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Technology: the cause of negative neurological changes or an extension of oneself?

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Using an algorithm that scans the landscape of the blogosphere every few minutes in search of emotive phrases, the website We Feel Fine embodies the movement that co-creator Sem Kamvar refers to as "one of the most interesting shifts on the web,"—the rising desire of internet users to share "their whole life online." (Kamvar, "An Almanac of Internet Emotion"). The website snatches up sentences containing the words "I feel" or "I am feeling," then displays the results in a colorful and ever-changing collage of the human emotions that are becoming so integral to the fabric of the internet. This increasing role of the internet in the way that people express themselves raises a fierce debate between those who usher in the technological revolution and those that fear that increased reliance on the internet has profoundly negative consequences on the way people think and behave. While variations in internet use can indeed affect the way people store, process, and express information, the interactions between humans and their increasingly intelligent tech-

process information. Their fundamental concern is that the internet, with its open door to an inundation of data and entertainment, hampers focus and prevents critical thinking. One of the primary proponents of this school of thought, author Nicholas Carr, claims that internet use alters thought patterns by intrinsically favoring the rapid acquisition of information that readers may not examine in detail, which in turn shortens attention span (Carr, "Is Google Making Us Stupid?"). He blames this phenomenon on website designers, who cater their websites to be more favorable to advertisers. Every click of a mouse than an internet user makes while browsing the web acts as data point for advertisers, allowing them to amass information about the interests of a particular website's visitors. This allows for more targeted and effective advertisements. Thus, advertisers tend to prefer web layouts that encourage quick browsing by providing digestible portions of information that readers can consume quickly.

The University College, London has documented this diffusion of attention span in a recent study designed to understand how people locate information on the internet. The study revealed several trends in the way that people conduct research using the web, including a tendency to "power browse" through a variety of sources without examining each one critically for accuracy, relevance, or authority. This trend was especially prevalent among young people who had been conducting internet research for a greater proportion of their lives. Their findings show that people of all ages prefer reading more brief sources of information, preferring to read abstracts and other small paragraphs over full-length papers (Carr, "Is Google Making Us Stupid?"). While it is difficult to determine whether these changes in research practices are due purely to the proliferation of the internet, it is evident that it enables users to engage in a style of web browsing that favors the quantity of information amassed over the quality. It is this kind of enabling power that some believe open the door to shortened attention spans and lack of

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nological counterparts are too complex for their results to be classified as entirely positive or negative. Indeed, this merging of the public and the private, the mind and the machine, has the potential to lend us profound insights inner workings of the human brain and spirit in a way that few other technological innovations can offer.

The primary concern of those who warn against the rapid encroachment of technology is that it will somehow fundamentally alter the ways in which we absorb and

reverence for comprehension and detail, encouraging the mind to flit from source to source without dwelling at any one location for too long.

The browsing patterns encouraged by internet use may also have important neurological implications. The opportunities for information and entertainment offered by technological devices encourage multitasking, which may in the long term do more harm than good. According to an informal study conducted by researchers at the New York Times, those who consider themselves to be heavy multi-taskers have more difficultly shutting out irrelevant information, a pattern which may persist into other activities (Richtel, "Your Brain on Computers"). According to Melina Uncapher, neurobiologist at Stanford, what many people refer to as multitasking may in fact be distraction, easily caused by an overabundance of small snippets of easily digestible information. The effects of information overload may be physiological as well. Research conducted at the University of California, Irvine, found that people frequently interrupted by such common diversions as email reported significantly higher stress levels than those left to focus, with profoundly negative consequences on short-term memory (Richtel, "Your Brain on Computers").

In addition to the higher level of stress hormones induced by the distractions of technology, technological gadgets themselves may be altering the way in which our brain stores information. According to a survey conducted by neuroscientist Ian Robertson, people can no longer remember as many basic facts such as birthdays and phone numbers, which he claims is due to increased reliance on external sources of memory such as computers and cell phones (Thompson, "Your Outboard Brain Knows

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All"). However, the results of this study should not be seen as inherently negative. According to science writer Carl Zimmer, studying the ways in which the human mind has adapted to technological changes provides an interest-
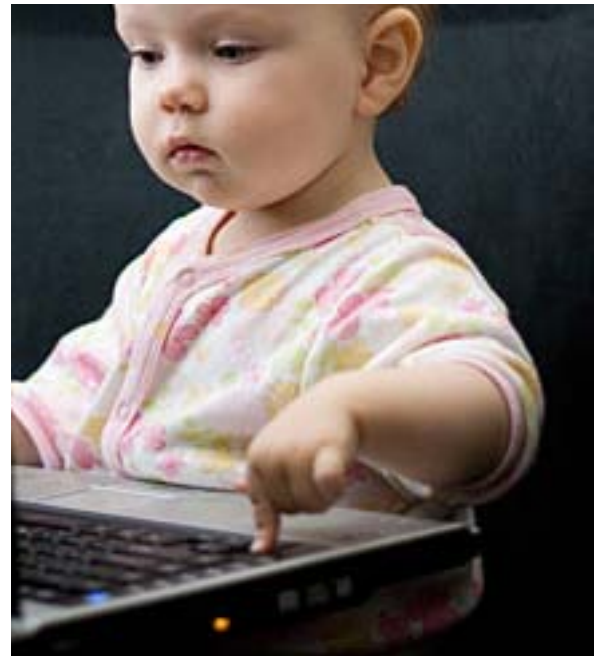

Figure 1. One of the innumeral reasons why many are against the growing dependence on technology.

ing window into the learning and evolutionary processes, both of which are completely natural. He claims that the human mind is designed to acquire tools and to make new technologies "an extension of itself." (Zimmer, "How Google is Making Us Smarter"). The brain never completely stops developing, even into adulthood new neurons can be formed in response to changes in behavior and technological adaptations, going back far before the invention of the internet.

"Everything you do changes your brain," says associate professor of Brain and Cognitive Sciences Daphne Bavelier at the University of Rochester. "When reading was invented, it also made huge changes to the kind of thinking we do." (Mitchum, "This is Your Brain on Facebook"). Those who embrace the rise of information technology point to what they believe to be a symbiotic relationship between the mind and its external environment. The questions raised by this argument are as much philosophical as neurological, but the conclusion that proponents from both intellectual fields have come to is that the brain and the tools it uses to acquire information cannot be analyzed in isolation. One of the pivotal papers in this debate, a work by Clark and Chalmers, argues that what we refer to as 'the mind' is a product of the physical workings of the brain and external environmental effects, such as the accessibility of technology and information (Zimmer, "How Google is Making Us Smarter"). According to a study that compared the brain activity in internet-savvy and less experienced senior citi-

zens at the University of California, Los Angeles, consistent internet use led to increased activity in multiple regions of the brain, implying that the brain continually adapts and recruits new neurological systems to help complete a particular task, even for tasks as seemingly simplistic as browsing the web (Mitchum, "This is Your Brain on Facebook").

Perhaps a more challenging question to address is—if internet use is indeed having spillover effects on cognition, what does this mean for how we process emotions? The internet itself can have profound effects on the way that we respond to emotional stimuli. Researchers at the University of Missouri have found a significant difference in emotional response to content found while casually browsing the internet as opposed to that which is deliberately searched for. Emotionally troubling information found through deliberate searching elicited greater heart rate acceleration during reading, and was also remembered with more accuracy than the same information found through typical web browsing, and readers tended to rate stories found intentionally as more troubling (University of Missouri-Columbia, "Internet Search Process Affects Cognition, Emotion"). Kevin Wise, co-director of the Psychological Research on Information and Media Effects at the University of Missouri, explains the differences in reaction by differences in the way the information was acquired. Stories found through intentional searching may have a higher emotional impact because readers put more effort into finding them, but there are neurological differences between the two processes as well. The researchers hypothesized that unpleasant information found through searches would have a more profound emotional impact because prior knowledge of the topic's unpleasant nature would lead to earlier activation of the brain's aversive motivational system, and thus the experience of negative feelings would begin sooner and monopolize more of the brain's information-processing resources (Wise, Hyo, Kim and Kim 2009). This research

Figure 2. Proprononts of technological advances agrue that it is merely human nature to accept these changes, yet the chance remains close to nonexistent that technology will ever have the ability to change who we are.

helps explain the interaction between technological processes and emotional response, but little research exists on the relationship between internet use and emotional expression.

Many psychological researchers have already taken advantage of the wealth of emotional data available on such sites as Twitter and We Feel Fine in order to conduct experiments that can be tested in real time, but the mere idea of 'emotional data' is still being reconciled within the scientific community. According to journalist Gary Wolf, the ease with which people can acquire emotional information on the internet does indeed have a profound effect on their desire to share that information themselves. This is especially true for what Wolf refers to as 'personal data,' detailed records of seemingly mundane activities such as the songs people listen to, books they read, and places they go, easily made available through sources such as Facebook. He writes, "personal data are ideally suited to a social life of sharing. You might not always have something to say, but you always have a number to report." (Wolf, "The Data-Driven Life").

However, it seems unlikely that the transition from subjective emotional statements to refined streams of data is one that many people will be willing or eager to make soon. Internet use is still a highly personal experience, defined in large part on an individual basis. Social networks have redefined the ways in which the internet is viewed—from a source of quantitative facts, to a much more human-oriented database of personal thoughts and feelings. Indeed social networking, the fourth most popular online activity, has the potential to both bridge gulfs between people and boost self-esteem, or amplify social anxieties and encourage isolation, all depending on the mindset of the person behind the computer screen (Disalvo, "Are Social Networks Messing With Your Head?"). As powerful a force as the internet might be, humans cannot stop being human, and a few decades of internet use cannot come close to undoing thousands years of evolutionary

engineering that have programmed us to seek out tools and society that allow us to better understand our environment. As Facebook software engineer Andrew Bosworth says, "It shocks me that people still think this is like a trivial thing. Like it's a distraction or it's a procrastination tool. […] This is so fundamentally human, to reach out and connect with people around us" (Grossman, "Person of the Year 2010 Mark Zuckerberg"). While technological advances may have the capacity to distract, to entertain, and to enlighten, the chance remains close to nonexistent they will ever have the ability to change who we are.

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