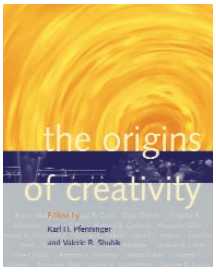
Building bridges

The Origins of Creativity
edited by Karl H. Pfenninger and Valerie R. Shubik, Oxford University Press, 2001. £20.00/$30.00 (285 pages)
ISBN 0 19 850715 1



During a lecture in Cambridge in June 1993, Andrew Wiles announced that he had proved the Tamiyama–Shimura conjecture and thereby one of the greatest unsolved problems in mathematics: Fermat's Last Theorem. Some weeks later disaster struck – a referee discovered what turned out to be a serious flaw. The whole proof was in the air again. For over a year Andrew Wiles struggled to make his proof work. Then one morning, as he recalls, and as anyone who has seen the BBC documentary will remember, 'suddenly, totally unexpectedly, I had this incredible revelation'[1]. And the rest we know is history.

Some time ago I read in a textbook on cognitive neuroscience[2] about the neural background to the childhood pastime of tapping your head while rubbing your stomach. I realized that this is merely one instance of a whole class of movements and so I asked a dancer I was working with at the time to find me some more. After a few hours of experimenting we (or mostly she) came up with various classes of movements, which extended beyond the combinations described in the literature on interlimb coordination[3].

Although I do not wish to compare myself with the genius of Andrew Wiles, there are some interesting parallels between both stories. Both begin with a sudden revelation. But a revelation is meaningless if it isn't elaborated. This usually requires work, hard work, as exemplified by the fact that it took Andrew Wiles seven years to construct his initial proof. And apart from work, the revelation itself is the product of a deep immersion in the subject. In the words of Andrew Wiles 'each of these breakthroughs, while sometimes they're momentary, sometimes over a period of a day or two, they are the culmination of, and couldn't exist without, the many months of stumbling around in the dark that precede them'[1]. It is likely that the brain processes leading up to a moment of discovery are partly unconscious. Indeed everyone will have experienced that strange sensation when you cannot find the word or the name you are searching for and then several hours later, in the midst of conversation, it suddenly springs to mind. While you were concentrating on other things some part of your brain continued searching.

To construct his proof Andrew Wiles had to build bridges between various disparate realms of mathematics and to create a number of new mathematical techniques. My own work takes ideas from cognitive neuroscience and mathematics and applies them to dance improvisation and choreography. According to *The Origins of Creativity*, this ability to transpose existing ideas into a new context and translate them into a work of art or science is one of the hallmarks of creativity.

This new book is both timely and timeless. It is timely because of the growing interest in the connections between art and science, and in a scientific approach to art and aesthetics[4–11]. It is timeless because as a contribution to this emerging field, it does an excellent job of introducing and clarifying the many aspects of creativity in both art and science.

At first glance the choice of contributors may surprise. At least, I could think of a number of other potentially appropriate names. After reading the book, however, I can only compliment the editors and organizers of the symposium on which it is based (*Higher Brain Function, Art and Science: An Interdisciplinary Examination of the Creative Process*, Aspen, Colorado, 1993), on their choice of speakers. The contributions read not as invited talks at yet another symposium, but as the product of years of reflection on the nature of creativity.

The different contributions are nicely balanced. Where the cognitive neuroscientist Antonio Damasio discusses the brain structures associated with creativity, the molecular neurobiologist Charles Stevens analyzes the neural mechanisms involved in the perception of lines and colors (and in the process settles a 200-year-old debate at the French Academy about the superiority of line versus color). Janina Galler, professor of psychiatry and public health, shows how malnutrition during early childhood can affect cognitive development, and Nobel prize winner in Medicine, George Pallade, shows how throughout history periods of heightened creativity appear to correlate with economic prosperity.

Each contribution also seems to illustrate another. Pallade emphasizes the importance of a stable and financially sound environment for the blooming of creativity. At IBM, the mathematician Benoit Mandelbrot, best known for his discovery of fractal geometry, found precisely that. Howard Gardner, who has contributed enormously to the study of creativity, argues that we should not ask *what* creativity is, but *where* it is. He suggests that an answer to this question is determined by a triangle consisting of three nodes: the individual who creates the work, the domain in which the work is situated (e.g. dance or mathematics) and the field of experts who judge the value of the work. He continues to argue that if the time isn't right, even the most creative individual might go unrecognized, a point also made by the molecular biologist and philosopher of science, Gunther Stent, in his contribution. As Mandelbrot recounts, this was the case with his discovery of fractal geometry in the early 1960's, the revolutionary nature of which wasn't recognized until some two decades later.

A lot more can be said about this wonderful book. Both the artist and writer Françoise Gilot and the composer Bruce Adolphe give an excellent overview of the artistic process of creating a painting or a musical score. Gilot's remark that once the first stroke has been applied everything that follows is a dialogue with the canvas, is particularly apt, and resonates with my own experience. Gunther Stent's contribution, in which he draws a new perspective on the differences and similarities between art and science, should be compulsory reading for anyone organizing a conference on art and science. And Thomas Cech's story of the discovery of catalytic RNA, which won him a Nobel Prize in Chemistry, is a perfect example of creative discovery in science.

 1364-6613/01/$ – see front matter PII: S1364-6613(00)01805-2

Both editors and authors are to be praised for maintaining the colloquial style of the original talks, which ensures a lively and accessible tone. The many cross-references give the *Origins of Creativity* a sense of coherence often missed in other edited volumes.

Only one word of criticism: some seven years have passed since the original symposium took place. I am sure there are good reasons for this long gap between symposium and book, but given the quality of the contributions one wishes it had been published six years ago. Again however, the authors deserve praise for updating their manuscript with the latest insights and references.

To invoke once more my own work, one of my improvisation techniques requires dancers to disassemble a composite movement sequence into various component parts and recombine them into novel phrases. To do this I have formulated various rules, analogous to the shape grammars developed by architects and industrial designers, and to David Cope's algorithmic approach to musical composition[12]. It won't be long before it will be possible for a robot equipped with a set of motor primitives and some rules for their combination to perform a similar task. Does this mean that the robot is creative? And if not, does it mean my dancers aren't either? Reading this book might not give you an answer, but it may help you frame the question.

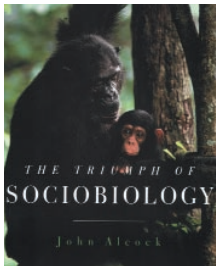
Ivar Hagendoorn
Choreographer and Scientist
e-mail: ivar@ivarhagendoorn.com
http://www.ivarhagendoorn.com.

References

1 Singh, S. (1998) *Fermat's Last Theorem*, Fourth Estate
2 Gazzaniga, M.S. *et al.* (1998) *Cognitive Neuroscience. The Biology of the Mind*, W.W. Norton
3 Franz, E.A. *et al.* (2001) Spatial conceptual influences on the coordination of bimanual actions: when a dual task becomes a single task. *J. Motor. Behav.* 33, 103–112
4 Zeki, S. (1999) *Inner Vision: An Exploration of Art and the Brain*, Oxford University Press
5 Ramachandran, V.S. and Hirstein, W. (1999) The science of art: a neurological theory of aesthetic experience. *J. Conscious. Stud.* 6, 15–51
6 Tyler, C.W. (1999) Is art lawful? *Science* 285, 673–674
7 Goguen, J.A. and Myin, E., eds (2000) Special feature on 'Art and the Brain' (Part II). *J. Conscious. Stud.* Vol. 7
8 Cipra, B. (1999) Duchamp and Poincaré renew an old acquaintance. *Science* 286, 1668–1669
9 Sloboda, J.A. (2000) Individual differences in music performance. *Trends Cognit. Sci.* 4, 397–403
10 Tramo, M.J. (2001) Music of the hemispheres. *Science* 291, 54–56
11 Latto, R. *et al.* (2000) An oblique effect in aesthetics: homage to Mondrian. *Perception* 29, 981–987
12 Cope, D. (1999) One approach to musical intelligence. *IEEE Intell. Syst.* 14, 21–25 (Available at http://arts.ucsc.edu/faculty/cope/expinmus.html)

Triumph or travesty?

The Triumph of Sociobiology
by John Alcock, Oxford University Press, 2001. £16.95/$25.50 (hbk) (x + 257 pages)
ISBN 0 19 514383 3



Imagine a textbook for students entitled *The Triumph of Neuroscience* (or of Ecology, or Biochemistry, or Genetics). Inconceivable? Under what circumstances might one want to call a scientific discipline triumphant? Only, presumably, when it feels its status uncertain and its premises under attack. Precisely this problem has dogged the branch of behavioural ecology that seeks to find evolutionarily adaptive explanations for individual and social behaviours among animals, and, more controversially, humans. This is sociobiology, a term which came to prominence with the publication of E.O. Wilson's book[1] in 1975. That book and its successors were both extravagantly praised and vociferously criticized. A quarter century later, battle has been re-joined around sociobiology's offspring, evolutionary psychology. *The Triumph of Sociobiology* is but one warrior in what have become known as the 'Darwin wars', and, despite being directed towards 'college students and their instructors', it is not exactly disinterested pedagogy. (It is of course only fair to point out that mine too is not a disinterested review, being, as I am, one of those authors who attracts Alcock's specific ire.)

Alcock's aim is to define sociobiology, to defend the scientific legitimacy of its evolutionary approach, to give examples of its methods and findings, and to fend off its various critics from within biology, the social sciences and philosophy. I fully respect his right to do so, but suspect that he is less than willing to accord similar respect to his critics, who are brushed aside as Marxists, feminists, social constructionists or 'blank slate' social scientists. He certainly gives a bizarre account of these various positions, as when he characterizes 'Marxist philosophy' as 'founded on the premise of the perfectibility of human institutions through ideological prescription' before going on to claim that such distinguished evolutionary geneticists as Richard Lewontin's critique of sociobiology was not so much scientific as an attempt 'to raise the political consciousness of society at large'. The ignorance of the first statement is only matched by the offensiveness of the second. I have no objection to political and cultural polemic, but surely it has no place in a student text?

Despite Alcock's claims, biologist critics of sociobiology and evolutionary psychology have no wish to deny the legitimacy of evolutionary arguments – how could we, who share Dobzhansky's view that, 'Nothing in biology makes sense except in the light of evolution.' The problem is that although Alcock accepts a degree of pluralism in biological explanation by distinguishing between 'proximate' and 'ultimate' explanations of behaviour, there is little doubt which type of explanation he regards as determining – only consider the almost metaphysical power of that word 'ultimate'. But he is generally insensitive to the power of words, as when he defends the use of the word 'rape' to describe seemingly forced copulation among various insect species, and then blithely transfers the same word to the qualitatively different human context. The point is that apart from broad universal statements, the human genome and evolutionary adaptations seem to be able to support a wide variety of human behaviours and institutions. Thus, for most purposes, evolutionary explanations are at best enabling and not determining. This is why they have been disparagingly dismissed as 'Just-So' stories, because for science to be productive, rather than speculative, it has to be able to identify determining causes. If popularizing sociobiologists, ever since Wilson and Dawkins, had not

 1364-6613/01/$ – see front matter PII: S1364-6613(00)01830-1