of the contemporary academy and society, the Digital Humanities are at risk of becoming a trade practice held captive by the interests of corporate capitalism. Together, they offer an enriched, expanded repertoire of strategies, approaches, and assumptions that can more fully address the challenges of the information age than can either alone. By this I do not mean to imply that the way forward will be harmonious or easy. Nevertheless, the clash of assumptions between the Traditional and Digital Humanities presents an opportunity to rethink humanistic practices and values at a time when the humanities in general are coming under increasing economic and culture pressures. Engaging with the broad spectrum of issues raised by the Digital Humanities can help to ensure the continuing vitality and relevance of the humanities into the twenty-first century and beyond.

{How We Read

Close, Hyper, Machine

The preceding chapter discussed the changes taking place within the humanities as a result of the increasing prevalence, use, and sophistication of digital media in academia. It was concerned mostly with activities central to the research mission of humanities faculty, with occasional comments on how teaching is affected as a result. This chapter looks at the other side of the coin, how digital media are affecting the practices in which our students are engaged, especially reading of digital versus print materials, with attention to the implications of these changes for pedagogy. Since the nature of cognition is centrally involved in these issues, this chapter also begins to develop a theory of embodied cognition encompassing conscious, unconscious, and nonconscious processes that will be crucial to the arguments of this and subsequent chapters.

The evidence is mounting: people in general, and young people in particular, are doing more screen reading of digital materials than ever before. Meanwhile, the reading of print
books and of literary genres (novels, plays, and poems) has been declining over the last twenty years. Worse, reading skills (as measured by the ability to identify themes, draw inferences, etc.) have been declining in junior high, high school, college, and even graduate schools for the same period. Two flagship reports from the National Endowment for the Arts (NEA), *Reading at Risk* (2004), reporting the results of its own surveys, and *To Read or Not to Read* (2007), drawing together other large-scale surveys, show that over a wide range of data-gathering instruments the results are consistent: people read less print, and they read print less well. This leads NEA chairman Dana Gioia to suggest that the correlation between decreased literary reading and poorer reading ability is indeed a causal connection (NEA 2004). The NEA argues (and I of course agree) that literary reading is a good in itself, insofar as it opens the portals of a rich literary heritage (see Griswold, McDonnell, and Wright [2005] for the continued high cultural value placed on reading). When decreased print reading, already a cultural concern, is linked with reading problems, it carries a double whammy.

Fortunately, the news is not all bad. A newer NEA report, *Reading on the Rise* (2009), shows for the first time in more than two decades an uptick in novel reading (but not plays or poems), including among the digitally native young adult cohort (ages eighteen to twenty-four). The uptick may be a result of the “Big Read” initiative by the NEA and similar programs by other organizations; whatever the reason, it shows that print can still be an alluring medium. At the same time, reading scores among fourth and eighth graders remain flat, despite the “No Child Left Behind” initiative. The complexities of the national picture notwithstanding, it seems clear that a critical nexus occurs at the juncture of digital reading (exponentially increasing among all but the oldest cohort) and print reading (downward trending with a slight uptick recently). The crucial questions are these: how to convert the increased digital reading into increased reading ability, and how to make effective bridges between digital reading and the literacy traditionally associated with print.

Mark Bauerlein (a consultant on the *Reading at Risk* report) in the offensively titled *The Dumbest Generation: How the Digital Age Stupefies Young Americans and Jeopardizes Our Future* (2009) makes no apology for linking the decline of reading skills directly to a decrease in print reading, issuing a stinging indictment to teachers, professors, and other mentors who think digital reading might encourage skills of its own. Not only is there no transfer between digital reading and print reading skills in his view, but digital reading does not even lead to strong digital reading skills (2009:93–111). I found *The Dumbest Generation* intriguing and infuriating in equal measure. The book is valuable for its synthesis of a great deal of empirical evidence, going well beyond the 2008 NEA report in this regard; it is infuriating in its tendentious refusal to admit any salutary effects from digital reading. As Bauerlein moves from the solid longitudinal data on the decline in print reading to the digital realm, the evidence becomes scantier and the anecdotes more frequent, with examples obviously weighted toward showing the inanity of online chats, blogs, and Facebook entries. It would, of course, be equally possible to harvest examples showing the depth, profundity, and brilliance of online discourse, so Bauerlein’s argument here fails to persuade. The two earlier NEA reports (2004, 2007) suffer from their own problems; their data do not clearly distinguish between print and digital reading, and they fail to measure how much digital reading is going on or its effects on reading abilities (Kirschbaum 2007). Nevertheless, despite these limitations and distortions, few readers are likely to come away unconvinced that there is something like a national crisis in reading and that it is especially acute with teen and young adult readers.

At this point, scholars in literary studies should be jumping on their desks and waving their hands in the air, saying, “Hey! Look at us! We know how to read really well, and we know how to teach students to read. There’s a national crisis in reading? We can help.” Yet there is little evidence that the profession of literary studies has made a significant difference in the national picture, including on the college level, where reading abilities continue to decline even into graduate school. This is strange. The inability to address the crisis successfully no doubt has multiple causes, but one in particular strikes me as vitally important. While literary studies continues to teach close reading to students, it does less well in exploiting the trend toward the digital. Students read incessantly in digital media and write in it as well, but only infrequently are they encouraged to do so in literature classes or in environments that encourage the transfer of print reading abilities to digital and vice versa. The two tracks, print and digital, run side by side, but messages from either track do not leap across to the other.

**Close Reading and Disciplinary Identity**

To explore why this should be so and open possibilities for synergistic interactions, I begin by revisiting that sacred icon of literary studies, close reading. When literary studies expanded its purview in the 1970s and 1980s, it turned to reading many different kinds of “texts,” from Donald Duck to
fashion clothing, television programs to prison architecture (Scholes 1999). This expansion into diverse textual realms meant that literature was no longer the de facto center of the field. Faced with the loss of this traditional center, literary scholars found a replacement in close reading, the one thing virtually all literary scholars know how to do well and agree is important. Close reading then assumed a preeminent role as the essence of the disciplinary identity.

Jane Gallop undoubtedly speaks for many when she writes, “I would argue that the most valuable thing English ever had to offer was the very thing that made us a discipline, that transformed us from cultured gentlemen into a profession [i.e., close reading]. . . . Close reading—learned through practice with literary texts, learned in literature classes—is a widely applicable skill, of real value to students as well as to scholars in other disciplines” (2009:15). Barbara Johnson, in her well-known essay “Teaching Deconstructively” (1985), goes further: “This [close reading] is the only teaching that can properly be called literary; anything else is history of ideas, biography, psychology, ethics, or bad philosophy” (140). For Gallop, Johnson, and many others, close reading not only justifies the professionalism of the profession but also makes literary studies an important asset to the culture. As such, close reading justifies the discipline’s continued existence in the academy, as well as the monies spent to support literature faculty and departments. More broadly, close reading in this view constitutes the major part of the cultural capital that literary studies relies on to prove its worth to society.

Literary scholars generally think they know what is meant by close reading, but looked at more closely, it proves not so easy to define or exemplify. Jonathan Culler (2010), quoting Peter Middleton, observes that “close reading is our contemporary term for a heterogeneous and largely unorganized set of practices and assumptions” (20). John Guillory (2010a) is more specific when he historicizes close reading, arguing that “close reading is a modern academic practice with an inaugural moment, a period of development, and now perhaps a period of decline” (8). He locates its prologue in the work of I. A. Richards, noting that Richards contrasted close reading with the media explosion of his day, television. If that McLuhanesque view of media is the prologue, then digital technologies, Guillory suggests, may be launching the epilogue. Citing my work on hyper attention (more on that shortly), Guillory sets up a dichotomy between the close reading recognizable to most literary scholars—detailed and precise attention to rhetoric, style, language choice, and so forth through a word-by-word analysis of a text’s linguistic techniques—to the digital world of fast reading and sporadic sampling. In this he anticipates the close versus digital reading flagrantly on display in Bauerlein’s book.

Amid the heterogeneity of close reading techniques, perhaps the dominant one in recent years has been what Stephen Best and Sharon Marcus (2009) call “symptomatic reading.” In a special issue of Representations titled “The Way We Read Now,” Best and Marcus launch a frontal assault on symptomatic reading as it was inaugurated by Fredric Jameson’s immensely influential The Political Unconscious (1981). For Jameson, with his motto “Always historicize,” the text is an alibi for subtextual ideological formations. The heroic task of the critic is to wrench a text’s ideology into the light, “massy and dripping” as Mary Crane puts it (2009:245), so that it can be unveiled and resisted (see Crane [2009] for a close analysis of Jameson’s metaphors). The trace of symptomatic reading may be detected in Barbara Johnson. Listing textual features that merit special attention, she includes such constructions as “ambiguous words,” “undecidable syntax,” and “incompatibilities between what a text says and what it does” (1985:141–42). Most if not all of these foci are exactly the places where scholars doing symptomatic reading would look for evidence of a text’s subsurface ideology.

After more than two decades of symptomatic reading, however, many literary scholars are not finding it a productive practice, perhaps because (like many deconstructive readings) its results have begun to seem formulaic, leading to predictable conclusions rather than compelling insights. In a phrase of Gilles Deleuze and Félix Guattari’s famous remark, “We are tired of trees,” the Representations special issue may be summarized as “We are tired of symptomatic reading.” The issue’s contributors are not the only ones who feel this way. In panel after panel at the conference sponsored by the National Humanities Center in spring 2010 entitled “The State and Stakes of Literary Studies,” presenters expressed similar views and urged a variety of other reading modes, including “surface reading,” in which the text is examined not for hidden clues but its overt messages; reading aimed at appreciation and articulation of the text’s aesthetic value; and a variety of other reading strategies focusing on affect, pleasure, and cultural va.ue.

Digital and Print Literacies

If one chapter of close reading is drawing to an end, what new possibilities are arising? Given the increase in digital reading, obvious sites for new kinds of reading techniques, pedagogical strategies, and initiatives are the interactions between digital and print literacies. Literary studies has been slow
to address these possibilities, however, because it continues to view close reading of print texts as the field's essence. As long as this belief holds sway, digital reading will at best be seen as peripheral to our concerns, pushed to the margins as not "really" reading or at least not compelling or interesting reading. Young people, who vote with their feet in college, are marching in another direction—the digital direction. No doubt those who already read well will take classes based on close reading and benefit from them, but what about others whose print reading skills are not as highly developed? To reach them, we must start close to where they are, rather than where we imagine or hope they might be. As David Laurence (2008) observes, "Good teachers deliberately focus on what the reader can do, make sure that both teacher and student recognize and acknowledge it, and use it as a platform of success from which to build" (4).

This principle was codified by the Belarusian psychologist L. S. Vygotsky in the 1930s as the "zone of proximal development." In *Mind in Society: Development of Higher Psychological Processes* (1978), he defined this zone as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers" (86). The concept implies that if the distance is too great between what one wants someone else to learn and where instruction begins, the teaching will not be effective. Imagine, for example, trying to explain *Hamlet* to a three-year-old (an endless string of "Why?") would no doubt result, the all-purpose response of young children to the mysterious workings of the adult world). More recent work on "scaffolding" (Robertson, Fluck, and Webb n.d.) and on the "zone of reflective capacity" (Tinsley and Lebak 2009) extends the idea and amplifies it with specific learning strategies. These authors agree that for learning to occur, the distance between instruction and available skills must be capable of being bridged, either through direct instruction or, as Vygotsky notes, through working with "more capable" peers. Bauerlein instances many responses from young people as they encounter difficult print texts to the effect the works are "boring" or not worth the trouble. How can we convey to such students the deep engagement we feel with challenging literary texts? I argue that we cannot do this effectively if our teaching does not take place in the zone of proximal development, that is, if we are focused exclusively on print close reading. Before opinion solidifies behind new versions of close reading, I want to argue for a disciplinary shift to a broader sense of reading strategies and their interrelation.

James Sosnoski (1999) presciently introduced the concept of hyper reading, which he defined as "reader-directed, screen-based, computer-assisted reading" (167). Examples include search queries (as in a Google search), filtering by keywords, skimming, hyperlinking, "pecking" (pulling out a few items from a longer text), and fragmenting (Sosnoski 1999:163–72). Updating his model, we may add juxtaposing, as when several open windows allow one to read across several texts, and scanning, as when one reads rapidly through a blog to identify items of interest. There is considerable evidence that hyper reading differs significantly from typical print reading, and moreover that hyper reading stimulates different brain functions than print reading.

For example, Jakob Nielsen and his consulting team, which advises companies and others on effective web design, does usability research by asking test subjects to deliver running verbal commentaries as they encounter web pages. Their reactions are recorded by a (human) tester; at the same time, eye-tracking equipment records their eye movements. The research shows that web pages are typically read in an F pattern (Nielsen 2006). A person reads the first two or three lines across the page, but as the eye travels down the screen, the scanned length gets smaller, and by the time the bottom of the page is reached, the eye is traveling in a vertical line aligned with the left margin. (Therefore the worst location for important information on a web page is on the bottom right corner.) In Bauerlein's view, this research confirms that digital reading is sloppy in the extreme; he would no doubt appreciate Woody Allen's quip, "I took a speed reading course and was able to read *War and Peace* in twenty minutes. It involves Russia" (qtd. in Dehaene 2009:18). Nevertheless, other research not cited by Bauerlein indicates that this and similar strategies work well to identify pages of interest and to distinguish them from pages with little or no relevance to the topic at hand (Sillence et al. 2007).

As a strategic response to an information-intensive environment, hyper reading is not without precedent. John Guillory, in "How Scholars Read" (2008), notes that "the fact of quantity is an intractable empirical given that must be managed by a determined method if analysis or interpretation is to be undertaken" (13). He is not talking here about digital reading but about archival research that requires a scholar to move through a great deal of material quickly to find the relevant texts or passages. He identifies two techniques in particular, scanning (looking for a particular keyword, image, or other textual feature) and skimming (trying to get the gist quickly). He also mentions the book wheel, a physical device invented in the Renaissance to
cope with the information explosion when the number of books increased exponentially with the advent of print. Resembling a five-foot-high Ferris wheel, the book wheel held several books on different shelves and could be spun around to make different texts accessible, in a predigital print version of hyper reading.

In contemporary digital environments, the information explosion of the web has again made an exponentially greater number of texts available, dwarfing the previous amount of print materials by several orders of magnitude. In digital environments, hyper reading has become a necessity. It enables a reader quickly to construct landscapes of associated research fields and subfields; it shows ranges of possibilities; it identifies texts and passages most relevant to a given query; and it easily juxtaposes many different texts and passages. Google searches and keyword filters are now as much part of the scholar’s toolkit as hyper reading itself. Yet hyper reading may not sit easily alongside close reading. Recent studies indicate that hyper reading not only requires different reading strategies than close reading but also may be involved with changes in brain architecture that makes close reading more difficult to achieve.

Much of this evidence is summarized by Nicholas Carr in The Shallows: What the Internet Is Doing to Our Brains (2010). More judicious than Bauerlein, he readily admits that web reading has enormously increased the scope of information available, from global politics to scholarly debates. He worries, however, that hyper reading leads to changes in brain function that make sustained concentration more difficult, leaving us in a constant state of distraction in which no problem can be explored for very long before our need for continuous stimulation kicks in and we check e-mail, scan blogs, message someone, or check our RSS feeds. The situation is reminiscent of Kurt Vonnegut’s satirical short story “Harrison Bergeron” ([1961] 1998), in which the pursuit of equality has led to a society that imposes handicaps on anyone with exceptional talents. The handsome, intelligent eponymous protagonist must among other handicaps wear eyeglasses that give him headaches; other brainiacs have radio transmitters implanted in their ears, which emit shrieking sounds two or three times every minute, interrupting their thoughts and preventing sustained concentration. The final satirical punch comes in framing the story from the perspective of Bergeron’s parents, Hazel and George, who see their son on TV when he proclaims his antihandicap manifesto (with fatal results for him), but, hampered by their own handicaps, they cannot concentrate enough to remember it.

The story’s publication in 1961 should give us a clue that a media-induced state of distraction is not a new phenomenon. Walter Benjamin, in “The Work of Art in the Age of Mechanical Reproduction” (1968b), wrote about the ability of mass entertainment forms such as cinema (as opposed to the contemplative view of a single work of art) to make distracted viewing a habit. Even though distraction, as Jonathan Crary (2001) has shown, has been a social concern since the late 1800s, there are some new features of web reading that make it a powerful practice for rewiring the brain (see Greenfield [2009]). Among these are hyperlinks that draw attention away from the linear flow of an article, very short forms such as tweets that encourage distracted forms of reading, small habitual actions such as clicking and navigating that increase the cognitive load, and, most pervasively, the enormous amount of material to be read, leading to the desire to skim everything because there is far too much material to pay close attention to anything for very long.

Reading on the Web

What evidence indicates that these web-specific effects are making distraction a contemporary cultural condition? Several studies have shown that, contrary to the claims of early hypertext enthusiasts such as George Landow, hyperlinks tend to degrade comprehension rather than enhance it. The following studies, cited by Carr in The Shallows (2010), demonstrate the trend. Erping Zhu (1999), coordinator of instructional development at the Center for Research on Learning and Teaching at the University of Michigan, had test subjects read the same online passage but varied the number of links. As the number of links increased, comprehension declined, as measured by writing a summary and completing a multiple-choice test. Similar results were found by two Canadian scholars, David S. Miall and Teresa Dobson (2001), who asked seventy people to read Elizabeth Bowen’s short story “The Demon Lover.” One group read it in a linear version and a second group with links. The first group outperformed the second on comprehension and grasp of the story’s plot; it also reported liking the story more than the second group. We may object that a print story would of course be best understood in a print-like linear mode; other evidence, however, indicates that a similar pattern obtains for digital-born material. D. S. Niederhauser and others (2000) had test subjects read two online articles, one arguing that “knowledge is objective” and the other that “knowledge is relative.” Each article
had links allowing readers to click between them. The researchers found that those who used the links, far from gaining a richer sense of the merits and limitations of the two positions, understood them less well than readers who chose to read the two in linear fashion. Comparable evidence was found in a review of thirty-eight experiments on hypertext reading by Diana DeStefano and Jo-Anne LeFevre (2007), psychologists with the Centre for Applied Cognitive Research at Canada's Carleton University. Carr summarizes their results, explaining that, in general, the evidence did not support the claim that hypertext led to "an enriched experience of the text" (qtd. in Carr 2010:129). One of DeStefano and LeFevre's conclusions was that "increased demands of decision-making and visual processing in hypertext impaired reading performance," especially in relation to "traditional print presentation" (qtd. in Carr 2010:129).

Why should hypertext, and web reading in general, lead to poorer comprehension? The answer, Carr believes, lies in the relation of working memory (i.e., the contents of consciousness) to long-term memory. Material is held in working memory for only a few minutes, and the capacity of working memory is severely limited. For a simple example, I think of the cell phone directory function that allows me to get phone numbers, which are given orally (there is an option to have a text message sent of the number, but for this the company charges an additional fee, and being of a frugal disposition, I don't go for that option). I find that if I repeat the numbers out loud several times so they occupy working memory to the exclusion of other things, I can retain them long enough to punch the number. For retention of more complex matters, the contents of working memory must be transferred to long-term memory, preferably with repetitions to facilitate the integration of the new material with existing knowledge schemas. The small distractions involved with hypertext and web reading—clicking on links, navigating a page, scrolling down or up, and so on—increase the cognitive load on working memory and thereby reduce the amount of new material it can hold. With linear reading, by contrast, the cognitive load is at a minimum, precisely because eye movements are more routine and fewer decisions need to be made about how to read the material and in what order. Hence the transfer to long-term memory happens more efficiently, especially when readers reread passages and pause to reflect on them as they go along.

Supplementing this research are other studies showing that small habitual actions, repeated over and over, are extraordinarily effective in creating new neural pathways. Carr recounts the story told by Norman Doidge in The Brain That Changes Itself of an accident victim who had a stroke that damaged his brain's right side, rendering his left hand and leg crippled (Carr 2010:30–31). He entered an experimental therapy program that had him performing routine tasks with his left arm and leg over and over, such as washing a window, tracing alphabet letters, and so forth. "The repeated actions," Carr reports, "were a means of coaxing his neurons and synapses to form new circuits that would take over the functions once carried out by the circuits in the damaged area in his brain" (2010:30). Eventually, the patient was able to regain most of the functionality of his unresponsive limbs. We may remember the film The Karate Kid (1984) when Daniel LaRusso (Ralph Macchio) is made to do the same repetitive tasks over and over again by his karate teacher, Mr. Miyagi (Pat Morita). In contemporary neurological terms, Mr. Miyagi is retraining the young man's neural circuits so he can master the essentials of karate movements.

These results are consistent with a large body of research on the impact of (print) reading on brain function. In a study cited by the French neurophysiologist Stanislas Dehaene (2009), a world-renowned expert in this area, researchers sought out siblings from poor Portuguese families who had followed the traditional custom of having an elder sister stay home and watch the infant children, while her younger sister went to school. Raised in the same family, the sisters could be assumed to have grown up in very similar environments; the pairing thus served as a way to control other variables. Using as test subjects six pairs of illiterate/literate sisters, researchers found that literacy had strengthened the ability to understand the phonemic structure of language. Functional magnetic resonance imaging (fMRI) scans showed pronounced differences in the anterior insula, adjacent to Broca’s area (a part of the brain associated with language use). “The literate brain,” Dehaene summarizes, “obviously engages many more left hemispheric resources that the illiterate brain, even when we only listen to speech... The macroscopic finding implies a massive increase in the exchange of information across the two hemispheres” (2009:209).

Equally intriguing is Dehaene’s “neural recycling” hypothesis, which suggests that reading repurposes existing brain circuits that evolved independently of reading (because literacy is a mere eye blink in our evolutionary history, it did not play a role in shaping the genetics of our Pleistocene brains but rather affects us epigenetically through environmental factors). Crucial in this regard is an area he calls the brain’s “letterbox,” located in the left occipito-temporal region at the back of the brain. This area, fMRI data show, is responsible for letter and phonemic recognition, transmitting its results to other distant areas through fiber bundles. He further argues that brain
architecture imposes significant constraints on the physical shapes that will be easily legible to us. He draws on research demonstrating that 115 of the world’s diverse writing systems (alphabetic and ideographic) use visual symbols consisting mostly of three strokes (plus or minus one). Moreover, the geometry of these strokes mirrors in their distribution the geometry of shapes in the natural environment. The idea, then, is that our writing systems evolved in the context of our ability to recognize natural shapes; scribal experimentation used this correspondence to craft writing systems that would most effectively repurpose existing neural circuitry. Dehaene thus envisions “a massive selection process: over time, scribes developed increasingly efficient notations that fitted the organization of our brains. In brief, our cortex did not specifically evolve for writing. Rather, writing evolved to fit the cortex” (2009:171).

Current evidence suggests that we are now in a new phase of the dance between epigenetic changes in brain function and the evolution of new reading and writing modalities on the web. Think, for example, of the F pattern of web reading that Nielson’s research revealed. Canny web designers use this information to craft web pages, and reading such pages further intensifies this mode of reading. How quickly neural circuits may be repurposed by digital reading is suggested by Gary Small’s experiments at the University of California, Los Angeles, on the effects of web reading on brain functionality. Small and his colleagues were looking for digitally naive subjects; they recruited three volunteers in their fifties and sixties who had never performed Google searches (Small and Vorgan 2008:15–17). This group was first tested with fMRI brain scans while wearing goggles onto which were projected web pages. Their scans differed significantly from another group of comparable age and background who were web savvy. Then the naïve group was asked to search the Internet for an hour a day for five days. When retested, their brain scans showed measurable differences in some brain areas, which the experimenters attributed to new neural pathways catalyzed by web searching. Citing this study among others, Carr concludes that “knowing what we know today, if you were to set out to invent a medium that would rewire our mental circuits as quickly and thoroughly as possible, you would probably end up designing something that looks and works a lot like the Internet” (2010:116).

How valid is this conclusion? Although Carr’s book is replete with many different kinds of studies, we should be cautious about taking his conclusions at face value. For example, in the fMRI study done by Small and his colleagues, many factors might skew the results. I don’t know if you have had a brain scan, but I have. As Small mentions, brain scans require that you be shoved into a tube just big enough to accommodate your supine body but not big enough for you to turn over. When the scan begins, supercooled powerful electromagnets generate a strong magnetic field, which, combined with a radio frequency emitter, allows minute changes in blood oxygen levels in the brain to be detected and measured. When the radio frequency emitter begins pulsing, it sounds as though a jackhammer is ripping up pavement next to your ear. These are hardly typical conditions for web reading. In addition, there is considerable evidence that fMRI scans, valuable as they are, are also subject to a number of interpretive errors and erroneous conclusions (Sanders 2009). Neural activity is not measured directly by fMRI scans (as a microelectrode might, for example). Rather, the most widely used kind of fMRI, BOLD (blood oxygen level dependent), measures tiny changes in oxygenated blood as a correlate for brain activity. BOLD research assumes that hardworking neurons require increased flows of oxygen-rich blood and that protons in hemoglobin molecules carrying oxygen respond differently to magnetic fields than protons in oxygen-depleted blood. These differences are tabulated and then statistically transformed into colored images, with different colors showing high levels of oxygen-rich compared to depleted-blood oxygen.

The chain of assumptions that led Small, for example, to conclude that brain function changed as a result of Google searches can go wrong in several different ways (see Sanders [2009] for a summary of these criticisms). First, researchers assume that the correlation between activity in a given brain area is caused by a particular stimulus; however, most areas of the brain respond similarly to several different kinds of stimuli, so another stimulus could be activating the change rather than the targeted one. Second, fMRI data sets typically have a lot of noise, and if the experiment is not repeated, the observed phenomenon may be a chimera rather than a genuine result (in Small’s case, the experiment was repeated later with eighteen additional volunteers). Because the data sets are large and unwieldy, researchers may resort to using sophisticated statistical software packages they do not entirely understand. In addition, the choice of colors used to visualize the statistical data is arbitrary, and different color contrasts may cause the images to be interpreted differently. Finally, researchers may be using a circular methodology in which the hypothesis affects how the data are seen (an effect called nonindependence). When checkers went back through fMRI research that had been published in the premier journals Nature, Science, Nature Neuroscience, Neuron, and the Journal of Neuroscience, they found
interpretive errors resulting from nonindependence in 42 percent of the papers (cited in Sanders 2009:16).

Relying on summaries of research in books such as Carr's creates additional hazards. I mentioned earlier a review of hypertext experiments (DeStefano and LeFevre 2007) cited by Carr, which he uses to buttress his claim that hypertext reading is not as good as linear reading. Consulting the review itself reveals that Carr has tilted the evidence to support his view. DeStefano and LeFevre state, for example, that "there may be cases in which enrichment or complexity of the hypertext experience is more desirable than maximizing comprehension and ease of navigation," remarking that this may be especially true for students who already read well. They argue not for abandoning hypertext but rather for "good hypertext design" that takes cognitive load into account "to ensure hypermedia provide at least as good a learning environment as more traditional text" (2007:1636; emphasis added). Having read through most of Carr's primary sources, I can testify that he is generally conscientious in reporting research results; nevertheless, the example illustrates the unsurprising fact that reading someone else's synthesis does not give as detailed or precise a picture as reading the primary sources themselves.

The Importance of Anecdotal Evidence

Faced with these complexities, what is a humanist to do? Obviously, few scholars in the humanities have the time—or the expertise—to backtrack through cited studies and evaluate them for correctness and replicability. In my view, these studies may be suggestive indicators but should be subject to the same kind of careful scrutiny we train our students to use with web research (reliability of sources, consensus among many different researchers, etc.). Perhaps our most valuable yardstick for evaluating these results, however, is our own experience. We know how we react to intensive web reading, and we know through repeated interactions with our students how they are likely to read, write, and think as they grapple with print and web materials. As teachers (and parents), we make daily observations that either confirm or disconfirm what we read in the scientific literature. The scientific research is valuable and should not be ignored, but our experiences are also valuable and can tell us a great deal about the advantages and disadvantages of hyper reading compared with close reading, as well as the long-term effects of engaging in either or both of these reading strategies.

Anecdotal evidence hooked me on this topic five years ago, when I was a Phi Beta Kappa Scholar for a year and in that capacity visited many different types of colleges and universities. Everywhere I went, I heard teachers reporting similar stories: "I can't get my students to read long novels anymore, so I've taken to assigning short stories"; "My students won't read long books, so now I assign chapters and excerpts." I hypothesized then that a shift in cognitive modes is taking place, from the deep attention characteristic of humanistic inquiry to the hyper attention characteristic of someone scanning web pages (Hayles 2007a). I further argued that the shift in cognitive modes is more pronounced the younger the age cohort. Drawing from anecdotal evidence as well as such surveys as the Kaiser Foundation's "Generation M" report (Roberts, Foehr, and Rideout 2005), I suggested that the shift toward hyper attention is now noticeable in college students. Since then, the trend has become even more apparent, and the flood of surveys, books, and articles on the topic of distraction is now so pervasive as to be, well, distracting.4

For me, the topic is much more than the latest research fad, because it hits me where I live: the college classroom. As a literary scholar, I deeply believe in the importance of writing and reading, so any large-scale change in how young people read and write is bound to capture my attention. In my work on hyper attention (published just when the topic was beginning to appear on the national radar), I argued that deep and hyper attention each have distinctive advantages. Deep attention is essential for coping with complex phenomena such as mathematical theorems, challenging literary works, and complex musical compositions; hyper attention is useful for its flexibility in switching between different information streams, its quick grasp of the gist of material, and its ability to move rapidly among and between different kinds of texts.5 As contemporary environments become more information-intensive, it is no surprise that hyper attention (and its associated reading strategy, hyper reading) is growing and that deep attention (and its correlated reading strategy, close reading) is diminishing, particularly among young adults and teens. The problem, as I see it, lies not in hyper attention and hyper reading as such but rather in the challenges the situation presents for parents and educators to ensure that deep attention and close reading continue to be vibrant components of our reading cultures and interact synergistically with the kind of web and hyper reading in which our young people are increasingly immersed. 6

Yet hyper reading and close reading are not the whole story. I earlier referred to Sosnoski's definition of hyper reading as "computer-assisted." More