For his review of the last 20 years of eye-movement research Rayner (1998) decides: “Because the quality of the research reported [in edited books] is somewhat variable the focus of the current review is on studies that have appeared in peer-reviewed journals”. Given this claim, why produce, read, or purchase an edited volume? *The Attentive Brain* edited by Raja Parasuraman is strong evidence that such volumes do still have both a purpose and utility. The book succeeds as an edited volume that is worth reading or owning for two substantive reasons. First, it is a handbook of the methods of cognitive neuroscience; key chapters in the early part of the book act as a guide to the methods within this interdisciplinary project and, as an edited book, each chapter is written by an expert. Second, the book is a manifesto for cognitive neuroscience as applied to the topic of attention. As the book is an edited volume, it becomes a chorus of academic voices singing the praises of a new era in attention research.

Section 2 of the book contains eight chapters that focus on the methods within cognitive neuroscience. This section includes core chapters on the Neuroanatomy of visual attention (chapter 2 by Martin and Ungerleider); Neurophysiology of visual attention (chapter 4 by Motter); ERP methods (chapter 5 by Luck and Girelli); PET methods (chapter 6 by Corbetta); fMRI (chapter 7 by Haxby, Courtney, and Clark); Cortical lesion studies (chapter 8 by Swick and Knight); and Computation methods (chapter 9 by Niebur and Koch) along with an excellent chapter on the less familiar Neurochemistry of attention (chapter 3 by Marrocco and Davidson). These are the most exciting chapters of the book and ones that I find myself returning to again and again. No one author could have written all these chapters and, as the list of authors makes clear, these techniques are being explained by leaders in the respective fields.

I was particularly impressed with chapter 7 by Haxby, Courtney, and Clark in which they explained in clear and simple terms the methods of fMRI. Of course it’s not possible to explain the physics of the technique completely. However, the chapter does not cut corners and I felt I understood more fully how the, honestly stated, limitations of the technique linked to the details of the nuts and bolts of how the fMRI actually imaged the brain.

What this section critically lacked was a chapter describing the methods of experimental psychology. I needed, as an experimental psychologist, the methods of PET described to me. I suspect that, in a similar manner, other participants in cognitive neuroscience needed the methods of experimental psychology explained to them. All of us who do truly interdisciplinary work know that these methods are not obvious or even simple to grasp by researchers from a different background. After all, experimental psychologists have produced complex and weighty texts on such topics as reaction times, signal detection theory, and experimental design. We owe it to the interdisciplinary dialogue to make these methods clear, if only to avoid basic errors of design being made in studies which can be enormously expensive both in time and money. Unfortunately, the lack of this type of chapter may lead one to believe that this section was primarily written for the experimental psychologist.

The second way in which this book succeeds is as a manifesto for cognitive neuroscience in general, and more specifically the success of such an approach for the study of attention. In his introductory chapter Parasuraman explains how this new emerging discipline brings together multiple approaches to give a new and important insight into the mind and brain. Section 3 of the book contains nine chapters, which look at varieties of attention and show how the techniques of cognitive neuroscience have allowed an insight into the different types of attention, for example vigilance, spatial selection, object based attention, or attention in language. In section 4 both development and pathologies of attention are covered in five excellent chapters. Overall, these sections are well written and provide a readable summary and reference on these topics. Having read these chapters, one is left with the initial impression that the application of cognitive neuroscience to attention has been a success. That is perhaps the feeling that you are
supposed to have at the end of reading a manifesto. However, a truly mature cognitive neuroscience will have to also be self-evaluative and maybe even openly critical of the difficulties associated with such a synthesis of techniques. For example, how easy is it really to relate work on the neurochemistry of attention to behavioural studies of attention? Only time will tell if researchers from these disparate disciplines with very different techniques will produce work that is truly convergent and can address the same topic from the molecular to the behavioural level. When this synthesis does work, and this book contains some examples, the results are outstanding and present a really exciting prospect for the future of attention research.

This edited book is a great deal more than simply a collection of papers which would not have made it through the peer-review process to be published in a journal. The book goes beyond that criticism by finding value in the edited book format. This is achieved because it is both a handbook of techniques and a manifesto for the interdisciplinary study of visual attention. As such, it provides a model and a standard that everyone contemplating producing an edited volume should be measured by.

Iain D Gilchrist
Department of Experimental Psychology, University of Bristol, 8 Woodland Road, Bristol BS8 1TN, UK

Reference
Rayner K, 1998 “Eye movements in reading and information processing: 20 years of research” *Psychological Bulletin* **124** 372–422

The cradle of knowledge: development of perception in infancy by P J Kellman, M E Arterberry; MIT Press, Cambridge, MA, 1998, 369 pages, $39.50 (£31.50) ISBN 0 262 11232 9

Piaget suggested that the origins of intelligent behaviour had to reside in the perceptual and motor skills of infants. The way we interact with the world as infants shapes how we understand that world for the rest of our lives. By understanding infant perceptual development, we can begin to understand how humans piece together a coherent and consistent representation of the world.

Perceptual development is also at the heart of the current nature–nurture debate. The late 1980s has seen the rise of the “competent infant” school of thought. Relying on methods initially devised to test infant perception, researchers have revealed startlingly sophisticated competences in very young infants. For example, infants as young as 3½ months appear to remember the existence of hidden objects, and by 5 months they can use this ability to demonstrate a basic ability in addition and subtraction. Understanding how infants extract meaning from a rich and complex environment, and how this ability might develop with age, puts the reader in an excellent position to evaluate these recent claims.

This book covers a broad range of topics as might be expected in an advanced undergraduate textbook. However, although it can be used as a textbook, *The Cradle of Knowledge* is clearly more than just a textbook. Kellman and Arterberry present an ecological perspective on perceptual development. The fundamental axiom of the ecological framework is that the infant and the environment are in harmony, and that there is no such thing as uninterpretable sensation (eg Gibson 1988).

The first two chapters provide the background necessary for understanding the rest of the book. Chapter 1 takes a Marrian perspective (Marr 1982) and reviews the different levels at which perception can be studied. The ecological perspective is firmly situated at the computational level. That is, it answers questions such as: What is the perceptual task?, What information is available for perceiving?, and What constraints simplify the task? Development within an ecological framework is contrasted with the enrichment view of perceptual change. In this view, perceptual development consists of learning to ground sensory percepts through semantic reference. That is, the infant constructs a meaningful representation of the world from primary perceptual information. In contrast, the ecological view of development suggests that there is no stage in development in which the senses yield an uninterpreted product. This is not to say that perception does not develop. Environmental information is far too rich to be extracted all at once. Development, in an ecological framework, consists largely in the improvement of the precision and speed of the pickup of information. With this in mind, chapter 2 provides an overview of the physiological substrate
and sensory foundations of perception. The intention of this chapter seems to be to provide the reader with a basic characterisation of the human infant’s sensory system. These characteristics provide constraints on the type of information that can be used to interpret the world.

The next four chapters focus primarily on more complex visual perception. The chapters are grouped according to the following themes: space perception, pattern perception, object perception, and motion and event perception. These are exceptionally well-crafted review chapters that really illustrate the expertise and experience of the authors. In combining historical reviews with lucid up-to-date reviews of current findings, these chapters provide an essential tool for students and academics less familiar with the perceptual development literature.

Chapters 7 and 8 broaden the debate to include other modalities. Intermodal perception and auditory perception (especially from a language-acquisition perspective) are discussed, thus rounding off the book as a general presentation of perceptual development. Chapter 9 starts to hint at what is to come by discussing how perception relates to action. Indeed, we are creatures who act on our environment, and it is hard to consider the “what” of perception without reference to the actions they will guide. The chapter focuses largely on reaching and locomotion to illustrate this point.

The final three chapters open up the debate of perceptual development and its relation to other infant abilities. By discussing how perceptual development can help drive social and cognitive development, Kellman and Arterberry present the real attraction of an ecological approach to perceptual development. What appear to be highly sophisticated social and cognitive skills can be grounded in context specific and goal-directed perceptual abilities. These chapters focus on recent striking findings revealing extraordinary abilities in imitation, face recognition, number, categorisation, and physical reasoning in young infants. Here again, the main ecological theme resonates—that there is no sensory stage in which meaningful reality must be constructed from sensation and action (in contrast to Piaget’s view). Perception delivers ecologically meaningful representations of people, objects, arrangements, and events. What develops is the precision with which this information is extracted from the environment.

In the end, though, I was disappointed by the fact that the book intentionally side-steps the question of the mechanisms of development. As developmental psychologists, we are in the business of identifying the causes of development. That is, of identifying the mechanisms by which one level of competence grows into another level of competence. Even if this process is only one of refining the precision of the information that is extracted from the environment, an account that does not explain this process is not a developmental account.

Computational modelling offers one way of addressing the issue of developmental mechanisms. Connectionist or artificial-neural-network approaches have recently been applied in studying perceptual and cognitive development in infancy (see Mareschal, in press, for a recent review). Examples of behaviours for which mechanisms of development have been proposed include: early infant categorisation abilities, infant abilities to perceive partially occluded objects as unified, and the role of dorsal and ventral routes in determining infants’ object-directed behaviours.

Artificial-neural-network models provide a tool for relating observed behaviours to the underlying neural substrate that supports perception. Although the degree of biological plausibility in these networks is currently poor, the models still provide a means of incorporating some biological constraints in our models of development. Computational modelling plays an important role in the study of adult (visual) perception. It is now time for this methodology to be applied in the study of infant perception. A better understanding of infant development constrains the type of processes that can be proposed to explain adult competence.

The question of mechanisms not withstanding, The Cradle of Knowledge is a very exciting book that provides an excellent overview of perceptual development while offering many questions for further thought. It is highly appropriate for students or researchers less familiar with infant development and who may wish to begin questioning the origins of the human mind.

Denis Mareschal
Centre for Brain and Cognitive Development, Department of Psychology, Birkbeck College, University of London, Malet Street, London WC1E 7HX, UK
References
Gibson E J, 1988 “Exploratory behavior in the development of perceiving, acting, and the acquiring of knowledge” Annual Review of Psychology 39 1–41
Mareschal D, in press, “Connectionist methods in infancy research”, in Progress in Infancy Research volume 2, Eds J W Fagen, H Hayne (Mahwah, NJ: Lawrence Erlbaum Associates)
Marr D, 1982 Vision (New York: W H Freeman)

All books for review should be sent to the publishers marked for the attention of the reviews editor. Inclusion in the list of books received does not preclude a full review.