
Reviews

Perceptual organization in vision: Behavioral and neural perspectives edited by R Kimchi, M Behrmann, C R Olson; Lawrence Erlbaum Associates, Mahwah, NJ (distributed in the United Kingdom by Eurospan, London), 2003, 475 pages, \$115.00 cloth, \$55.00 paper (£75.95, £36.50) ISBN 0 8058 3872 4, 0 8058 3873 2

"I stand at the window and see a house, trees, sky.

Theoretically I might say there were 327 brightnesses and nuances of colour. Do I have "327"? No. I have sky, house, and trees. It is impossible to achieve "327" as such. And yet even though such droll calculation were possible and implied, say, for the house 120, the trees 90, the sky 117—I should at least have this arrangement and division of the total, and not, say, 127 and 100 and 100; or 150 and 177.

The concrete division which I see is not determined by some arbitrary mode of organization lying solely within my own pleasure; instead I see the arrangement and division which is given there before me."

Max Wertheimer (1923) *Laws of Organization in Perceptual Forms*

The processes of perceptual organization span areas as broad and diverse as perceptual grouping, various forms of perceptual completion, and figure–ground segregation. To say that they affect just about any basic aspect of perceptual processing pervasively and profoundly is an understatement, to say the least. The organised and structured nature of our visual world is such a fundamental feature of perception that, as with all other basic and fundamental aspects of our visual experience, it can be difficult to realise that there is a problem to be solved at all. Although first recognised nearly a century ago by the Gestalt school, the ubiquity of the problem of perceptual organisation and its (often neglected) importance for understanding vision is being increasingly appreciated again. These organisational processes span areas as broad and diverse as perceptual grouping, various forms of perceptual completion, and figure–ground segregation and to say that they affect just about any basic aspect of perceptual processing pervasively and profoundly is an understatement, to say the least. The organised and structured nature of our visual world is such a fundamental feature of perception that, as with all other basic and fundamental aspects of our visual experience, it can be difficult to realise that there is a problem to be solved at all. Through a growing body of recent research efforts in this area it has become apparent (again) that this is not an easy problem. *Perceptual Organization in Vision: Behavioral and Neural Perspectives* highlights the convergence of interest from several different disciplines in the problem of perceptual organisation in vision and aims to enrich our understanding of these phenomena. The volume is based on papers presented at the 31st Carnegie Symposium on Cognition in June 2000 that brought together some of the leading researchers from behavioural, development, neurophysiological, neuropsychological, and computational backgrounds. In the preface, the editors reveal that in preparation for the symposium and this volume the authors were asked to address the following questions:

1. What are the processes involved in perceptual organisation?
2. Where in the sequence of visual processing does organisation occur?
3. What are the stimulus factors that engage the process of organisation?
4. What is the role of learning and experience in perceptual organisation and its development?
5. What is the relation between perceptual organisation and other cognitive processes?
6. What are the neural mechanisms underlying perceptual organisation?

The volume, to a remarkable degree, succeeds in addressing these questions in a manner that is both accessible to beginners and appealing to researchers with more specialised expertise in the field. It is divided into four parts that provide an overview of the current state of theoretical and empirical issues in selected aspects of perceptual organisation.

The longest and perhaps the strongest part of this volume is its first part, which deals with cognitive approaches to perceptual organisation. The chapters in this part are well integrated

and present work that significantly and importantly builds upon and extends the foundations laid out by the Gestalt school. Three chapters (by Palmer, by Kubovy and Gephstein, and by Kimchi) deal with complementary aspects of perceptual grouping. Separately and together they present an excellent overview of historical, theoretical, and methodological approaches to studying the spatial and temporal dynamics of various forms of perceptual grouping. These authors also describe recent work from their own laboratories that provides interesting and valuable insights regarding the role and place of perceptual grouping processes in the visual processing hierarchy and their interrelationship with other processes such as attention. In her chapter, Peterson tackles many important unanswered questions of figure–ground segregation, focusing on the *unsuspected* role of object recognition in this process. Finally, Kellman delivers a comprehensive, state-of-the-art overview of phenomena and theoretical and empirical issues related to the visual completion of objects and their boundaries.

The second part addresses issues concerning the development of perceptual organisation and the role of learning in this process. Although the coverage of these issues is not as extensive as was the case with the cognitive approaches, the two chapters highlight fascinating characteristics of infants' early object segregation (Needham and Ormsbee) and the way top–down processes such as categorisation affect the perceptual building blocks used for representing and segregating objects (Goldstone).

The third part, *Neural Approaches to Perceptual Organization*, presents neurophysiological and neuropsychological investigations of the cortical mechanisms mediating processes of perceptual organisation. I particularly enjoyed the two chapters describing the effects of cortical lesions on perceptual organisation and detailing rare studies of patients with integrative agnosia (Behrmann and Kimchi) and, in addition, Balint's syndrome (Humphreys). Behrman and Kimchi's conclusions nicely complement Kimchi's microgenetic studies in suggesting that not all organisational processes are created equal but represent a multiplicity of processes that operate at separate stages of visual processing with different contributions to object-recognition processes. The other two chapters in this section present single-cell studies of figure–ground processing in early visual areas (van der Heydt, Zhou, and Friedman) and the effect of spatial context on response of neurons in motion-sensitive cortical areas (Albright, Croner, Duncan, and Stoner). Although the two neurophysiological chapters certainly cover the relevant neurophysiological underpinnings of several aspects of perceptual organisation in a quite comprehensive manner, one might regret the omission in this part of some relevant and exciting work concerning the neural correlates of amodally and modally completed object fragments. Although Lee's chapter in the following part presents his work on the early neural substrates of modally completed contours, one would not mind seeing some additional work in this area represented as well.

Two computational approaches to perceptual organisation constitute the last part of this volume. Jacobs presents a computational account where perceptual organisation is viewed as a process of generic (as opposed to a specific) object recognition, and considers it important for the alignment between our prior knowledge of the world with its current instantiation. Lee, in his computational approach, integrates bottom–up organisational processes with the top–down attentional processes into a single hierarchical system. Owing to space constraints, it was probably impossible to include computational efforts concerning the related phenomena of perceptual completion.

In summary, this volume brings together a diverse group of scientists who share the same general excitement for and appreciation of the processes of perceptual organisation. The future will show if this volume ultimately will succeed in furthering its stated aim of interdisciplinary approaches to perceptual organisation. The editors have done an excellent job as facilitators and for that should be commended. They have compiled a useful and engaging source of information regarding selected contemporary approaches to some of the most important problems in visual processing.

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Ways of seeing: the scope and limits of visual cognition by P Jacob, M Jeannerod; Oxford University Press, Oxford, 2003, 250 pages, £65.00 cloth, £27.50 paper (US\$130.00, \$54.50) ISBN 0 19 850920 0, 0 19 850921 9

The psychology and neuroscience community has debated for decades the possibility that the human visual system is dualistic. Vision, it is often argued, is not simply for perception but also for guiding behaviour, and the computational goals that are imposed by the visuomotor system are not (or at least need not be) identical to those of visual perception. Why, for example, when I reach for my coffee cup, should my visuomotor system care about all of the contextual effects that give rise to colour or size constancy? Only the metrical properties of the object should matter for successful visuomotor transformations. While my decision to reach to that particular cup might hinge on contextual effects, the mechanism of the reach itself gains little or nothing by incorporating much of the information that determines visual perception. There may therefore be, in effect, two visual systems: one for action, and one for perception.

This dualistic view is by no means universally held, and numerous variations on the theme have evolved [initially from Trevarthen (1968) and Schneider (1969); Ingle (1973); Mishkin et al (1983); and, more recently, Goodale and Milner (1992), among many others]. The debate has sparked an industry of research investigating the dissociation between the ventral and dorsal pathways, especially the role the dorsal pathway plays in controlling visually guided behaviour, the degree of its informational encapsulation, and its contribution (if any) to visual perception.

In *Ways of Seeing*, Jacob and Jeannerod take a moderate (and moderating) position. They squarely hold the dualistic view that there is vision-for-perception and vision-for-action, but they argue that the division does not simply and exclusively map onto the ventral and dorsal streams as proposed by Goodale and Milner (1992). For example, while the parietal lobes may be responsible for the pragmatic visuomotor transformations that are necessary for visually guided reaching, they may also serve other visuo-perceptual functions (eg, perceiving the relative positions between objects or tracking the positions of the objects over space and time).

The book provides a broad review of neurological, behavioural, neuroimaging, and physiological evidence for the dual-visual-systems hypothesis. The authors convincingly argue in favor of a weakened version of the hypothesis that dissociates visual information for perception and action, but only to a point.

The real strength of the book, however, is the approach that it takes. The book introduces the dual-visual-systems hypothesis not only from psychological and neuroscientific perspectives, but also from a philosophical one. Debates in the philosophy of mind frequently use visual perception as one of the starting blocks from which to make arguments or create thought experiments. However, philosophers are rarely practising scientists, and even less often are scientists practising philosophers. The unfortunate result of specialisation (one that is not unique to the fields of philosophy and vision) is that vision researchers are unaware of the philosophical implications of, or the problems with, the conclusions they draw from their data. Correspondingly, philosophers may inadvertently rely on outdated (or even incorrect) scientific information; thought experiments are not very fruitful when the premises are false.

Jacob and Jeannerod cleverly interweave the philosophical questions and implications of the dual-visual-systems hypothesis throughout the book. The authors have a clear agenda and perspective on the subject of consciousness, advocating a particular brand of intentionalism. Regardless of their specific position, however, the noteworthy aspect of their efforts is how they use the dual-visual-systems hypothesis, and the accompanying experimental support for it, to inform philosophical issues such as the explanatory gap—a question famously posed as, “why is all this processing [in the brain] accompanied by an experienced inner life?” (Chalmers, 1996). Using debates in modern neuroscience to inform questions of consciousness is a welcome approach, especially for vision researchers who are reluctant to wade through philosophical discussions that often seem obscure or at least detached from the experiments they conduct. Jacob and Jeannerod provide a guidebook—mapping scientific findings onto philosophical questions and generally keeping us on track.

The book's strength—using the duality of visual processing as a tool to understand broader issues of consciousness (perhaps even to test philosophical theories of consciousness)—is simultaneously its weakness. The book covers a great deal of detailed (albeit interesting) material in the dual-visual-systems literature but also must wade through some very heavy philosophical issues.

For philosophers, the esoteric debate over psychophysical evidence for and against the dual-visual-systems hypothesis (cf Carey 2001; Franz 2001) may prove difficult. On the other hand, the philosophical issues are equally, if not much more, complex, and neuroscientists may be prone to start daydreaming about their next planned experiment during some of the longer philosophy-laden chapters.

Fortunately, although many of the chapters are instantly identifiable as science-heavy or philosophy-heavy, the authors have made a genuine effort to link each chapter with the overarching theme—the duality of vision for perception and action. For example, after contemplating the details of various metaphysical debates, there is usually a passage that links the material to the broader picture.

Jacob and Jeannerod have largely succeeded in joining a recent development in neuroscience with long-standing debates in the philosophy of mind. A few authors have accomplished this in the past—relying heavily upon the science to constrain the philosophical arguments [Hardin's *Color for Philosophers* (1988) is a nice example]. Yet, few texts employ such recent neuroscientific developments as the dual-visual-systems hypothesis.

Although the clarification of the dual-visual-systems hypothesis merits attention on its own, the book is far more than this. Jacob and Jeannerod provide an example of the importance of forming a bridge—creating clearer channels of communication—between neuroscientists and philosophers, as this is the only way that we will be able to approach the ‘hard problem’ of consciousness.

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Handbook of face recognition edited by S Z Li, A K Jain; Springer, New York, 2005, 395 pages, \$64.95 (£46.00, €59.95) ISBN 0 387 40595 X

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