

## THE GLOBE AND MAIL

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### Information-rich and attention-poor

By Peter Nicholson  
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*Coping with the troubling tradeoff between depth of what we know and how fast we retrieve it may require something like peripheral intellectual vision*

Twenty-eight years ago, psychologist and computer scientist Herbert Simon observed that the most fundamental consequence of the superabundance of information created by the digital revolution was a corresponding scarcity of attention. In becoming information-rich, we have become attention-poor.

The three technologies that have powered the information revolution - computation, data transmission and data storage - have each increased in capability (and declined in cost per unit of capability) by about 10 million times since the early 1960s. It is as if a house that cost half a million dollars in 1964 could be bought today for a nickel, or if life expectancy had been reduced from 75 years to four minutes.

This has unleashed a torrential abundance of data and information. But economics teaches that the counterpart of every new abundance is a new scarcity - in this case, the scarcity of human time and attention. The cost of one's time (approximated, for example, by the average wage) relative to the cost of data manipulation, transmission and storage has increased roughly 10-million-fold in just over two generations - a change in relative "prices" utterly without precedent. This, above all, is what is driving the evolution of online behaviour and culture, with profound implications for the production and consumption of knowledge. The primary consequence is the growing emphasis on speed at the expense of depth.

Behaviour inevitably adapts to conserve the scarce resource - in this case, attention and time - and to "waste" the abundant resource. Thus, for example, much of the new technology's capability has been spent on simplifying interfaces and reducing communications latencies essentially to zero; both of these conserve precious time for users. The same motive has also spawned a plethora of indexing and searching schemes, of which Google is the chief example. These are all seeking to be attention-optimizers.

Today's information technology is nowhere near its theoretical physical limits, though many engineering and cost hurdles may slow development after 2015. Nanotechnologies and quantum phenomena nevertheless promise to support a new growth path for decades to come. For example, a recently announced storage technology using carbon nanotubes may allow digital information to be held without degradation for a billion years or more - an innovation that would eliminate the major shortcoming of the digital archive.

We may think metaphorically of the production of knowledge as a function of "information" and "attention," with attention understood as the set of activities by which information is ultimately transformed into various forms of knowledge. By virtue of its unprecedented impact on the relative prices of information and human attention, information technology is driving a correspondingly profound transformation of knowledge production, the main feature of which is a shift of emphasis from "depth" to "speed." This is simply because depth and nuance require time and attention to absorb. So as attention has become the dominant scarcity, depth has become less "affordable."

Moreover, with information so abundant, strategies are needed to process it more quickly, lest something of vital interest or importance is missed.

## THE 24-HOUR KNOWLEDGE CYCLE

Knowledge is evolving from a "stock" to a "flow." Stock and flow - for example, wealth and income - are concepts familiar to accountants and economists. A stock of knowledge may be thought of as a quasi-permanent repository - such as a book or an entire library - whereas the flow is the process of developing the knowledge. The old Encyclopedia Britannica was quintessentially a stock; Wikipedia is the paradigmatic example of flow. Obviously, a stock of knowledge is rarely permanent; it depreciates like any other form of capital. But electronic information technology is profoundly changing the rate of depreciation. By analogy with the 24-hour news cycle (which was an early consequence of the growing abundance of video bandwidth as cable television replaced scarce over-the-air frequencies), there is now the equivalent of a 24-hour knowledge cycle - "late-breaking knowledge," as it were. Knowledge is becoming more like a river than a lake, more and more dominated by the flow than by the stock. What is driving this?

Most obvious is the fact that the media by which electronic information is presented and manipulated permit it to be changed continuously and almost at no cost. Information products are therefore constantly evolving, for the simple reason that, faced with the option, who would not choose an updated over an outdated version? By the time information products eventually come to rest, they are very likely to be considered obsolete. In the cutthroat competition for attention, they are no longer "news."

Consequently, there is little time to think and reflect as the flow moves on. This has a subtle and pernicious implication for the production of knowledge. When the effective shelf-life of a document (or any information product) shrinks, fewer resources will be invested in its creation. This is because the period during which the product is likely to be read or referred to is too short to repay a large allocation of scarce time and skill in its production. As a result, the "market" for depth is narrowing.

There is also under way a shift of intellectual authority from producers of depth - the traditional "expert" - to the broader public. This is nowhere more tellingly illustrated than by Wikipedia, which has roughly 300,000 volunteer contributors every month. The upshot is that thousands of heads working in parallel are, in an environment of information superabundance, presumably better than one, even if that one is an expert.

What makes the mobilization of "crowd wisdom" intellectually powerful is that the technology of the Web makes it so easy for even amateurs to access a growing fraction of the corpus of human knowledge. But while hundreds of thousands of Web-empowered volunteers are able to very efficiently dedicate small slices of their discretionary time, the traditional experts - professors, journalists, authors and filmmakers - need to be compensated for their effort, since expertise is what they have to sell. Unfortunately for them, this has become a much harder sell because the ethic of "free" rules the economics of so much Web content. Moreover, the value of traditional expert authority is itself being diluted by the new incentive structure created by information technology that militates against what is deep and nuanced in favour of what is fast and stripped-down.

The result is the growing disintermediation of experts and gatekeepers of virtually all kinds. The irony is that experts have been the source of most of the nuggets of knowledge that the crowd now draws upon in rather parasitic fashion - for example, news and political bloggers depend heavily on a relatively small number of sources of professional journalism, just as many Wikipedia articles assimilate prior scholarship. The system works because it is able to mine intellectual capital. This suggests that today's "cult of the amateur" will ultimately be self-limiting and will require continuous fresh infusions of more traditional forms of expert knowledge.

With almost all of the world's codified knowledge at your fingertips, why should you spend increasingly scarce attention loading up your own mind just in case you may some day need this particular fact or concept? Far better, one might argue, to access efficiently what you need, when you need it. This depends, of course, on building up a sufficient internalized structure of concepts to be able to link with the online store of knowledge. How to teach this is perhaps the greatest challenge and opportunity facing educators in the 21st century.

For now, the just-in-time approach seems to be narrowing peripheral intellectual vision and thus reducing the serendipity that has been the source of most radical innovation. What is apparently being eroded is the deep, integrative mode of knowledge generation that can come only from the "10,000 hours" of individual intellectual focus - a process that mysteriously gives rise to the insights that occur, often quite suddenly, to the well-prepared mind. We

appear to be seeing fewer of the great synthetic innovations associated with names like Newton, Einstein or Watson and Crick.

## THE AGE OF DIGITAL NATIVES

So we decry the increasing compartmentalization of knowledge - knowing more and more about less and less - while awaiting the great syntheses that some day may be achieved by millions of linked minds, all with fingertip access to the world's codified knowledge but with a globe-spanning spectrum of different perspectives. The hyperlinked and socially networked structure of the Internet may be making the metaphor of the Web as global "cyber-nervous system" into a reality - still primitive, but with potential for a far more integrated collective intelligence than we can imagine today.

Those of us who are still skeptical might recall that Plato, in the *Phaedrus*, suggested that writing would "create forgetfulness in the minds of those who learn to use it." This is a striking example of a particular kind of generation gap in which masters of an established paradigm can only see the shortcomings, and not the potential, of the truly novel. Today, the electronic screen, with its lack of linear constraint, its ephemeral scintilla and its hyperlinked multimedia content, portends a very different paradigm. How this may condition the habits of thought of the so-called "digital natives" - who, after all, are about to become both the custodians and creators of human knowledge - is one of the deepest and most significant questions facing our species. The challenge is to adapt, and then to evolve, in a world where there continues to be an exponential increase in the supply of information relative to the supply of human attention.

*Peter Nicholson is president of the Council of Canadian Academies*

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