

Cerebral circuitry

By April Dembosky

Researchers are focusing on whether gadgets are changing how our brains work as regards empathy and human interaction



I am flying. No plane, no wings, just me soaring over rooftops with a mild flip in my belly as I dip closer to the grid of city streets. I lean to the right to curve past a skyscraper, then speed up and tilt left to skirt by a tree. There has been an earthquake and I am looking for a lost child who is diabetic and needs insulin. This is not a dream. I am awake, wearing my normal clothes – no cape or leotard – standing squarely on both feet in a room of the virtual reality laboratory at Stanford University.

About 70 test subjects have done the same simulation, half of them flying in a virtual helicopter, the other half granted the virtual superpower of flight. Half from each group have a mission: find and save the lost child.

After the simulation, head gear returned to a hook on the wall, a researcher reaches for her clipboard to ask a few questions. She accidentally knocks over a tin of pens. In sociology studies, this is a classic trick for measuring altruistic intent. The test subjects who flew Superman-style rushed to help clean up the spill. They responded four seconds faster and picked up two more pens on average than the helicopter passengers.

“If you are flying, you feel very powerful, so the sense of having power made people more generous, more altruistic,” says Robin Rosenberg, a clinical psychologist in San Francisco who helped design the study, accepted for publication in the e-journal Plos One. “It could also be that the desire to be helpful was directly related to conscious or unconscious associations to Superman,” she adds.

Many new technologies begin with such virtuous goals of making the world a better place and its citizens better people. But many come with hidden costs that take time to surface. Now that mainstream internet sites such as Google, [Facebook](#) and [Amazon](#) are all in close reach with a few touches of the smartphone in your pocket, the human side-effects of being constantly connected are starting to emerge.

There is growing concern that our emotional and empathetic pathways are being eroded by all the screen time. We spend so much time on our computers and gadgets that we are starting to think like them. Brain circuits are being rewired to accommodate these tools of modern life. We process more bits and bytes of information, and we are quite fast at it. But there could be a trade-off – our motivations to act like Superman are diminishing.

“We have been designing a paradise for people with Asperger’s syndrome,” says Jaron Lanier, a prominent Silicon Valley technologist and author of *You Are Not A Gadget*. “I don’t think we’re making ourselves stupid or inferior, but I do think we’re making ourselves more narrow.”

Online culture, and social networks in particular, are oriented toward outer lives, rather than inner lives, he says. It favours objective, quantitative thoughts over subjective, qualitative feelings.

Today's dominant internet programs reflect the analytic minds of the engineers who built them and fail to capture the humanistic elements of everyday life, he says. As a result, technology is reducing the range of cognitive styles, similar to monocropping in agriculture, where the cultivation of one massive crop of wheat on the same land year after year reduces the diversity of soil nutrients and results in less resilient plants.

“We're creating a mono brain,” Mr Lanier says. “We are losing a little bit of empathy for other people's internal lives. We're substituting ethics for empathy in more and more situations. In other words, we have logical reasons for being nice to each other rather than emotional reasons.”

The question of what technology is doing to our cognitive learning patterns has been the subject of many hypotheses and some studies.

The ability to search and find information via a few keystrokes on [Google](#), for example, is affecting our memory. Knowing that the name of an actor or piece of second world war trivia can be pulled up in seconds by Googling it, our ability to recall actual facts is diminished. In a series of four experiments, published in the journal *Science* in 2011, researchers found that people have come to rely on the internet as an external memory. We are less good at remembering information, but we have become better at knowing where and how to find it. We have outsourced our memory to the internet.

Similarly, some Chinese students now struggle to write characters by hand because of predictive spelling on computers that completes the character after a few strokes.

Our ability to pay attention and focus is also being taxed. Most studies show the human brain is not equipped to handle multiple streams of information at once. But we sit for many hours in front of multiple screens, flitting back and forth between various windows. A 2009 study published in the *Proceedings of the National Academy of Sciences* found that people who had become practised at “chronic media multitasking” were worse at filtering out irrelevant distractions and at switching between tasks than people who spent less time on gadgets.

Various experts argue these changes are marginal rather than fundamental. In fact, technology use could be making us more intelligent.

Mike Anderson, a professor of psychology and cognitive science at Franklin & Marshall College in Pennsylvania says the brain has been adapting to new tools for learning since before it was even fully human. New neural patterns emerged when people began speaking, writing and doing mathematics. Operating computers is just the next evolution.

“There’s nothing markedly different from iPads or iPhones and a pen and paper,” he says. “A truly radical technology that our brains couldn’t handle wouldn’t get picked up.”

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Dopamine jolt behind internet addiction

A 24-year-old woman arrives at the psychiatric clinic of the University of Athens school of medicine in Greece. Her symptoms: mild anxiety, sleep disturbance and a loss of interest in hobbies. Instead, she spends five hours a day on Facebook. She was even fired from her job as a waitress because she compulsively left her post to go to an internet café. Her diagnosis: social media addiction.

For lots of people – as many as a quarter of youngsters in one Polish study – internet use has grown to the point where they cannot stop themselves from obsessively emailing, advancing to the next level of a *FarmVille* game or trawling for shoe deals on eBay. Researchers have outlined five different types of internet addiction: computer games, gambling and shopping, pornography, web surfing and online relationships.

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Ultimately, no one has figured out exactly how the brain works. So even with MRI scans that show different parts of the brain lighting up when people text or do a Google search, it is difficult to draw conclusions about what that means, or whether the neural activity is good or bad.

Emotional learning is even less understood. Investigations into the impact technology might have on less tangible, quantifiable things such as emotional development, interpersonal interactions and moral decision making are rare to none.

Whatever is happening to our neural pathways, a categorical shift in behaviour is evident from the mere hours people spend accessing information and communicating with others through flat liquid crystal display screens.

At the Keating House, a bed and breakfast establishment in San Diego, California, hotelier Ben Baltic remembers one guest who came to him in a frenzy and thrust the battery of her husband's BlackBerry at him. "Hide this!" she told him. Mr Baltic tucked it behind a clock during the couple's vacation until the man sheepishly asked for it back the day they left.

Couples are indeed struggling to pull each other away from their devices to spend quality time together on a regular basis. Young people, in particular, have come to prefer communicating electronically over face-to-face interactions.

A Stanford study found that university students prefer to text a classmate down the hall in their dormitory rather than knock on their door and talk in person, because texting is "less risky" and "less awkward".

Psychologists worry that this avoidance causes young people to miss the emotional training that comes from reading facial expressions and navigating social ambiguity.

Empathy is learnt over time and many studies show that older people in general are more empathetic than younger people and better at modulating their own emotional responses.

"One concern with all this tech time is that there are missed opportunities in neural development for a young person that could be problematic later," says Gary Small, professor of psychiatry and biobehavioural sciences at UCLA school of medicine.

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Matt Langione lies on his back in an MRI machine, reading a copy of Jane Austen's *Mansfield Park*. Neuroscientists in Stanford's imaging laboratory are comparing the patterns in his brain when he skims the pages leisurely, and when he concentrates hard on the literary form. The technicians are surprised by what they find. The areas of the brain that light up during close reading are not just those associated with attention, but also those involved in movement and touch. It is as if readers physically place themselves in the story when they analyse it more carefully.

It is precisely this type of reading that Naomi Baron, a professor of linguistics at American University in Washington, says is being lost as people read more on internet-enabled devices.

“There are so many interruptions,” she says. “There are things we lose when reading is done on screens: focus and contemplation, sitting back and thinking.” That could mean the more people read superficially, the less they put themselves in other people’s shoes. The internet has increasingly become our eyes and ears. It has given us access to information from around the world, even live tweets from Egyptian protesters. But there is much it does not capture. [Social media are not communicating the full range](#) of fear, exhilaration and compassion that come from encountering a place or person first hand.

The trouble is, when we do not know the context behind something, we project it ourselves, says Lisa Feldman Barrett, director of the Interdisciplinary Affective Science Laboratory at Northeastern University. “Our brains do that automatically,” she says. “When information is stripped away, we add it back. We fill in the information when it’s not there.”

So the danger is that we assume we have been able to identify fully with the [Egyptian tweet](#) on a first read when we actually understand virtually nothing of its real context.

Proponents of virtual reality believe a new technology can help repair these problems. The ability of virtual reality to elicit empathetic responses in individuals has been proven so many times, it is now used to train people out of stereotypes and prejudices.

Ms Rosenberg imagines schools using it for anti-bullying programmes. Jeremy Bailenson, the director of the Stanford laboratory, envisages corporations using virtual reality for diversity training. The US military commissioned him to draft a training programme for US soldiers going to Iraq, teaching them to have more compassion for Iraqis.

But as more industries imagine how to tweak the technology to their own commercial interests, researchers worry it could become even more compulsive. Mr Bailenson imagines video games even more immersive than [World of Warcraft](#), which can keep many young men plastered to their computers for 20 hours a week.

“Once gaming really feels like Vegas, if we’re addicted now, how’s it going to be when you get all those other perks?” he says.