

Only Connect: What the Internet Might be Doing to Us

Mind Change: How Digital Technologies are Leaving Their Mark on Our Brains.

By Susan Greenfield. New York, NY: Random House, 2015.

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What constitutes evidence that a theory is true? Holdouts still deny the Holocaust happened, but facts prove them wrong. For many years, it was uncertain whether tobacco really caused cancer, but finally the linkage is undeniable. Climate change doubters have long claimed that human activity isn't to blame for global warming, but the science is now (at least for nearly all of us) indisputable.

Is the internet like climate change? More specifically, is using the internet detrimental, at least in some important instances, to how people think, interact, and live? And are these effects detectable in the ways our brains work?

Neuroscientist Susan Greenfield thinks so. Or at least she thinks it's highly likely, making the case in *Mind Change: How Digital Technologies are Leaving Their Mark on Our Brains*. In Greenfield's words,

The human brain will adapt to whatever environment in which it is placed. The cyberworld of the twenty-first century is offering a new type of environment.

Therefore the brain could be changing ... in corresponding new ways. (p. 14)

Is she right? Are we in a position yet to know? And does it matter how soon we can be confident about our conclusion?

That last question is crucial. In the case of tobacco, had the connection between smoking and health risks been definitively established earlier, much human suffering and mortality could have been avoided. With climate change, the question now is whether it's even too late to undo our damage to Mother Earth.

Is the internet really like cigarettes and coal-fired furnaces? Probably not. Early in the book, Greenfield pushes the analogy, though by the end, she tempers her rhetoric, acknowledging that "Unlike the unambiguous agenda set by climate change, *Mind Change* depends on what each of us wants and where we want to go as individuals" (p. 271). That said, like Al Gore's 2006 documentary "An Inconvenient Truth," Greenfield's analogy certainly gets our attention.

The goal of *Mind Change* is to move the general public's thinking about the internet beyond personal opinion by examining a range of arguments concerning how the Net might be changing us. Here is Greenfield's case in a nutshell. Our brain is composed of billions of neurons. The brain becomes a mind – and more specifically, our own mind – by establishing a unique set of neural connections. The internet, or more accurately, the tools available on it and the ways we utilize those tools, have the potential to alter those neural connections. While we tend to think of neural connections as relating to cognitive issues, connections are also formed by how we interact socially and the ways in which our individual psyches function. At stake is whether using the internet is resulting in new – and, in some cases, undesirable – mental connections.

Just as neuroscience is a new discipline whose findings are often up for reinterpretation and calls for more studies, research into the impact of internet technology on people is very much in its infancy. Accordingly, whatever conclusions we come to about how life online changes us, we need to be prepared to re-evaluate when we have more information. (One stark exception is the dangers of using mobile phones while driving, a frightening problem we'll get to.)

Greenfield organizes her argument around three themes: social networking (and its implications for individual identity and social relationships), video gaming (and its consequences for attention, addiction, and aggression), and search engines (and what their use is doing to the way we learn and what we remember). We'll encompass all three domains, but through a different organizational lens.

Cognitive Issues

In 2008, Nicholas Carr wrote the provocatively-entitled “Is Google Making Us Stupid? What the Internet is Doing to Our Brains?” Public reaction was swift (e.g., Cascio, 2009; Pinker, 2010) and sometimes downright nasty. How, critics scoffed, could Carr fail to appreciate the tools that were empowering us with unfettered access to information and social connectivity? Greenfield experienced similar skepticism when she participated in a debate in the UK's House of Lords, of which she is a member. After a discussion about regulation of websites available to children, she was skewered with such headlines in the popular press as “Baroness Says Computers Rot the Brain” (p. xiii).

What does the science say, at least thus far?

The Act of the Search

Today's internet is tailor-made for searching. You can find the current temperature in Genoa, a digitized version of The Book of Kells, an explanation of global warming. Sometimes we use the Net to explore in depth. Yet most often, we surf.

As ever more of human knowledge and experience makes its way online, it's hardly surprising that educators are increasingly taking it as their task to train students how to do sophisticated searching. Google offers classes on "Power Searching," run by Senior Research Scientist Dan Russell (<https://coursebuilder.withgoogle.com/sample/preview>), and a wealth of free pedagogical material for K-12 teachers is available online.

The good news about internet searches is that often you can quickly locate what you're looking for. How accurate that information is, and whether you would have unearthed far more useful finds, given the patience to continue down to the third or fourth screen-load of hits, are issues we won't pursue here.

Part of the bad news is that a quickie search hardly encourages thoughtful consideration of the results. As Greenfield puts it,

The very effort we invest in the journey of discovery, in the time spent ... making connections across networks of neurons, gives ... a significance to what we learn ... Now we are in danger of entering ... an arguably question-poor world where our brains are saturation-bombed with answers (p. 207)

But there is more bad news, this time about what Google and its cousins seem to be doing to our memory and even our beliefs about how much we know.

What Do We Remember?

If we have the internet and powerful search engines, what is the role of human memory? Greenfield reminds us of the important research by Sparrow, Liu, & Wegner (2011) indicating that people seem to have better memory of the search path used to reach a result than of the result itself.

But there is more to understanding this story. Daniel Wegner's theory of transactive memory (1986), upon which Sparrow et al. draw, argues that in normal social experience, we

divide up memory responsibilities: You remember everyone's birthday, and I'll remember where we keep the appliance warranties. Why not make the internet a memory partner?

One reason is that we stop making the effort to remember things (Sparrow & Chapman, 2013; Ward, 2013). A recent study found that 36% of subjects turned to the internet before even trying to remember the information themselves (Kaspersky Lab, 2015). Other research indicates that after doing internet searches, users have inflated beliefs regarding what they know about topics they haven't researched (Fisher et al., 2015).

How Do We Read?

The internet also poses challenges for how and what we read. The issue is not whether we're nostalgic for print books. Rather, it's the challenge of using digital technologies that are designed for quick searching and rapid scrolling when we tackle serious continuous prose. (For a detailed discussion, see Baron, 2015.)

Reading experts talk about "deep reading," meaning a contemplative process involving not just comprehension but "inferential and deductive reasoning, analogical skills, critical analysis, reflection, and insight" (Wolf & Barzillai, 2009). Granted, we don't do this sort of reading all the time, but it's the kind of mindset appropriate for reading Plato or Proust. These days, though, our fast-paced life on the internet engenders what has been called hyper reading, which Katherine Hayles describes as "a strategic response to an information-intensive environment," whereby we "conserve attention by quickly identifying relevant information, so that only relatively few portions of a given text are actually read" (Hayles 2012, p. 12)

The internet is home base for that information-intensive environment.

Hyper reading is the antithesis of deep reading. It's also antithetical to concentration. In my own research on the reading practices of over 400 university students, across five countries, 92% reported it was easiest to concentrate when reading in print. One main reason is that digital reading is very commonly coupled with multitasking.

The Case of Multitasking

For decades, laboratory psychologists have documented that multitasking (more formally known as dual tasking) nearly always leads to diminished performance on each task or

increased time for completion. With the coming of digital technologies that allow us to attend to multiple screens or use the technology (like texting on a mobile phone) when we are doing something else (like driving), concerns about the consequences of multitasking have mushroomed. Contemporary studies are providing initial neurological evidence of what the brain does while attempting to multitask (Loh & Kanai, 2014). (For a current review of the multitasking literature as it applies to child development, see Courage et al., 2015.)

Perhaps the biggest cognitive challenge of multitasking is that many people think they are good at it – but actually aren't. Researchers at Stanford University (Ophir et al., 2009) demonstrated that people who think they are successful multitaskers do worse on standard dual-task experiments than those who are less confident about their multitasking abilities. Similar results were reported by Sanbonmatsu et al., 2013.

An obvious venue where preconceptions about success in multitasking can matter is when students are doing homework. The recent Common Sense Media study (2015) of how tweens and teens are using media illustrates the challenge. Of those teenagers who said they “often” or “sometimes” engaged in the following activities while doing their homework, here is how they viewed the effect of multitasking on the quality of their schoolwork:

- 63% didn't think simultaneously watching TV made a difference
- 64% didn't think simultaneously texting made a difference
- 55% didn't think simultaneously engaging in social networking made a difference

(pp. 82-83). While we don't have grades for these students' assignments, data from college students should give us pause. Research at California State University Dominguez Hills concluded that “studying, doing homework, learning during lectures, learning from other sources, grades, and GPA likely are all negatively affected by concurrent multitasking with technology” (Carrier et al., 2015, p. 64). Work by Junco & Cotton (2012) yielded comparable findings.

If you fail your chemistry course because you were tweeting during lecture, the consequences are essentially yours alone. But if you multitask while driving, someone else (as well as you) might end up maimed or dead.

The literature on multitasking with digital technologies while driving is unequivocal: Don't do it. Some of the most damning evidence comes from car simulator studies by David Strayer (Strayer, 2015). The effects of using your phone while driving mirror those of driving

drunk (Strayer et al., 2006). And no, hands-free devices aren't any safer than hand-held gadgets. Repeated practice with multitasking hasn't resulted in brain changes enabling us to safely talk or text on phones while operating a moving vehicle.

Is there any digital activity in which practice leads to more successful performance, including with multitasking? Maybe video games.

Video Games

Parents bemoan their children spending countless hours playing video games. The concerns include not just time lost from physical activity, reading, or face-to-face social interaction but worries about shortened attention span, transferred aggressive behavior (in the case of violent games), and addiction. In the most recent edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5), "Internet Gaming Disorder" was formally recognized as an emerging diagnosis requiring further study.

On the other side are defenders of video games. Books are appearing with such titles as *Everything Bad is Good for You* (Johnson, 2005) and *What Video Games Have to Teach Us about Learning and Literacy* (Gee, 2007).

Research on gaming is yielding important results. On the issue of violent video games, a meta study by the American Psychological Association (2015) reviewing more than 150 research reports found a correlation between playing violent video games and "aggressive behavior, aggressive cognitions and aggressive affect." However, the APA was unable to establish a definitive correlation between playing such games and subsequent violent activity.

Some of the most interesting research on video games has focused not on violence but on action, that is, games in which players are called upon to undertake challenges and make decisions. Daphne Bavelier and her colleagues (Green & Bavelier, 2015) have documented a variety of cognitive skills that seem to be enhanced by playing action video games. These include visual sensitivity and processing speed. Gong et al. (2015) report that engaging with action video games leads to observable neural changes that are related to attentional and sensorimotor functions.

There is another cognitive domain in which experience playing action video games seems to produce enhanced ability: multitasking. Does that mean that all types of multitasking can be improved through practice? Cardoso-Leite, Green, & Bavelier (2015) suggest probably

not. The literature is clear that practice with media multitasking of the sort tested by Ophir et al. and Sanbonmatsu et al. does not lead to enhanced multitasking skills. By contrast, “action video games ... might prove exceptionally efficient tools to enhance multitasking ability” because “they require players to constantly re-evaluate their current task set in the context of a fast changing environment” (Cardoso-Leite et al. 2015, p. 110).

The reasons for this discrepancy are not yet clear. As research goes forward, it behooves us to think about multitasking behavior in a way analogous to how we now study cancer, recognizing that surface manifestations of a phenomenon may have different etiologies and outcomes.

Social and Psychological Concerns

Use of the internet on digital devices is clearly associated with a number of cognitive outcomes, some of which are worrisome. But outside of a handful of neurological studies, it’s hard to judge whether these technologies are actually “leaving their mark on our brains” (as Greenfield’s subtitle could have it). Equally uncertain (though highly likely) are the effects on our social and psychological lives.

Social Interaction

One central debate concerns whether life online is affecting how we function in social communities. Sociologists such as Barry Wellman and his colleagues (Boase et al., 2006; Wellman et al., 2001) argue that communication via the internet supplements face-to-face interaction with individuals and groups, rather than diminishing these relationships. By contrast, the political scientist Norman Nie maintained that “Internet use at home has a strong negative impact on time spent with friends and family as well as time spent on social activities” (Nie & Hillygus, 2002, p. 1), while sociologist Robert Kraut and his colleagues concluded that “using the Internet predicted better outcomes for extraverts and those with more social support but worse outcomes for introverts and those with less support” (Kraut et al., 2002, p. 49).

Where does truth lie? It’s complicated – and more so these days, with the explosion of social networking sites in recent years.

Social Networking Sites and Their Consequences

As of 2015, there were over 1.5 billion people who used Facebook at least monthly. Whatsapp clocked in at 900 million, Instagram at 400 million, Twitter at over 300 million, Snapchat at 200 million, and Vine at 100 million. That's an incredible amount of social networking. Many of those users are young people. The 2015 Common Sense Media study reported that teenagers in America were averaging two hours a day on these platforms.

What's the problem with social networking? According to Greenfield, lots. One challenge is that in constructing online identities, we build what she calls "the hoped-for, possible self," which is likely "an exaggerated version of the real self" (p. 117), a case of "performance art" (p. 265). Another is that in the process of presenting ourselves online, we veer into narcissism. Traveling these days to tourist destinations, observers are overwhelmed by the number of people toting selfie sticks – and using them. Those selfies then make a rapid march online.

If you're expending effort worrying how you are presenting yourself online, have you energy left to feel empathy for your interlocutor? Greenfield cites evidence that in recent years, there has been a steep drop in empathy levels among US college students (Konrath et al., 2011). She also notes a Pew Research Center report that "U.S. social network users aged twelve to nineteen overwhelmingly choose negative rather than positive adjectives to describe how people act on social networking sites" (Lenhart et al., 2011).

Other observers of the social networking scene go further. An article by Stephen Marche (2012) asked "Is Facebook Making Us Lonely?" Subsequent research (Song et al., 2014) indicates that it's not Facebook causing loneliness but rather that people who are lonely are more likely to use such sites. This finding reminds us of Kraut et al.'s conclusion that internet use benefits socially-comfortable users but not introverts.

A study of young girls aged 8-12 revealed striking relationships between heavy use of media (including online communication, media multitasking, and video) and a range of social measures (Pea et al., 2012). Persistent media activity correlated with lower feelings of social success, lower feelings of normalcy, less sleep, and more friends their parents felt were a negative influence. By contrast, one factor correlated with the opposite effects: face-to-face conversation. The more these girls reported talking face-to-face, the better the social outcomes.

The Art of Conversation

Sherry Turkle (2015) is one of an increasing number of voices asking whether online communication can – or should – replace physical, face-to-face interaction. Another example is the *New York Times* op-ed written by John Spencer (2015), a major in the United States Army. Spencer compares the social cohesion among his troops that he experienced in Baghdad in 2008 with what he had witnessed in Iraq in 2003. The difference: By 2008, after a day on patrol, soldiers were sitting around posting on Myspace and Facebook. In 2003, contact with the outside world was much sparser, and time spent together more intense. As a military commander, Spencer argues for

the importance of conversation during noncombat time – the hours of nothingness, the shared boredom – where bonds of trust, friendship and group identify are built.... The more connected soldiers are to the outside world, the more individual and separated they become. And that will not help us win future wars.

You don't have to be a hawk for the import of Spencer's message to resonate.

Why Assessing the Impact of the Internet Matters

Undoubtedly, digital technologies connected through the internet are reshaping our behavior patterns. Are these new ways of functioning literally changing our brains? A growing stream of data is suggesting places in which the answer is “yes.” But unless we are lab scientists, most of us are far more concerned with how the technologies may be altering the tangible ways in which we think, learn, interact with one another, and forge a sense of self.

Start with cognitive issues. However wonderful the internet is as a source of information, it's reasonable to be concerned that it reduces our motivation to acquire new knowledge that dwells in our heads. Playing action video games shows correlations with a cluster of useful cognitive skills, but we still haven't sorted out other potential consequences of long hours spent gaming, including playing violent games (many of which are “action games”). When it comes to reading, it's too soon to argue definitively whether deep reading can happen as easily on a digital screen as in hard copy, though self-reports on difficulty

concentrating while reading digitally should give us pause. The place it's not premature to pass judgment concerns using mobile phones while driving. To repeat: Don't.

Social/psychological effects of using the internet, especially for online social networking, are also complex to assess. Evidence thus far suggests that people comfortable in their own skin, who have a cadre of real friends, and who engage in face-to-face conversation with ease are benefitting from internet use. Those on the other end of the social/psychological spectrum are more likely to find that retreating to virtual communication produces negative outcomes.

As human beings, we are wired to make connections. The connections we lay down in our brains form our individual minds. We connect with data and information that we discover. We connect with each other, and we connect with ourselves.

The linkages we make impact not just us as individuals but those around us. Parents and teachers need strategies to educate a generation that increasingly believes all relevant knowledge resides online. As social beings, we need to figure out how to build viable communities and confident psyches when so much of our interaction is virtual.

Digital technologies are leaving their mark on more than our brains.

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