MEDIA MONITORS
INCISIVE INSIGHT

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# The Brain's New World

## Not only is technology changing our lives, it may also be changing our neural pathways, writes Dr Michael Nagel.

Many people today overlook the fact that advances in technology and the birth of the information age are relatively new in the greater scheme of human history. Indeed, the television has been around for only about 70 years, the desktop computer has been in widespread use only since the mid-1980s and the internet emerged just prior to the turn of the century. The rapid advance of technology in the last two decades has resulted in machines and procedures that were only the ideas of science-fiction writers in the 1950s. Our way of life has been vastly altered.

And new areas of neuroscientific research suggest that not only is technology changing our lives, it may also be changing our brains.

Digital natives, or young people born into a world of Nintendo, laptop computers, blogging, text messaging, twittering and virtual reality, spend a great deal of time each day involved with technology. Where adults once spoke of time in relation to hours and days, the digital generation is focusing on nanoseconds. How frustrated they become when the World Wide Web is slower than usual or when they do not get an immediate response to their text message or email. Part of the reason for this may be found in the grey matter of their brains, which we now know changes in response to the environment. Neuroscientists have identified not only that the brain has a developmental timeline, but that it is also very 'plastic' and shapes itself in response to the world around it.

Within the brains of humans, continuous interactions and chemical communications occur between cells called neurons. Neurons look like long fibres with finger-like projections at both ends, with one end serving as a group of antennae and the other end as a group of transmitters. Neurons do not physically touch each other, but communicate through an electro-chemical impulse referred to as a synapse. This communication process begins roughly three weeks after conception and results in creating the overall neurocircuitry of the brain. Most of this complex work is done through the first few years of life and then it plateaus until adolescence kicks in, resulting in a major restructuring of the brain's architecture. It is when we are in our twenties that our brains come to full maturation. However, while the majority of the hard wiring is in place before we turn 30, the brain is flexible enough for new neural pathways to be laid down throughout our lives in response to new or novel experiences.

These neural pathways comprise many tens of thousands of interconnected neurons and while the physical alignment of neurons is determined genetically, the connections between them are malleable and responsive to environmental stimuli. The brain changes every day, but the strength of the neural connections is determined through experience and repetition. This then begs the question of what happens when the brain changes its organisation to accommodate a world of stimulation, where technology and high-speed communication and media are in abundance? A growing number of neuroscientists and researchers believe that

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the answer to that question lies in the observable behaviour of digital natives. Let's take the act of doing homework as an example.

Today, an average young person can be seen doing homework with an earphone for their iPod in one ear and an earphone for their mobile phone in the other. On their desk they have a computer and on the computer monitor can be one or any number of screens, which might include the internet, an email account and a chat room running simultaneously. Multi-tasking is easily observable in today's students as they navigate their way through this homework environment while deftly shifting focus from one attention-seeking device to another. World-renowned neurologist and neuropsychiatrist Dr Richard Restak believes that it is this type of attention switching that may be a contributing factor to the behavioural conditions known as ADD and/or ADHD.

Attention deficit disorder (ADD) and attention deficit hyperactivity disorder (ADHD) have, arguably, been around for quite some time, but have only been readily diagnosed as some form of behavioural disorder since the mid to late 1970s. There is a great deal of debate surrounding many aspects of ADD/ADHD, especially in terms of over-diagnosis and medication, which goes beyond the focus of this article. However, there is also widespread agreement that while instances of ADD/ADHD are inherited, many cases of this condition occur in both children and adults without any hereditary disposition, suggesting the probability that ADD/ADHD is also a product of our culture and environment. Considering that the vast majority of people diagnosed with ADD/ADHD live in modern, Western society, the technological link to such behaviour is also becoming increasingly evident. The principal argument here is that many conditions that were formerly labelled as hyperactivity, impulsivity and easy distractibility are becoming the norm and have their roots in the demands being put on the attention centres of the brain while it is developing. The constant shifting of attention required to watch contemporary television programs, to manoeuvre from one mode of communication to another and to effectively use the internet and other cyber environments might indicate that ADD and

suggested that technology may be changing the way we interact with each other. Small argued that when we spend a disproportionate amount of time in a technological environment rather than with other people, the brain's ability to perform fundamental social skills, such as reading facial expressions during conversations, is hampered. Over time, the neurocircuitry involved in such important social skills becomes weaker which, in turn, may lead to changes in behaviour, such as social awkwardness, isolation and diminished interest in the social dynamics of classroom learning. Consequently, Small argues that it will become increasingly important to help digital natives improve their social skills, given that any notion of limiting the pervasive impact of technology is misguided and unrealistic.

This brave new world will also require digital immigrants – those who did not develop their full range of neuro-architecture during the advent of modern-day technology – to improve their technology skills to ensure that they are better able to understand their children's worlds and be in a better position to communicate with them.

The types of behaviour we are starting to see more frequently, and have conveniently diagnosed as a form of disorder based on past behavioural expectations, may in fact be an evolutionary stage. This suggests that we must not be too quick to judge behaviours as negative personality traits, and must also think carefully about how we engage with children in home and school environments.

> ADHD are in fact culturally distinctive types of brain organisation. If this is the case, then parents and educators will have to carefully consider what the future might hold in terms of raising and educating children.

Late last year, the findings of research conducted by Dr Gary Small and colleagues at UCLA (University of California, Los Angeles)

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A student who is well connected to the world around them and capable of shifting attention quickly and proficiently will, in all likelihood, find a traditional classroom a very difficult environment in which to succeed. This is already being played out in many classrooms by students who are bored and disengaged from learning and as a result end up with 'behavioural' problems. And while there are examples of teachers and schools working to alleviate this tension, it may be time for a collective rethink of what might constitute 21st-century learning environments.

We are only just beginning to understand what may be happening inside the brains of young people and therefore we cannot assume that the changes that may be occurring are always negative. Some of the skills that young people now possess will serve them well in the future.

As we learn more about the likely impact of technology on the brains of our children, our human interactions need to temper these technological interactions and help to ensure that our children do not become technology's captives. ■

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