Try to see things differently

Stuart Sutherland

Vision, Brain, and Cooperative Computation. Edited by Michael A. Arbib and Allen R. Hanson. *MIT Press: 1987. Pp. 730. $65, £58.50.*

ONLY 20 years ago it was possible to keep up with all the research published on vision, with the possible exception of colour vision — always an arcane speciality. Today there is so much work done in each subdivision of the field that it is impossible to keep abreast of it all: indeed it has become difficult to cope adequately even with one of the many subdivisions such as motion perception, stereopsis, eye movements, the extraction of lines and edges from the retinal image, the use of motion to form a three-dimensional description of an object, the ability to construct a representation of a scene from glimpses obtained through successive fixations, and the recognition of patterns and objects.

Vision, Brain, and Cooperative Computation deals with all these topics and many more, and as the title implies it does so from the point of view of psychology, neurophysiology and artificial intelligence. The book is not for the faint hearted, for it would take a polyopticist to understand in depth its highly technical chapters covering such a wide range of phenomena and ways of thought. Nor do the editors, Michael Arbib and Allen Hanson, do much to help, for the graphs are often poorly labelled and captioned, and much of the writing is slovenly. Take for example the sentence "The level of formulation is in terms of symbolic constraints and algorithms for solving them": surely one does not solve constraints though one may use constraints to solve problems. Also, the book is so full of abbreviations that parts of it are more akin to Stock Exchange listings than to prose. It is sometimes difficult to separate what is new from the frequently occurring but magisterial statements of the banal, such as "I suggest that the cortex has adopted representational and computational strategies that make the computation of invariants efficient", a view with which few are likely to disagree.

Nevertheless — and despite the fact that the conference on which the book is based took place four years ago — most workers on vision will find scattered through its pages nuggets of information with which they are unfamiliar. Sparks and Jay argue that in the superior colliculus, which is involved in the control of eye movements, cells code for the target position of the eye in its orbit, not simply for the retinal distance and direction from the fixation point of the target to be fixated. If the target is briefly illuminated and an eye movement occurs before the fixation movement to the target, account is taken of the new position of the eye.

A more dramatic and better known neurophysiological result is Spinelli's finding that cats exposed only to vertical lines on one eye and only to horizontal on the other develop central cells that are maximally stimulated by a vertical line on the former eye and a horizontal on the latter. This result is important because it demonstrates conclusively that learning can occur at this level of the visual system — the combination of lines is one that cannot occur in nature.

On the psychological side, Weisstein and Wong review some elegant experiments showing that judgements of orientation are much better for lines embedded in a part of the scene that is taken as figure than for lines on what is taken as background. Moreover, while sharp lines are more readily detected when inside a figure, blurred lines are more readily detected when in the background. In both cases the lines were fixated, so these results are not due to differences in retinal position. Under most circumstances fine detail within a figure is important to us, whereas a general impression of the background will suffice. It is nevertheless remarkable that the visual system has evolved to meet these task requirements in so subtle a way.

Readers' hopes will be aroused by a sentence beginning "In an informal study of the motor skills involved in drinking beer . . .", but alas the findings have no practical application, particularly as they concern only the replacement of the beer mug on the table, not the action of picking it up. In replacing it, there is a fast movement to a point above the table followed by a slower movement that lowers it gently on to the table. The distance above the table at which the fast movement ends increases with increased alcoholic intake, thus allowing a greater margin of error — again a nice example of the way in which the human brain adapts, though in this case the adaptation is presumably due to learning not evolution.

The chapters on artificial intelligence are so opaque that it is hard to know what to make of them. One presents a network for storing the representations of events in their temporal order, but it gives no consideration to the factors that influence people's memory of temporal order. Another develops a suggestion of Alan Cowey's that the reason why different properties of the visual image are coded in different central cells is that far more cells would be needed if there were different cells coding for each possible combination of properties. Rightly or wrongly I felt that many of these contributions were merely restating a problem rather than attempting to solve it.

Like most books of collected papers, this one fails to make a satisfying meal. But it does provide quite a few tid-bits, some of which are more easy to digest than others. □

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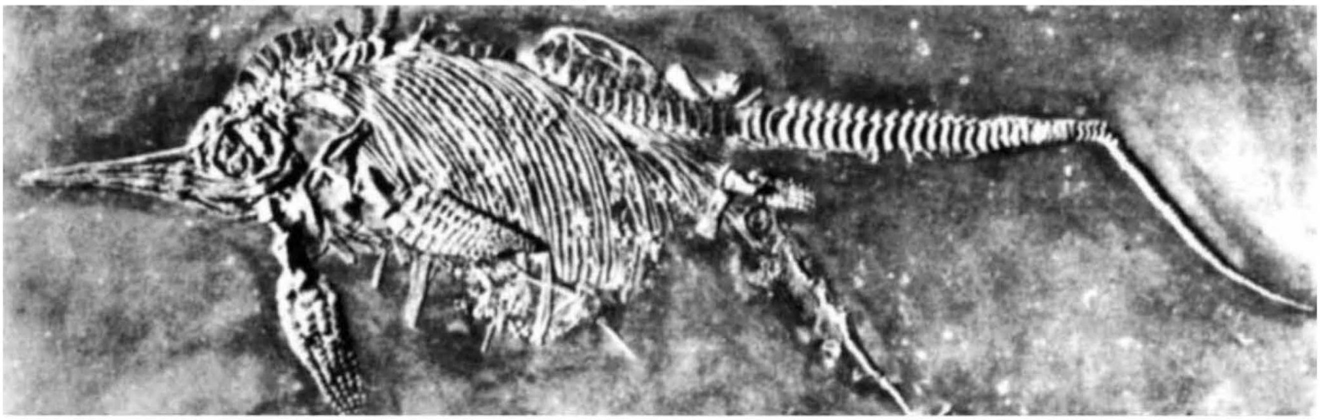

Freeze-frame — a fossil skeleton of a Liassic ichthyosaur in the process of giving birth c. *200 million years ago. The photograph is taken from* Vertebrate Paleontology and Evolution *by Robert L. Carroll, which examines each fossil group in terms of classification, skeletal and functional anatomy, distribution and ecology. The book has over 1,700 illustrations, is just published by W. H. Freeman and costs $52.95, £47.50.*