Book Reviews

The Bases of Behavior

Comparative Psychology at Issue. Papers from conferences, Tokyo and Honolulu, Aug. and Sept. 1972. ETHEL TOBACH, HELMUT E. ADLER, and LEONORE LOEB ADLER, Eds. New York Academy of Sciences, New York, 1973. 198 pp., illus. Paper, $18. Annals of the New York Academy of Sciences, vol. 223.

This timely little volume consists of papers presented by 15 contributors at a series of meetings held in 1972. At these meetings leading investigators and theorists discussed the issues that had been raised in an article by R. B. Lockard a year earlier ("Reflections on the fall of comparative psychology," *Am. Psychol.* **26**, 168 [1971]). In the end no clear statements are made either in support of or refuting Lockard's main arguments, but this may be a reflection of the "committee" approach.

Two main themes emerge. One is the growing evidence that evolution has produced behavioral adaptations highly tuned to ecological conditions in closely related as well as in distantly related animal species, giving rise to behavioral diversity among animals. On the other hand, common descent and, on a smaller scale, speciation imply underlying communalities of behavioral mechanisms. As Hidaka expresses it, "The theme is always hidden in the variations and is never stated beforehand; and the variations are really the existing species, which are all we can observe" (p. 75).

Lockard's argument has serious flaws that are only touched upon by several writers. He asserts that natural selection acts only on heritable behavioral traits, resulting in the transmission of genetically based behavioral adaptations to specific ecological niches. If this means anything more than that surviving animals (therefore adapted ones) produce like young, which cannot be disputed, it ignores the fact that natural selection acts only upon the outcomes of behavior and is indifferent to the mechanism by which these outcomes are achieved. Moreover, "genetically based behavior" refers to all behavior, including those behaviors which depend upon genetically based mechanisms for acquiring behavior through experience. Genetic material is indifferent to the mechanisms by which it is transmitted to offspring: like natural selection, it is concerned only with outcomes. Innate behavior may be defined, as it is by Lockard, as genetically based, but this definition is not equivalent to "developing without experience" as Lockard is prone to believe. In this volume only Klopfer challenges the concept of innate behavior as proposed by Lockard.

Nevertheless, the various authors discuss issues of concern to comparative psychologists. The value of the comparative method is discussed by J. P. Scott, D. A. Dewsbury, W. Wickler, T. Hidaka, and H. Moltz as applied to the study of behavioral development, the nature of imprinting, mating behavior in mammals and in Lepidoptera, and convergent adaptation. Behavior patterns having similar adaptive functions in different species can be the starting point for the analysis of species differences in behavioral organization. Behavioral homology is discussed by several writers, and the difficulty of deriving lineages to account for existing behavioral homologies is acknowledged to a greater extent than in Lockard's article.

W. H. Thorpe and C. Pfaffman, from different viewpoints, discuss the significance of the evolution of behavioral capacities as adaptations to specific habitats. Thorpe proposes that mechanisms of both innate and learned behavior are specialized adaptations and gives examples from several species to support this view. Pfaffman discusses how the use in neurophysiology of natural stimuli derived from analysis of species-specific behavior patterns has led to the discovery of specialized neurophysiological capacities, particularly in sensory perception (that is, sensory coding). To this reviewer there remains a question whether the ethological "lock and key" conception of the releasing stimulus is compatible with the properties of neural functioning revealed through sensory neurophysiology.

The subject of higher mental functions, often neglected in comparative psychology, is represented by the articles of L. V. Krushinskii and K. H. Pribram. The former discusses complex spatial perception as it appears in different species, and the latter addresses himself to the problem of language use and the processes that underlie it.

The most comprehensive theoretical article is that of H. P. Ziegler, who attempts to deal with the central issues raised by Lockard and by the problem of dealing simultaneously with the similarities and differences that are presented to us by the diversity of animals and their specialized behavioral adaptations. It is a complex article, difficult to summarize, but highly recommended.

The editors were wise not to try to impose too much form on the individual contributions or to attempt in their epilogue to integrate or resolve the issues raised during the meetings. I doubt that the latter can be done at the present time, and that perhaps is the message of this volume.

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Artificial Intelligence

Computer Models of Thought and Language. ROGER C. SCHANK and KENNETH MARK COLBY, Eds. Freeman, San Francisco, 1973. x, 454 pp., illus. $13.50. A Series of Books in Psychology.

The "computer models" in this anthology's title are of two sorts: computer programs which are meant to act as models of human thought processes, and accounts of mental activity which compare the mind to a computing system but which have no particular computer program associated with them. The models of the second kind might more properly be called theories, but there is a tendency throughout the book to use the words interchangeably and to obscure the fact that one of the principal difficulties both in constructing and in appreciating model programs is in sorting out the part that is of theoretical interest from the part that is not.

The book is arranged in four sections. The first consists of a single paper by Allen Newell surveying the field of artificial intelligence from several points of view and trying to explain why anybody should do such work. Unfortunately the paper was written some years ago and does not cover the sort of work on language and the representation of knowledge and belief to which much of the volume is devoted.

The next two sections cover theories about the mental programs that determine how we interpret and react to language. The writers in the first of these sections (Schank, Simmons, Wilks, and Winograd) put their emphasis on sophisticated techniques for discovering and representing the literal meanings of utterances. Colby and Abelson, who follow, are content with a cruder linguistic analysis and are more concerned with what significance the utterance has for the hearer. Colby's model of paranoid behavior, for instance, is concerned primarily with detecting the degree of hostility in the remarks addressed to it, and can do this to some extent by simply noting references to certain topics, without always recognizing what is being said about them. Abelson's simulation of a right-wing political ideologue is primed with a "masterscript" for world events, representing the myths by which it lives, and it tries to relate everything it is asked or told to this script. The only events it believes possible are the kind that occur in the script—that is, the Free World might defend neutral nations, but will never attack them—and, given an event that matches the script, the program is willing to predict what will happen next and ascribe motives to the actors involved.

The other four authors are interested primarily in advertising the merits of various theoretical tools for studying language. Winograd advocates the representation of knowledge by procedures—he wants to view knowing as largely a matter of knowing how—while Wilks uses "paraplates," Simmons "semantic networks," and Schank "conceptual dependency," a scheme for building up complicated concepts out of simpler ones that is also used by Abelson later on. Only Winograd describes a program that is sufficiently impressive in itself to force us to take his ideas seriously. The techniques of the others have to get by on whatever intuitive appeal they can muster.

Winograd's program displays a scene, consisting of a collection of blocks, on a television screen. It moves the blocks about on command and answers questions both about the scene and about its own actions. It is capable of understanding a wide range of English constructions.

The final section of the book consists of three papers, by Earl Hunt, Robert K. Lindsay, and Joseph D. Becker, using computational terminology to discuss some of the properties of human memory. Hunt, for example, suggests that "man is describable as a dual processor, dual memory system with extensive input-output buffering within each system." These writers are more concerned than the others to have their models learn from experience, but there is no serious attempt to account for the learning of skills as complex as those discussed in the previous sections.

The editors say in the preface that the collection "has been compiled to present more extensive information than that already disseminated in journal descriptions of artificial intelligence." They do not entirely succeed in this awkwardly expressed aim because the papers are mostly condensed or reworked versions of material that has appeared elsewhere and the reader often finds himself referred to the original for details. The book does afford a glimpse of some of the big names in the field, and, with its extensive bibliography, it provides a useful entry into the maze of literature on artificial intelligence. The students for whom it is evidently intended may find $13.50 a bit steep for such a service, however, especially in a rapidly changing area.

Finally, there are a number of misprints (especially in Newell's paper) and there is some hideous prose. A supposed authority on language should not write sentences like "one basic assumption presented in this work is that since it is true that people can understand natural language, it should be possible to imitate the human understanding process on a computer, if it is possible to state those processes explicitly" (Schank, p. 187). It is sometimes difficult to guess whether a sentence has been garbled by the author or the typesetter, as with "a semantic network is a structure that contains meanings of language arranged in network" (Simmons, p. 77). In either case, the editors were asleep at the switch.

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Regulators of Water Intake

The Neuropsychology of Thirst. New Findings and Advances in Concepts. A conference, Philadelphia, Dec. 1971. ALAN N. EPSTEIN, HARRY R. KISSILEFF, and ELIOT STELLAR, Eds. Winston, Washington, D.C., 1973 (distributor, Halsted [Wiley], New York). xviii, 358 pp., illus. $17.50.

Textbooks of physiology have universally emphasized the kidney as the prime maintainer of body water, and thirst has received relatively little attention. Except in a few species such as some desert-adapted rodents, the kidney alone cannot maintain body fluids, however, and periodic water intake is necessary. This volume would serve a valuable function even if its only virtue were that it points up the importance of thirst and the precision of its regulation.

The first chapters are devoted to the internal stimuli and the receptors that activate thirst. These chapters (by Blass, Peck, and Stricker) make it clear that fluid intake is controlled by extracellular fluid changes as well as by the more familiar intracellular or cellular dehydration mechanism. In fact the role of the latter mechanism is now in question. Andersson, one of the original proponents of the cellular dehydration hypothesis, has now altered his position and argues, in a rebuttal to the chapters of Blass and Peck, that specific Na^+ receptors are more important in thirst than are dehydration receptors. Notwithstanding this controversy, these chapters make clear that much progress has been made since the time the cellular dehydration hypothesis, let alone the "dry mouth" hypothesis, was considered a complete explanation of thirst.

The papers on central neural mechanisms in thirst are perhaps the least satisfying ones of the book, not because they are of lower quality but because they appear to be more concerned with the validity of central electrical stimulation as a research tool than with thirst directly. Mogenson's chapter is the one most concerned with thirst, yet it still directs much attention to the methodological problems of brain stimulation. Teitelbaum and Valenstein's chapters are concerned almost exclusively with methodological questions. For someone using this book to illustrate problems in physiological and behavioral research, however, this section might be the most useful of all.