

**Attention, Reflection and Distraction: The Impact of
Technology on Learning**

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Abstract

Over the centuries, humans have developed a series of technologies that have had a profound impact on our ability to learn from the environment and to devise strategies that will enhance our ability to learn and survive. Literacy enhanced the human ability to think creatively and critically—to be able to think both inductively (bottom-up) and deductively (top-down). The key: the ability to pay close attention to what one is learning and to later reflect on what has been learned. The technologies developed over the past seventy years have begun to change the way we learn, think and understand the world—they have distracted the brain with a constant stream of visual stimuli and information that has diminished the ability of the individual to process information deeply and to later use remembered information in a novel way. The technology has changed our ability to focus and attend to what we want to learn. It has altered the way we remember and the way we reflect on information. The immediacy of the technology has distracted us and has forged a new foundation that leaves us in need of a reasoned and critical examination of the technological environment that seems to undermine many aspects of thought and memory.

It's All about the Focus One Chooses

When asked how people read online, Jakob Nielsen (1997) replied, “**They Don’t!**” He had discovered that “people rarely read Web pages word by word; instead, they scan the page, picking out individual words and sentences.” (Nielsen) The immediacy of computer technology has had a profound impact on the way people read—or don’t read—on the way people focus and reflect on what they have learned. The technology, in fact, has become pervasive throughout every aspect of what we do and how we think and relate to reality. It is important that educators seriously evaluate the impact of technology in order to recommend positive ways to enhance learning.

One of the problems facing an author when writing about the impact of technology on learning, and on the ability of the human being to function at peak efficiencies, is that much of what we do today is technology based and technology delivered. An earlier article of mine, “Against the Grain: An Argument for Using Less Technology in Education,” had to be published in an online journal because the print journals only accept manuscripts of four to six thousand words. Indeed, the very process of writing any manuscript—from research to completion—depends on some aspect of technology—from searching online databases to word processing. The technology seems ubiquitous, and trying to get the idea across that we ought to examine how we use that technology by using that very technology seems, somehow, absurd.

Neil Postman (1990) has written many books and articles that focus on teaching and learning. He sees the use of technology as a “Faustian bargain,” where people are easily distracted by the enticements of electronic media and modern computer technologies. (p.1) The factors of distraction discussed in this article reflect his idea that “...technology ... is never one-sided.” (p. 2)

Over the thirty years of my experience as an educator, I have seen the rise of a technology that has had a significant impact on the mode learning experienced by many if not most students. Each year, the number of students who come prepared to write in composition classes has diminished. Each year, more and more students admit they have not read ten books on their own, or five, and many, almost as a taunt, admit that they have never read a book on their own. They don’t have to, they say, and they don’t have the time. The students come to college having never read the classics in their schools, and they are the product of a system that does not require developing synthetic solutions to problems that require them to process information deeply or meaningfully—multiple choice is quite enough. Yet these same students are generally quite savvy in the use of computer technology.

Young people, people, in general, are searching for quick solutions and easy relationships, and they use technology to help them do just that. They frequently text each other and use social Internet sites as a point of communal interaction and as the primary means for that interaction. Personal contact is not necessary to begin or continue a relationship, but there are consequences that have changed the expectations of people in their associations. There is always so much going on that people are usually not really at

any given place at any given time. Conversations, meals, studies, classes are frequently interrupted by a tune, a buzz or a vibration that takes the person away from the focus of the moment. Not only has this nearly constant distraction taken hold of people's psyche, but it is even difficult to have an intellectual conversation with most students and faculty (regrettably). In the case of the former, there is neither in depth knowledge nor the desire to acquire that knowledge, and, in the case of the later, there is neither the desire to converse deeply nor the desire to devote the time to do so.

On a number of occasions, I have had the honor and pleasure to work with educators and students from Leech Lake Tribal College (LLTC) of the Anishinaabe Tribe in Minnesota. I have been able to learn from them that their cultural prescription for learning requires reflection before accepting new information. The non-tribal teacher who enters their classrooms expecting immediate feedback about a lecture will usually be met with silence as the students process the information and reflect upon the impact the new material might have on them and their tribal values. Their core values, humility, truth, courage, honesty, respect, love and wisdom are reflected in a statement of "Guiding Principles" written by Dr. Henrietta Mann posted on their website:

It is vitally important that Native people a) have a sense of history and are able to connect contemporary and historical issues; b) have a sense of values; c) acknowledge philosophical kinship and our responsibility to these relationships; and d) understand the Circle of Life as both a privilege and a responsibility.
(LLTC)

This guiding statement of Leech Lake Tribal College is different from that of many other colleges and universities. It exudes a warmth and a human quality that bespeaks a different perspective of what it means to be human. The Anishinaabe believe that they are part of the "web of life" and seek a harmonious "kinship" with the rest of creation. (LLTC) It is a striking philosophy that, to me, pinpoints many of the values that are being left behind by so many people in mainstream modern technological society. That electronic culture has lost sight of some of the time-honored human values as it rushes to some unknown destination controlled by computers and machines.

It seems, however, that there has been some erosion of the old Anishinaabe tribal values—partly because the technological world of the cell phone and text messaging which requires immediacy has been introduced. Deborah LeClaire, then an instructor at Leech Lake, related in an interview in 2010 that sometimes students do not exchange amenities at the beginning of a tutorial session, and do not always take the time to reflect before responding to questions about learned material. Both of these qualities—amiability and reflection—have been at the foundation of the society of the Anishinaabe for generations. These seeming modest changes in the Anishinaabe cultural values appear to be a ripple effect of the major changes in the larger mainstream social context. Out there, the changes are significant. Out there, time is at a premium, and many people increasingly feel the stress of not completing tasks and are overwhelmed by the amount of information that confronts them. The change in technology has imposed itself on people who are now faced with the daunting chore of "multitasking" to stay on top of things.

Basic Learning Principles

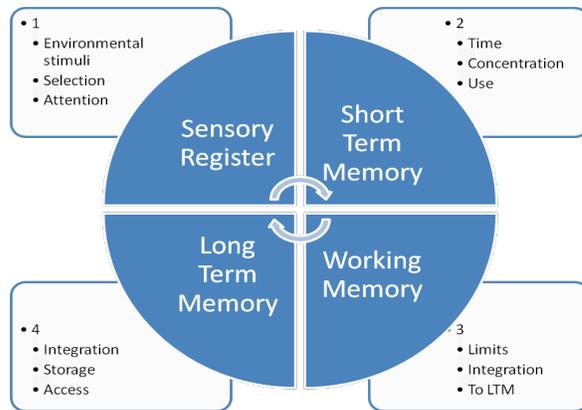
Among all of the learning strategies discussed by educators and neuroscientists, two, in particular, stand out: attention and reflection. Nicholas Carr comments that our ability to attend to “the richness of our thoughts, our memories and even our personalities hinges on our ability to focus the mind and sustain concentration.” He cites Nobel Prize-winning neuroscientist Eric Kandel as commenting that “only when we pay deep attention to a new piece of information are we able to associate it ‘meaningfully and systematically with knowledge already well established in memory.’” (Carr 2010a) Attention is primary to getting information into our short-term and, consequently, our long-term memory. Once there, our ability to reflect on associations between and among those memories is essential to the development of critical and creative thinking skills.

It is important to bear in mind the notion that there is no one correct way to learn, remember or access information. Each individual has to find his or her own way to process and apply the information s/he needs to think critically and creatively. There are many ways to see and understand the world around us. As Amy Brown points out while discussing Winifred Gallagher's *Rapt: Attention and the Focused Life*, “even when we're ‘in the zone’ with a beloved subject, we may still need to be mindful of managing different types of attention that animate our understanding.” These modes of attention, Brown explains, can be seen in the following behaviors:

Sometimes we consciously direct our attention, shining a tractor beam of thought exactly where we want it to go. That ‘top down’ focus, driven by will, feels very different from the second mode of attention, which is more passive and expansive. Rather than a precisely aimed beam, this second type of attention wanders over the terrain, illuminating whatever seems most salient or unusual. Instead of being driven to find a particular thing, this type of focus, which Gallagher dubs ‘bottom-up attention,’ simply notices what is there, registering all its aspects. (Brown)

Attention to the details of what one is learning is a key to memory. Nicholas Carr tells us that, “Storing explicit memories and, equally important, forming connections between them requires strong mental concentration, amplified by repetition or by intense intellectual or emotional engagement. *The sharper the attention, the sharper the memory* [emphasis mine].” (Carr 2010 p. 193) The information has to be processed deeply. The recurrent interaction between long-term, short-term and working memory is of vital importance. Working memory, however, can only hold a limited amount of information.

The graphic below represents how the brain processes information from a given stimulus to the ultimate storage of that information in long-term memory. The sensory impulse goes from short-term memory to working memory where the hippocampus and cerebellum process and integrate the new information with information that has been pulled from long-term memory. Once that initial integration is completed, the information is retransmitted to long-term memory. This integration of information is an important component of the memory process because long-term memories can later be retrieved by using both bottom-up and top-down thinking strategies.



Both top-down and bottom-up thinking strategies play an important role in helping humans to learn from and function in the environment. Top-down thinking offers a holistic view of any given problem and draws on stored information to serve as the foundation for processing new data being received from the environment. Bottom-up thinking is more immediate, and the individual builds a larger scale picture of the problem as

more information is gathered. As we will discover in the section on multitasking, a person may have some cognitive difficulties if bottom-up thinking is the sole factor for learning and is overwhelmed by the amount of information being processed by short-term and working memory. As Carr points out:

...the depth of our intelligence hinges on our ability to transfer information from working memory, the scratch pad of consciousness, to long-term memory, the mind's filing system. When facts and experiences enter our long-term memory, we are able to weave them into the complex ideas that give richness to our thought. However, if there are breaks in attention or an overload of information, the transfer to long-term memory may be interrupted. Whereas long-term memory has an almost unlimited capacity, working memory can hold only a relatively small amount of information at a time. ... short-term storage is fragile: A break in our attention can sweep its contents from our mind." (Carr 2010b p. 3)

The less information stored in the brain, the more difficult it may be to think critically or creatively. Part of the whole process of thinking is the ability to reflect—to be in the present moment and aware of one's place in time, to make the effort to understand more holistically (to see how ideas fit together), to take the time to revisit ideas and develop relevant questions and ideas that will enhance one's perspective and cognitive abilities. Scientific thinking may serve as a good example for the need to reflect.

Patricia Greenfield (2009) points out, "scientific thinking goes beyond the techniques provided by visual literacy, highlighting the importance of a number of other qualities: reflection, inductive analysis, critical thinking, mindful thought, and imagination. We start with reflection and inductive analysis." (p. 71) If we follow the formulation of an hypothesis, we can see how this all goes together. From some environmental stimulus (visual literacy—understanding what one perceives, the context, the epistemology, if you will), the individual reflects on other experiences s/he has had that fall into that general category of events/ideas (reflection, inductive analysis). S/he then tries to determine how or what specific concept might tie them all together (critical thinking, mindful thought and imagination). We can also see how the individual might apply creative thinking to the process in deciding how to test and, hopefully, verify the hypothesis. The learning process is both top-down and bottom-up.

Humans learn from their experiences, and, over the years, the variety of skills a person has had to learn has increased many fold. In his 2005 interview with Stephanie Olsen, Michael Merzenich pointed out, “In each stage of cultural development ... the average human had to learn complex new skills and abilities that all involve massive brain change. Our brains are vastly different, in fine detail, from the brains of our ancestors.” (Olsen) Merzenich, a renowned researcher in the field of neuroplasticity, has shown that the human brain changes according to the environment in which it functions and the conscious attention of the individual as s/he connects information. Each time we learn something new or connect bits of information together, the topography of our brains changes—new synaptic connections are formed, others wither away.

One of the areas of specialization in learning can be found in the ability to read. Reading offers the individual the time to reflect and to consider at his or her leisure the ideas in any given text. Greenfield sees reading as the one form of communication that allows the individual the time to reflect and solve problems. She tells us that “... better readers are also more reflective than less skilled readers. And reflection (contrasted with impulsivity) is associated with inductive problem-solving competence in children as young as first grade.” She continues by saying that “Reading is also key to the development of critical thinking. The amount of out-of-class reading done during the college years is a statistically significant predictor of critical thinking skills. (p. 71) If, however, there is evidence, as Greenfield contends “that visual technology inhibits imaginative response, that reading is associated with reflection, television is associated with impulsivity,” (p. 71) then the broad use of technology in the educational system may have a negative impact on learning.

There does seem to be some evidence that technology does not necessarily have a negative impact on learning. Known as the Flynn effect, researchers have found a rise in IQ scores over the past century. “This rise...is concentrated in nonverbal IQ performance (mainly tested through visual tests) but has also occurred, albeit to a lesser extent, in verbal IQ,” says Greenfield (p. 69) She also notes that the increase in the scores for visual/spatial relationships may be the result of the focus of formal education and the details that high-tech societies consider important. Greenfield also points to newer electronic forms of informal education—video gaming, in particular—that increase visual and spatial acuity. While the individual can respond more quickly to given spatial prompts, the foundation of learning and, hence, the rewiring of the brain occurs both as the immediate response occurs and anticipation of the next stimulus interrupts the ability to reflectively ponder the situation. She believes that the educational system has to respond to this change in how we think by “taking advantage of new strengths in visual-spatial intelligence ... [while] compensating for new weaknesses in higher-order cognitive processes: abstract vocabulary, mindfulness, reflection, inductive problem solving, critical thinking, and imagination.” (p. 69) To me, the solution seems to include more reading and active exercises that will engage the students and, essentially, force them to think more deeply about the problems they face.

The environment in which we find ourselves does have a direct impact on the way we access and use information. We respond to our surroundings. Each change of

technology has a significant impact on our perception of reality and our ability to discern valid from invalid information. Our ability to think cognitively is based on how the brain integrates new information. It is also the product of technological changes that have brought what seems to be an infinite amount of information to the fingertips of the individual who wishes to sit long enough to do the research. The more information that is available, the more the individual can use to develop a broader synthesis.

A possible negative aspect of the “triumph of technology,” Merzenich notes, is that “our abstract thinking abilities ... [will] be *substantially superseded* by machines.” [emphasis mine] (Olsen) If, as Merzenich also contends, “the brain needs to learn, to reason, to act,” then some way has to be found to help the individual understand the need to purposefully and mindfully learn on his or her own. Nicholas Carr agrees. “If we are unable to attend to the information in our working memory, the information lasts only as long as the neurons that hold and maintain their electric charge—a few seconds.... Then it's gone...” (2010 p.193) If we don’t attend and reflect, we don’t learn anything new.

Attention and reflection, then, can be seen to be relatively fragile and easily disturbed by outside events. Maggie Jackson (2009) sees our ability to “increasingly connect with even our most intimate friends and family via instant messaging, virtual visits, and fleeting meetings that are rescheduled a half a dozen times, then punctuated when they do occur by pings and beeps and multitasking” (p. 13) as the root of “intellectual fragmentation, and sensory detachment.” (p. 13) Our ability to focus and concentrate on one thing at a time is impinged upon by the sights and sounds of the new technology.

Postman (1993) points out that the change from print media to computer technology is one key to understanding the change in the way we think. He sees that:
... new technologies compete with old ones—for time, for attention, for money, for prestige, but mostly predominance of their worldview... a medium contains an ideological bias... it is not merely a matter of school against tool—the alphabet attacking ideal graphic writing, the printing press attacking the illuminated manuscript, the photograph attacking the art of painting, television attacking the printed word. When media make war against each other it is a case of worldviews in collision. (p. 16)

When Postman wrote these opinions, television was still the primary technological force in American society. As noted earlier, Postman saw computer technology as a potentially double-edged sword—something that could bring great benefit as well as great a great detriment to the way people learned. He saw the collision of technologies having the impact of creating biases that would be of great importance to how students would learn, think and reflect.

On the one hand, there is the world of the printed word with its emphasis on logic sequence, history, exposition, objectivity, detachment and discipline; on the other, there is the world of television with its emphasis on imagery, narrative, pleasantness, simultaneity, intimacy, immediate gratification, and quick emotional response. Children come to school having been deeply conditioned by the biases

of television. There, they encounter the world of the printed word. A sort of psychic battle takes place and the casualties—children who can't learn to read or children who cannot organize their thoughts into logical structure even in a simple paragraph... (Postman 1993 page 16-7)

Maggie Jackson sees the collision of technologies the face children in the educational setting as "eroding our capacity for deep, sustained, perceptive attention—the building block of intimacy, wisdom, and cultural progress." She believes that the impact of this erosion of attention, reflection and deep thought "may come at great cost to ourselves and to society," because as she says "attention defines us and is the bedrock of society." Jackson cites William James' contention that attention "is that taking possession by the mind, in clear and vivid form... out of what seems several simultaneously possible objects or trains of thought. It implies withdrawal from some things in order to deal effectively with others, and it is a condition which has a real opposite in the confused, dazed, scatterbrained state which in French is called *distraction*..." (p. 13-4)

Jackson contends that, "*attention helps us understand and make sense of the world that is crucial as a first step to creating memory.*" [emphasis mine] (p. 93) However, more than simply attending is necessary. Citing researchers Scott Brown and Fergus Craik, Jackson continues, "To build memory is to construct a treasure trove of experience, wisdom, and pertinent information. If attention makes us human, then long-term memory makes each of us an individual." (p. 94) Building memory also depends on eliminating as much distraction as possible and involves rote and repetition and "elaborate rehearsal," or meaningfully relating what one is trying to learn or remember with other information, preferably not too quickly.

Postman (1996) sees the discussion and argument about the effects of electronic media as a new development that requires clearly stated questions. He discusses the speculation of Marshall McLuhan in *Understanding Media* which, Postman contends, refers to "the structure of a medium [that] alter[s] the ways in which people 'make sense' of the world ..." through the "*forms* of human communication." (p. 140) Both Postman and McLuhan believe "our young are well suited to address such queries" precisely because they are not "as 'ABCDE-minded' as their teachers are apt to be." (p. 140-1) I would, however, ask: how can a person who has been immersed by others in a technology and who has little or no knowledge of any other way of doing things actually be suited to address the questions raised about the value and efficacy of that technology? There being no foundation to make comparisons, the conclusions may be tautologically proscribed.

Friedrich Nietzsche, the renowned German Existentialist philosopher, once commented that "with the tremendous acceleration of life, ... I have become accustomed to seeing and judging partially or inaccurately... everyone is like the travelers who get to know a land and its people from a ... [train] carriage." That is, a technological development, the train, had an impact on the way people attended to and understood reality. (cited in Jackson p. 39) Nietzsche had a foot in two realms of life—the slower

paced life before the acceleration of a new technology and the life determined by that acceleration. Mark Slouka, in his critique of technology sees it this way:

"What it comes down to... is this: human culture depends on the shared evidence of the senses, always has... A technology designed to short-circuit the senses, a technology capable of providing an alternate world—abstract, yet fully inhabitable, real to her senses and accessible only through a computer screen—would take away this common ground and replace it with one manufactured for us by the technologists" (Slouka 1995 p. 12-3).

That change in technology may also change our ability to see cause-and-effect, our ability to see a continuum, our ability to judge for ourselves and our ability to understand the concept of free will.

Technology and Learning

Greenfield (2009) has researched the possible impact of technology on the ability of people to learn. She believes that no one technology can do everything required for a comprehensive education, that "the visual capabilities of television, video games, and the Internet may develop impressive visual intelligence, [but] the cost seems to be deep processing: mindful knowledge acquisition, inductive analysis, critical thinking, imagination, and reflection. The developing human mind still needs a balanced media diet." (p. 71) As she investigated both the formal and informal socialization aspects of learning she found that "it is difficult for schools to teach reflective habits of mind to children whose informal education and cognitive socialization have not prepared them for this kind of learning and thinking." (p. 71) Richtel (2010a) points out, "Researchers worry that constant digital stimulation ... creates attention problems for children with brains that are still developing, who already struggle to set priorities and resist impulses." (p. 4)

Postman (1996) believes that the role of technology should be considered without hyperbole. While "the computer and its associated technologies are also additions to a culture, and they are quite capable of altering the psychic, let alone sleeping, habits of our young." He continues, "it is strange—indeed, shocking—that ... we can still talk of new technologies as if they were unmixed blessings, gifts, as it were, from the gods." (p. 41-2) We can see this belief in the unadulterated view of the value of technology whenever a new update of a product hits the shelves—actually when they are advertised weeks and months beforehand to stimulate the "need" for that product. People do not reflect on the value of the product but on the social standing possessing it will give them.

As professor emeritus and culture critique Theodore Roscack (1994), and a self-proclaimed Neo-Luddite, points out "sometimes an idea becomes so commonplace, so much a part of the cultural consensus that it sinks out of awareness, becoming an invisible thread in the fabric of the culture." (p. 105) The value of the thing or the idea is no longer questioned because it has become ingrained in the subconscious schema of the individuals of the society. Rarely are there questions about the possible negatives of that thing or idea. To ask those kind of questions makes one a pariah in social circles. The

term Luddite has taken on such a negative tone, that to be so-named is to be excluded from much of the conversations about where the technology might be taking us. So, too, the term technology has taken on a life of its own, and its value is no longer questioned by most people. They accept the fact that technology has value and do not think about possible negative results.

It is precisely this commonplace “knowledge” that has placed the idea of technology at the forefront of our technology-based culture and the multitasking that has become commonplace for many people. As Roscak says, “most of our ideas about nature and human nature, logic and value eventually become so nearly subliminal that we rarely reflect upon them as human inventions, artifacts of the mind. We take them for granted as part of our cultural heritage.” (Roscak p. 106) The blind acceptance of the new technology has brought us to the point where one author, Lewis Perelman, in his book *Schools Out*, seriously advocates that “modern information technologies have rendered schools entirely irrelevant, since there is now much more information available outside the classroom than inside.” (cited in Postman 1996 p. 40)

That last statement “there is now much more information available outside the classroom than inside” seems to be a key to the discussion—or lack thereof. I would contend that information is not knowledge. Information offers descriptions in a multitude of languages and symbolic forms, insights about various ideas—essentially pieces to environmental puzzles that will help the individual make a decision. Knowledge, and, later, wisdom, are a result of how well the person uses the bits of information s/he receives—how s/he puts them together. For example, we can gather pieces of information about the Patriot Act and recite them, just like a computer; however, to extrapolate from that information and insightfully predict the impact of that Act on the personal freedoms of American citizens is knowledge based on understanding the historical process and the information one can gather and reflect upon. The historical process includes seeing the subtle shifts and changes in social events that are a result of the on-going implementation of the Patriot Act and the results of those actions. The computer does a wonderful job at getting those bits of information to the person, but the computer cannot be said to have knowledge about them. It is the human brain that creatively and critically, puts information together into a comprehensive package. Theodore Roscak would put it this way:

... those who celebrate the computer as an information keeper and provider tend to underrate, if not ignore the value of ideas, [they assume] ... that information somehow compiles itself automatically into knowledge without the active intervention of theoretical imagination” (Roscak p. 109).

I am not arguing against using computers. I am arguing against the way we allow them to distract us from more important things. The acquiescence of many to the idea that computers *are* the solution to the dearth of intellectual discussions about the most important issues of our times is seen in the citation Postman (1996) offers from Theodore Roscak:

Like all cults, this one [the love of technology] has the intention of enlisting mindless allegiance and acquiescence. People who have no clear idea of what

they mean by information, or why they should want so much of it, are nonetheless prepared to believe that we live in an information age, which makes every computer around us what the relics of the true Cross were in the age of Faith: emblems of salvation. (p. 44).

Harold Innis, in his book *The Bias of Communication*, offers a broad panoramic description of the progression of media from orality to literacy—the change in cognitive technology from mnemonics to the printed word. He speaks to the impact various media [technologies] of communication have had on the perception of the individual—from clay, to papyrus, to paper, to electronic media. (Innis p. 3) We are conditioned by the technology we use. Each change in technology brings with it a change in how we perceive the world. That change in our perception of the world is confirmation of the idea that, as Postman (1993) says, “every tool is an ideological bias, a predisposition to construct the world as one thing rather than another, to value one thing over another, to amplify one's sins or skills or attitudes more loudly than another.” (p. 13)

Media bias is only too evident in the work of Jakob Nielsen (1997) who offers advice to website developers about how to get people to read the information offered on their websites. Nielsen has conducted research on the eye movements of Internet users as they react to the design and information offered on particular websites. He states that “in research on how people read websites we found that 79 percent of our test users always scanned any new page they came across; only 16 percent read word-by-word.” So that the users of a website are not forced to face the “cognitive burden” of actually thinking about difficult narrative text, Nielsen recommends that website developers “employ scannable text, using highlighted keywords ... [and] hypertext links, ... highlighting [and] typeface variations, ... meaningful sub-headings (not "clever" ones), bulleted lists, one idea per paragraph, the inverted pyramid style, starting with the conclusion, [and] half the word count (or less) than conventional writing.” (Nielsen) In others words, in order to ensure that people will read the information on a website, the website developers have to dumb down the text and use clever strategies to shorten the text so that the website users can easily skim the information. It is this shallow reading that prevents deep processing of information.

Of course, the case can be made that we do not always have to read deeply—that indexing information may be one way to allow us to develop a general idea about the content of some narrative. This contention does carry some weight because it is impossible to read everything. Having a generalized notion of what information is available may have great value. However, as one researches and delves into information in order to argue some point, it is necessary to access that index and find information that can and will be deeply processed for the sake of clarity and concision in the argument.

Developing websites with the distractions of bulleted information and hyperlinks already built in that take the reader away from the main theme of the page may be, as Clay Shirky suggests, the point from which we have to figure out what response we need to shape our use of digital tools. In his article “Does the Internet Make You Smarter?” he tells us that:

In the history of print, we got erotic novels 100 years before we got scientific journals, and complaints about distraction have been rampant; no less a beneficiary of the printing press than Martin Luther complained, ‘The multitude of books is a great evil. There is no measure of limit to this fever for writing.’ Edgar Allan Poe, writing during another surge in publishing, concluded, ‘The enormous multiplication of books in every branch of knowledge is one of the greatest evils of this age; since it presents one of the most serious obstacles to the acquisition of correct information.’ (Shirky)

Shirky’s recommendation is to teach people how to use the technology. “The response to distraction,” he says, “then as now, was social structure. Reading is an unnatural act; we are no more evolved to read books than we are to use computers. Literate societies become literate by investing extraordinary resources, every year, training children to read. Now it’s our turn...” (Shirky) But reading allowed for deep processing, reflection and attention. Even Shirky sees some problems, "10 years after the web turned every institution into an accidental publisher, the simple difficulties of long-term storage [turned] them into accidental archivists as well." (cited in Jackson p. 223) Collecting information is not the only task we face when learning—retrieving it is also important. If we cannot find the information, if it is not linked to other information or labeled properly, we cannot be said to be learned. Shirky, according to Jackson, “likens the problem to burning the card catalog at a major library; the books may as well be lost. ‘The real problem is findability.’” (Jackson p. 223) So not only relying on the technology to establish standards for reading that will enhance our ability to learn, but relying on the technology to index and store our memories may be problematic.

Russell Neuman (2010) critiqued Carr’s 2008 article "Is Google Making Us Stupid?" He says “The premise of the piece seemed to be that the instantaneous response of the Web to our every query was making us, well, not so much stupid as impatient, no longer able to concentrate on ‘long stretches of prose’ and the various ‘turns of the argument.’” Neuman goes on to say that it is “probably a good thing that somebody is worrying and raising concerns [about the pervasiveness of the technology].” Carr, the author of the article claims that “the uncharted attentional dynamics of looking at the world through a Google search window” may offer more snippets of information but asks, “The digital citizenry may be content with the information it retrieves, but is it any better informed?” (Neuman 2010) Our lack of concentration added to the broad range of possible sites to gather information makes it even more difficult to focus our attention on one thing at a time.

Multitasking

One of the difficulties with the online search is that readers attempt to multitask while skimming over the text. One researcher, N. Katherine Hayles, has offered this view about the possible benefits of computer learning: “the new, multimedia world generates ‘hyper attention’—which is different from, but not necessarily worse than, attention as traditionally understood. In a media-rich environment... young people’s

brains are getting better at making conceptual connections across a wide variety of domains.” (Brown 2010)

Hayles continues, “Students today don't start in deep attention. They start in hyper attention. And our pedagogical challenge will be to combine hyper attention with deep attention and to cultivate both.” But Amy Brown also offers the contrary view of Clifford I. Nass of Stanford University. He is “skeptical,” Brown says, because he “found that chronic media multitaskers—people who spent several hours a day juggling multiple screen tasks—performed worse than otherwise similar peers on analytic questions drawn from the LSAT.” Nass, who says his parents taught him the adage from Sir Joshua Reynolds that “‘There is no expedient to which man will not resort to avoid the real labor of thinking,’ says he ‘isn't sure which way the causation runs here,’” but he is troubled that “media multitasking might actually be destroying students' capacity for reasoning.” (Brown 2010) It just might be that one person's “hyper-attention” is another's “hyper-distraction.” We are returned to Postman's argument that any technology has more than one impact on the user.

In “Multitasking: The Good, the Bad, and the Unknown,” Cora Dzubak (2007) discussed the research of Hembrooke and Gay. They noted “we have both conscious and unconscious mechanisms that determine what information is selected for encoding.” This, she says, serves “as a strong reminder that although one might be exposed to sensory input from the environment that it does not mean that the sensory stimulation will be encoded and stored.” (p. 5) She went on to say that the researchers' findings suggest “when the neural channel becomes overloaded, some of the information is filtered out, while other information is selected for further processing.” (p. 5) The selection of which sensation to process to long term memory has far-reaching implications in our understanding of the effect of multitasking on attention, learning and memory. If there is a “fixed amount” of “cognitive resources” available for processing information, then hyper-attention may be an illusion. Dzubak states, “Any breakdowns in this process of encoding and storage of information reflect some misattribution of resources to the task at hand,” and asks “Could this ‘misattribution of resources’ be due to the divided attention characteristic of multitasking as well as the time cost incurred when switching tasks?” (p. 6)

It is important that we review that last section of information. If there is some interruption, some distraction during the process of sensation and putting that sensory information into our long-term memory, then the memory will not be formed. One must remember that memory of new information is formed when the individual associates, in some conscious manner, the new information with the information already stored in memory. The brain changes and grows new synaptic connections to accommodate the formation of these new memories and associations.

Dzubak underlines the idea that “multitasking takes more time and involves more errors than focus on a single task.” (p. 4) Citing the 2001 research of Rubinstein, Meyer, and Evans, (2001), she notes that when “learning with distractions associated with multitasking, students' brains are trying to ‘wing it’ by using a region [of the brain] that

is not best suited for long term memory and understanding.” She also notes that these findings are “consistent with the findings of Delbridge (2001) who also noted that focusing on one task or a single goal results in fewer errors and less time than trying to focus on multiple tasks and goals.” (p. 4) Focus and attention to a single task results in better memory creation and affords better retention and access to information later on. Multitasking may prevent the transfer of information into long-term memory.

Richtel (2010a) reports that there may be people who can “easily juggle multiple information streams. These ‘supertaskers’ represent less than 3 percent of the population, according to scientists at the University of Utah.” (p. 3) With this said, Richtel also tells us that “heavy multitaskers actually have more trouble focusing and shutting out irrelevant information, . . . and they experience more stress,” he says, and “they exhibit fractured thinking and lack of focus.” (p. 1) That lack of focus is both a result of and an indication of other cognitive difficulties caused by the distraction of multitasking.

When faced with multiple tasks at the same time, certain areas of the brain “act as information bottlenecks, clogging information transfer from one portion of the brain to another,” says Yang. (2011) Citing the work of Dr. Earl Miller, Yang tells us the “brain suffer[s] when multitasking. This is in part due to tasks competing for finite resources, sometimes within similar areas of the brain.” (Yang) He also cites research at Cornell University which points out the fact that “individuals have the propensity to overrate their abilities and lack the metacognitive ability to realize that the decisions they have made are incorrect. Simply put, we are likely the worst judges of our own abilities.” Yang also discusses the work of a group led by Etienne Koechlin that argues there is the “possibility of limited multitasking.” This team found that some people can complete two tasks simultaneously. However, “when accosted with three tasks, completion accuracy dramatically decreased. It appeared that the third task could simply not find the available brain space in which to concurrently process.” (Yang)

The tasks we face may also be interrupted by habitual behaviors incited by technological stimulation. According to Nora Volkow, director of the National Institute of Drug Abuse and one of the world’s leading brain scientists, the idea is not so far-fetched. “The technology is rewiring our brains,” she said, and she and her research group likened the “lure of digital stimulation less to that of drugs and alcohol than to food and sex, which are essential but counterproductive in excess.” (cited in Richtel 2010a p. 1) In 1991, an episode of *Star Trek: Next Generation* entitled “The Game” aired on network television. The plot of the episode revolved around an electronic mind game that would reward the player with a pleasurable (clearly sexual) release whenever the player was able to capture a floating disk. Richtel substantiates the addictive possibilities of “The Game” when he reports that scientists have found that “juggling e-mail, phone calls and other incoming information can change how people think and behave . . . [that] our ability to focus is being undermined by bursts of information.” The immediacy of these bottom-up stimuli “play to a primitive impulse to respond to immediate opportunities and threats. The stimulation provokes excitement — a dopamine squirt — that researchers say can be addictive. In its absence, people feel bored.” (Richtel 2010a p. 1)

Other emotions may be affected by the use of the technology. Nass has said that heavy technology use may reduce the feelings of empathy one feels as well as the way people relate to one another. “The way we become more human is by paying attention to each other,” he said. “It shows how much you care.” (Richtel 2010a p. 4) One might say that the constant texting and use of the cell phone is the effort of one person to pay attention to another. But when the text messages interrupt face-to-face conversation or take the place of direct human contact, there may be a problem. In many cases the cell phone user and chronic texter are neither in this place nor this time; s/he is always seeking something else—s/he is fragmented.

Fragmentation causes the brain to react in a negative way. Neuman points out that “our brains can process only so much information. If we exceed our cognitive threshold, we panic or shut down or find ourselves in the biological equivalent of a computer system's crash. ... While we can, at times, selectively choose information—some of us... can concentrate on one conversation among dozens within earshot at a gathering [and] can find the passage we seek by scanning an article quickly,” we may be beleaguered by the amount of information we come in contact with. (Neuman 2010)

The amount of information a person receives at any given moment may have a negative impact on how that person deals with that information. As Greenfield has commented, “Indeed, no real-time medium—including film, television, and radio—permits time to reflect. (Greenfield p.71) Michael Heim has warned of the possible dangers of multitasking and heavy computer usage for years.

“As we are overwhelmed by the amount of information in our current information age our attention span shortens. We collect fragments. We become mentally poorer in overall meaning. We get into the habit of clinging to knowledge bits and lose our feel for the wisdom behind knowledge. In the information age, some people even believe that literacy or culture is a matter of having the right facts at our fingertips. We expect access to everything NOW, instantly and simultaneously.” (Heim p. 10)

All of this means that less information will be stored in long-term memory, and that may have a dramatic impact on society as a whole. Christine Rosen (2008) reports that a Kaiser Family Foundation report in 2006 indicated that “In this media-heavy world, it is likely that brains that are more adept at media multitasking will be passed along and these changes will be naturally selected.” Reflecting Spencer’s social-Darwinist perspective that forgave the excesses of colonialism as part of the “White man’s burden,” the report stated, “After all, information is power, and if one can process more information all at once, perhaps one can be more powerful.” This, according to Rosen is “techno-social Darwinism, nature red in pixel and claw.” (p. 108)

However, Amy Brown (2010) cites Winifred Gallagher, who in her book about the psychological results of multitasking flatly states “Multitasking doesn't work, particularly for cognitively demanding activities like research and writing. Uninterrupted focus for substantial periods remains vital to accomplishing anything requiring synthesis, insight, and articulation.” In other words, one must focus on a specific task and use the

information stored in the brain along with the information one has received from the environment in order to develop cogent, clearly articulated thoughts. Brown offers some advice. “If we disconnect from our electronic devices and stubbornly set aside regular times to focus, our shriveled capacity for concentration will once again unfurl and flourish.”

The ability to disconnect, however, may be more difficult than it appears on the surface. The mid-brain contains numerous elements that function to integrate sensation, to alert the person to immediate environmental dangers that initiate the fight or flight responses. These are essentially bottom-up processing events that are unconscious in nature. Although they rely on stored information, they are immediate responses to a given environmental stimulus. Today, we have turned over part of this function to the computer that tells us when we have a meeting or when an email message or any other electronic communications program message has been received. The alarm clock—a buzz, a chime, a radio program—wakes us up in the morning. Our devices essentially control our actions, or at least help us to handle all of the things we are supposed to do during our hectic days. But all of the “help” has another side to it.

Nass contends that today our ability to respond is governed, somewhat, by our electronic tools; “we’ve got a large and growing group of people who think the slightest hint that something interesting might be going on is like catnip. They can’t ignore it.” Nass says, “it is important to see the effects of electronic media and multitasking because of their lingering effects: ‘... they can’t shut off their multitasking tendencies when they’re not multitasking.’” (cited in Richtel 2010a p. 3) We become habituated to the stimulus we receive from our gadgets. We become habituated to our distractions.

And so we ask the Internet to keep interrupting us in ever more varied ways. We willingly accept the loss of concentration and focus, the fragmentation of our attention, and the thinning of our thoughts in return for the wealth of compelling, or at least diverting, information we receive. We rarely stop to think that it might actually make more sense just to tune it all out. (Carr 2010b p 4).

Dzubak (2007) refers to the research of Naveh-Benjamin, et al. They found that when individuals switched between two tasks “one of which was to be learned and stored in memory... [and] attention was switched to a secondary task and away from the first task, memory performance on the first task declined and secondary task performance improved. (p.2) Dzubak likened these findings to those of Delbridge who noted that “the impact of a distraction on memory depends on whether the distraction is active as in talking, counting or singing, or whether it is passive, as in listening to music. Not unexpectedly, active distractions have the potential to interfere significantly with what is processed and stored in memory.” (p. 2-3) These findings suggest there is impact on our ability to process information when we are distracted. However, Delbridge also “noted that attention is limited and has some finite quality to it, and that an individual cannot attend to unlimited stimuli simultaneously. This suggests that “practice” and repetition of multitasking behaviors can improve one’s ability and that there are “differences among people in multitasking performance and that some people are less susceptible to the

process losses caused by multitasking or have an increased ability to handle them.” (Dzubak 2007 p 2-3)

Dzubak noted that “a distinction needs to be made between active and passive distractions and their impact on learning and memory.” (p. 3) In his book, *The Myth of Multitasking*, Dave Crenshaw defines these two terms slightly differently. Active switches are those times, he says, when “you decide to switch tasks to make a call, get up from your desk to go talk to someone, or decide to check e-mail on your own. Anytime you are the one making the switch, it is an active switch.” (p. 22) Passive switches “are initiated by someone or something other than you. Examples of passive interruptions are automatic e-mail arrival notifications, the cell phone ringing, or someone walking into your office without an appointment.” (p. 22) Either type of distraction, using whichever definition of the terms, may cause the individual to switch tasks.

Crenshaw discusses the cost of “switchtasking,” (p. 17-8) a series of events where the individual switches tasks without realizing it. Switchtasking, Crenshaw says, causes the average person to lose “about 28% of the work they do to interruptions and inefficiencies. Multitasking—or switchtasking—is probably the biggest culprit.” (p. 26) The reason switchtasking costs so much time is because as cited from the Harvard Business School, “people must go back and review what they've done before they can resume work on a task. The more complicated the task... the greater the cost.” (p. 20) In addition, a study conducted by the Department of Information and Computer Science, University of California, Irvine concluded “the longer a worker is distracted by an interruption, the more likely that they will continue to be interrupted and not resume the task in that same day.” (p. 21)

The distraction of multitasking is defined in Wikipedia, says Crenshaw, as “the apparent simultaneous performance of two or more tasks via computer's central processing unit.” To Crenshaw the term *apparent* in that definition is very important. “Just like your brain, the computer really can't focus on two or more things at the same time. What the processor is really doing is switching rapidly between one program and the other, giving the illusion that is doing it all at the same time” (Crenshaw p. 30-1)

Another illusion surrounding the use of computers is epitomized by the comments made by Randy Bomer, President of the National Council of Teachers of English. Bomer stated that:

An ample and growing body of research shows us that adolescents are expert users of many and varied forms and technologies of literacy. Their practices are purposeful and sophisticated, and they use literacy to do the kinds of things people have always done with literacy. As most parents of adolescents know very well, kids are more likely to be expert at emerging information and communications technologies than their parents or their teachers are. They have sophisticated *viewer literacies* [emphasis mine]—understandings about how video, TV, and film work and vast reserves of knowledge about how what they are watching now exists in dialogue with older stories, characters, and forms.” (Bauerlein p. 64)

Bomer's comment is astounding. He seems to imply that knowledge and wisdom need not be obtained through deep reflection or strenuous cognitive thought. One must ask a number of questions about this statement. How many young and adolescent individuals are truly "purposeful and sophisticated" and can "use literacy as people ... always [have]"? What do "viewer literacies" have to do with literacy? And how have people always used literacy? How would any child or adolescent be able to "have vast reserves of knowledge" about anything?

Bomer effectively changes the definition of the term literacy from one that deals with the ability to read, write, and think creatively and critically to one where being able to use a technology is of foremost importance. Adolescents and young adults who have not spent the time reading and learning the "older stories, characters and forms" cannot know how to effectively compare the new with the old. Bomer neglects the fact that putting everything—ideas, books, art, music, philosophy, political science, literature, science—on the computer is not putting those very same things into the person's brain. We live in a society that forgives mediocrity, indeed, where mediocrity is the standard. The seeming inability of people and students to think deeply is precisely related to the extraordinary thinking of people like Bomer who don't see the dangers of a society where people do not have the in-depth learning that will ensure their ability to think critically or synthesize information across curricular boundaries. Remember, the movie is not the book; the electronic media is immediate and does not stimulate deep processing or reflective thinking. As Bauerlein put it:

In truth, the teens Bomer exalts are drowning in their own ignorance and e-literacy, and to aggrandize the minds and skills of the kids isn't just about a weapon to use against the alarmists. It feeds the generational consciousness that keeps kids from growing up. (Bauerlein p. 65)

Technophiles are people who spend a great deal of time developing programs that will make life easier and free our minds for other things. What other things? Our brains serve as our connection to other people, to our past, our heritage; it allows us to succeed in an environment that, at times, may be hostile. If we do not store the memories of our own lives in our own brains, how can we hope to delve into the knowledge of the past and develop the wisdom to deal with the problems that may arise in our future if we have no foundation from which to work?

"E-literacy—that's the new virtue, the intellectual feat of the rising generation," says Bauerlein. He cites Jonathan Fanton of the MacArthur Foundation: "today's digital youth are in the process of creating a new kind of literacy, which extends beyond the traditions of reading and writing into an evolving community of expression and problem-solving that is changing not only their world, but ours, as well." To which one must ask, how, then, will today's youth communicate the important details of that evolving community? Fanton goes on:

The twenty-first-century economy requires rapid communications, faster transfers of info, the reasoning goes, and ambitious teams don't have time to deliberate over a volume of Robert Frost or learn five new words a day. E-literacy derives not from bibliophobia, then, but from the miraculous and evolving advent of digital

technology, the new information age in the electronic world. The more young adults master the practices of digital life, the better they succeed. (Bauerlein p. 66-7)

But that literacy is fleeting, ephemeral. Young people may know how to manipulate the technology, but the technology is becoming the master. If young people do not have a broad vocabulary, they will lose the ability to understand nuance, to engage in debate and in-depth discussions; they will struggle in this new world marketplace. If young people, people, in general, cannot compute mathematics without the aid of a computer or hand-held calculator, they face the danger of being duped. As Michael Heim points out:

The computer doesn't merely place another tool at your fingertips. It builds a whole new environment, and information environment in which the mind breathes a different atmosphere. Space, the computer atmosphere, belongs to an information-rich world -- which soon becomes an information-polluted world. (Heim p. 13)

If people cannot find their way through the information pollution, if they do not have the literacy skills to discern valid arguments from exaggeration and fallacy, then the wealth of fragmented information they have at their cyber-fingertips is worthless.

If we have nothing to tell but fragmented bits, if there is nothing of great substance in our memories, if we cannot be critical or creative, how can we understand the sequence of events that is necessary for us to survive? How do we get past the seeming inability to think critically that distraction and so-called e-literacy and information overload has brought upon us? I find Neil Postman's comment from his 1996 book, *The End of Education*, enlightening. In that work, he discusses the need for a central theme, a narrative, a story, that will help to focus the people of any given age on the purpose of their society.

Our genius lies in our capacity to make meaning through the creation of narratives that give point to our labors, exalt our history, elucidate the present, and give direction to our future. To do their work, such narratives do not have to be "true" in a scientific sense. There are many enduring narratives whose details include things that are false to observable fact. The purpose of the narrative is to give meaning to the world, not to describe it scientifically. The measure of a narrative's "truth" or "falsity" is in its consequences: does it provide people with a sense of personal identity, a sense of community life, a basis for moral conduct, explanations of which cannot be known" (p. 7)

Reading, Multitasking and Information Overload

The narrative of our age is just a click away. Or is it?

In his article "The Web Shatters Focus, Rewires Brains," Carr (2010b) tells us the "Internet is an interruption system. It seizes our attention only to scramble it." (p. 4) The problem with the scrambled narrative is that there is no continuity, no sequence, no cause

and effect. Carr goes on, “hypertext and the many different kinds of media [come] at us simultaneously... [and] we generally juggle several tasks.” (p. 4) The switching costs pile ever higher.” Switchtasking, we saw earlier, has a cost—that of cognitive overload and the loss of focus. Carr informs us:

Psychologists refer to the information flowing into our working memory as our cognitive load. When the load exceeds our mind’s ability to process and store it, we’re unable to retain the information or to draw connections with other memories. We can’t translate the new material into conceptual knowledge. Our ability to learn suffers, and our understanding remains weak. (p. 4)

Add to that warning the admonition that electronic media may cause a major reduction in the ability of the individual to understand the scope and impact of media penetration in our society. Neuman (2010) has found that in 2005 there were “more than 20,000 minutes (about two weeks) of unique mediated content theoretically available for every minute of every day.” The Internet is only counted as “a single channel,” but it was “available 24 hours a day in 59 percent of American households.” Indeed, Neuman contends “the Web offers an intimidating, essentially unlimited variety of sources and channels.” He cites a Google report that they were “monitoring approximately 8.5 billion ‘Web addresses’ in 2005.” This broad availability of information sources seems beyond the capacity of the human brain to comprehend. To Neuman it is “not a human-scale cognitive challenge; it is one in which humans will inevitably turn to the increasingly intelligent digital technologies—search engines... and so on—that created the abundance in the first place.” In other words, we have to let the machine give us the orientation we need to understand—a task the computer cannot achieve—the machine does not have intelligence.

The potential danger for the individual learner, then, is that there are so many avenues to find information that it may be difficult to sort the good from the bad, the reliable from the phony. In addition, the individual can create computer settings that will announce each new item of information from whichever source is selected. Carr (2010b) points out, “We want to be interrupted, because each interruption—email, tweet, instant message, RSS headline—brings us a valuable piece of information. To turn off these alerts is to risk feeling out of touch or even socially isolated. The stream of new information also plays to our natural tendency to overemphasize the immediate. We crave the new even when we know it’s trivial.” (p. 4) To be interrupted by the each new bit of information is to destroy our ability to deeply process that very same information—leaving us with, essentially, a futile enterprise.

Maggie Jackson points out that “depending too heavily on multitasking to navigate a complex environment and on technology as our guide carries a final risk: the derailling of the painstaking work of adding to our storehouses of knowledge.” (p. 93) There are a number of reasons for this including the shear bulk of information available, the seemingly unlimited sources of media, the constant distractions the individual faces while trying to gather relevant information and the idea that one can multitask.

Dr. Edward Hallowell, a Massachusetts-based psychiatrist has identified what he calls “Attention Deficit Trait.” Hallowell said that multitasking is a “mythical activity in which people believe they can perform two or more tasks simultaneously,” that this “Trait” is “a response to the hyperkinetic environment in which we live,” and our behavioral response is similar to those of a person with ADD. (p. 106) Hallowell continues: “Never in history has the human brain been asked to track so many data points;” and that this difficulty with maintaining poise and purpose “can be controlled only by creatively engineering one’s environment and one’s emotional and physical health.” (p. 106) Whereas the person with ADD loses focus because of a chemical imbalance in the brain—neuro-inhibitors do not turn off neurons after transmission or reception of electrical impulses—the cyber-addict loses focus because s/he cannot turn off the urge to acquire more information, even if it can’t be processed or remembered.

One has only to understand Nielsen’s 2006 study of how people read online. He tracked people’s eye-movements while they browsed the Internet and read articles they found interesting. “Nielsen found that hardly any of the participants read online text in a methodical, line-by-line way, as they typically read a page of text in a book,” and that “the vast majority skimmed the text quickly, their eyes skipping down the page in a pattern that resembled, roughly, the letter F.” They “would read the first two or three lines as they normally would, but then their eyes would drop down a bit, and they scanned about halfway across a few more lines. Finally, they let their eyes curiously drift the little further down the left-hand side of the page.” (Carr, p. 9) The distractions of the media and the idea that one can multitask are compounded by the fact that people do not read online in a manner that is conducive to deep processing of information. This means they will not be able to reflect or even remember much of what they have read. Again, an exercise in futility.

Maggie Jackson points out that “the last key to decoding the landscape of distraction is movement. Just as the virtual shatters our conceptions of simultaneity redefines our notions of *time*, so a life of perpetual movement reshapes our relationship to *place* and what it means to be in the world.” (p. 99) One need only to go to just about any website to get an idea of what Jackson is talking about.

Most narrative text on a website is cluttered with hyperlinks—bits of information that the website designer thinks is important and relevant to the topic at hand. However, as one begins to click on the various hyperlinks, one is taken further and further from the original query. One distracts oneself from the purpose and goal of the research, and one reads only snippets of information about subjects further and further removed from the central theme. I think one example of following the links may suffice to prove the point.

Although Wikipedia is not the most reliable source of information on the Web, it will suffice for our example. Should one use Google to search for information about “deconstruction,” one can enter the Wiki site with information about that topic. The first line of text, however, suggests two choices—“deconstructivism” and “deconstruction (disambiguation).” Click on either of these choices and the journey begins. One may choose to skip the links on the first line and go to the first paragraph, instead. The name

Jacques Derrida is hyperlinked on that line, and once again, a click will take the reader to another page that discusses the biographical information about him. But also found on that biographical page are the terms “post-structuralism” and “postmodern philosophy.” Another click and one is even further away from the original quest. As I continued my search, I clicked through “empiricism” to “Hume” to “Kant” to “Konigsberg.” At that point, I decided to stop and go back to my original task. In essence, I effectively distracted myself by trying to “juggle many tasks” and became “less creative and less productive than those who do one thing at a time.” (Carr 2010b) Of course, I did have additional snippets of information, but they were disconnected and not easy to coordinate into a coherent theme. One does not have to follow all of the hyperlinks, but the fact that they are there are a temptation many find irresistible.

Richtel (2010b) notes that the brains of computer users “are rewarded not for staying on task but for jumping to the next thing.” He continues, “The worry is we’re raising a generation of kids in front of screens whose brains are going to be wired differently.” (p. 1-2) This dire prediction about the impact of multitasking on the younger generation is echoed by Rosen (2008) who believes that for young people “the great electronic din is an expected part of everyday life.” Rosen goes on to say: “... neuroscience and anecdotal evidence have shown us, this state of constant intentional self-distraction could well be of profound detriment to individual and cultural well-being. (p. 108)

The Brain and Multitasking

Carr (2010b) cites a 2003 study published in *Nature* that suggests that “Web browsing ... strengthens brain functions related to fast-paced problem-solving, particularly when it requires spotting patterns in a welter of data.” (p. 6) He goes on to say that the “mental consequences of our online info-crunching are not universally bad. Certain cognitive skills ... such as hand-eye coordination, reflex response, and the processing of visual cues” are strengthened. (p. 6) These cognitive functions, however, are of a more primitive nature and are an indication of bottom-up, immediate responses that are not evidence of reflective thought.

Russell Poldrack, a psychology professor at the UCLA, who found that “multitasking adversely affects how you learn. Even if you learn while multitasking, that learning is less flexible and more specialized, so you cannot retrieve the information as easily.” The reason for this, Poldrack says, is “We’re really built to focus. And when we sort of force ourselves to multitask, we’re driving ourselves to perhaps be less efficient in the long run even though it sometimes feels like we’re being more efficient.” (cited in Rosen p. 107)

David Meyer, a psychologist at the University of Michigan believes people can be trained to efficiently switchtask, also found that “multitasking contributes to the release of stress hormones and adrenaline, which can cause long-term health problems if not controlled, and contributes to the loss of short-term memory.” (cited in Rosen 2008) Dzubak (2007) might add:

there is cognitive interference when attempting to perform two tasks. If we do try to select two responses or engage in two activities at the same time, there will inevitably be a delay in the initiation of one of the tasks and getting cognitively reoriented after each interruption takes more time, [and] [t]he backlog of information waiting to be processed by the brain... is delayed until use of the neurologic pathways from task one is completed. This 'time cost' increases as the tasks become more complex and if they are too cognitively similar. (p. 10-1)

All of this information about how multitasking affects the brain seems to point to the idea that while the brain is plastic and changes and grows when new information is stored as memory, those changes can have a negative effect on our ability to learn and remember new information. The long-term effects may be seen in the difficulty of heavy multitaskers to effectively reflect and think critically and creatively.

Hassabis and Maguire (2009) conducted extensive research on the function of the hippocampus with respect to the integration of information into memory and the eventual retrieval and "construction" of that information to resolve a variety of problems to critically and creatively formulate judgments about them:

... a scriptwriter or novelist who is writing a passage in a film or book may play out the whole scene using their construction system, not with the idea of predicting the future, but instead for the purpose of evaluating its aesthetic suitability. Similarly, an engineer might approach the problem of designing the features of a new household product by envisaging how it would be used by someone in the home. Again, the use of construction is not for future prediction per se but to facilitate evaluation judgments of general fitness for purpose of a tool.... This allows humans to be limitlessly creative and inventive even though constrained by a basic set of raw component elements gleaned over a lifetime of experiences. (p 8)

If there is nothing to draw upon, if the memories are scattered or fragmented, if much of the information is irrelevant or arcane, the whole "construction system" falls apart. People can be taught, however, that there are alternative learning strategies and behaviors that can enhance their ability to learn and later construct, or reconstruct, meaning from the information they have gathered.

Carr cites a 2009 experiment conducted at Stanford University where "subjects at a computer were briefly shown an image of red rectangles... then ... a similar image and were asked whether any of the rectangles had moved." Later in the test, an additional blue rectangle was added, but the subjects were told to ignore them. However, "heavy multitaskers were much more easily distracted, had significantly less control over their working memory, and were generally much less able to concentrate on a task. (Carr 2010b p. 4) Carr also refers us to a statement by Michael Merzenich:

We know that the human brain is highly plastic; neurons and synapses change as circumstances change. When we adapt to a new cultural phenomenon, including the use of a new medium, we end up with a different brain.... That means our online habits continue to reverberate in the workings of our brain cells even when we're not at a computer. We're exercising the neural circuits devoted to skimming

and multitasking while ignoring those used for reading and thinking deeply.
(Carr 2010b p.5)

The brain, then, is hampered by constant interruptions. These distractions reduce focus and make it more difficult to send information to long-term memory. Multitaskers seek new information rather than accept a reward for putting older, more valuable information to work. Our thinking is therefore based on immediate responses to sensual perceptions and our ability to discern relevant information is curtailed. We are restricted by our lack of stored information from making critical judgments. Nass says multitaskers are “suckers for irrelevancy... Everything,” he says, “distracts them.” (cited in Carr 2010b p. 4) Michael Merzenich goes even further when he says, “As we multitask online, we are ‘training our brains to pay attention to the crap.’” (Carr 2010b p. 4)

Virtual Reality

Michael Heim tells us that William Gibson, author of *Neuromancer* (once required reading for the folks at the Media Lab of MIT), calls cyberspace “an infinite cage.” (p. 79) The virtual nature of cyberspace becomes “reality,” and the distortions and fragmented bits of information that people use as the foundation of their perception of that reality changes what they believe and what they consider valuable. As Heim explains:

Cyberspace readers are represented in an artificial world, a world made up of the information that our systems produce and what we feed back into the system....
The more we habituate ourselves to an interface, the more we live in cyberspace, in what William Gibson calls the ‘consensual hallucination.’ (p. 79)

Heim tells us that a “cybernetic infrastructure” is created when technology begins to take over specific tasks of the lives individuals. The technology becomes an “interconnected system... no longer a set of discrete machines” where separate tasks are linked together with or without input from human beings. (p. 75) The major difference between the linked cyber-infrastructure and what a person would do to, for example, write an article about multitasking and distraction is that the cyber-structure is programmed by someone and completes each task according to a predetermined program. Alternative “behaviors” are limited by the programmer. The person writing the article would be able to ask a series of questions s/he wanted to answer and follow a plan s/he developed to find the answers. Alternative behaviors would be governed only by the answers s/he discovered and the manner in which s/he wanted to creatively, critically and insightfully deal with them.

But, Heim informs us there is “artificial information ... with no apparent center.” This cyber-infrastructure “suggests the absence of philosophical or religious absolutes. ... The electronic world, unlike a traditional book industry, does not protect its readers ... by following rules [or meeting]... certain expectations.” (p.104) This electronic world is already taking the place of the “real world” as more and more people join social groups that never meet in person, or enter gaming and social sites as someone other than themselves only to suffer the same pains they would feel if their favorite soap opera character should meet some unseemly demise.



As Maggie Jackson so clearly states, "The seduction of alternative virtual universes, the addictive allure of multitasking people and things, our near religious allegiance to a constant state of motion: these are markers of the land of distraction, in which our old conceptions of space, time, and place have been shattered." People have not only lost the narrative Postman finds so necessary for a coherent society. We are scattered and find it difficult to find the time to do all the things we have convinced ourselves are necessary in our modern society, and we are perpetually at loose ends. We seem to be on the verge of losing our capacity as a society for deep, sustained focus, but, at the same time, we continue to embrace the technology that has brought us to an era where it is hard to see, hear, and comprehend what's relevant and permanent. (Postman 1993 p. 14)

Jackson defines a dark age as a "distinct turning point in history, a period of flux that often produces great technological and other changes that ultimately results in a declining civilization in the desert lifestyle of collective forgetting." (p. 15) Until relatively recently—ten years, or so—libraries were the repositories of the collective historical wisdom of the ages. They housed the books and hard copy archives that would allow people to sit and reflect, to find a personal relationship with the ideas of others and of the past. Jackson reminds us that although the medieval era brought the technological invention of "eyeglasses, glazed windows, fireplaces, windmills, and stirrups, along with the compass, mechanical clock," during the sixth century, "all of continental Europe's great libraries not only had disappeared but the *memory* of them was lost to an emerging feudal society..." (p. 15) Today, our libraries are quickly becoming an electronic arena where people go to surf the net and enter cyber archives in order to learn while they are entertained.

Two important points about virtual communities and the explosive acceleration of computer technology that is designed to take the place of the human mind, Matt Slouka tells us, are the comments by E. O. Wilson, the Nobel Prize-winning biologist and physicist Robert Park. Wilson pointed out, "humans evolved in a bio-centric world, not a machine-regulated world; to assume that we can sever our connection to the physical environment in which the mind originated, and in which it retains 'permanently rooted,' therefore, is foolish." (cited in Slouka p. 134) Park noted, "Evolution is a very slow business. It cannot keep up with the pace of change in recent decades." (cited in Slouka p. 134) Slouka continues, "trapped in an increasingly alien world, a world more and more at odds with our biological selves, the wonder is not that some of us act strangely at times or hold irrational beliefs but that we cope at all" (p. 134)

Conclusion

We have embraced a technology that has had a profound impact on the way people think. In fact, the technology has become pervasive throughout every aspect of our lives: what we do and how we relate to others—how we perceive reality. As

Postman (1993) put it, “New technologies alter the structure of our interests: the things we think *about*. They alter the character of our symbols: the things we think *with*. And they alter the nature of community: the arena in which thoughts develop.” (p. 20)

When many people try to accommodate themselves to the tempo of society dictated by the electronic media, they find themselves lost and unable to maintain the pace. To stay ahead of the curve, people attempt to multitask to make up time. But the reality is that multitasking, for the vast majority of people on the planet, is a myth, and any attempt to do so brings fragmented understanding, incomplete work and a reduction in the ability of people to think deeply, critically and creatively.

The ability to use the technology has made our lives easier, and as Carr (2010b) tells us, “The ability to scan and browse is as important as the ability to read deeply and think attentively.” (p. 5) However, we have gotten to the point where “skimming is becoming our dominant mode of thought,” (p. 5) and that has caused a significant reduction in the intellectual development of a great many people. Carr says:

What we’re experiencing is, in a metaphorical sense, a reversal of the early trajectory of civilization: We are evolving from cultivators of personal knowledge into hunters and gatherers in the electronic data forest. In the process, we seem fated to sacrifice much of what makes our minds so interesting. (p. 5)

Our minds are interesting because of the depth of understanding we can glean from reflecting on the information we have stored there. People, today, are becoming shallower in their thinking and are losing sight of the important realities not only of our time but of the historical continuum that has brought us to this time and this place. Maggie Jackson offers this dire warning:

Twilight cultures begin to show a preference for veneer and form, not depth and content: a stubborn blindness to the consequences of actions, from the leadership on down. In other words, an epidemic erosion of attention is a sure sign of an impending dark age. (Jackson p. 26)

We evolved intellectually over thousands of years by learning from our environment and processing that information in new ways that would make our lives easier but, at the same time, more fulfilling. Our very nature as human beings—so called *homo sapien sapien*—is dependent on our cognitive ability to use our brains to their fullest extent—to solve problems that present themselves, to deal with the pressures of the world and society, to actively engage with others to create those things that will advance our humanity. However, Mark Slouka suggests:

As this culture of distraction comes to play an increasingly significant role in American life, it will become more and more necessary to refocus our attention on *actual* communities, on *real friends and neighbors*, on *the significance and value of our physical* rather than our virtual environments. (p. 133)

We need to know how the technology is altering our conception of learning, and how it changes our interactions with others. We need to know how the electronic media changes our perception of reality and what it means to succeed or be happy or how we

can actively participate in our own governance—what it means to be a human citizen of the world. We have to find ways to refocus and understand what it means to strive for excellence and reject mediocrity—to do one thing at a time, but to do it well. As David Yang pointed out, this quest for focus is thousands of years old. He cites Publilius Syrus who wrote in the first century BC: “‘To do two things at once is to do neither.’ Sadly, it has taken us until the 21st century AD to realize that Syrus may have had a point.” (Yang 2011) The current technology has accelerated the number of distractions that interrupt our thoughts and has made the quest for excellence more difficult.

I think it only fitting to return to the narrative I introduced at the beginning of this manuscript. As a society, we have come quite a distance from those “Guiding Principles” offered by Dr. Henrietta Mann. I believe it is essential that we learn and actively engage “a sense of history” and be “able to connect contemporary and historical issues.” We have to reconnect with a “sense of values,” “acknowledge philosophical kinship” with other people on the planet and accept “our responsibility to these relationships.” And finally, we have to understand our responsibility to the environment and to “understand the Circle of Life as both a privilege and a responsibility.” While we continue to use technology to help us improve our lot in life, we also have to be certain that the technology does not diminish our ability to think clearly and constructively.

The technology we use to help us conduct our daily business and to entertain ourselves has begun to overwhelm us with distractions. Our solutions for keeping pace with the machines have included accepting the contention that machines can remember for us *and* accepting the nearly impossible chore of multitasking to meet the requirements of an electronic world. In too many cases, the technology has taken us from “the circle of life” and has deposited us in a virtual environment where what is “physically real” is confused with what is virtually real—to our collective detriment. To find our way back, we have to rediscover how to focus on and attend to those things we want to know, the things we find valuable. As Amy Brown would say, “disconnect from our electronic devices and stubbornly set aside regular times to focus...”—to use our brains in a manner that will allow us to think critically and creatively and understand the implications of what it means to be human.

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Graphic on p. 26 <http://www.squidoo.com>

Technology has played a big role in changing the way our children learn, get entertained, how they interact with friends, it has impacted their level of creativeness, and how they behave in society . Todayâ€™s children use more technology compared to kids in 1990 . Many technological companies are inventing technological tools for kids. Technology has both positive and negative impacts on our children. As much as technology has changed the way our kids learn or entertain themselves, it has also affected their ability to learn and have real entertainment with their friends.