

# Book Reviews

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**Christopher D. Frith and  
Daniel M. Wolpert (ed.)**

*The Neuroscience of Social Interaction:  
Decoding, Imitating, and Influencing the  
Actions of Others*

The Royal Society, Oxford University Press, 2004,  
329 pp. ISBN 0 19 852925 2 (hbk); 0 19 852926 0  
(pbk)

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The increasing refinement of fMRI has given neuroscientists insights into how the living cortex participates in a host of human scenarios. This approach has had a dramatic impact on the study of social interactions. Suddenly fields as diverse as robotics, primate behaviour, neuroanatomy, neurophysiology and child psychology have a dynamic relationship to socially crippling conditions such as autism. New information has emerged about segregation of function, even at the level of the cognitive and perceptual machinery that serves human interactions. In crafting the theories and challenges that enrich what must surely be one of the greatest mysteries of the human condition, it is difficult to imagine a better mix of articles than those in this collection.

The book has three sections. In the first, *Biological motion: decoding social signals*, Puce and Perrett present an excellent review of the historical origins of, and cortical participation in, the representation of biological motion, revealing the manner in which the movement of living things penetrates specific aspects of human consciousness there to play a fundamental role in the creation of social strategies. The

utilization of this information is taken up in the next article by Csibra, who argues that human infants inherently respond to the goals apparent in the movements of animated shapes, the 'body language' of living agents, in a manner that does not necessarily implicate cognitive processes. The Friths then present an insightful review of the involvement of thought in the social interactions of humans as young as 18 months, comprehensively reviewing recent fMRI studies on a host of psychosocial scenarios. These implicate several post-prefrontal areas in the representation of emotion and body language, also the medial prefrontal cortex (Brodmann's area 9) in social cognition. Their article provides a provocative introduction to that of Rittscher *et al.*, which reports attempts to design machines able to read body language, a problem which is primarily visual but also requiring the utilization of 'motion primitives' as a means of quantitatively representing and interpreting the nuances of human behaviour.

In the second section, *Mirror neurons: imitating the behavior of others*, Meltzoff and Decety present their classical work on imitation in postnatal infants and describe their more recent attempts to use machines to test whether, in imitating complex actions, older infants focus on the goals, or the means of achieving them, or the identity of the agent. At the end of their article they cite the fascinating theory that the inferior parietal cortex may be unique to humans and apes, thus accounting for the oft-mentioned inability of monkeys to imitate. Wohlschlagel *et al.* then discuss their theory of goal-directed imitation wherein

imitation does not involve visual-to-motor mapping but is guided by a set of cognitively specified goals. Gallese then outlines his theory that inter-personal relations rely on a 'shared manifold' wherein imitation, empathy and the attribution of intentions are achieved by activation of cortical networks common to all humans, which are also basic to the processes of (mentally inspired) imagination. Next, Byrne summarizes his studies on feeding behaviour in mountain gorillas to differentiate between what he refers to as 'action-level' and 'program-level' imitation. His article again highlights the importance of movement primitives in the composition of complex sequences of actions that compose inherently invariant behaviours. His paper thus forms an excellent introduction to that of Schaal *et al.* on the computational strategies underlying the construction of robotic imitation, where the creation of intent remains an elusive but tantalizing goal.

The third section, *Mentalizing: closing the communication loop*, begins with Johnson's analysis of the social and biological triggers which elicit the attention of human infants. This paper raises important issues of differentiating thought as a factor in the social behaviour of early infancy. In addition, it enables the perceptive reader to glimpse the vast gulf between what is acceptable in imputing thought to non-human primates and what is acceptable in similar studies of the human infant. It might be said that all things begin as emotional perturbations. In this vein the next article, by Blair, presents important new findings on the differential roles of the orbital cortex and the amygdala in recognizing the primary emotions of fear, anger, sadness and happiness — findings that have important implications for the differentiation of psychopathy from lesion-induced acquired sociopathy. His concept of 'cognitive emotions', which extend beyond the boundaries of the primary emotions and by definition involve a cognitive or mentalizing element working alongside the brain's emotional centres, is especially noteworthy.

The interactions between two people are then examined by Griffin and Gonzalez, who outline their methodology for statistical modeling of dyadic social interactions. This is followed by Sally's application of game theory to understanding social interaction. In particular this article differentiates between subjectivity and

logic in the cognitive processes that underlie the playing of games, thereby predicting the existence of domains of cognition outside the psychosocial domain. Finally, Wolpert *et al.* review progress on discerning how we assess identical movements when these are made for differing purposes. Their analyses focus on how the needs of social interaction might be served by a hierarchy of representational levels that can be accommodated in a computational network.

In summary the articles are well written and accessible to the scholarly reader. They highlight the importance of this emerging field of study and indicate how new insights into human behaviour are generating the need for a new vocabulary that will inevitably bring both language and understanding into a greater harmony with the fundamental nature of human beings.

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### **K. Ramakrishna Rao**

*Consciousness Studies:*

*Cross-Cultural Perspectives*

McFarland & Co, 2002, 350 pp. \$65.00  
ISBN 0786413824.

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This systematic review of the literature on consciousness explores both the Western scientific and the Eastern spiritual perspectives. Rao's main objective is to highlight the limitations of the Western tradition and supplement it with the best of Eastern traditions. For the most part, he remains unbiased in his presentation, although he acknowledges he has little time for perspectives that view consciousness as meaningless or illusory.

The first section draws on contemporary writings (Baars, Chalmers, Flanagan, Lancaster, Nagel, Searle, and Velmans) as well as classic ones (Bergson, Hume, Husserl, James, Kant, and Locke) to tease out the differing viewpoints on primary, paradoxical and pathological consciousness. Later Rao takes a look at parapsychology and the speculative 'New Physics' of consciousness. He has written extensively on parapsychology elsewhere (e.g. Rao, 1982; 1993; 2001). In this book, he examines the more scholarly research on ESP and psychokinesis (PK) and argues that the six crit-

icisms of Moss and Butler (1978) against these phenomena are not warranted. He concludes that there is significant evidence for the existence of both ESP and PK, and that lack of perceived harmony with the 'established laws' of science does not warrant the rejection of the evidence.

An increased willingness among researchers to acknowledge the primacy of subjective experience has prompted many to consider alternative, non-Western models of consciousness. The second half of Rao's book examines the two major perspectives of the Eastern tradition: the Chinese and the Indian. The Chinese tradition, often considered more humanistic and less introspective than the Indian, focuses on a natural mysticism centred in human nature. As a result, it lacks the systematic speculation in metaphysics and epistemology that is characteristic of the dominant Indian traditions (Samkhya-Yoga, Advaita Vedanta, and Buddhism). Rao feels these Indian traditions offer viable alternatives to the Western view because they overcome what he sees as a major flaw in Western thinking: the equating of mind and consciousness, which results in consciousness' becoming either 'a vacuous concept or one that is simply beyond objective and scientific study' (p. 298).

The prevailing Western view makes intentionality a defining characteristic of consciousness. Consciousness is always *of* or about something. The Eastern view, however, regards consciousness as an independent source that makes awareness possible. (Buddhism does not view consciousness as a source that is separate from mental states, but it does allow for transcendental states and provides for non-intentional states of consciousness.) A distinction is made between mind and consciousness. In both the Advaita and Samkhya-Yoga perspectives, consciousness is considered a fundamental principle that lies outside the physical dimension.

In the Eastern view, consciousness is not part of the mind and does not interact with it. It has *no* causative role in our mental activity. On the opposite plane lies the brain: a physical system of neural networks. The mind is seen as an interfacing mechanism between the two. The mind collects information from the brain and presents it to consciousness. Thus, although the mind engages in both upward as well as downward

causation since it can interface with both consciousness and the brain, consciousness-as-such remains in a reflexive relationship with mind, each projecting itself on the other.

The Eastern focus is on consciousness-as-such, rather than on mind and brain. When the mind connects with consciousness as opposed to sensory input, transcendental realization occurs. The mind moves from states of awareness that result in representational knowledge to those that result in direct, unmediated knowledge. In these states, there is no dissociation between cognition and conduct.

The Eastern perspective, then, seeks the transformation of the individual through the attainment of higher states of consciousness. Its literature is replete with phenomenological accounts and detailed classifications of conscious states. However, it often ignores the day-to-day normal brain processes. Westerners, on the other hand, tend to give detailed attention to the brain and 'objective' information. As a result, subjective aspects of mental phenomena are not accounted for. Can the two viewpoints be reconciled? Rao admits that they are like two streams flowing in different directions. His own attempt at reconciliation is really a call for scholars to use what is best from both perspectives. The starting point is a recognition of the significance of subjectivity in research. Consciousness is not reducible to brain states. Rao points to Max Velmans (2000) and Francisco Varela (1999) as examples of scholars willing to embrace new models of consciousness that recognize the primacy of subjectivity.

*Daniel Simmons*

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**Richard L. Gregory (ed.)***The Oxford Companion to the Mind*

Oxford University Press, 2nd ed. 2004,  
xx + 1004 pp. £40 ISBN 0-19-866224-6 (hbk.).

Around 120 star performers contributed to this handsome tome, ably conducted by someone who is probably the most eminent British psychologist of his generation. The first edition appeared in 1987 to wide acclaim, but much of the material in this book is new. Although 20% longer than the previous version, some of the older content, especially that to do with basic neurology and Freudian theory, has been omitted. What sort of book is it, and who will use it?

Ranging from 'abacus' to 'zombie', it looks at first sight like an encyclopaedia — but not a very good one. Cross-references between entries are scanty, while literature references can seem idiosyncratic or out-dated. If you are a person, you have to be dead to rate an entry. Broadbent (d. 1993) makes it, but Varela (d. 2001) does not. So the book is far from up-to-date in this respect, too. More serious, perhaps, is the fact that entries are sometimes misleadingly incomplete. That on 'brain imaging', for instance, makes no mention of xenon flow, SPECT or BEAM, nor of how PET techniques may be used for anything other than measuring cerebral blood flow, and does not even discuss which aspects of neural activity may be reflected in fMRI. Perhaps inevitably, it is also easy to criticize the balance displayed. The 'hippocampus' rates five lines only, while 'human (somatic) growth', a subject of only the most dubious relevance to the mind, gets nearly three pages. 'Mememes' have an entry but 'archetypes' don't. 'Out-of-body experience' appears, but 'near death experience' has no separate acknowledgment.

Gregory hopes that the book may be useful to a wide range of students and non-specialists, including 'people and families with problems' (p. vi). Certainly most of the entries are clearly, often beautifully, written. They can easily be understood by non-specialists and are generally very sensible, albeit stimulating and provocative in places. Some people with problems who turn to it may well feel let down, though. The entry on 'ECT' (electro-convulsive therapy) for example, a topic which can greatly concern some patients and their families, consists of nine quite uninformative lines. The whole of

'psychopharmacology' gets only just over one and a half pages, and there are no separate entries for 'antidepressants', 'neuroleptics' and the like.

So the *Companion* is really not that companionable in relation to any easily identifiable function. Why, then, am I so anxious to hold on to my review copy? The answer has to be that, as a whole, it is instructive and it is fun and, above all, is clearly a classy piece of work. A Porsche is far from ideal when it comes to the school run or collecting the shopping. Nevertheless few of us would turn down the chance to drive one. Much the same applies to this book. Who could resist running through such nuggets as the entry on the 'military mind' (unlikely to show much improvement in the near future, is the somewhat depressing conclusion)? Which of us would willingly forgo the chance to learn about 'Pulfrich's pendulum'? And there are hundreds of gems like these scattered throughout the text. This book is less for the workaday week than for the high days and holidays of the mind. In that context, it excels.

The city of Oxford itself is quirky, overcrowded, and sometimes infuriatingly provincial. It is also endlessly fascinating, often magically beautiful, and breathes history. How apt, then, that this work should be entitled the *Oxford Companion*. Everyone ought to have a copy.

Chris Nunn

**Tim Bliss, Graham Collingridge and Richard Morris (ed.)***Long-Term Potentiation: Enhancing Neuroscience for 30 years*

Oxford University Press, 2004, 432 pp., \$110  
ISBN 0-19-853030-7 (hbk).

Conference proceedings are often of limited value, rife with typographical errors and worth little more than the paper they are printed on. We all know the story; a group of friends assemble for a workshop in some pleasant place, and a 'book' is thrown together to satisfy the funding officer or her manager in the bowels of a bureaucracy. *Long-Term Potentiation* is different. Originally organized as an invited meeting at the Royal Society of London and published in 2003 as a 'Theme Issue' in the *Philosophical Transactions of the Royal Soci-*

ety (Series B), the present work is now virtually error free, but why should this subject be of interest to readers of the *Journal of Consciousness Studies*?

First observed 30 years ago, long-term potentiation (LTP) is neuroscience-speak for a family of refractory phenomena that last for hours, days and weeks; thus LTP offers an empirical basis for long-term memory, which is essential to much of the content of consciousness. As the book comprises 29 chapters, it would take more than the space allotted for this review to give a laundry list of the chapter titles, but describing the broad categories into which the chapters are arranged seems appropriate. (The chapters titles can be found on the publisher's web site.)

Following an insightful introduction by the editors (all of whom are major players in the field) come seven chapters in a section on the early history of LTP research written in reader-friendly fashion by those who were at the birthing. I found these chapters to be particularly valuable because they help to overcome the common difficulty that authors of research papers often assume readers to be familiar with their field, thus creating many problems for people who aren't. In addition, these early chapters will be of interest to historians of neuroscience as primary source material.

LTP is important in neuroscience because it has confirmed the reality of synaptic plasticity as was suggested by Donald Hebb in his classic work *The Organization of Behavior*, following Sherrington and Freud, among others. Thus studies of LTP offer a means of getting at the corresponding physiological bases for memory. A key discovery in making this connection was an agonist called NMDA (N-methyl-DL-aspartate) which can trigger the induction of LTP by acting on corresponding receptors (NMDRs). Along with with other activators such as AMPA and Kainate, the techniques of molecular biology have already led to plausible microscopic means for realization of LTP — and of long-term depression (LTD) — which are amusingly and ably laid out by Mark Bear in chapter 8 of this book. 'Amusingly' because Bear employs the 'BCM' model, which was proposed by Bienenstock, Cooper, and Munro in 1982, and the very same Leon Cooper participated in the 1972 Nobel Prize in Physics for the 'BCS' theory of superconductivity. As the con-

cept of a 'Cooper pair' of electrons is central to the microscopic theory of superconductivity, Bear has proposed the term 'Cooper synapse' for those synapses that can be bidirectionally changed by postsynaptic voltage — an insider's joke that seems not to have caught on with the neuroscience community. Two other chapters present additional biochemical details on induction of LTP, followed by seven on expression of the phenomena, which has been an area of vigorous dispute (a 'battleground') between those who hold that strengthening is entirely caused by presynaptic events and those who claim that postsynaptic changes are also important. Four chapters on persistence raise the difficult question of how long LTP can last (and why), and a section of five chapters on function considers the implications of this ongoing research for experimental psychology, neatly tying the discussion back to the original motivation. Finally a short section of three chapters sketches some of the directions in which future LTP and LTD research may be heading.

An outstanding question is whether the phenomena described in this book provide a basis for our very long term memories — like the fact that I can vividly recall events from more than a half century ago. Although several of the enzymatic mechanisms proposed herein may support such very old memories, some consider it problematic that enzymes are continually being replenished while others point to a protein (CaMKII) which can maintain its active state upon reconstitution. In either case, the possibility that some of our neocortical information is stored in the axonal connectivity among neurons or in the geometrical structures of axonal and dendritic arborizations should not be overlooked.

In the many chapters of *Long-Term Potentiation*, oddly, there was no analytic description of the effects of LTP and LTD, although such a model was presented almost a decade ago (see Migliore *et al.*, 1995 and Migliore and Lansky, 1999, for example). That these references do not appear among the many bibliographies in the work is either an oversight by the otherwise diligent and competent organizers of the original conference or an indication that no members of this subfield of neuroscience yet think in mathematical terms. Based upon the above noted empirical results

presented by Bear, the Migliore model comprises six ordinary differential equations with a dozen or so numerical parameters. In addition to an input stimulus, the dependent variables in these equations are a neurotransmitter, a post-synaptic signal, an internal generator, a retro-grade messenger, and presynaptic variables governing both LTP and LTD. Such models are useful in several ways. First, they are concise. Lacking a mathematical model, one is reduced to Rube Goldberg prose reminiscent of the early days in ham radio ('Electrons flow from the antenna onto the grid of the first tube, causing the plate current to decrease. This in turn reduces the current flowing into the grid of the second tube, causing ... and so on.'). as is the case in several tortured dynamical descriptions in this book. Second, mathematical models provide an efficient way to find the experimental parameters needed to describe an effect and to understand how errors in their determination influence the accuracy of a prediction. Third, as has often been demonstrated by the nerve impulse equations of Hodgkin and Huxley (HH), mathematical models provide a convenient way for researchers to precisely communicate. Finally, mathematical models are being used to mesh the phenomena of LTP and LTD

into higher-order descriptions, such as that of Hebb's cell assembly. And this is among the long-term aims of consciousness studies.

A significant development in computational neuroscience over recent decades has been the emergence of a variety of nerve impulse models with varying degrees of simplification from the original HH system and experimental realism. With this spectrum of models in hand, the numerical analyst can choose the one most appropriate for the constraints of a particular study. It is anticipated that correspondingly simplified analytic representations of LTP and LTD will appear in coming years, making contributions to our understanding of both short-term and long-term memories in the ongoing dynamics of the human brain.

*Alwyn Scott*

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