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EDITORIAL

Blogs, Google and Cognitive Decline

The physicist John Archibald Wheeler is reported to have remarked that 'the only reason universities have students is to educate the professors'. He counted amongst his students Richard Feynman. As a long time professor, I have had the good fortune of being educated by generations of students; each group reflecting changing times. When research students leave, after years of apprenticeship under a mentor, there are mixed feelings; an undoubted sense of relief on both sides, that a long drawn out battle to produce a Ph D thesis has been won, superimposed on a sense of sadness and apprehension that the bird must, inevitably, leave the nest. Parting gifts given by grateful students are treasured by mentors and I have received my share. Boxes of sweets, carefully wrapped, provide both cheer and nutrition. More recently, as I have aged, I have noticed that students (and colleagues) give me books, undoubtedly suggesting that the mind too needs nutrition. The nature of the books that are gifted sometimes is a clear sign of the times. In quick succession, I have been presented with books that are an emphatic reminder that we live in the age of information, imprisoned by the world wide web and the internet. A student, who still hoped to evoke a latent entrepreneurial spirit in me, gave me a book describing the phenomenal rise of *Google* (*The Google Story*, David A. Wise, Pan Books, London, 2005). Having been captivated by the *Google* logo for the past few years and having read popular accounts of the fairy tale story of Sergey Brin and Larry Page, *Google's* founders, I did not believe that the book would grip my attention. I set it aside. A few days ago, another departing student gave me a book with an eye catching title, '*blog!*'. The absence of capital letters and the exclamation mark in the title were all signs of a new age. While presenting me with the book my student added, for good measure, that it was time that I learnt to blog. Her message was simple and direct; the student attempting to educate the professor. Anyone with pretensions to writing for a general readership, she felt, would be well advised to blog, in the hope of attracting the increasing number of people who seem to flit from site to site on the internet. Laptops, palmtops and 'smart phones' now allow, those who rush about ceaselessly, to exercise their fingers, while they surf through cyberspace. The book she left me

proclaims to describe 'how the newest media revolution is changing politics, business, and culture' (*blog!*, David Kline and Dan Burstein, CDS Books, New York, 2005). I have only skimmed, superficially, through the book but it is clear that the 'on-line' world has transformed dramatically in the half-a-dozen years since its publication. Facebook, Twitter and YouTube are terms I hear frequently. 'Blog', I learnt, topped the US Dictionary Words of the Year in 2004 making me feel quite dated, having begun to visit a few sites only three years ago. In reading the first few pages of *blog!*, I was reminded of Charles Dodgson's (more famous as Lewis Carrol) characterization of man, 'as an animal that writes letters'. Kline and Burstein list a number of qualities that mark us as human and add: 'But there is another distinguishing characteristic of human beings that has been unknown or underestimated till recently: We blog.' Blogs and the new social media are transforming global communication and impacting not only politics and culture, but also science and scientific journals in a manner that must leave senior citizens (and I count myself among them) bemused.

The book on *Google's* short and spectacular history begins by proclaiming: 'Not since Gutenberg invented the modern printing press more than 500 years ago, making books and scientific tomes affordable and widely available to the masses, has any new invention empowered individuals and transformed access to information as profoundly as *Google*.' Interestingly, the words 'blog' and 'google' both appeared in 1997; both are used today as nouns and verbs. It is hard to imagine searching for information before *Google* entered our lives. The days of hunting through stacks of dusty and disorganized piles of printed journals, scouring indices in large, heavy, bound back volumes are fading rapidly from memory. A new generation of students has arrived, for whom the printed journal is almost as distant as the dinosaur. Few realize that searching the internet may require some skill, a little patience and significant foreknowledge, especially in wading through the literature of science. Typing in a few ill chosen keywords or search terms into *Google* can result in an outpouring of irrelevant 'hits'; their numbers large enough to convince novices that the literature they seek is before them. In the hands of those who are

experienced, *Google* can be a weapon of great power, enabling information to be accessed in comfort. 'Googling' can be an addictive pastime; like all addictions those who have succumbed may have to pay a price.

In 2008, Nicholas Carr wrote a provocative piece in *The Atlantic* (2008, 302, 56) asking the question: 'Is Google making us stupid?' I found Carr's thesis, on 'what the internet is doing to our brains', strangely disturbing. He begins, recalling a scene from Stanley Kubrick's *2001: A Space Odyssey*, where the supercomputer HAL laments '... my Mind is going... I can feel it, I can feel it,' even as its memory circuits are disconnected. Carr notes that 'over the past few years, I've had an uncomfortable sense that someone or something has been tinkering with my brain, remapping the neural circuitry, reprogramming the memory'. He observes that reading books and lengthy articles has become difficult. In words that must undoubtedly strike a chord, in those for whom reading was a hobby in the pre-internet era, he says: 'Now my concentration often starts to drift after two or three pages. I get fidgety, lose the thread, begin looking for something else to do. I feel as if I'm always dragging my wayward brain back to the text. The deep reading that used to come naturally has become a struggle.' Have Google and the internet already begun to mold our brains? Is the plasticity, that is so often discussed by neuroscientists, making our brains respond to the new and all pervasive technologies in a manner that could hardly have been anticipated? A study just published online in *Science* seems to suggest that the ways we handle information are already beginning to show the imprint of the new age. In a report entitled *Google effects on memory: Cognitive consequences of having information at our fingertips*, Betsy Sparrow, Jenny Liu and Daniel Wegner demonstrate that the knowledge that information can be found is indeed resulting in an impairment of the ability to 'remember' the information (*Scienceexpress*, 14 July 2011). A news analysis notes that the study by Sparrow *et al.* was based on the old concept of 'transactive memory'; a term used to describe the ability of groups of people to 'divide the labour of remembering certain types of shared information' (Bohannon, J., *Science*, 2011, 333, 277). Sparrow *et al.* use a set of cleverly designed experiments to test the ability of large groups of student volunteers to memorise information, when they can access Google to search instead. Using four sets of experiments they suggest 'that when faced with difficult questions people are primed to think about computers and that when people expect to have future access to information, they have lower rates of recall of the information itself and enhanced recall instead of where to access it'. They conclude that the internet and the search engines have together 'become a primary transactive memory source'. They also observe that 'we are becoming symbiotic with our computer tools, growing into interconnected systems

that remember less by knowing information than by knowing where the information can be found'.

If Google is making us more forgetful, are blogs affecting the way science is discussed? The book by Kline and Burstein makes no reference to science. Some years ago science journals had already begun to notice blogs. A survey that trawled 46.7 million blogs and ranked them (in the manner that search engines do) found only five, by scientists writing about science, that made it into the top 3500. The topmost science blog came in at 179, a site maintained by a biologist and named *Pharyngula*, in the style unique to blogs and bloggers. The other four sites trailed far behind, testimony to the limited drawing power of science in cyberspace (Butler, D., *Nature*, 2006, 442, 9). The intrusion of the brave new world of blogs into the traditional methods of disseminating science has been dramatically illustrated by the episode of the 'arsenic-eating bacteria'. Even as the paper went on-line in *Science*, a NASA press conference had triggered a burst of attention. The first sceptical comments on a blog appeared within a couple of days, catalysing an outpouring of critical analysis. The paper's appearance in print was delayed to accommodate simultaneous publication of as many as eight technical comments, all of which cast doubts on the major premise of the paper, that bacteria may conceivably adapt themselves to using arsenic instead of phosphorus; the latter element being central to the biochemistry of life (*Science*, June 3, 2011). Two blogs on the *Scientific American* site (June 16, 2011) summarize the saga. In a posting titled *From the Shadows to the Spotlight to the Dustbin – the Rise and Fall of GFAJ-1*, Rosie Redfield details the overwhelming case against the original paper. In the post, *Arsenic-Eating Bacteria Have Changed Science Education*, Marie-Claire Shanahan addresses 'the changing nature of scientific critique', which appears to be moving 'from the private world of science to the public world of blogs, twitter and online news'. She adds that 'it will be essential for students as future citizens to be able to navigate these media astutely'. I suspect that it may be necessary also for present-day professors to develop some understanding of the rapidly changing face of science communication.

In reflecting on the profound impact of computers and the internet, I am drawn again to Carr's essay, which conveys a sense of bleakness. He turns to the world of *2001* where 'people have become so machinelike that the most human character turns out to be a machine'. For Carr there is a darkly prophetic message in Kubrick's film: '...as we come to rely on computers to mediate our understanding of the world, it is our own intelligence that flattens into artificial intelligence'. It would be one of the great ironies of the age of technology if the growing power of computers fosters collective cognitive decline.

P. Balam