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Reviews

Neural mechanisms of color vision: Double-opponent cells in the visual cortex

by B R Conway; Kluwer, Boston/Dordrecht, 2002, 143 pages, $174.00 (€185.00, £120.00)
ISBN 1 4020 7092 6

One of the main attractions of visual neuroscience as a subject is the very real potential it offers for understanding the relationship between mental events and physical phenomena in the brain. David Marr (1982) characterised the study of vision in terms of three levels of explanation—the computational (what is the problem to be solved), the algorithmic (how can the problem be solved), and the implementational (how is the brain organised to carry out this solution). In colour vision, we have a pretty good idea of the problem. The perceived colour of an object should have some near-enough constant relationship to the properties of the object's surface—how well it reflects light of different wavelengths—regardless of the colour of light illuminating the object. Edwin Land devised an extremely satisfying basic solution to this problem, the retinex algorithm, many years ago (eg Land and McCann 1971). If colour perception really involves the application of the retinex algorithm to estimation of the reflectance properties of the surfaces of objects, then we should also be able to find some evidence of its simple implementation in the brain. One of the key features of the retinex algorithm is the role played by the local chromatic contrast between adjacent surfaces in the visual scene. A good reflector of long-wavelength light placed next to a poor reflector of long-wavelength light will keep reflecting more long-wavelength light than its neighbour, no matter what the composition of the light illuminating them is. One might therefore expect to find cells in the visual system which, individually or collectively, extract colour contrasts across spatial boundaries. Evidence that cells with the right properties existed in the primary visual cortex of monkeys began to appear in the 1960s and 1970s; however, subsequent analyses suggested that these were not, in fact, the elusive double-opponent cells that would compute chromatic contrasts across borders.

Bevil Conway describes all this and more in a 25-page introductory chapter on the history of colour research that would provide an excellent starting point for an advanced undergraduate course on colour vision. He goes on to describe, in considerable detail, the experiments he conducted which finally provide compelling evidence for the existence of double-opponent cells in macaque striate cortex, and their spectral, spatial, and temporal tuning properties. A final chapter discusses more general issues regarding specialisation in the visual system, parallel processing, and the 'binding problem'. This structure—historical introduction, detailed experimental work, broad concluding chapter—should give the game away: this is clearly a PhD thesis. There is absolutely nothing wrong with publishing a PhD thesis as a book, and this is an excellent thesis. It is, however, a phenomenally expensive, and fairly slim, book (a pound a page, excluding references and blank pages) and the reproduction of the figures is not especially good. Moreover, Conway's journal publications of the experimental work are also highly detailed (Conway 2001; related work is reported in Conway et al 2002), so, if you have already read the papers, for your £120 you get the introduction and conclusion. I need to reiterate that this is fascinating and important work and that the introduction is an especially enjoyable, clear, useful addition to the published experimental work. If money was no object I would recommend this as a worthy addition to your office bookshelf or your library, but ...

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Marr D, 1982 *Vision* (New York: W H Freeman)

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The physiology of cognitive processes edited by A Parker, A Derrington, C Blakemore; Oxford University Press, Oxford, 2003, 294 pages, £85.00 cloth, £39.50 paper (US $125.00, $60.00) ISBN 0 19 852560 5

Filling-in: From perceptual completion to cortical reorganization edited by L Pessoa, P De Weerd; Oxford University Press, Oxford, 2003, 340 pages, £49.50 (US $69.95) ISBN 0 19 514013 3

Folk physics for apes: The chimpanzee's theory of how the world works by D J Povinelli; Oxford University Press, Oxford, 2003 (first published 2000, reprinted with corrections 2003), 391 pages, £19.95 paper (US $35.00) ISBN 0 19 857219 0

Why we see what we do: An empirical theory of vision by D Purves, R Beau Lotto; Sinauer, Sunderland, MA (distributed in the United Kingdom by Macmillan Distribution Ltd, Houndsmills, Basingstoke, Hants), 2003, 260 pages, $42.95 paper (£27.99) ISBN 0 87893 752 8

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