Technology and the Way We Think

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"Are [modern tools] helping our brains develop or can there be negative consequences from our exposure to technology?"

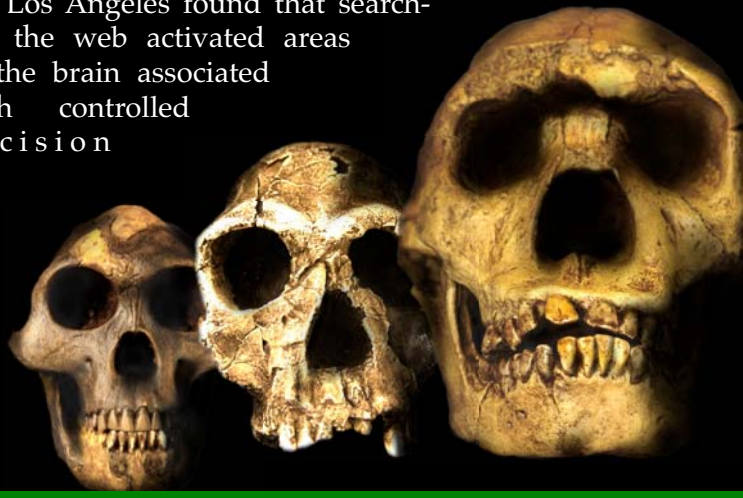
The development of technology has been linked to an increase in human cognitive abilities. In "Paleolithic Technology and Human Evolution," Stanley H. Ambrose traces the human biological and cultural evolution due to technology. Starting around 2.5 million years ago, early humans began to see an increase in brain size, population size, and geographic range. At that time stone tool technology was being developed. By creating better tools, humans had greater access to food sources that were able to support the high metabolic demands of a larger brain size. Amborse also suggests that language and composite-tool making coevolved about 300,000 years ago. Both speech and composite tool-making involve nonrepetitive motor control, and they are both controlled by adjacent areas of the interior frontal lobe (Ambrose 2001). Not only that, but the assembly of the tools from smaller units is similar to the assembly of words from sounds and sentences or phrases from words. Ambrose also points out that composite tool manufacture contributed to the evolution of the frontal lobe, which is involved in planning. In Making Silent Stones Speak, Kathy Schick and Nicholas Patrick Toth provide more reasons for the cognitive developments that followed the use of tools. By creating tools, humans had to conceptualize possible uses for them as well as the time and the place to use them. They also had to think about the resources needed to make the tools and finally how to make tools with other tools.

Given the theories on early human tool use, it is easy to wonder how the use of modern "tools" is influencing us. Are they helping our brains develop or can there be negative consequences from our exposure to technology?

Business, culture, and technology writer Nicholas Carr points out the negative aspects of the internet. In an article for the Atlantic Monthly, "Is Google Making Us Stupid?" Carr expresses his concern for the fragmented attention and lack of concentration he thinks resulted from regular internet use. He provides anecdotal evidence of people's concentrations dwindling with the expansion of the internet. In addition to that, he cites a study done by scientists at the University College London on online research habits. They looked at the logs of two popular research sites and found that people tend to skim articles instead of reading them in depth. Also, when visitors saved a long article, there is no evidence that they went back to read it. It seems that with the vast amount and instant availability of information, skimming has replaced concentrated reading. As for the question of whether reading more articles makes up for the fact that they are not read in depth individually, Carr argues (with the help of cognitive neuroscientist, Maryanne Wolf) that our ability to make rich mental connections stems from concentrated reading.

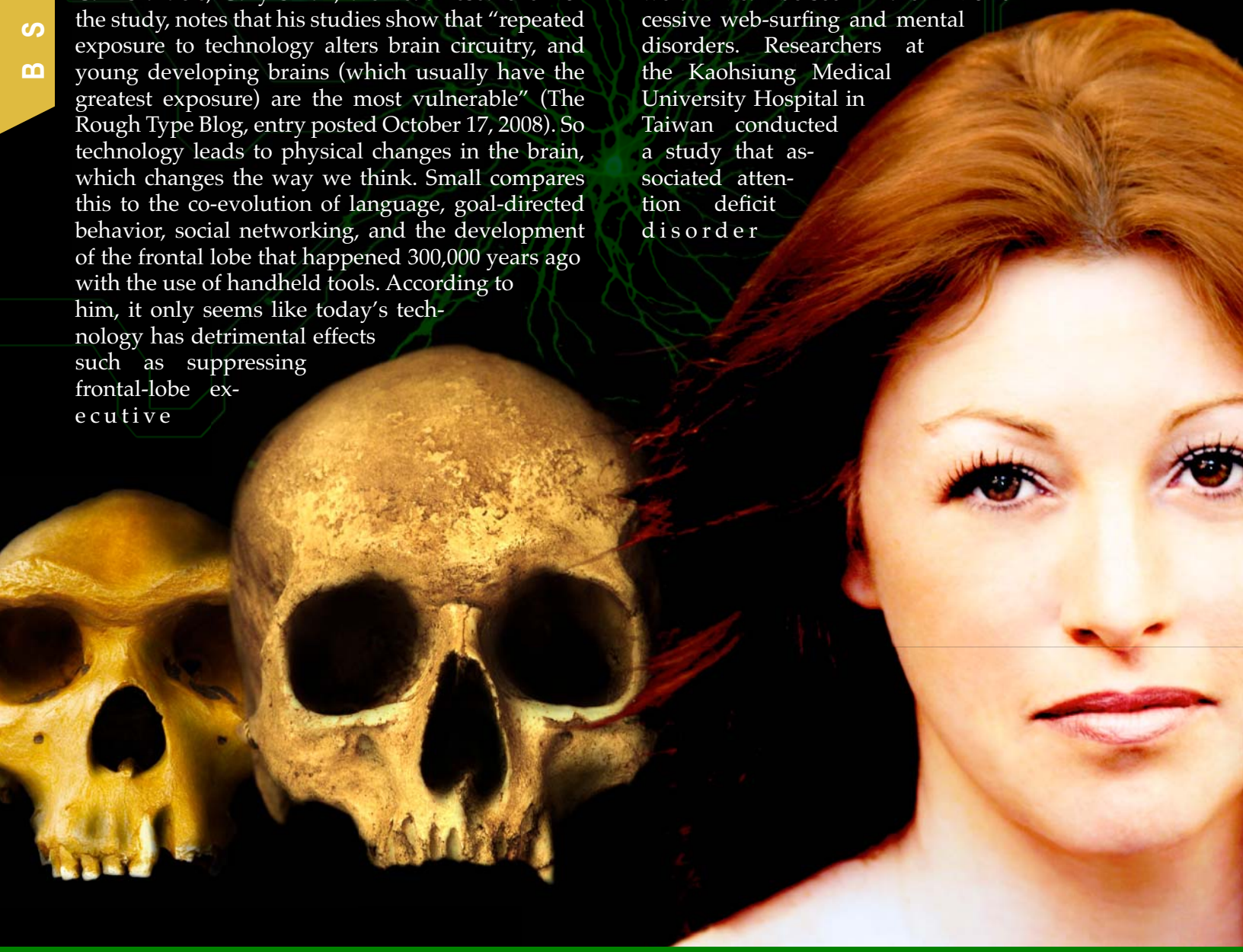
Despite the fact that there are certain drawbacks to modern technology, perhaps we are learning to think in ways that are just as rewarding. Though the internet may not be a good medium for the rich mental connections of deep reading, maybe we will learn to make different types of connections through our exposure to a broad range of information. We might be able to see general patterns in information or connect two seemingly disparate topics. It is hard to find evidence for such occurrences; however, there is evidence that surfing the internet activates parts of the brain that are different from those activated by more traditional mediums.

Recent findings suggest that internet surfing could be good for middle-aged and older people. Researchers at the University of California Los Angeles found that searching the web activated areas in the brain associated with controlled decision



making and complex reasoning (BBC News 2008). Activation exercises those areas and can lead to improvements in the long run. The study also found that with experienced web-users, the internet-based activity lead to more activation in the decision-making and complex reasoning areas than the task of reading a book. In all other areas there was equal activation for both tasks. In response to Nicholas Carr's article, Gary Small, the head researcher for the study, notes that his studies show that "repeated exposure to technology alters brain circuitry, and young developing brains (which usually have the greatest exposure) are the most vulnerable" (The Rough Type Blog, entry posted October 17, 2008). So technology leads to physical changes in the brain, which changes the way we think. Small compares this to the co-evolution of language, goal-directed behavior, social networking, and the development of the frontal lobe that happened 300,000 years ago with the use of handheld tools. According to him, it only seems like today's technology has detrimental effects such as suppressing frontal-lobe executive skills and our ability to communicate face-to-face. However, we are just adapting to a new multitasking technology culture. Though the amount and availability of information found on the net is making it difficult to concentrate on one item, there is still something to be gained from exercising the brain's decision making and complex reasoning areas.

More evidence of the internet influencing how we think can be seen in the link of excessive web-surfing and mental disorders. Researchers at the Kaohsiung Medical University Hospital in Taiwan conducted a study that associated attention deficit disorder



(ADHD), social phobia, and hostility with internet addiction. They evaluated a total of 2114 students for the aforementioned conditions through self-reported questionnaires. The study showed that male students with internet addiction had higher ADHD symptoms, depression and hostility, while female students with internet addiction had higher ADHD symptoms and depression. Frequent exposure to the net is associated with mental disorders, which suggests that the internet influences the way the adolescents think and behave. However, there is also the possibility that people who are susceptible to or already have mental disorders would be more inclined to use the internet heavily.

On the other side of the argument, technology has been associated with the reduction of some of the symptoms of ADHD. Some researchers are finding ways to use technology in order to treat ADHD. Andrew Campbell at the University of Sydney has been trying to do so through therapeutic computer games. He and his PhD student, Krestina Amon have found an off-the-shelf computer game, which decreases stress and improves the concentration of children with ADHD. The game uses meditation and biofeedback devices. Dr Campbell is now trying to use such methods in order to develop new beneficial computer games. With these therapeutic games, concentration can be improved in those with mild to moderate ADHD. The gaming company Nexon is funding Dr Campbell's research at the University of Sydney's Faculty of Health Sciences. Whether excessive internet use is associated with ADHD, or whether computer games have been shown to decrease ADHD symptoms, technology is nonetheless linked to changes in behavior. As for the question of whether or not it is detrimental to mental health, it is hard to tell because of the conflicting evidence.

"Repeated exposure to technology alters brain circuitry, and young developing brains... are the most vulnerable" - Gary Small

Finally, our brains act in such a way that allows technology to be easily integrated into the thinking process. The philosopher Andy Clark argues that because the brain exploits external information, it allows technology to become a part of the way information is processed. In order to do this, Clark begins by discussing the way the visual system processes information. One way the visual system could work is by having an inner model of the scene, so the knowledge you need is readily available. However due to evidence from visual phenomena, Andy Clark notes that "the visual brain is opportunistic, always ready to make due and mend, to get the most of what the world already presents rather than building whole inner cognitive routines from neural cloth" (Clark, 68). Instead of having an inner representation, it lets the world serve as its own cognitive inner model. So, not all cognitive elements have to be located in the brain. To further illustrate his point he uses the example of watching a basketball game. As you watch it, you are aware of a few useful facts, such as a players ranking or three-point field goal percentage. In both the vision and basketball example, we are "in command of a rich and detailed visual database in which information about the current scene is stored, organized, and poised for use" (Clark, 69). The data is easily accessible. More importantly, Clark points out that for both cases it does not matter where the data and processes are located, they could be just as easily in the brain as in the outside world. What matters is whether or not they are easily retrievable. Because our brain is opportunistic, even something external to it can be used just as smoothly as something internal. This means that certain technologies can be integrated into our minds, as long as they can be readily and easily used. He concludes that by acknowledging that it is in our nature to incorporate nonbiological technology into our cognition we can help optimize such unions. So, because our brain exploits its surroundings, technology becomes a part of the way we think. Acknowledging this fact can only help us take advantage of it.

Ever since prehistoric times, technology has been shaping the way we think. It has been doing so on a biological level, such as 2.5 million years ago when better tools led to better food sources that fueled the

brain, or in modern times when repeated exposure to the internet lead to changes in brain circuitry. Technology also forces people to think in different ways and by doing so regularly, this has an impact on human thought in general. Prehistoric tool manufacture had an impact on our frontal lobe, just as today having to process a lot of information on the internet has an impact on which parts of the brain are used. Because the development of technology often parallels that of thought, the differences in behavior we are seeing as a result of the internet or videogames are perhaps reflecting substantial changes in the way we think, similar to those that occurred in prehistoric times. Maybe with practice we can eventually get better at concentrating on many ideas at once, getting the best out of having a lot of information readily available. Either way, recognizing that technology has an impact on the way we think can help us take advantage of it and learn to better adapt. In the end the changes could be for the better.

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