Book Reviews

Nicholas Maxwell
Is Science Neurotic?
Imperial College Press, 2004, 260 pp.
£29.00, ISBN 1-86094-500-7

Is 'proper' science really a search for factual, testable truth unencumbered by presuppositions or value-based influences? Anyone can see that science today is awash with metaphysical conjectures, values and political pressures. So why, when it comes to accepting or rejecting formulated theories or expanding scientific knowledge, does much of the scientific community still preach total fidelity to standard empiricism? In his latest book Nicholas Maxwell argues that this is due to institutional neuroticism. But how can the neurosis of an enterprise, rather than an individual, be treated?

Slipping science onto the couch, Maxwell tries to bring some of its unconscious into the light of consciousness. Unless the scientific undertaking is a complete waste of time, he begins, we must concede one assumption: namely that the universe is knowable. If this is not the case, he says, 'we cannot acquire knowledge … however we proceed'. What's more, when we consider the countless proto-scientific hypotheses that must be rejected daily, we may detect a pattern. Scientifically acceptable theories are generally explanatory and coherent. Thus, as the implicit becomes explicit, our recovery process gets underway. He advises that if we go on to articulate, organise and critically evaluate the range of underlying assumptions and fundamental physical theories, then we will be better able to promote their healthier, more authentic application. *Aim oriented empiricism* is the open model advocated here of ranked assumptions against which to evaluate new theories: the panacea for his diagnosis of *rationalistic neurosis*.

The author has previously tackled a wide range of topics (e.g. *Understanding Sensations*, 1968, or *The Human World in The Physical Universe: Consciousness, Free Will and Evolution,* 2002) so it comes as no surprise that he doesn't stop at the physical sciences. All fields of academic inquiry, he argues, would be healthier if, by adopting a similar hierarchical approach to aims and methods, we could finally acknowledge that our chief aim is a civilised 'life of value' for all humanity. Having established this, we can then direct and educate ourselves towards a world that is 'democratic, liberal, just, sustainable and wise'. Maxwell calls the model *aim oriented rationality* (AOR).

Karl Popper has long been a key source of inspiration to Maxwell, ever since attending Popper's seminars at the LSE as a young academic in the early sixties. Just as Popper based critical rationalism on the idea of falsificationism, Maxwell develops, from a theory of comprehensibility, his alternative to standard empiricism (i.e. *aim oriented empiricism*). And just as Popper ultimately applied critical rationalism to social and political problems, so too Maxwell evolves AOR to tackle such problems.

However, this picture of a society within which we co-operatively and wisely maintain a hierarchy of agreed assumptions and physical

theories for the greater good of mankind may well make some of us squirm. Perhaps this is because AOR must surely imply the need for a single decision-making body to maintain the hierarchy. Perhaps, on the other hand, unease arises because Maxwell, impatient for the debate to begin, hosts internally a debate by proxy, presenting proposals and counter arguments, playing both judge and jury. Whatever the cause, Maxwell's vision seems to share the disadvantages of Plato's *Republic*; disadvantages that Popper avoided with his critical rationalism. Nevertheless, Maxwell comes across as a liberal thinker, who has worthwhile things to say: particularly that, if we desire a saner, wiser world, the process of education and debate has to start now.

This book does indeed provide a good account of issues needing debate. In accessible language, Maxwell articulates many of today's key scientific and social issues. Readers may not agree with each of his proposals – one may disagree with his choice of physicalism as a fundamental scientific thesis, another may have doubts about proposing democracy to be a key social aim, for example. But his methodical analysis of topics such as induction and unity, his historical perspective on the Enlightenment, his opinions on string theory and his identification of the most important problems of living are absorbing and insightful.

Einstein remarked once, 'When the solution is simple, God is answering.' This book is bursting with intellectual energy and ambition but frustratingly the truth is that, in the end, it does not provide a beautifully simple solution. Maxwell's reach exceeds his grasp. Perhaps, though, he has provided a nudge in the right direction. Maybe one day, inspired by Maxwell, made cautious by Popper's strictures against Utopian social engineering and healed by therapists, we shall all arrive at something beautiful and simple — in the meantime, though, I shall go on being a fruitcake!

Clare McNiven

Jeffrey Gray
Consciousness:
*Creeping up on the Hard Problem**
Oxford University Press, 2004, 341 pp.
£29.95/$54.50, ISBN 0 19 852090 5 (Hbk)

'What is the answer?', Gertrude Stein is said to have asked on her deathbed; then in the ensuing silence, her very last words: 'What is the question?'

What mystified Stein about life in general applies specifically to our bewilderment in the face of the phenomenon we call *consciousness*. Just what *is* the question? It turns out to be a whole complex of questions from which Gray teases apart such standard problems as *binding, symbol grounding, intentionality,* and finally, the existence of *qualia,* those mysterious and controversial 'distinctive qualitative features of conscious experience'. David Chalmers, on the occasion of the first Tucson Conference 'Toward a Science of Consciousness' (1994), labeled this the *Hard Problem.* For lack of a better name, the label stuck. The *Hard Problem,* as Gray sees it, is just this: 'How does the brain create qualia?'

Jeffrey Gray was one of the leading British experimental psychologists. He held a chair in psychology at London's Institute of Psychiatry and, after retirement, spent a happy year at the Center for Advanced Studies at Stanford University, California. His untimely death coincided — almost to the day — with the publication of this book.

Gray addresses each of the items from the complex of questions in twenty informative chapters that are intended to satisfy a sophisticated general reader, but will also be appreciated by the expert for his thoughtful comments on such traditional approaches as *epiphenomenalism* and *functionalism,* or Dennett's *multiple draft model.* Generally speaking, he has little use for such purely philosophical stances. He offers persuasive arguments against the once popular *functionalism* — citing his own experiments. He also rejects the belief that 'normal science', given enough data, will eventually solve the Hard Problem. He never expresses any doubt that consciousness is a real phenomenon, but proposes that radically new scientific principles will be required, just as *quantum mechanics* was needed to cope with phenomena discovered in physics around the

---

* **Advance Notice**: *JCS* has in train a special issue being edited by Stevan Harnad that will focus on the contributions to consciousness studies made by Jeffrey Gray, as highlighted in this book, and by the Crick-Koch partenership, presented conveniently in Christof Koch's *The Quest for Consciousness*.

beginning of the last century. In a chapter titled *Taking Physics Seriously*, he offers a glimpse of the Penrose-Hameroff 'OrchOR' hypothesesis, which attempts to combine microphysiological principles of brain function with a still emerging theory of quantum gravity — an extremely ambitious and complex undertaking. Gray admits his lack of competence in the arcane field of quantum mechanics, but valiantly tries to explain it to the reader, with occasional glitches such as calling the wave function an equation. He returns to the subject in his final Overview (Chapter 20) to suggest that 'OrchOR' may not be the answer, but comes closest to providing what is needed. He accepts the *panpsychism* inherent in the theory, and — in a leap of reasoning — pronounces it as 'inevitable' in any physical account of consciousness.

Gray is best at laying out for the reader the neurobiological principles by which the brain processes sensory information (Chapters 11 through 15), the *sine qua non* of consciousness. Here he presents the concepts of *working memory*, *executive functions* and *global workspace.* The last is a somewhat ill-defined concept, and the discussion here does not make it clearer. A glossary at the end of the text would have been helpful.

Chapter 5 (*Reality and Illusion*) contains a section titled 'The unreality of the external world'. Here Gray tells us that 'the cow perceived as being out there in the world is, in fact, not out there: it is constructed in the brain.' What are we to make of this? Of course, *perception* is in the brain, along with all the underlying memories and associations. But what about physical reality? Gray closes the door on that concept, by denying what he calls the *fall-back position* of having a perceived world and a real world, with something like a correspondence between them. Since — he says — there is no way of knowing more about the outside than what our senses tell us, 'the claim that the former "represents" the latter is therefore vacuous.' As a physicist I must take exception to this. We *do* know more because we have discovered *laws of nature* that apply to all matter all the time and equally for all observers. We take for granted the reality of the external world because our perceptions — unlike our dreams — conform to these laws. The Berkeley philosopher John Searle, commenting on a view similar to Gray's held by Christof Koch, as expressed in Koch's book *The Quest for Consciousness,* calls this 'the single most disastrous view in the past four centuries of epistemology'.

What is the good of consciousness? Gray argues against epiphenomenalism, according to which consciousness is a useless byproduct of brain activity — like the whistle of a steam engine. He is quite emphatic about what he considers our overemphasis on the role consciousness plays in behaviour, pointing out that consciousness is a sluggish process that takes at least a quarter of a second to appear, too slow to direct fast action. The example frequently given is that of a tennis player who must respond with a complex motor action to a rapidly approaching ball. The conclusion, widely accepted by neuroscientists and emphasized by Gray, is that consciousness cannot be of any help in such activities. I believe it is a wrong conclusion. It overlooks the anticipatory quality of consciousness. The mind of the tennis player is far from being a tabula rasa prior to seeing the approaching ball; he has consciously anticipated the probable form of the opponent's return, while at the same time preparing for the unexpected. He most likely has mental images of his own possible responses that involve complex motor programs learned and practised over years of training. They are held in readiness and can be released quickly by appropriate stimuli. There is a subtle conscious interplay between the minds of the two players: 'he thinks I expect the ball to be returned to this side of the court, so he will try to fool me. I'll be prepared'. Similarly the subject of an experiment in psychology, who is told to push a button in response to a visual or auditory cue, had his button-pushing program in readiness and is aware of what he is about to do before receiving the cue that releases the action. To be sure, there are many actions that are not guided by consciousness, and Max Velman's list of unconscious actions, which Gray cites, is still valid.

Gray concludes — almost reluctantly — that consciousness serves *some* important functions. In what is a very broad application of standard evolutionary theory, he argues that — 'by the general principles of Darwinian selection' — consciousness must have survival value. He mentions the creation of language,

science, and artistic expression as requiring the presence of consciousness.

I have cited some points of disagreement. These are mostly matters of personal opinions, deductions from the facts, of which Gray is thoroughly in control. His book is an excellent overview that touches expertly on the many biological and psychological features underlying the conscious experience. The Hard Problem, the nature of qualia, is still with us. Here Gray offers at least a bit of hope: some profoundly new scientific principles may emerge, something of the order of the Penrose-Hameroff theory, to embrace the Hard Problem within the general methodology of science.

Erich Harth
Syracuse University

Anthony Freeman
Consciousness: A Guide To The Debates
ABC-CLIO Press, 2003, 338 pp.
£57.95/$85.00, ISBN 1-57607-791-8

What could you do if you had for 10 years been managing editor of a journal that covered every conceivable aspect of consciousness studies? You would already have lined up the best writers to represent the widest range of views, helped compile some of this into books, attended conferences, given presentations and edited a multitude of reviews. But *comprehending* all of this, and being able to write clearly about it, takes a person who can cut through details to pick out the essentials in each area. In this book, Anthony Freeman shows that he has that capability. His book represents *breadth* in decent balance with *depth*. While each reader may chuckle over some detail omitted by Anthony that *that* reader champions — and even make sage suggestions for Freeman's 'second edition' (like clarifying the relationships between the differing 'Ungerleiter' and the 'Goodale' views of the 'dorsal' visual stream, in the way that *I* have clarified recently!) — most will be delighted at how well the book illuminates unfamiliar areas of debate.

There are 12 chapters, to cover the basic themes of consciousness studies, plus 10 documents comprising excerpts of primary source material from Descartes to LaBerge. I will describe the coverage in enough detail to show how very comprehensive it is. The book begins with a broad survey of philosophy and psychology preceding modern consciousness debates, including views of body, mind and soul in ancient and mediaeval thought, Descartes, and beyond. Chapter 2 is a basic introduction to brain mechanisms and neuronal firing, brain mapping, and single-cell investigations. Chapter 3 describes the basics of visual perception, dealing with many of the issues central to the current consciousness debate — dorsal/ventral distinction, binding problem, 'seeing for action', agnosias, blindsight, change blindness, inattentional blindness, and the debate over whether the visual cortex presents us with 'a grand illusion' — the first of several whirlwind tours!

Chapter 4 is devoted to 'the conscious brain' (a phrase that causes many to cringe) and finding the Neural Correlates of Consciousness. It cites Bernie Baars' audacious habit of referring to the 'neural *basis* of consciousness' (p. 62) and introduces Chalmers' 'hard problem', functionalists' 'multiple realizability', subcortical consciousness switches, Hobson's sleep states, evidence from binocular rivalry, gamma-waves dancing in neuronal synchrony and re-entry signaling pathways.

Moving from the brand spanking new quest for 'neural correlates of consciousness' to the time-worn focus on the 'Mind–Body Problem' (don't philosophers ever resolve anything?), Chapter 5 begins with John Searle's blunt question: i.e. why is there a mind–body problem, but not a digestion–body problem? Freeman's clarifications are elegant: being able to *imagine* your mind existing independently does not make it so, but is enough to present us with a 'mind–body problem' (p. 81). A tutorial follows on how Descartes' 'res extensa' and 'res cogitans' were de-*res*-ified by Gilbert Ryle's philosophical behaviourism and on Descartes' inability to show how such different 'res'es' could possibly *interact* in the 'res world' (sic!). And, if not interacting, are mind and consciousness mere epiphenomena not explainable by science? Freeman outlines the wide range of responses, which extend from reductive physicalism to panpsychism with many stations along the way.

Chapter 6 tackles artificial intelligence, contrasting the possibility that 'a computer is just an adding machine' (p. 101) — which can never be intelligent, let alone conscious — with

the view that it is a 'functional system', in which 'multiply realizable' mental states might in principle be instantiated, so reducing the brain/mind distinction to the hardware/software distinction. Freeman ends with the question: 'if the mind is a computer, who is using it?' (p. 112). Chapter 7 deals with 'embodied consciousness', with Damasio's disavowal of both Cartesian 'disembodied mind' and functionalist 'disembodied brain' views, positing instead emotional systems as central to consciousness and cognition. This chapter also deals with theories of embodiment, consciousness-in-action, agency, thought as 'proxied movement', 'mirror neurons', the subcortical (amygdala, PAG, ERTAS, etc.) core 'proto self' and the autobiographical self. This leads on to a look at the neurophysiology underlying different aspects of memory, and at disorders like Alzheimer's disease. The chapter closes with the distinction between self as 'personal identity' and sense of identity over time.

Chapter 9 deals with one of the most provocative (or irrelevant?) areas in consciousness studies: whether quantum physics is needed to account for consciousness. The treacherous pathways of QM are described in a way helpful for those who get pretty confused about the collapse of wave functions, 'Copenhagen interpretation', and Schrödinger's 'cat'; citing researchers ranging from Von Neumann to Hameroff. Chapter 10 picks up the free will question, with Benjamin Libet's provocative finding of evoked 'readiness potential' (RP) waves over movement-planning cortical areas about 350 ms *before* subjects indicate consciousness of their decision to move. Libet concludes that 'free will' remains as a 'veto power' over our non-consciously originated actions. Freeman cites David Hodgson as pointing out an objection shared by many, including me: namely that subjects consciously decided to move prior to the unconscious RP that Libet detected. In earlier research, Libet concluded that it takes about ½ a second for consciousness of a percept to develop, and that the subjective experience of the percept is referred backward to the time at which it actually reached the brain. Freeman concludes the chapter with the historical debate between free will and causality, from Newton, Hume, and Kant on, with a variety of positions from strong 'libertarian', 'incompatibilist' concepts of free will to weaker 'compatibilist' views. He concludes that 'there is strong reason to assume [at least a weak position on free will] unless science unequivocally excludes it.' (p. 195).

Chapter 11 is on dreams, including lucid dreaming, vision and art, and the 40-Hz EEG waves associated with intense mental activity whether in dreams or awake; also the involvements of serotonin, acetylcholine, LSD, and dopamine in moderating conscious states. There is a section on God and the Brain, dealing with altered states of consciousness, shamanism, trances, psychedelic drugs, mystical experience, Buddhist meditation, self–other boundaries, cosmic consciousness, and epilepsy. Then a section on Art and Brain with the famous picture of one of my childhood favourites, Marilyn Monroe, over the air grates. Finally chapter 12 raises both the famous Thomas Nagel claim that to have subjective/qualia experience is to have a 'point of view', such that 'there is something that it like to be that organism' (p. 219), and Frank Jackson's famous sometime-colour-blind Mary. The chapter then traces the debate between Searle, Dennett and Chalmers over qualia and zombies. Not mentioned is the degeneration of this debate into the 'Zombie Blues' doggerel contest at the Tucson Conferences' so-called 'Talent Night', co-hosted by Dennett, Chalmers and Hameroff. The last, long section of the book is devoted to David Chalmers' 'Hard Problem' of consciousness, which is 'how and why in the physical universe there should be any such thing as conscious experience at all' (p. 228) and its various champions and detractors.

Following these chapters are 10 primary source documents that give the reader a fresh chance to get into the actual debates so well described throughout the book. Again, I would say that while readers might sputter about some detail or things left out in their own areas of expertise, this is a fine effort to frame the field and the debates within. Although the book is embarrassingly (to Freeman) expensive, I strongly recommend it to those interested in how the full jig-saw puzzle of consciousness studies may look when we have finally settled many of the 'easy' problems and have whittled away at the 'hard' problem.

Bill Faw
Brewton-Parker College

(*Review editor's note: This was a difficult one for me. Anthony's book clearly merited review*

in JCS, but who should do it? Suppose the book was dreadful and required slating — professional relationships might never be the same again! Someone with broad experience of the field, great independence and a track record of showing neither fear nor favour was needed. Bill Faw was the obvious choice. I'm most grateful to him for having undertaken the task, as well as relieved that no slating was necessary.)

Naoyuki Osaka (ed.)
Neural Basis of Consciousness
John Benjamins Publishing Co., 2002, 211 pp.
ISBN 158811340X

A book boasting the title *Neural Basis of Consciousness* is bound to be ambitious, which is a good thing. But any attempt to leap a chasm as wide as that between conscious awareness and our present knowledge of neurobiology entails risking a nasty tumble. Professor Naoyuki Osaka of Kyoto University must be congratulated on his courage in trying to bridge the gap. Success in the attempt is perhaps less important than having tried.

Following a brief introduction by the editor, the opening chapter by Bernard Baars is on his well-established global workspace theory; not the best starting point for a book with this title because neurons hardly get a mention here. There are plenty of box diagrams and flow charts with useful sounding cognitive systems like 'Central Executive' and 'Visual-spatial Sketchpad', but not enough on how these systems could be grounded in real neurons. The key attribute of the global workspace is clearly its capacity for 'global broadcasting' — but who is doing the broadcasting, how is it broadcast and who is listening? None of this is made clear. The closest approach to an answer is, 'neuronal candidates for a global workspace capacity include sensory cortices, prefrontal cortex, and perhaps some nuclei of the thalamus', but there's no explanation of why these were chosen. A good deal of space is devoted to examining the relationship between working memory and the Global Workspace. Baars argues, on evolutionary grounds, that consciousness and the Workspace emerged well before hominids put it to use in working memory. Here again the argument is short on detail, relying on assertions like, 'Certainly the dream state, characterised by rich conscious visual imagery, evolved with early mammals', which ignores Nagel's famous account of the difficulty of making valid assertions about the subjective states of animals.

Some of the blank spaces in the Global Workspace theory are subsequently filled in by Osaka, describing his own laboratory work on using fMRI to identify brain regions that are active during working memory operation. In contrast to the Baar's chapter, Osaka's contribution is dense with data. His main conclusion is that the neural substrate of verbal working memory involves interconnections between prefrontal cortex, temporal lobes and anterior cingulate cortex.

Rodney Coterill's chapter returns to theory with his proposal that consciousness is intimately related to an organism's motor probing of its environment. Of course all organisms interact with their environments, but Coterill suggests that creatures with consciousness can 'expand their reactive options' by a kind of simulated movement in thought. The theory has much in common with others that propose consciousness to be a kind of theatre, allowing us to rehearse possible actions so that the most desirable outcome can be selected. But this and similar theories fail, in my view, to explain why rehearsal should give rise to consciousness. Flight simulators have been rehearsing motor actions of pilots for decades but none, as far as we know, is conscious. Instead of a mechanistic account we get statements that beg too many questions such as, 'when activation of the schema is accompanied by attention, a quale is produced'.

A chapter by Benjamin Libet then describes his well-known neuronal time-factor experiments. These are of course controversial and important experiments, whose interpretation has stimulated a small industry. As with most neurobiology, the devil is in the detail. Libet provides us with excellent methodological accounts of the fine detail of each experiment. He goes on to outline his 'time-on' theory; namely that a minimum activity ('time-on') of about 0.5 seconds is required to produce conscious experience. Three options are given to account for why this should be so: first a specific neuronal event could be triggered by an integrative mechanisms linked to the 'time-on' state; alternatively the duration of the activity

itself may constitute a 'code' for the appearance of consciousness; finally, prolonged activity may be necessary for forming a memory (required for reporting the stimulus). Libet excludes option one but leaves two and three open. He goes on to explore the implications of his findings for 'free will', proposing that consciousness may still have a role to play in vetoing selected actions (more 'free won't' than 'free will'). Next comes a description of his conscious mental field (CMF) theory, that consciousness is some kind of field in the brain. This has much in common with other field theories such as my own cemi field theory and the electromagnetic field theories of Susan Pockett and E.R. John. It also overlaps with quantum theories. However, Libet specifically excludes the possibility that his CMF is 'any category of known physical field, such as electromagnetic gravitational, etc.' Indeed, his CMF is 'not describable in terms of any externally observable physical events or any known physical theory as presently constituted.' Libet seems to have boxed himself into a Cartesian corner that leaves the theory in a philosophical limbo.

Chapters 6 (by Logothetis, Leopold and Sheinberg) and 7 (by Valerie Hardcastle) describe fascinating experiments on the cognitive pre-requisites for conscious experience. The Logothetis *et al*. experiments are mostly to do with neuronal activation, binocular rivalry, etc. in response to ambiguous stimuli shown to monkeys. They clearly show that neural activity in the visual cortex does not always predict awareness of visual stimuli, indicating that some other level of activity is likely to be the correlate of attention and consciousness. The authors do not speculate on what activity might be the key, but suggest that a 'study of dynamic interactions among neurons … will be of great importance…' This of course refers to the work of Wolf Singer and colleagues, whose finding that synchronous firing of neurons correlates with attention and awareness is perhaps one of the most intriguing to be made in recent decades. It is regrettable that there was not more on this topic in the book. Hardcastle's chapter looks at cognitive experiments in humans, such as meta-contrast masking, which demonstrate that 'Attentional processes can alter the content or flavour of our conscious perceptions'. She ends with the excellent line:

> How to distinguish James's riverbed for consciousness from the bank on either side remains a deep mystery … and an exciting but still unanswered intellectual challenge.

That line should be pinned over the desk of anyone writing about consciousness!

A section on 'Neural Philosophy' follows, with chapters by Paul and Patricia Churchland that examine neural networks and propose that recurrence is the key to consciousness. This strikes me as being too non-specific. Recurrence is found everywhere in the brain. How much recurrence is then necessary for consciousness? Why that much? Why not more … or less?

Last come quantum mind theories, with chapters by Friedrich Beck and the late John Eccles, Stuart Hameroff and Nancy Woolf, and an account of quantum dynamics by Alwyn Scott. I like quantum theories of consciousness. At least they give you numbers and they deal with neurons. But sadly, a couple of decades after they were first proposed we are no further forward. None of them adequately addresses the problem of how to maintain long-range coherence in a warm, wet brain. The Beck and Eccles chapter proposes a mechanism based on non-linear dynamics and Fröhlich coherence, but these ideas were first proposed several decades ago and, although some experiments in the early 1980s hinted at the existence of these kind of dynamics in living systems, no further work seems to have been done on them since that time.

Professor Osaka has brought together an excellent cast of 'experts in the field' to produce a useful series of essays that summarize their current thinking. The book was hard work, though. Like many of the same sort, it could have done with further editing to achieve a more cohesive style and better synthesis of the ideas, particularly those relevant to general conclusions about the neurobiological basis of consciousness. Nevertheless, the volume is dense with information and ideas. It could prove useful to anyone with an interest in this area.

Johnjoe McFadden
University of Surrey