

BOOK REVIEWS

Transparent Things

Foundations of Cyclopean Perception. By Bela Julesz. Pp. xiv+406. (University of Chicago: Chicago and London, 1971.) £9.

Foundations of Cyclopean Perception is an exciting, stimulating book about one of the most interesting recent developments in perceptual psychology. It is also beautifully produced, worth buying as an object in its own right. As a book it can be read and understood on several levels. It is a mixture of transparent clarity—most of the experiments the author discusses can be attempted by the reader—and of abstraction which can be difficult and even ambiguous.

Julesz has worked on binocular interactions in human vision for about 15 years. His fundamental technique is to use a pair of patterns which give a depth percept when fused binocularly, as in a stereoscope, but which contain no monocularly perceivable form. The advent of large digital computers made the generation of such stimuli possible: perhaps Julesz's greatest achievement is his combination of modern technology with conceptually simple experiments. A typical stimulus is a pair of patterns of equal numbers of black-and-white square picture elements arranged at random in 100 element square arrays, giving the impression of randomized chess boards. Both patterns of a pair are identical except that, say, a central square portion of the array in one is shifted horizontally by an integral number of picture elements with respect to the same region of the other. When the two patterns are fused binocularly the lateral disparity leads to the percept of a central square region standing out in depth from the remainder of the fused array, which forms a rectangular surround in a different depth. Although the disparities cannot be detected by visual inspection of the separate patterns of each pair, the retinal disparities between the fused images are perceived. In normal vision such differences in retinal disparity between regions of fused images automatically lead to the perception of depth, but before Julesz's work it was assumed that the disparity

information could not be used without prior recognition of forms in the visual stimulus. A clear conclusion from this kind of experiment is that depth perception, and the underlying processes required to detect the disparities between two retinal images, can be entirely central processes not requiring monocularly recognizable structure and independent of eye movements and vergence. Not only is it possible to draw conclusions about depth perception, but it is also possible to use Julesz's technique to distinguish the central and peripheral components of a wide range of visual phenomena. Many such experiments are described in the book, and the significance of their results to visual pattern processing and to general theories of neuronal function is discussed in detail.

Julesz's technique has led to two kinds of achievement; a much better understanding of the mechanisms of binocular vision and depth perception, and a method for locating function within the central nervous system. I shall not list his major results, but I do think that it is worth stressing their relevance to the most difficult unsolved problems of perceptual psychology. First, he shows clearly that "familiarity deprivation" can lead to novel and surprising insight. New kinds of stimulation may be necessary for new discoveries. Second, as had been well understood by many earlier workers, the use of binocular interaction is an extraordinarily powerful tool for locating visual function. Obviously it provides a way of separating peripheral from central components of a percept, but more than this, a hierarchy can be built up, in which the relative level of a function can be assigned a place. For example, in some circumstances it is clear that motion perception can occur after fusion, at a higher level than the pattern-matching process for random dot stereograms. In this case the stereograms were used to separate cues for movement that are inextricably mixed in normal vision.

There are several irritating aspects to the book—for example, considerable redundancy—but as a whole it is a huge

achievement, making an original synthesis of visual perception and providing stimulation and suggestions for experiment that will be hard to exhaust. I think that some of the material is included prematurely, for example, sections on eidetic imagery and model building, but for many readers these may well provide a feeling of more immediate contact with work actually in progress.

In short, Julesz has written an original, idiosyncratic, immensely exciting and beautiful book. It deserves a wide audience, particularly because almost all the experiments described can be performed by the reader using the anaglyph representations of Julesz patterns (which, incidentally, are of the highest quality that I have seen printed). The accessibility of the results makes it much easier to accept Julesz's slightly dogmatic style, and gives one a much greater feeling for the synthesis of perceptual psychology and neurophysiology towards which Julesz is continually pointing, and without which an understanding of perception is impossible.

ANTHONY ROBERTSON

Wallace and Darwin

Wallace and Natural Selection. By Lewis McKinney. Pp. xix+193. (Yale University: New Haven and London, September 1972.) \$12.50; £4.95.

DR MCKINNEY has given more than six years of close study to Alfred Russel Wallace. He has traced minutely the intellectual and empirical sources of that great naturalist's thoughts on selection, and has carefully documented the relations between Wallace and Darwin. The results appear in this book—an elegant and readable piece of scholarship, drawing together a vast quantity of published and archival material. The microscopic examinations of Wallace's deception over the actual place of his "sudden insight" into the mechanism of evolution, and the even more interesting deception by Darwin over Wallace's 1858 paper, are fine examples of historical detection. Some intriguing ques-