already saturated with technology. While Melissa may not have taken to mainframe computer technology as a member of the military, she nevertheless as a military dependent understood computers as integral to what her father and the military were all about.

In addition to the military, however, Melissa's immersion in the African American culture, in which young women are encouraged to take charge (hooks), may well have shaped her future work with computers. Hortense Spillers, a black feminist at Cornell University, argues that early on, given the experience of their lives, black women were exempt from some racially dominant expectations of white feminine behavior, behavior that excluded, for instance, expertise with machines. This cultural exemption may well have helped some African American women, in this case Melissa (and perhaps Nichole), claim a subject position that allows black women to take pride in their own technological expertise.

Gateways to the literacies of technology

This project has reminded us that people often acquire and develop the literacies they need in places other than the classroom where, often, instructors tend to limit literacy activities to the narrow bandwidth of conventional written English (Selfe et al. "Stasis"). Nonetheless, schools, along with workplaces, communities, and homes, represent the major gateways through which people in the United States have gained access to computer technology over the last twenty-five years. In general, our interviews indicate that the more gateways people have open to them, the more likely they are, over their lifetimes, to acquire and develop effective sets of digital literacy skills and to value these literacies of technology. The relative importance of these gateways in people's lives varies according to the needs and motivations of those who use them, the timing of these needs within individual lives, the historical contexts in which such gateways exist, and the sets of social circumstances which shape

them—all factors that influence the cultural ecology in which people acquire electronic literacies.

Of particular note in the cases that we have collected from young people who have come to value and practice various digital literacies is the fact that schools are not currently uniform in their predispositions to digital literacy, in general, and to visually rich—and multimodal¹⁷—digital literacies, more specifically. Although the various educational institutions these people have attended as students, for instance, value computer-based literacies at some level, in English composition classes and in most official assessments of communication ability, the focus is primarily on conventional, alphabetic, and print literacy.

To a large extent, this valuing of official forms of alphabetic and print literacy is generational. Such literacies have, after all, been the major shaping forces in the educational experiences of faculty members teaching at these schools and, thus, in the ongoing formulation of their official grading and evaluation standards. The primacy of alphabetic and print literacies has also affected the hiring decisions of these educational institutions—and the values of employers who recruit their graduates and expect these people to be able to meet minimal standards. The culture of print and alphabetic literacy exerts,

too, a powerful force on the expectations of parents who enroll children at these educational institutions and the historically defined literacy ideals of the larger society in which the educational institutions exist and are expected to thrive.

This contested situation—in which print-based and alphabetic literacies continue to compete at many levels with some students' computer-based literacies that Raised and educated in a culture that valued, and continues to value, alphabetic and print literacies, many of these teachers remain unsure of how to value new-media literacies, unsure how to practice these new literacies themselves, and unprepared to integrate them at curricular and intellectual levels appropriate for these particular young people.

often exceed the alphabetic—may help explain why most English composition teachers who have worked regularly with Brittney, Charles, Damon, and Josh have not addressed their new media literacies on a systematic basis. Raised and educated in a culture that valued, and continues to value, alphabetic and print literacies, many of these teachers remain unsure of how to value newmedia literacies, unsure how to practice these new literacies themselves, and unprepared to integrate them at curricular and intellectual levels appropriate for these particular young people. In this context, teachers cannot take full advantage of the literacy strengths computer-savvy kids bring to the classroom and may miss some important opportunities to link their own instructional goals to the developing literacy strengths of these talented young people.

Workplace settings have provided a second major gateway for electronic literacy—as Melissa's and other participants' narratives suggest. Since the 1980s, businesses and corporations have become increasingly dependent on computer-based communications.¹⁸ Driving this dependence have been the forces of globalization, the rapid growth in computer manufacturing¹⁹ and in the information technology sector, government policies designed to increase the export of U.S. computer goods and services, and the rapid innovation and decreasing costs characterizing the computer industry. As a result of these related trends, workplaces have provided many employees with both access to technology and the pragmatic motivations for taking advantage of this access. This historical tracing does not suggest, however, that access to computer technology in the workplace has been equitable. Computer use in the workplace, as in schools, also continues to be differentially distributed along the axes of race and income as we have already noted.

Communities also serve as critical technological literacy gateways by providing access to social groups in which people form friendships that frequently support technological literacies, such as those Brittney has encountered, but also by providing public access facilities, such as community centers, community networks, and libraries for people's online literacy practices. The 2002 U.S. government report, A Nation Online, revealed that many in the U.S. who lack access to computers and the Internet at home turn to libraries for access, and this was certainly true for several of the participants in our study. Time and again, they mentioned libraries as important gateways for literacy activities. Older participants spoke of the Carnegie libraries and the weekly trips each made to the library to borrow books, and the younger participants, like Damon, not only borrowed books but also talked about writing school papers with word processing and doing research on the Web at local libraries. Significantly, A Nation Online reports that "a far higher percentage of Hispanic (39 percent) and Black (45 percent) children rely solely on public access facilities to use computers than White children (15 percent)" (United States, Nation 9). Thus these public access facilities also help address the inequitable computing conditions that remain constant and seemingly insurmountable as problems in the U.S.

And, finally, families and homes provide the fourth major gateway through which people come to the literacies of technology. Within the environment of their homes, parents again and again provided a rich environment in which the participants learned and practiced print and digital literacies. Parents bought computers that they could sometimes ill afford in order to give their children and themselves greater educational and economic opportunities. When the participants became parents, such as Melissa, they too made sure that their own children had a wide assortment of electronic resources at their fingertips. In fact, compared to the latest U.S. Census Bureau's statistics on the percentage of households in the U.S. owning a computer, the participants in our study are probably more likely to own computers than the average U.S. resident. Fifty-four million households in the U.S., or 51%, had at least one computer in August 2000 (Newburger). As many of the participants seemed to know intuitively, household ownership of computers along with Internet access—and thus ready access to online reading, writing, and communicating at home—has been a major factor contributing to people's high degrees of proficiency with digital literacies.

Access and its complications

Importantly, access is a much more complexly rendered social formation than we have heretofore recognized. While physical access to computers is neces-

sary, it is not sufficient for developing digital literacies (Hawisher, "Accessing"; *Spanning*; DeVoss et al.). Rather, the specific *conditions* of access (and the timing of these conditions) seem to be important in determining when and how people acquire and develop effec-

The specific *conditions* of access (and the timing of these conditions) seem to be important in determining when and how people acquire and develop effective sets of technological literacy skills—or, indeed, if they choose to do so.

tive sets of technological literacy skills-or, indeed, if they choose to do so.

Although it is difficult to indicate the scope and complexity of the ecological relationships that affect the conditions of people's access, we can illustrate these principles a bit more specifically by tracing how they play out at various levels in the lives of the two women we have featured in this article. At a *macro*level, for example, Melissa's and Brittney's access to technological literacy was affected by large-scale historical, political, and economic factors such as, but not limited to, the development of microcomputers in the late 1970s, the resulting expansion of the U.S. computer industry in the 1980s (Freeman; McConnell; Moris; Warnke), the Clinton administration's decision to invest in technology as the economic engine that would drive the country's economic expansion in the 1990s (Selfe), and the ongoing partnership between universities and the military industrial complex (Castells, *The Rise*). All of these converging factors exerted a great tendential force in our culture, feeding the rapid development of microcomputers, contributing to the falling costs of these devices, and affecting the availability of computers in schools, workplaces, communities, and homes.

The condition of Melissa's and Brittney's access to technology was also affected at *medial* levels by the different institutions, organizations, and professions that exerted shaping influences—often, but not exclusively, bureaucratic and institutional in nature. For example, Melissa, as a bank employee, was required to make use of a limited number of applications on which the banking industry had begun to depend and which were becoming standard for managing accounts. Similarly, Brittney's school had a computer-use policy that dictated a much more limited range of use at school where her movements online were constrained by firewalls and filters designed to prevent her from accessing material educators considered inappropriate for her age group.

*Micro*level factors similarly affected the conditions of these women's access to technology. Melissa's marriage and birth of her children led to her work in a middle school, which propelled her back into higher education at a time when computers were more readily available for her literacy efforts. Her courses and work with other graduate students and faculty spurred her interest in Web authoring that was made all the easier by her now owning a computer. In Brittney's case, her brothers supported her early attempts to use computers at home, and her family supported her efforts with financial resources. Brittney also had a close friend in her community who used computers, educational opportunities that exposed her to computers, and a home life that could accommodate personal computers with a minimum of space reallocation.

The transmission of digital literacy values and practices

Perhaps most fascinating, the cases we have collected form a complex mapping of the routes by which literacy values and practices are passed along within individual families. Under the right conditions, literacy practices and values both print and electronic—can flow upstream as well as downstream in a family. An NPR/Kaiser/Kennedy School poll conducted in 1999, for example, found that 33% of adults reported asking their children for help with computer problems, and 55% of the children reported asking their parents for such help (adult's survey question 32, children's survey question 14) ("Survey Shows"). Thus, it is

not surprising to find that Brittney's older brother influenced his younger sister's values regarding computer-based literacy practices, nor is it unusual that Brittney had, in turn, taught her parents how to send e-mail and connect to the Internet. And Melissa, similarly, introduced her brother and mother to ways in which the literacies of technology could support their emerging business projects. Three years Melissa's junior, Mary Sheridan-Rabideau, another participant in our study who initially valued computers less than some of her contemporaries and whose well-educated parents valued them not at all, eventually went to the trouble to outfit a computer she purchased for her parents with coded keys to facilitate their learning. Today, although her parents still struggle with the technology, they remain connected. Paula, similarly, made sure her extended family in Chicago was connected through e-mail so that, for her own convenience, she'd have family members to whom she could send email regularly. Other interviews we have completed for this project—including Dean's and Charles's-also indicate that these intrafamily patterns affect peoples' access to computers, with computers being passed from children to parents, from parents to children, from aunts to nieces, from mothers-in-law to daughters-in-law, and from grandchildren to grandparents.

As we continue ...

The stories we have told here are not complete histories. Chosen from more than 350 interviews, excerpted, and reduced, they comprise only a very small portion of some larger national narratives: how individuals and families have adapted their literacy values and practices to computer-supported environments; how people's access to computers has varied, in part, along the axes of race and class; how and why technological literacy has thrived within the cultural ecology existing within the United States from 1978 to the present; how people have struggled to acquire computer-based literacies in an attempt to improve their own prospects or those of their children; how children have shared computer-based literacies with adults and how adults have shared with children.

We recognize (and hope readers do as well) that no one story we have told here and, certainly, not this collection of stories can be considered indicative or representative of any larger population. There are far too many stories that remain uncollected, unheard, unappreciated for such larger narratives to be completely or even accurately rendered. We also recognize that drawing conclusions from a limited set of data is always dangerous business, so we approach the task with caution and hope readers will do so as well. This recognition, however, does not serve to diminish the value of the first-hand accounts like those we have told here. On the contrary, to us, these literacy histories have proven to be richly sown with insights that have immediate face validity. And we hope that other faculty members, parents, policy makers, and program directors will react to them in the same way.

For us, some of the more surprising discoveries to come from the autobiographies we have collected focus on how little teachers of English, composition, and communication know about the many literacies students bring to the classroom. Our professional radar is tuned so narrowly to the bandwidth of print and the alphabetic—to school-based and workplace writing—that we miss a great deal of the more interesting and engaging self-sponsored reading and composing students do on their own time. These activities, these values remain generally invisible to us. And because we often miss such activities, our instructional practices and values, our interests, and the texts we read and compose may be moving further and further away from those that students consider important.

Under these conditions and with the best of intentions, writing instructors—ourselves among them—face the danger of teaching in ways that ignore

We fail to build on the literacies that students already have—and we fail to learn about these literacies or why they seem so important to so many students. We also fail, as we deny the value of these new literacies, to recognize *ourselves as illiterate* in some spheres. And in this intellectual arrogance, we neglect to open ourselves to learning new literacies that could teach us more about human discursive practices. the considerable strengths in technological literacies that some students bring to our classes. As a result, we fail to build on the literacies that students already have—and we fail to learn about these literacies or why they seem so important to so many students. We also fail, as we deny the value of these new literacies, to recognize *ourselves as illiterate* in some spheres. And in this intellectual arrogance, we neglect to open ourselves to learning new literacies that could teach us more about human discursive practices.

With regard to computer technology more specifically, these stories also suggest to us how important it is to remember, as teachers, that all students are not the same (Faigley). They inhabit different patches of a larger cultural ecology. They come from different backgrounds and have had access to different technology gateways. They have differing proclivities and support for technological agency; they have differing family traditions and friends. Thus, we must show caution in designing computer-supported lessons that assume too much or too little or misjudge students' motivations. And we need to be increasingly wary about assuming that school is the primary gateway for learning about and using technology.

But changing people's attitudes toward literacy is not a simple or easy task. Many composition instructors have been raised and educated in a world that focuses on alphabetic, print literacy. Many faculty lack training in digital literacies, and many lack access to the technology and professional support systems that could help them feel more confident in these realms. This may be especially true, as we have pointed out elsewhere, in institutions that have high populations of students of color and poor students. And it may be especially true in schools hard hit by recent budgetary cutbacks in which the U.S. has sacrificed school funding to military spending and international warfare.

However, faculty members can start to change their attitudes about literacy—to broaden their understanding of, and appreciation for, students' literacies—by attending as closely to students' online reading and composing practices as they do to their own more traditional writing practices; by listening closely, and with open minds, to what students are saying about the role of new-media compositions in the world they inhabit; and by expanding their definitions of "texts" and "composing" practices to include a range of other behaviors: among them, reading and composing images and animations; creating multimedia assemblages; combining visual elements, sounds, and language symbols into alternatively organized and presented forms of communication in digital environments.

More than anything, instructors can discipline themselves to become increasingly open to a flexible understanding of composing and composition instruction, not more constrained. We can remind ourselves of our professional responsibilities as scholars of language to recognize, study, and address a full range, rather than a narrow bandwidth, of semiotic practices and channels: those that may use images, animations, sounds, and multiple media; those that represent newly emerging literacies *as well as* established literacies *and* competing literacies *and* fading literacies. Composition teachers can also remind themselves and students about how specific historical periods and cultural ecologies shape, and are shaped by, literacy standards, values, and practices (emerging, established, competing, *and* fading). And in doing this work, they can help students negotiate and reconcile the contested values and practices associated with the various kinds of reading and composing work they currently do for different classes in school; in family, peer-group, and community settings; and in the workplace. This kind of work will also pay dividends as students change their reading and composing habits and encounter differing habits from differing cultural ecologies, over the course of their lifetimes.

Finally, the literacy narratives on which we have focused in this article suggest that closing the gaps associated with information technologies in the lives of some people will depend not on providing them with access to computers through one technology gateway but on providing them with access through several such gateways—school, workplace, community, and home. The specific *conditions* of access—and how these are aligned in our country with interrelated formations of race, class, and gender—must be addressed in order to assure productive environments within which the beginning steps of physical access can make a real difference. One necessary element of these conditions must be a broad understanding and valuing of multiple literacies—emerging, competing, and fading—in home, school, community, and workplace environments. And it is in schools and universities—in our roles as teachers—that we are uniquely positioned to make a difference in the literate activities of students.

None of these changes in literacy, of course, can be addressed in isolation from the larger cultural ecology within which computers—and the acquisition and development of the literacies of technology—exist. But all of them can make a difference in peoples' literate lives during this information age.

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Notes

1. By *technological literacy* or *literacies* we mean the practices involved in reading, writing, and exchanging information in online environments, as well as the values associated with such practices—cultural, social, political, and educational. For us, the term differs from *computer literacy* in that it focuses primarily on the word *literacy* and, thus, on communication skills and values rather than on the skills

required to use a computer. To distinguish technological literacy from computer literacy, literacy scholars have also used the related terms *electronic literacy* (Sullivan and Dautermann; Selfe and Hawisher, "Historical Look"), *digital literacy* (Tyner), and the *literacies of technology* (Hawisher and Selfe). We use the last term, literacies of technology, as an all-encompassing phrase to connect social practices, people, technology, values, and literate activity, which, in turn, are embedded in a larger cultural ecology. All these terms are synonymous with our use of technological literacy, and we use them in this article interchangeably. In all cases, they focus on literacy practices and values in online environments rather than on the skills required to use computers themselves.

2. Evidence of the increasing importance placed on computing as a prerequisite for many available jobs is not difficult to come by. For various takes on this pattern, consult the Hudson Institute's *Workforce 2020* (Judy and D'Amico), the *Digital Workforce* report issued by the Office on Technology Policy (Meares and Sargent), and *Futurework* issued by the U.S. Department of Labor.

3. See Paul Prior's *Writing/Disciplinarity* for a particularly apt discussion of literate activity, technological or otherwise. He writes, in part, that "writers and readers are inescapably situated in particular places and in the moment-to-moment flow of lived time.... Literate activity... is not located *in* acts of reading and writing, but *as* cultural forms of life saturated with textuality, that is strongly motivated and mediated by texts" (138, emphasis in original).

4. Compare, for example, the *Falling through the Net* series (United States) issued by the National Telecommunications and Information Administration during the Clinton presidency from 1995 to 1999 and during the Bush administration in 2000, along with the more recent 2002 *A Nation Online* (United States).

5. We couple the concept of "literacy" with technology while recognizing the unease with which some scholars view the proliferation of terms like "digital literacy," "visual literacy," "media literacy," and so forth. Anne Wysocki and Johndan Johnson-Eilola, for example, have argued that "when we speak . . . of [alphabetic] 'literacy' as though it were a basic, neutral, contextless set of skills, the word keeps us hoping . . . that there could be an easy cure for economic and social and political pain, that only a lack of literacy keeps people poor or oppressed" (355). And, increasingly, of course, this same kind of thinking is applied to online literacy practices. Gunther Kress (*Literacy*) also suggests that *literacy* is an inappropriate word to link with terms not specifically aimed at "[making] messages using letters as the means for recording that message (23)." For Kress, not only is the move imperialistic (many cultures don't use the concept of literacy, and still others don't even use letters or an alphabet), but also it's also confusing. According to Kress, the move allows us to conflate too simply the individual competencies required to make meaning in multimodal contexts. Nevertheless, we endorse linking *literacy* with words, such as *technological, digital, electronic* as well as the all-encompassing "literacies of technology." We believe that by naming these abilities "literacies," we signal the enormous importance they hold for living in today's literate world. James Gee (*What Video*) would seem to agree. By emphasizing "the idea of different sorts of multimodal literacy" (14) and by asserting that "both modes and multimodality go far beyond images and words to include sounds, music, movement, bodily sensations, and smells" (14), he too extends the reach of "literacy." For Gee, "in the modern world, print literacy is not enough. People need to be literate in a great variety of different semiotic domains" (*What Video* 19). We agree.

6. An extended account of this project and the life-history narratives it generated appears in Cynthia L. Selfe and Gail E. Hawisher's *Literate Lives in the Information Age: Narratives of Literacy from the United States.* This project has been funded, in part, by generous support from the National Council of Teachers of English, the Society for Technical Communication, Michigan Technological University, and the University of Illinois, Urbana-Champaign.

7. In using the term *patch*, we are indebted to the work of Jay L. Lemke. In *Textual Politics*, he writes:

... activities in human communities are interrelated both in terms of exchanges of matter and energy and in terms of relationships of meaning. The fundamental unit of analysis will turn out to be a "patch," a mini-ecosystem containing human organisms in interaction with their social and material environments according to both cultural and ecological-physical principles. The patch is part of a mosaic of other patches each with its own unique history, all interacting and forming a larger scale patch in a larger scale eco-social system... underlying them are the interconnected doings, the ecological and social processes that link organism to organism, organism to environments, and which at smaller scales operate to constitute organisms, artifacts, landscapes, dialects, communities, cultures, and social individuals as self-organizing systems. (94)

When we use the term *patch*, we refer to the smaller eco-units of families, peer groups, institutions, professions, etc.

8. See Bertram C. Bruce and Maureen Hogan's chapter for a fascinating discussion on "The Disappearance of Technology." They argue that

[a]s technologies embed themselves in everyday discourse and activity, a curious thing happens. The more we look, the more they slip into the background. Despite our attention, we lose sight of the way they give shape to our daily lives. This disappearance effect is evident when we consider whether a technology empowers people to do things that would be difficult, or even impossible otherwise. (270)

9. Importantly, we have asked the participants on whom we focused to coauthor their own case studies with us. We were influenced in this decision by Caroline Brettell's When They Read What We Write, a collection that presents a series of perspectives on studies like ours-anthropological projects, ethnographies, and life histories—and talks about the ways in which modernist approaches to such writing have often suffered from the limited perspectives of academics and professional scholars who, as Donald Schoen notes, still cling to an understanding of "the superior academic value of 'pure knowledge' inherited from the 'model of technical rationality' that has been influential in all American social sciences" (27). As Alexandra Jaffe points out in the Brettell collection, this kind of approach to research claims a "distance between observer and observed" that is, to a great extent, an "ethnographic fiction," one that scholars have employed to assure "control over [their] 'subjects'" (51). As a corrective to this modernist approach, Brettell and others in her collection suggest an alternative method of having subjects talk back, comment on, modify, change, correct scholars' interpretations of what they said. Talking back, as Jaffe goes on to say, helps to undermine professional ethnographers' "ability to construct an unproblematic Other, and hence, an unproblematic self" (52). In our experience, the reflexivity established by this dialogue is not only a positive and productive characteristic of postmodern anthropology but also, as Jaffe points out, a realistic and "essential condition of interaction with the people we study" (51). See Gail E. Hawisher and Cynthia L. Selfe's "Collaborative Configurations" for further discussion.

10. For an extensive explanation of the role that networked computers have played in bringing about change and ensuring certain political phenomena an extended global impact—among them, international terrorism, religious fundamentalism, the Green movement, and feminism—see Manuel Castells's three-volume series, collectively entitled *The Information Age: Economy, Society, and Culture.* In addition, the New London Group, in their recently published book, *Multiliteracies: Literacy Learning and the Design of Social Futures*, explores the role that computer networks and technological communications systems have played in multiplying and transforming individuals' "lifeworlds" (see Cope and Kalantzis).

11. The extended life-history narratives of these participants can be found in the chapters they have coauthored within *Literate Lives in the Information Age* (Selfe and Hawisher) or in other work we have published.

12. See the Clinton administration's *Falling through the Net* series (1995, 1998, 1999, 2000), issued by the National Telecommunications and Information Administration (United States), and the 1997 Educational Testing Service report by Richard Coley, J. Crandler, and P. Engle, *Computers and Classrooms: The Status of Technology in U.S. Schools*.

13. These markers of Internet development and many others can be found in *Hobbes' Internet Timeline*, *v5.6*, compiled by Robert H. Zakon. Zakon's timeline chronicles the growth of the Internet, focusing primarily on the development of hardware, software, and networking systems. This timeline, and others, can be accessed from the Web site of the Internet Society at <http://info.isoc.org/internet/history/> or at <http://www.zakon.org/robert/internet/timeline/>.

14. We do not mean to suggest by this statistic that access to the Internet has been or has become evenly distributed around the world or within the U.S. The distribution of technology has been uneven and aligned along existing axes of race and socioeconomic status—globally (cf., Castells; Norris) and nationally (cf., United States, *Falling*; "Digital Divide"; Castells; United Nations, *Human Development*; Selfe). In addition, at various times and depending on the current cultural ecology, technology has also been differentially distributed along the axes of age (cf., Pastore; Pew Internet Project, "Gray Gap" and "Wired Seniors"), gender (cf., Cassell and Jenkins; United Nations, *Human Development*; Jessup; Pew Internet Project, "Tracking"), and geographic location (cf. Castells; United Nations, *Human Development*; Norris), both nationally and globally.

15. In 1995 in her groundbreaking article, "Accumulating Literacies," Deborah Brandt noted that literacies—with the invention of computer-based communication technologies—were proliferating in the years marking the end of the 20th century. Computer-based literacies imparted a "complex flavor even to elementary acts of reading and writing . . . creating new and hybrid forms of literacy where once there might have been fewer and more circumscribed forms" (651). This "rapid proliferation and diversification of literacy" (651), Brandt continued, places increasing pressure on those in the U.S. whose ultimate success may be "best measured as a person's capacity to amalgamate new reading and writing practices in response to rapid social change" ("Accumulating" 651).

16. For further information on the diffusion of technologies among Native Americans in the U.S., see James Casey, Randy Ross, and Marcia Warren.

17. See Bill Cope and Mary Kalantzis, and Gunther Kress and Theo Van Leeuwen.

18. For explorations of this claim, compare William Johnston and Arnold Packer; Richard Judy and Carol D'Amico; Carol Meares and John Sargent; and the U.S. Department of Labor's *Futurework*.

19. Published in 1996, volume 119, number 8 of the *Monthly Labor Review* provides an excellent historical snapshot of how computers were shaping the U.S. economy at that time. Among the articles in this issue, we recommend those authored by Laura Freeman, William Goodman, Sheila McConnell, Francisco Moris, and Jacqueline Warnke.

Appendix: Interview Protocol

We're doing research to find out primarily how people came to computers and what their experiences using computers have been. We're interested in what experiences different generations of people living in the United States have had with computers.

Demographic Information

Name: Current Occupation: Previous Occupations: Nationality: Race: Orientation (only if volunteered by subject): Let me get down a few facts about your family as you were growing up. Immediate family members and ages:

How would you describe your family circumstances? Income Level

Growing up?

Now?

Parents' Literacy Histories (e.g., literacy values, education, reading/writing/computing activities):

Did your parents value literacy? How? Any literacy stories?

Parents' Education and Professions:

Can you tell us a bit about yourself? Where were you born? Where did you grow up? What is your family like? What are you like?

Place and date of birth:

Where did you live? Growing up: Now: Schooling History: Elementary College Secondary Other

Early Exposure to Literacy/Computers

Can you tell us how/when/why you learned to read and write?

Can you tell us the story about when, where, how you first came in contact with computers?

Can you tell us the story about when, where, how you first learned to use computers?

Do you remember what the prevailing images/representations of computers were when you were growing up? (e.g., movies, television, magazines, books?)

At Home

If your family had a computer at home when you were growing up, can you tell us the story of buying the computer? Who bought it? When? Why?

Can you tell us how much the computer cost? Can you talk about how significant/ serious that investment was in terms of your family's regular budget?

For what purposes did you use the computer when you first started? As you continued to learn?

Can you tell how a typical session might have gone in your home computing environment?

How often did you use the computer? What contributed to your use of it or not? Are there any stories/incidents that you can remember about this?

Can you remember any books/texts about computers that you had at home? Any that you read? Any computer games?

Can you identify any images that you remember about computer use?

What did you and your siblings and parents use the computer for at this time? As you continued to use it?

At School

Tell the story of how you first learned to use the computer at school: What was your motivation? Age? Who helped? How did they help? What kind of support did you have? In what classes did you learn to use the computer? How much access did you have to a computer per day/week/month?

Describe your use of this computer: Who was there? What times of day? What were the surroundings like?

For what purposes did you use this computer?

For what purposes did other kids use the computer at school when you were all first learning to use technology? As you continued to learn?

Can you tell how a typical session might have gone in this environment?

What determined how frequently you used the computer? Are there any stories/incidents that you can remember about this?

Can you remember any books/texts about computers that you had access to at school? Any that you read? Any computer games?

Can you identify any images that you remember about computer use that you encountered at school? Educational images?

What did your family think about computers? Your learning computers? Your parents? Sisters and brothers? Uncles and Aunts? Cousins? Grandparents? What values did they place on this activity? On your participation? On their role? Do you have any stories you can tell us that would illustrate the value your family placed on computers or computer literacy?

What did your friends think about computers: What values did they place on this activity? On your participation? On their role? Do you have any stories you can tell us that would illustrate the value your friends placed on computers or computer literacy?

What did your teachers/the school you went to think about computers: What values did they place on this activity? On your participation? On their role? Do you have any stories you can tell us that would illustrate the value the educational system placed on computers or computer literacy?

Did you used to read about computers? If so, where? When?

Can you remember any pictures of computers or computer use that struck you as memorable? Where did you see these?

Current Exposure

Do you (or your family) own a computer now? If so, please describe it.

If "yes"

Can you tell us the story of buying the computer? Who bought it? When? Why?

Can you tell us how much the computer cost? Can you talk about how significant/ serious that investment was in terms of (your, your parents, your family's) regular budget?

Describe for us where you keep the computer in your house/apartment/dorm room. What are the things you have around the computer? What items of furniture do you associate with the computer?

For what purposes do you use this computer? (e.g., what kinds of work? what applications?)

For what purposes do your siblings/parents/children use the computer? Who taught them? Who provides support? (e-mail?)

Do you access the Web? What do you use it for?

Tell the story of how you learned to use the computer in this environment. What was your motivation? Who helped? What kind of support did you have? Do you continue to have?

What are the rules associated with using a computer in your home/apartment/dorm? Who made these rules up? How do they affect you?

Can you identify books/texts about computers that you have access to at your home/ apartment/dorm? Any that you read?

Also

Do you currently have access to a computer someplace other than at home? Where (workplace? school?) When? For how long? How do you get there? How much does it cost to use this computer? How do you get that money to pay for access?

Describe the surroundings in which you use this computer: Who is there? What times of day? What are the surroundings like?

For what purposes do you use this computer?

For what purposes do other students/co-workers use the computer?

Can you tell how a typical session might go in this environment?

Tell the story of how you learned to use the computer in this environment: What was your motivation? Who helped? What kind of support did you have? Do you continue to have?

What are the rules associated with using a computer in this environment? Who made these rules up? How do they affect you?

Can you identify books/texts about computers that you have access to at your school/ workplace/other? Any that you read?

Can you describe your current level of skill with computers? Novice, competent, expert? Any stories about your expertise?

What do you think about computers now? Why?

What do your family think about computers now: Your parents? Sisters and brothers? Uncles and Aunts? Cousins? Grandparents? Your friends? What values do they place on computer use? On your participation? On their role? Do you have any stories you can tell us that would illustrate the value your family and friends now place on computers or computer literacy?

What values does the educational system currently place on computer use? Do you have any stories you can tell us that would illustrate the value your schools now place on computers or computer literacy?

How/when/where/why do you see yourself using computers in the future?

Do you read about computers? If so, where? When? What do you read on computers?

Can you identify any images of computer use that have struck you recently? Where have you seen these images?

Do you use a particular brand of computer? If so, why? Which one? Names of programs?

Anything more you'd like to say about your relationship with computers?

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