BOOK REVIEW

The aesthetics of neuroscience—and the neuroscience of aesthetics

Samuel Johnson, the colourful 18th-century English lexicographer, asserted that ‘No man but a blockhead ever wrote, except for money’ (Boswell, 1934). Since unlikely to be applicable to the two books discussed here, Dr Johnson’s quip leads one to seek alternative motives and ask what led the authors to write these books, and why and for whom each book was written.

Dealing first with what inspired the authors, in the preface to his Portraits of the Mind: Visualizing the Brain from Antiquity to the 21st Century, Dr Schoonover records how an informal group of American writers and scientists met to discuss ‘novel ways of communicating science to nonscientists’. The group, now called NeuWrite, addressed the ‘infamous methods section’, the section described as ‘somewhat of a downer’ which appears in almost every scientific paper. The aim was to combine pictures that illustrate the methodology inherent in producing neuroscientific data with an explanation of the scientific technique or principles behind each picture. But Schoonover aims for more: ‘For if the images are extraordinarily beautiful, I would argue that the principles underlying the techniques that created them are in some instances even more exquisite’, and Schoonover wants the reader to appreciate the beauty of the methodology as much as the images.

The methods discussed range from techniques of microscopy to neurophysiology, and are arranged in chapters comprising 15–20 images, each chapter being prefaced by a short essay by an acknowledged expert in the field. The background to each picture is written by Schoonover and comprises not simply a caption but a succinct and interesting commentary. The chapter headings convey the scope: ‘Early history: from Galen to Golgi’; ‘The birth of modern neuroscience: Santiago Ramón y Cajal’; ‘After Cajal: from black and white to color’; ‘Breaking the diffraction barrier: from cells to molecules’; ‘Electricity in the brain’; ‘The brain as circuit’; and ‘From brain structure to brain function’. The book concludes with end-notes, bibliography and picture credits, which provide detailed sources of reference for each image and its background. Thus the methods under discussion span the entire known history of neuroscience, although when it comes to antiquity, the concept of ‘methods’ must be viewed in the loosest of terms. Pictures of Fludd’s ‘Mind and universe’ and Descartes’ ‘Pineal gland’ are hardly relevant to ‘methods’ as we would use the term today, an issue avoided in the similarly extensive approach already adopted in the scholarly, seminal work by Clarke and Dewhurst entitled An Illustrated History of Brain Function, now in its second edition with Michael Aminoff an additional contributor.

By contrast, the preface to Dr Butter’s book, Crossing Cultural Borders: Universals in Art and their Biological Roots, reveals his motivation as largely personal. Citing professional and personal reasons, Butter describes what inspired him to write his book, one reason—the same as Schoonover’s—being his interest in ‘forging of new links between art and science’, and the increasing potential for such links resulting from neuroscientific advances such as developments in brain imaging. But this book has a specific and unusual focus; its premise is that artistic features are universal—since they are ubiquitous in different cultures, places
and times—and so the roots of art must have at least some unifying and therefore biological basis for which brain mechanisms must be responsible. In exploring this subject, numerous different artistic features are discussed, some of which encroach on the territories of the art historian and the psychologist which are referred to below, and this unusual perspective is reflected when again the titles of the chapters are listed: ‘The Biological Roots of Art’; ‘Balance in Art and in the Brain’; ‘Depicting Expressiveness: How The Brain Codes Human Movement, Feelings And Intentions In Art’; ‘Ornamentation: Why The Brain Prefers Variety in Unity’; ‘Symbolism In Art And The Brain’s Binding Power’; ‘Coherence in Art And Brain’; and ‘Pictures Ripe In My Brain’. Each chapter is profusely illustrated, and concludes with end-notes including references.

Both these books therefore deal with complex matters, and in their own remarkably contrasting ways they are each fascinating. For the present writer an interesting feature that both have in common then became apparent; each is dealing simultaneously with two intertwined but somewhat different aspects that are discussed below in turn: one concerns the academic links between neuroscience and art; the other is the divide between neuroscientists and laymen, and attempts at a more populist bridging of that divide.

The first issue, the academic links between neuroscience and art, has become a rapidly expanding subject. From the neuroscientists have come numerous major contributions; and, to cite just a few examples, they include studies on how the brain processes pictures in terms of their colour, motion effects and other categories, and the effects on artistry that result from damage affecting the visual pathways (Zeki, 1999); how stroke, dementia and other brain damage affect artistic creativity (e.g. see contributions in Rose, 2006); investigations of how size affects the perception of shape, as examined in Chuck Close’s portraits (Pelli, 1999); the spectrum of art undertaken during and between migraine attacks (Podoll and Robinson, 2008); and pictures created when the artist is under the influence of psychoactive and hallucinogenic drugs (Critchley, 1987)—including the picture drawn by no less a figure than the young Dr Charcot when under the influence of hashish (Meige, 1898). Then there are two new fields of study claiming links between neuroscience and art, with what Raymond Tallis has ridiculed as their ‘often ludicrously tendentious ideas’ (Tallis, 2008): neuroaesthetics, a word coined by Semir Zeki, which concerns the neurological basis for perception of beauty in art (Cinzia and Vittorio, 2009); and neuroarthistory, its approach being ‘a readiness to use neuroscientific knowledge to answer any of the questions that an art historian may wish to know’ (Onians, 2007).

Turning from this background to consider Portraits of the Mind, Schoonover demonstrates that here the picture is the science. There is no creative artistry, rather there is illustration; as with anatomical pictures of the brain, brain imaging and graphic neurophysiological data, it is the scientist who produces the illustration and the creative artist is not involved, and so the picture explains the science rather than the reverse situation which obtains with Butter’s book discussed next. The pictures in Portraits are arguably the dominant component and are magnificent. Their clarity, size and in many instances their vivid colour indeed make many of them beautiful—although, as discussed elsewhere, in the case of colour and pseudocolour their very attractiveness can sometimes mislead (Schott, 2010). Whether or not the pictures are ‘art’ is a subjective matter, but does the non-scientist have ‘equal appreciation for the craft that underlies its genesis’? I doubt it; despite the excellent text, I suspect most readers will see an impressive and often beautiful picture, and may seek to understand the science behind it; but Schoonover perhaps anticipates too much of these readers if appreciation of the beauty of the science is also his aim.

A quite different approach is seen in Crossing Cultural Borders, which is all about art and neuroscience, in that order. The book deals with numerous neural mechanisms that may underlie the production and appreciation of art, and takes in many cultures and many periods. In that sense the book continues the work of the famous academic art historians and psychologists concerned with mechanisms subserving art, its creation and perception. Thus until comparatively recently it was predominantly these scholars who studied the way artists achieve their artistry, and how art is perceived and enjoyed. Art historians such as Ernst Gombrich in The Image and the Eye and The Sense of Order, and psychologists such as JJ Gibson in The Perception of the Visual World and R Arnhem in Art and Visual Perception, all made massive contributions to understanding in these fields. However, they did not have available modern brain imaging or electrophysiological techniques to help them—although this is changing (Kemp, 2009); neither did they have the scientific background that enabled neuroscientists such as Margaret Livingstone in her Vision and Art: the Biology of Seeing to explain many of the neuroscientific processes engaged when looking at art.

This is where Crossing Cultural Borders comes into its own, as it attempts to use contemporary neuroscience when considering the intriguing and less often addressed issues such as, in Chapter 6, how we integrate the various components of a work of art; and in the final chapter the role of visual imagery and memory in artistic creativity. The problem with such a vast field of study that Butter unrealistically seeks to encompass in 132 pages is that simplification, selectivity and superficiality are inevitable, albeit understandable; and the book could be viewed as an adventurous précis of, or ‘taster’ for, a huge field of study that is very well worth exploring. For instance, Butter discusses eye movements and fixations when looking at images—and here as an example he cites a study of the Bust of Queen Nefertiti. But, as Quiroga and colleagues (2011) noted in their recent and pertinent paper on the differences in eye tracking when viewing a picture in an art gallery compared with in the laboratory (Quiroga et al., 2011), the subject has been studied for over 70 years; it is thus far more extensive than can be adequately considered in just a few lines on pages 22–23.

However, what in Butter’s book is far more disturbing than simplification is the potential for rampant though unacknowledged speculation. Two examples will suffice. One concerns a discussion of the art of autistic children. Many of these children are unable to depict, as well as to understand, emotional expressions, and Butter explains that ‘The brain’s emotional MN [mirror neuron] system, the neural foundation of social intelligence, is crucial for rendering these expressions’ (p. 47). But although Butter thereby implies that the art of autistic children is due to a damaged mirror neuron.
system, he provides no evidence to support this view in respect of their art, even if a dysfunctional ‘mirror neuron system’ may be a feature of autism (see for example, Dapretto et al., 2006). Indeed, the whole notion of mirror neurons as the physiological basis for art, and for much else, has been attributed to ‘neuromaniacs’ and robustly criticized, again by Raymond Tallis (2011).

The other example concerns the role of balance in certain pictures. Butter writes of the pleasing balance exemplified by Miró’s ‘Le Jour et la Nuit’ (p. 15), and states ‘Balance around the center in art has its biological roots in brain mechanisms that represent the space around us, control our exploration of space and our ability to locate things in it’ (p. 13). Vilayanur Ramachandran, however, adopts a very different viewpoint. A simple picture he drew at school depicting two symmetrically placed hills with a tree in the middle was considered unsatisfactory by his teacher, and was improved by moving the tree to one side in the picture; in doing so, of course, the symmetrical picture had become asymmetric. Ramachandran not only proclaimed ‘The brain dislikes unique vantage points and prefers generic ones’, but also ‘one of the most important laws in aesthetic perception: the abhorrence of coincidences’ (Ramachandran, 2011). It seems to the present writer that such entirely different but equally contentious explanations accounting for what is spatially pleasing in art mean that at present the neurological basis for our likes and dislikes in such art is unknown; the emperor indeed has no clothes.

The second aspect common to both books, bridging the divide between neuroscientists and laymen, recognizes the dichotomy brought to widespread attention by CP Snow in his landmark Rede Lecture of 1959. Although the divide Snow discussed was between science and literature, it could equally well have applied to science and art, and the title of the lecture and book—The Two Cultures (Snow, 1993)—is a term that has endured and remains in common usage.

Amongst laymen of course will be included most artists; what about their contribution in respect of links between art and neuroscience? Artists of all stripes, from the serious to the frivolous, have frequently utilized, adapted or incorporated products of neurological studies, and pictures of cross-sectional brain slices, brain scan images and EEG patterns, three-dimensional casts of angiograms, and the like have all featured in creations inspired by both normal and abnormal brains, and countless works attest to these artists’ inventiveness and ingenuity. However, I am doubtful that most artists are in any way seeking to bridge the gap between art and neuroscience. And why should they? Artists create from within, often for themselves, and this is not necessarily a reciprocal or campaigning endeavour.

In contrast, numerous neuroscientists have responded to the challenge in diverse ways, including public lectures, television programmes and books—although, compared with science in general, bridging the divide when it specifically concerns art has attracted comparatively little attention. Referred to above, Zeki’s Inner Vision and Margaret Livingstone’s admirable Vision and Art are both examples of books which tackle the subject effectively from the visual scientist’s perspective, and Zeki has even expounded his views in a recent interview in a daily newspaper (Yong, 2011). But there are other perspectives too. This is where Schoonover’s and Butter’s books might prove particularly valuable, and bridge-building between neuroscientist and layman is nicely demonstrated even at the outset. The foreword to Portraits of the Mind is by a journalist with a neuroscientific background, Jonah Lehrer; and Crossing Cultural Borders has its foreword written by an artist, Stan Rosenthal, who, although ‘close buddies’ via the Internet, has never met Butter face to face. CP Snow would have approved. How else do the books fare?

Portraits proves very successful, and the introductory essays at the beginning of each section and the texts that accompany the pictures are all written in a most appealing way that anyone can understand and appreciate. For example, Goldberg’s story of cerebral localization evolving from clinical observations of neuropsychology to intracranial microelectrode recordings is an elegant and easy to read prelude, both to the individual essays and to the pictures in that chapter ranging from a single ion channel recording to two-photon calcium imaging of synaptic transmission. In another particularly engaging essay, Sanes recounts the development of fluorescent markers for visualizing neurons in living animals and tissues, markers that made possible the book’s most beautiful images of, amongst others, motor neurons and cerebellar Purkinje fibres, and several images using the Brainbow technique. And, to pick out some further examples, confocal microscopy, the patch-clamp technique, and how a century ago Otto Deiters revealed the anatomy of the neuron, are all explained in comprehensible ways that are a pleasure to read.

Crossing Cultural Borders is easily accessible for the layman too. To some extent this is to be expected, because art is part of our cultural heritage, and so the book’s starting point falls within almost everyone’s experience. Furthermore, by the very nature of the book, there is frequent reference to what might be called the outside world. For example, Chapter 4 includes discussions about ornament versus simplicity, complex versus simple patterns, and boredom versus confusion, and when exploring the neurological processes possibly mediating these phenomena, Butter helpfully illustrates the text with a detail from a 16th-century mosque ceiling, patterns on fabrics and boxes from India, and a 19th-century clothing pattern on bark from Polynesia. A quite different example is the account of Anton Räderscheidt’s spatial neglect resulting from stroke, and the neurological basis for the evolving changes in his self-portraits; this account tells of Räderscheidt’s wartime experiences, and whether this is relevant to the matter in hand is doubtful, but it certainly leavens the science for the lay reader. This anchoring of neuroscience within the wider world, to which the non-scientist has the same access as the scientist, ensures the ‘two cultures’ readily come together.

And so to the books as products, and here comparisons between them are striking. Portraits of the Mind is outstanding; its pictures have been lauded at length above, the typography and layout are immaculate, and the book has the quality of an impressive coffee-table book—using that term in an approving sense—since the images are such an important component. Nothing could be more different with Crossing Cultural Borders, in which unhappily almost every aspect of the production is disappointing. Such an adverse comment demands justification, and some examples follow. Many of the pictures have simply been obtained from Wikipedia, often resulting in poor images, many of which are small and rather indistinct. Which pictures coloured in the original
are reproduced in black and white seems random; thus Rembrandt’s coloured ‘The Syndics of the Clothmaker’s [sic] Guild’ is shown in black and white, whereas Cézanne’s ‘The Judgement of Paris’ is reproduced in colour. The lack of punctuation in some of the books’ titles is unfortunate: Gombrich’s *The Sense of Order A Study in the Psychology of Decorative Art* and Kemp’s *Visualizations The Nature book of Art and Science* are just two instances; the end-notes are not fully justified on the page whereas the text is; the index is arranged in alphabetical blocks rather than in the customary vertical ordering; there is haphazard use of capital letters—see the chapter headings cited earlier; and there are several spelling errors, e.g. ‘same’ instead of ‘some imposing features’, and both ‘still-lifes’ and ‘still lifes’ on page 92, an apparently indecent picture in the ‘pubic [sic] domain’ on page 75, and ‘Breugel’ instead of ‘Bruegel’ in various places. Such examples point to a woeful lack of editing, which must be attributed to the book being self-published: caveat auctor.

Both *Portraits of the Mind* and *Crossing Cultural Borders*, despite the latter’s deficiencies, have a lot to offer. The former is more explanatory, the latter more speculative, but both books prove Dr Johnson’s quotation at the beginning, ‘No man but a blockhead wrote, except for money’, rightly continues ‘Numerous instances to refute this will occur…’ (Boswell, 1934): the authors here write because they have very interesting things to say about very interesting subjects.

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**G. D. Schott**

*The National Hospital for Neurology and Neurosurgery,*

*Queen Square,*

*London, WC1N 3BG,*

*UK*

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