The Brain and e-Information:
Lessons from Popular Neuroscience

Paul Sturges

r.p.sturges@lboro.ac.uk
Loughborough University, Department of Information Science, UK.

Curriculum Vitae

Paul Sturges has 40 years experience as a researcher, writer (over 150 publications) and speaker (in over 60 countries) on an eclectic range of topics, clustering around freedom of expression. He was Chair of IFLA's FAIFE Committee 2003-9 and received the UK honour OBE in 2010 and the IFLA Medal in 2011.

Abstract

Modern neuroscience suggests that we are much more dependent than we realise on information, ideas and sensations that are acquired and processed by areas of the brain not always immediately accessible to the conscious mind. Consequently the intuitive aspects of e-information and e-learning can offer a better fit for human need than the comparative rigidities of text-based learning. Important insights from the recent wealth of popular books on neuroscience will be offered to suggest arguments on how normal brain function relates to the modes and structures of e-information. The connection with ideas such as the concept of 'flow', and the so-called 'passive information seeking' in models of information seeking will be tentatively explored.

Introduction

Information science has been brainless for much too long. That is to say, in writings on information theory and the theory of information seeking in particular, no role has been offered for the brain as a functioning body organ. (Wilson, 2000) The 'mind' of an incompletely articulated 'self' has sought and received information acquired in positively structured ways that, on reflection, bear little resemblance to the hunches and inspirations of real life engagement with information, or indeed its confusions and compromises. The information scientist's notional information seeker has moved in a conscious way from the first imprecise perception of an information need, through to the need's definition and refinement, its transformation into search terms that can be used to address information resources and the obtaining of an appropriate response when they are so addressed. In defence of information science, neuroscience's knowledge of the brain has until recently been comparatively incomplete and not especially helpful to the layperson. That has changed. There is now a positive outpouring of books, journalism and broadcasts that popularises neuroscience's findings, some of which has been consulted for this paper. The clearer knowledge of the brain and its workings that the literature offers challenges the paradigms of a host of human-centred disciplines. Theology, psychology, pedagogy, computer science and, of course, information science are all obliged to respond to the findings of neuroscience and generally to concede that their assumptions about human beings have been imperfect guesswork.

If we ask why there has been this change, the answer is solidly based in the technology available to the scientist. In the past, it was only possible to derive an understanding of the brain using a limited range of approaches. Medical ethics generally rules out intrusive investigation and experimentation with the brains of living human subjects. Dissection of the brains of dead subjects established the basic shape and structure of the tissue, and a great deal has been learned by inference from the experience of people who have suffered brain and other neurological injuries. What has made the difference is the availability of a range of sophisticated scanning techniques. (Winston, 2003, pp.41-7) In the first half of the twentieth century ways of measuring blood flow and electrical charge in the brain began to be developed. From the former, the technique known as Positron Emission Tomography (PET scanning) was developed to provide three dimensional images of the brain at work. Since then, Magnetic Resonance Imaging (MRI) and functional MRI (fMRI) have been developed to provide images of even greater clarity. Now Magnetoencephalography (MEG) can read very small traces of magnetic activity during periods of thousandths of a second. Today, the activity of a single neuron can be monitored, as can many neurons working together. Previous vagueness about what actually happens in the brain is being dispersed.

What does Neuroscience tell us?

First of all, we should accept that although knowledge and ideas are abundant in neuroscience, the discipline probably still lacks a ‘big theory’. (Ramachandran and Blakeslee, 1999, preface). To summarise even part of the universe of ideas within which neuroscientists are working would take very much more than the few paragraphs available. We will merely try to indicate a theme which leads towards some ideas on human interaction with information. First, neuroscientists now know a great deal about the functions that various parts of the brain perform and how they interact with each other. The two halves of the brain each include the occipital lobe (which handles visual processing); temporal lobe (language and sound processing); parietal lobe (perceptions of space); frontal lobe (thought and planning); there are the structures of the limbic system which are regarded as the seat of the emotions; there is the hippocampus which is involved in the storage and retrieval of memories; and there is the cerebellum, at the back of the brain, that is increasingly seen as the seat of various aspects of cognition, including language and reading. Elements serving cognition and consciousness are in all of these and other parts of the brain.

Yet the more we learn about the brain the less obvious it becomes where, if anywhere, consciousness is seated and its significance in relation to a host of automatic functions that the brain is found to be performing. In the first place, the two halves of the brain can perform the same functions, for instance memory can be stored in different places and different ways. The important point is perhaps that the brain has an amazing capacity to switch functions between areas in response to damage, which suggests that communication and what we might call cooperation between areas of the brain is at least as important as specialisation. This is incredibly complex and provides much of the subject matter of research in neuroscience. As Eagleman (2011, pp131-2) puts it, ‘Almost all of our actions are run by alien subroutines, also known as zombie systems’. Learned and instinctive systems generally work in managed relationships. For instance, the autonomic nervous system can identify things like statistical patterns well before consciousness does. Consciousness is needed when there is a new problem to solve: it offers the cognitive flexibility that zombie systems cannot offer. He concludes that consciousness is useful, but only in small amounts for specific tasks (such as long term planning). Therefore the brain tends to serve consciousness on a need-to-know basis, ignoring things until awareness is necessary and then passing on the information, in a highly processed form for contemplation and decision making.

We ourselves are not aware of the vast majority of our own brain’s activities and we couldn’t cope if we did know what was happening. The fact that this might seem to reduce humanity to a set of automatic, subconscious responses, some of them described by the ugly word zombie, might particularly disturb those who cling on to a more spiritual interpretation. For instance, ‘Not only all personal relationships, but all creative work in literature, painting, music, architecture, and equally in all the great scientific advances, pre-supposes a significant degree of intellectual and physical freedom.’ (Hick, 2006, p205) Well, yes, but what does ‘significant’ mean in this context? We don’t need to posit an immortal soul, or indeed a noble, free humanity to account for human achievement, if we are prepared to accept the magnificently effective interaction between subconscious and conscious that neuroscience is offering.

Information implications

The idea of the brain as an organ that processes massive quantities of information in a host of deeply or lightly coded forms, with only limited conscious intervention leads us to ask ‘Does this have implications for information seeking and use?’ Of course it does, but the implications are comparatively imprecise. When looking for connections between the nature of brain function and information seeking and use, we can turn for instance to the idea of flow. This concept elaborated by Csikszentmihaly (1990), describes a mental state of full immersion in a mental or physical activity to the extent that there is a loss of self-consciousness and the emotions are directed towards a full involvement in performing and learning. In sports, for instance, we can talk of *the zone* as a perfect balance between conscious intent and a complex set of subconscious perceptions and calculations. A ball coming at a fielder in cricket or baseball with a velocity and curve of trajectory that the eye does not have the time to formulate as a single coherent message to the receptor areas, and so hard and heavy that the hands must be perfectly placed to receive it and soft enough for it to sink into them and stay, will never be caught by conscious calculation. In information science, the idea of the passive information seeker is a rather clumsy attempt to approximate a description of this far from passive, but mainly subconscious interaction with information.

What is significant in this context is that it can be identified very closely with the intuitive nature of searching and surfing the web. The web and its hyperlinked resources are particularly conducive to experiencing ‘the flow’. But to reverse this: something about the human brain is particularly adapted to exploring resources and searching opportunities that have these structures arising from natural associations. Search decisions based on systematic planning can be less important than following the implications of connections that are offered incidentally in the course of scanning and reading hyperlinked content. It is true that one can experience more or less this phenomenon in a great library where at the end of a day one is surrounded by a pile of books fetched from the shelves in response to clues and bibliographical guidance obtained along the way. This is, however a very clumsy process, delightful though it may be, requiring catalogue use, conversations with librarians, trips up and down the shelves, consultation of book indexes and other time-consuming activities. It is flow, but not as we have come to experience it. The brain can handle these connections, clues and pointers much faster than a library can offer up the resources. It is as if we have been waiting for something that can respond to our inherent capacity to work in the flow. Today the wait is over, we do have the answer, or the best answer available at this juncture, in the form of the web.

Conclusion

There is just too much happening in the brain at any one time for the conscious mind to handle the data and calculations that even a simple process, like standing up and walking for a few paces, requires. Most of what we do (and think) is handled somewhere below the level of consciousness. Once we recognise this in relation to our educational, professional and leisure use of information, we can see that an information activity that provides a guaranteed direct line between the need to know (apprehended or implicit) and some form of resolution of the need is almost inconceivable. We need a broad exposure to information of the kind we could find in a very big, very accessible library, and now have available for our use on both fixed and mobile devices through the web. What we are doing when browsing or surfing is essentially accepting the message, implicit in so much of what we learn from neuroscience, that we need to free ourselves from an unhelpful over-concern with the conscious mind and put the whole of the brain at the centre of our information universe.

References

Csikszentmihaly, M. (1990). *Flow: the psychology of optimal expression*. New York: Harper and Row.

Eagleman, D. (2011). *Incognito: the secret lives of the brain*. Edinburgh: Canongate.

Hick, J. (2006). *The new frontier of religion and science: religious experience, neuroscience and the transcendent*. Basingstoke: Palgrave Macmillan.

Ramachandran, V. and Blakeslee, S. (1999). *Phantoms in the brain: human nature and the architecture of the mind*. London: Fourth Estate.

Wilson, T. (2000). Human information behaviour. *Informing science* 3(2), 49-56. Retrieved November 17, 2011 from http://inform.nu/Articles/Vol3/v3n2p49-56.pdf

Winston, R. (2003). *The human mind and how to make the most of it*. London: Bantam Books.