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BOOK REVIEWS

Vision and Brain: How We Perceive the World. By James V. Stone. Cambridge: MIT Press, 2012. 264 pp. Paperback \$30.00. ISBN: 9780262517737.

Vision research is an enormous field served by several dedicated journals. The overwhelming challenge of distilling this information for the beginner is not trivial but is elegantly accomplished in the new book *Vision and Brain* by James V. Stone. In a very readable 224 pages, Stone takes the novice from a strong motivation of the conceptual problems of vision (“Seeing is very easy—and very hard”) to a point where they have sufficient information regarding how we perceive the world to constructively attack Stone’s arguments—fulfilling, in this reviewer’s opinion, the key job of an introductory text. The book begins with a useful, succinct survey of visual illusions, including classic ones of illusory contours as well as less familiar ones that illustrate the profound computational problem resolved by the visual brain: transforming necessarily ambiguous two-dimensional retinal image projections into decisive representations of the three-dimensional world. This is followed by a lucid chapter sketching out the structure and function of the eye.

What makes the book so strong is the conceptual framework within which each chapter is written: rather than a deluge of facts, the book builds a narrative out of the problem of vision. For example, in the chapter on the eye, the book begins with Charles Darwin’s famous “cold shudder” at the complexity of the eye—which for Darwin represented a possible affront to his evolutionary theory. Stone shows how Darwin overcame his initial intuition that the eye was too complex to be accounted for by evolutionary processes, and in so doing guides the novice toward a deeper insight not only into how the visual system evolved and operates but also into how to approach problems in visual neuroscience: with logic, not faith. This lesson is especially relevant in visual neuroscience since the process of vision is so immediate, unconscious and “obvious” that many beginners find it hard to recognize the awesome challenge that the system poses to science.

The conceptual framework is especially useful in the context of relating the neural mechanisms of vision to computational processes, which Stone does by invoking Ben Logan’s powerful theory that the locations of luminance edges provide all the necessary information to reconstruct a retinal image. Stone uses a set of simple figures to take the reader through the argument, made compelling by an initial explication of visual receptive fields from a psychological perspective, and a return to Hubel and Wiesel’s Nobel-winning discoveries of orientation-tuned receptive fields in primary visual cortex. By sandwiching the conceptually challenging computational work between the psychology and the neurobiology, Stone manages to weave together several sub-fields—psychology, neurobiology, and computation—and shows how these fields can benefit by cross fertilization.

After logical progression that follows retinal signals through visual cortex, the book arrives in Chapter 7 (finally!) with a consideration of color. The topic of the book is vision in general, but for those of us who think that color is the rosier lens through which to view all conceptual problems of vision, the delay in getting to color is protracted. The chapter may be disappointing to experts who will quibble with the gambit that there are “three primary colors (red, green, and blue), and these correspond to the three cone types in the retina,” but it does an admirable job fleshing out the problems that the visual system has to solve. It does so within the computational framework established earlier in the book, here considering the bottleneck imposed by the optic nerve and solutions to this bottleneck provided by information theory. For many readers, this motivation to the study of color may seem obtuse: we are inherently interested in color. However, it allows Stone to tackle the neuroscience of color in contemporary terms, interpreting cone-opponency not as the basis for Hering’s color processes as was common in textbooks of the past, but rather as a mechanism for communicating maximum color information with minimal chromatic channels.

(continued on page 217)

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BOOK REVIEWS

(Continued from page 176)

The chapter on color underscores a minor weakness in the book that might upset some more cautious scholars: Stone treats the psychological processes of vision and their neural implementation in a teleological vein. The implication throughout the book is that the system operates the way it does because this is the best way to operate, an assumption that is impossible to test and one that might just be wrong. However, it is a useful heuristic, and if not taken too seriously will serve its purpose to carry the reader toward an understanding of how the system operates. The largest weakness of the book, however, is that it does not develop an account of color beyond the retina. Unlike the rest of the book, which takes up neurobiological implementation within the cortex, Stone leaves out any consideration of the cortical mechanisms for color. Important psychological material—color constancy, memory colors, color categories, color–shape interactions—are left out.

Illumination, Color and Imaging, Evaluation and Optimization of Visual Displays. By Peter Bodrogi and Tran Quoc Khanh. Wiley-SID Series in Display Technology Berlin: Wiley-VCH, 2012. 395 pp. \$135.00. ISBN-13: 9783527410408.

Peter Bodrogi and Tran Quoc Khanh’s book, *Illumination, Color and Imaging, Evaluation and Optimization of Visual Displays*, is an up-to-date, much needed, and very comprehensive reference on self-luminous, color display technology that, till now, has been bereft of any such treatise since the beginnings of color in CRT displays more than 50 years ago. It is, as stated by Dr. Bodrogi in the book’s preface, “. . . a monograph about how to exploit the knowledge of the human color information processing system in order to design usable, ergonomic and pleasing information displays, entertainment displays, or a high quality visual environment” from the trichromatic retinal receptors to the higher orders of cognition - color preference, harmony, and

Anyone who may have heard about a single specialized “cortical color area” will be left harboring this misimpression. This is unfortunate since there have been many exciting developments in color neurophysiology that have broad implications for understanding mechanisms of vision generally. For Stone, color is simply another domain in which to advance a computational conception of vision, and readers who are genuinely interested in the unique role that color serves in vision will be left hungry. However, Stone meets his goal: the reader is now equipped to dive into the primary literature and find the answers they seek.

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emotions. While the breadth of the book’s scope is limited to self-luminous display technology, the depth of its scope is as deep as the most comprehensive of references, and any review cannot possibly cover all that this reference brings. Hence, the following can only point out some of the highlights that make it so very unique. The book is readable but slightly awkward in its grammar in some places as if it was translated from the German.

The relevant features of color vision, from the retina through the higher orders of the brain are introduced first: retinal photoreceptor structure, spatial and temporal contrast sensitivity, color appearance, and color difference perception; legibility, visibility, and conspicuity of colored objects in information display applications; and preferred, harmonic, and emotional color. The technical challenges and opportunities to display and illuminant technology that each of these represent are discussed.

(continued on page 228)