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Visual Cognition

Edited by Steven Pinker. Cambridge, MA: MIT Press, 1985. 280 pp. Paper, $17.50.

This collection of the six articles of a 1983 special issue of the journal *Cognition* addresses two themes: visual pattern recognition and visual imagery.

Recognition is addressed by "Parts of Recognition" by Donald D. Hoffman and Whitman A. Richards and "Visual Routines" by Shimon Ullman. Hoffman and Richards focus on a problem noted by Marr: the subjective decomposition of complex shapes into parts at regions of concave discontinuities. The contribution here is the citation of the topological constraint (the transversality regularity) that the arbitrary interpenetration of shapes will virtually *always* produce concave discontinuities. No developed scheme for recognition is proposed by Hoffman and Richards, but they do critique various proposals for shape primitives with the claim that such primitives "are clearly inappropriate for faces, cars, shoes . . ." (p. 76). In the absence of a principled analysis of data on the recognition of such stimuli, their critique must be regarded with caution. In fact, recognition is most efficient when it *can* be controlled by a description of shape primitives (Biederman, 1987). Stimuli such as shoes likely suffer when compared with objects, such as airplanes, that allow a ready decomposition into a number of shape primitives. Although faces probably constitute a special biologically defined case, it is not particularly difficult to model a face with shape primitives. And it is likely that one has more trouble discriminating between two faces than between a face and a giraffe!

Ullman examines a number of problems regarding shape processing, such as determining whether a point is inside or outside of a given region or whether two points are on the same contour. He argues that general visual

routines—for example, coloring (fill) and contour tracing—underlie our capacities for performing such tasks and that these routines are essential for recognition. Although the problems identified by Ullman have been neglected, my own guess is that they (or at least their assessment) involve processing that is much too slow for the 100 ms required to recognize a picture of an object. Moreover, object recognition latencies are shorter for objects that contain more parts and, consequently, more contour. Instead, Ullman's tasks may be more relevant to the understanding of complex search and reasoning activities about shapes and contours *following* recognition.

Roger N. Shepard and Shelley Hurwitz explore the relation of *up.* Their analysis is reminiscent of Clark's (1973) investigation of the origin of spatial terms and spatial metaphors. In this case, *up* is interpreted as not only referring to the vertical direction away from gravity but also as the direction toward a significant reference object, north, and the direction ahead. The last yields to a particularly interesting analysis by Shepard based on the projective geometry that more distant points will project to a higher point to an above-ground viewer. Chronometric experiments suggest that mental rotation is required when straight ahead is not aligned with *up* when interpreting line bends, as is often apparent when reading maps (where the rotation can be of the map itself). One point of confusion: The authors argue that *up* metaphorically refers to a direction toward a significant entity, the unmarked direction *up* identified with the "unmarked near" (p. 165). But near is marked.

Stephen M. Kosslyn, Jennifer Brunn, Kyle R. Cave, and Roger W. Wallach apply psychometric techniques to individual differences in imagery ability. They argue that imagery is not an undifferentiated general skill but can be decomposed into a number of components. Presumably these can be identified with portions of the Kosslyn-Schwartz theory. Martha J. Farah attempts a similar decomposition of the factors underlying imagery from the standpoint of deficits manifested by selected neurological patients.

The introductory chapter by Steven Pinker is alone worth the price of the book. In particular, his summary of the status of imagery theory and research is the best I have seen. Pinker's presentation of shape representation and recognition is also of high quality. Perhaps it can be faulted as being restricted to Marr's approach, but Marr's contribution certainly needs to be considered by perceptual psychologists and Pinker does a masterful job. A more critical treatment might have brought out the Binford-Witkin-Tenenbaum-Lowe emphasis on nonaccidental properties (NAPs) as an alternative to Marr's approach. My own view is that NAPs provide a more likely candidate for the preferred algorithm by which the visual system and brain solve the problem of inferring a 3-D world from a 2-D image.

A curious contrast is evident in the character of the research activity on the two themes of this book. Research on imagery is accompanied by voluminous experimental data with somewhat modestly developed theory. In contrast, theories of shape for recognition have well-developed theory but are rarely accompanied by experimental data. The problems of imagery

research have received ample documentation in other sources, but what can account for the surprising state of affairs in visual-pattern recognition? I suggest at least two factors, perhaps both generated by a failure to be clear about the goals of the computation for human recognition. Many investigators of pattern recognition appear to have succumbed to what may be called the Doctrine of Casual Viewing: If an image that has been filtered or altered in some manner can be more-or-less interpreted, then whatever was affected by the filtering is taken to be of no consequence. Quite the opposite is often the case once the time course of perception is measured. The second factor is that many theorists are looking for a single simple formalism to describe all of shape representation. But it is likely that different aspects of images, for example, parts, relations, and textures, are handled by different processes.

Befitting the reputation of the contributors, all the chapters in this volume are of high quality, and the student of visual cognition will be amply rewarded by reading them even years after the original appearance of the papers.

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User Centered System Design: New Perspectives on Human-Computer Interaction

Edited by Donald A. Norman and Stephen W. Draper. Hillsdale, NJ: Erlbaum, 1986. 526 pp. Cloth, $39.95. Paper, $19.95.

This book is the outcome of research conducted at the University of California, San Diego, by faculty in psychology and artificial intelligence. The book represents a combined effort by a group of participants in the ongoing research projects and an additional group invited to join them in a workshop that was truly a collaborative effort. That there was indeed more interaction among contributors than is often found in this type of book is evidenced throughout by references to chapters other than those by the author.

There are seven sections: "A Survey of the Field as a Whole"; "On the Interface Experience"; "On User's Understanding"; "User Activities"; "Toward a Pragmatics of Human-Machine Communication"; "Information Flow"; and "The Context of Computing." Each section has one or more chapters with a brief overview for each.

The book is a must for software designers, applied cognitive psychologists,