chapters occasionally feel as if they're veering away from the main course of the book. However, this heterogeneity is probably a good thing, and serves to emphasise that there is a groundswell of interest from a variety of different fields. This comes across as a specialist text, and I would imagine that scientists working on imagery, spatial cognition, or language will get the most out of it. However, the breadth of topics does mean that this collection will be as useful to dip into as it will be to absorb as a whole, and it may therefore reward a wider range of readers, from advanced undergraduate levels onwards. Perhaps this mixture of remits is something that we should all aspire to.

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Vision and brain: How we perceive the world by J V Stone; MIT Press, Cambridge, MA, 2012, 264 pages, $30.00 paper (£20.95) ISBN 9780262517737

I loved this book. A highly readable and accessible introduction to vision, it is distinctive in its emphasis on the computational principles underlying our visual perception.

This emphasis is laid out uncompromisingly in the first chapter. Rather than starting with the anatomy of the retina, the book begins by convincing the reader that vision is hard and inherently ambiguous. A succession of striking visual illusions helps Stone make the case that, although visual perception appears effortless to us, it is in fact an unexpectedly challenging problem, whose solution involves more assumptions and outright guesses than logical deductions. Stone ends the chapter by laying out Marr's famous three levels of analysis, arguing that the computational (or informational) principles are as important to understanding our vision as an acknowledgement of the neuronal hardware.

In the next three chapters Stone does then take us through the neuronal hardware: the anatomy of the eye, the projections from retina to thalamus to visual cortex, and so on. But at every stage he is concerned to bring out the underlying computational principles. The on–off centre receptive fields of retinal ganglion cells are not just described as experimental facts, but related to push–pull processes for achieving linearity. We learn about Fourier analysis and Taylor's theorem as well as orientation columns and cytochrome oxidase blobs.

As befits the title (vision and brain, not vision and eye), there is relatively little detail on retinal circuitry (amacrine, horizontal, or bipolar cells are not mentioned, for example) or phototransduction, but we find instead a whole chapter on Bayesian inference. While I welcomed this chapter in principle, in practice I felt it was one of the less successful parts of the book. The treatment is a little nonstandard, delaying the introduction of noise until relatively late. I found the text rather involved and hard to follow, especially the discussion of figure 6.4, and could not recommend this as an introduction to Bayesian theory.

This was uncharacteristic, because throughout most of the book the text is exceptionally enjoyable and easy to follow. I liked the unashamed poetry of Stone's language. Each chapter begins with a quotation, followed by a couple of sentences of "Impressions", sometimes in rather purple prose. For example:

> "Vast plains of gray, a virtual famine of information, a desert bereft even of redundant data. An arc of pure light sears itself into the retina, abutting an arc of darkness, creating a long cliff edge of light, and the famine is over."

I found some of these Impressions more successful than others, but they provided a refreshing change of pace. The book is full of striking images—for example, that "a neuron is like a wineglass", because it resonates with its preferred input. As well as figures and diagrams to aid comprehension, it includes pictures which are not strictly 'necessary' but serve to break up the text and make key points more memorable—for example, a picture of the Wright brothers' 1902 glider to illustrate Marr's point that "trying to understand vision by studying only neurons is like trying to understand bird flight by studying only feathers."

In summary, this book is an excellent addition to the range of introductory texts available in vision science. I will certainly be recommending it to my students, undergraduate and postgraduate alike.

Jenny Read, Institute of Neuroscience, Newcastle University

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How we perceive things is a very broad topic to attempt to fit into a book of only 224 pages (body of text). The anatomy of the eye, the nervous reactions and impulses from retina to visual cortex, and the various different aspects of perception (such as colour, contrast, and, the most fickle, depth) have enough detail in them to take up a book of more pages alone themselves. However, Stone does a brilliant job of summarising everything in very neat packages before giving the information out in a structured, scientific way that very rarely patronises the reader while ensuring that even the most complex concepts can be broken down into simple analogies that undergraduates, postgraduates, and postdoctorates can relate to and understand on any 'sticky' topics they suffer.

Stone starts with an introduction to the concepts discussed with many helpful illusory diagrams to underline the issues he is talking about, with a brief outline on why the eye perceives these illusions as such, without going into too much detail or going off on a tangent from the track of the book. The diagrams themselves are well presented, and the accompanying paragraphs provide a very clear representation of what each figure is there for. The next few chapters study much of the biology associated with the eye, covering topics such as the evolution of the eye itself, the way neurons send out signals, and the mechanisms used to transmit images from the retinal field to the mapping in the cortex. Much of this information is simplified, and small anecdotes provide a breakdown for anybody without a high enough standard of biological knowledge for the more complex subjects. A running theme throughout the book is the comparisons between computers and the work involving numbers. Stone regularly refers back to the concept of *computational theory*, strongly proposed by Marr, about the actual mechanism used to perform a task being unimportant, but the reason or function behind the task being the most imperative aspect to look at, and also quotes various speeds and sizes cited throughout. The chapter focusing on depth perception towards the middle of the book takes a closer look at the way the brain and eye cooperate to transform a 2-D mapping into a 3-D representation of the space around us, using cues from the environment and the aid of stereovision. The chapter very cleverly splits our depth cues into the various aspects before piecing the jigsaw together in the conclusion.

The book then moves on to the statistical model that the brain and eye appear to follow in the decisions on what the retina is portraying to what we are actually 'seeing': Bayesian inference. Stone explains and discusses the broad concepts and background of Bayesian statistics in a nutshell, and how they can be applied to vision and how research has indicated that indeed the visual system does rely on Bayesian inference. While the book covers all the key areas well, there should have been more page space allocated for writing out the equations correctly and maybe highlighting that the constant can be removed and a proportional sign can be swapped for an equals sign, with perhaps a couple of easier, purely mathematical examples to show how the numbers might fit into it all. That said, the content is all there and explained well for anybody in the scientific field with some, but not much, statistical background knowledge.

The information coding chapter was for the most part very interesting. The chapter goes into details about the way the information from the brain can be compressed using information theory. Reading about how the ganglion cells encode the information in bits, albeit a simplified explanation, was both stimulating and thought-provoking. The simplifications made the reading a lot more manageable, and the examples taken through were both short and clear. The way this chapter linked in with previous chapters in the book was also nice, as it reinforced ideas already covered in the book. The final part of the chapter about colour opponency, although only briefly touched upon, was the clearest explanation I have seen in any book or paper.

The book continues with the various deficiencies that the brain can suffer from, including the various forms of agnosia, which Stone describes from the viewpoint of suffering patients. It also goes into detail very well, from a different angle to usual, on why the brain sees as it does, via the independence of the visual characteristics the brain responds to. Stone goes into clear detail about the different low-level and high-level parameters (pages 213–219).

Finally, Stone closes with explaining his own personal stance on the field of visual science and explains that he worries that soon "we are in danger of ending up wandering around inside a silicon chip, knowing the inputs and outputs but without understanding *how* each component transforms … nor *why* such … is desirable." He goes on to express that as scientists we should ask for more than just an explanation of the mechanisms of vision, but also the underlying computation that goes on around it. This is a view I find particularly appealing, and one that could be applied to many other aspects of biology, particularly the other sensory systems. The further reading Stone suggests at the end of his writing leaves no doubt to the reader that this is very much an overview of the different facets of vision that can be researched, although a chapter-by-chapter further reading list might have been helpful, had somebody had only one particular part of the book they wanted to explore further.

Vision and Brain has compiled various important aspects of human perception in a clear, thorough, and succinct way. Stone's to-the-point explanations make every page worth reading twice, and his anecdotal way of explaining the more complicated concepts lends itself well to this book being used at any level. The topics covered delve just deep enough to raise many a complicated question and then proceed to answer just a handful. I would argue that the book could, in fact, be read even by nonacademics who just had a slight interest in the eye and how the eyes see; however, the price may put these readers off when there are cheaper alternatives or free sources such as Wikipedia that they could use. That being said, any academic who wonders if the book is worth the £20.95 price tag for only 224 pages will not be disappointed. As a postgraduate student from a maths background I found the information was delivered at a good level of understanding and with enough detail for me to grasp the ideas but not get lost in the details. I particularly thought the figures and mathematics lent themselves well to the book, as they were put in at the right moments and not used simply as illustrations to stop the reader from becoming bogged down with the amount of words they were reading. Stone has done an excellent job of bringing together many pieces of the visual puzzle, and showing the bigger picture in an engaging, concise, and accessible way for any audience of readers, be they undergraduate or postgraduate.

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Understanding pain: exploring the perception of pain by F Cervero; MIT Press, Cambridge, MA, 2012, 192 pages, $24.95 cloth (£17.95) ISBN 9780262018043

Understanding Pain by Fernando Cervero begins with a 3-year-old's first remembered experience of pain: falling from a swing in the playground, they cry, and are comforted by their mother who treats the cut knee and tells him that "Big boys don't cry" (Preface, page xi). This is a nice demonstration of the pain that we all experience from one time to another during our lives, which is described in this book as an example of 'good' pain, as opposed to the 'bad' pain that may occur following injury when things go wrong in the central nervous system. All throughout *Understanding Pain* Fernando Cervero illustrates the biological enigma that is pain through the use of carefully chosen anecdotes, and patients' descriptions of their symptoms. The book provides a comprehensive and accessible review of the neurobiological basis of pain perception, and will be of interest to both pain researchers and the reader with a general interest in pain.

To put pain in a historical context, the pioneering work of Charles Sherrington is presented. At the turn of the 20th century Sherrington identified a new class of nerve fibres, known as nociceptors, that are specialised for detecting tissue-damaging stimuli. The importance of Sherrington's discovery was that it directly addressed the prevailing theories about pain perception, developed centuries earlier, by Aristotle and Descartes. They postulated that pain was either the result of activity of specific tissue-damage sensing fibres or arose due to patterns of intense activity of the five 'conventional' senses (touch, taste, hearing, sight, and smell). Sherrington's work favoured Descartes's interpretation of nociception. It is interesting to learn from this historical perspective how theories about mind and body have shaped, and continue to shape, ideas about how we process pain-related information. Of course, to understand pain, you need to be able to measure it, and this book does an excellent job of explaining just how difficult this is. Indeed, many of the tools of the trade—from the problem of pain measurement with visual analogue scales in humans, to the inadequacies of the tail-flick response to noxious stimuli in rodents—are discussed in some detail. However, whilst recognising the difficulties in using nonhuman animals to study pain, this book missed an opportunity to describe the development of more ethologically valid measures of pain behaviour in animals.

If there is one criticism (and also a strength) of this book, it is that it deals with the author's own research area (nociceptors) in perhaps a bit too much depth. The author comments on feeling guilty that his daughter was "the only kid in her [elementary school] class who knew what TRPV1 receptors were" (Preface, page xv), and it is clear that this is a subject that is dear to the author's heart. That said, for the reader who wants to know about the nociceptor's place in history, and its role in generating pain,