Menzel and his group. Menzel is able to make his chimpanzee data relevant to a variety of fascinating, sociobiological, evolutionary, and even epistemological issues. His article is essential reading for those who would keep abreast of the primate literature.

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CONCEPTS IN ETHOLOGY. *Animal and Human Behavior. The Wesley W. Spink Lectures on Comparative Medicine. Volume 2.*

By M. W. Fox; Foreword by René Dubos. University of Minnesota Press, Minneapolis. $8.50. xviii + 139 p.; ill.; index. 1974.

The emphasis in this volume of four lectures by M. W. Fox is on the application of ethological techniques and findings to the study of man and to the management of laboratory and domestic animals. In Chapter 1, Fox sketches the history of ethology and some of the discipline's major concepts, especially as they apply to humans. Chapter 2 includes a summary of some of Fox's studies on canid social behavior as well as a comparison of wolf and human society. A discussion of early experience and how it affects social development can be found in Chapter 3. In his final Chapter, Fox considers the application of ethology to the maintenance of domestic and laboratory animals and concludes with some comments on man's present condition.

This book is geared to a lay audience not conversant with ethology. It touches on several areas of the discipline which are currently in vogue and in which Fox is especially competent. The text is, however, erratic in quality. One section (Chapter 3), for example, is a good summary of an important and growing area of ethology, that of development. On the other hand, the final Chapter is a superficial, repetitive and, at times, contradictory discussion of how to use knowledge of animal behavior in designing experiments and in managing animals in laboratories, zoos, and on farms. For example, Fox initially emphasizes the importance of standardizing environmental conditions to reduce the experiential variability of experimental animals, while later he suggests the establishment of semi-natural enclosures for breeding laboratory animals, an approach which is sure to maximize variability.

Another example of Fox's inconsistencies can be found in the discussion of pair-bond maintenance in canids, infra-human primates and man. Initially he contrasts the canids with all primates including man, suggesting that a "social need" maintains the pair in canids while a primarily "sexual motivation" is responsible for pair-bond maintenance in primates (p. 32–33). Later, he indicates that infra-human primates, in fact (like canids), do not show constant sexual activity or receptivity, but man does and this maintains the strong pair bond and family structure of humans (p. 52). In fact, there is no evidence that any species of mammal in which monogamy is the major reproductive and social system cements the pair bond with the glue of constant or even frequent sexual activity. Thus, man is unusual in this respect; perhaps alternate explanations should be sought for our high level of sexuality.

in Fox's attempts to relate ethological findings to our understanding of human behavior, the major contradiction of the book emerges. At the outset, Fox suggests that the material presented might provide some stimulus "for reflective introspection about human nature" (p. 6). And in his first two chapters, he presents many analogies between human and animal behavior including some which are better found on the cocktail party circuit than in a serious volume. For example, Fox suggests that the specialized breeds of dog and the many roles of Modern Man are analogous (p. 53), a point that many would dispute since dogs have been selectively bred for their specializations and Man has not.

After three chapters of analogies between human and animal behavior, which would lead a non-specialist to believe that ethological techniques and findings can aid our understanding of human behavior, Fox strongly suggests that the relevance of many animal studies to human behavior is "tenuous" and that we should "not diffuse our resources in the development of animal models which can only take us so far" (p. 113). And Fox then contends that the most urgent priorities for research are in the area of "human awareness, communication, and consciousness-raising" (p. 118)! In the final conclusions, Fox essentially ignores ethology while delving into the spheres of sociology, philosophy, and social psychology to find answers to Western Man's current alienation. Such a reversal suggests that Fox is confused in his own assessment of the relevance of ethology to Man, which, of course, was a major assumption throughout the book. This fact as well as other more minor inconsistencies is bound to confuse the non-specialist reader.

Other aspects of the book are irritating. Except for Chapter 3, Fox is erratic in citing references to material he discusses. Thus a reader unfamiliar with the literature could not explore areas of interest.

There are certain errors, such as stating that the Sub-Department of Animal Behaviour is headed by Robert Hinde when, in fact, Professor Hinde heads the MRC Unit on the Development and Integration of Behaviour. Fox also refers to caviomorph rodents as caviemorphs (p. 96). Figures 24 and 25 add little to the text.

There is currently a surfeit of books available exploring human behavior from the standpoint of ethology. Fox presents a case, and then abandons it. Although I recognize that this volume is a series of popular lectures and as such should not be judged as a textbook, it is difficult to recommend to animal

behaviorists, other biologists, or non-specialists.

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THE SENSES OF ANIMALS. *The Wykeham Science Series. By E. T. Burtt and Alan Pringle. Wykeham Publications, London and Winchester; Springer-Verlag, New York.* $7.80 (paper). viii + 157 p.; ill.; index. p. 150–153. 1974.

Errors in this outdated volume begin on the cover with omission of the second author's name. The table of contents indicates a modality approach, but discussions of one sense are so clogged by analogies from another that it is difficult to remember the primary concern. The introduction never mentions that infrahuman beasts might perceive the world through different filters; instead it is a convoluted solipsist discussion.

The book is capricious in depth. For example, early chapters assume basic knowledge of neurochemistry and fine structure; the last chapter presents basic CNS anatomy. Chapter 3 on mechanoreceptors barely treats vertebrate somasthetic senses but digresses into acoustic examples of the Weber-Fechner law wherein dB is misdefined.

The chapter on hearing would have been current in 1940; it is now misleading. Discussions of vertebrate hearing would have benefited from the work of E. G. Wever and of Capranica. The section on insect hearing is from Pumphrey's 1940 review, ignoring recent works (e.g., Michelson's) that invalidate earlier conclusions. The discussion of echolocation in bats ignores FM, leads one to believe that some bat families are diurnal and that eating fruit precludes echolocation. Roeder's moth work is unreferenced and presented as though the discoveries might have been Burtt's own.

The book is heavy on insects, but there are no consistent comparisons of invertebrate-vertebrate systems. Nominally, one-quarter of the book treats vision. The figure nears one-half if one counts the pages of confusing optics analogies slipped into inappropriate chapters. Yet the functions of rods and cones are never clearly differentiated. The last chapter, miscellaneous and unknown senses, ignores the vomeronasal organ but devotes two pages to ESP.

In general this paperback is tedious reading. The authors can so convolute a sentence as to render it meaningless and are masters of the misplaced modifier. The text is poorly referenced and there is no bibliography. At $7.80 it is no bargain.

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BEHAVIOR AS AN ECOLOGICAL FACTOR. *Benchmark Papers in Ecology.*

Edited by David E. Davis. Dowden, Hutchinson & Ross (a division of John Wiley & Sons), Stroudsburg, Pennsylvania. $24.00. xvi + 390 p.; ill.; author and subject indexes. 1974.

This collection of 27 previous-published papers and excerpts from longer works, entitled *Behavior as an Ecological Factor,* is a deceptive volume. It is as much a history of field biology as a selection of papers of fundamental theoretical or methodological importance to ecology. The papers are arranged into five sections: behavioral adjustments to habitat, reproductive behavior, social behavior, behavior of populations, and applied behavior; few papers are dated either earlier than 1930 or later than 1960. Overall, these papers are an embarrassingly accurate picture of field biology before 1960: researchers straining to find principles of organization and patterns in natural animal populations, researchers also having considerable difficulty distinguishing exceptions to rules from the rules themselves.

For example, climatic and other meteorological variables receive much attention in these papers, yet only a 1950 paper by Koskimies demonstrates any important relationship between weather and behavior; in this case a relationship between temperature and the availability of aeroplankton as a food source for swifts. Many papers include detailed and often tortuous descriptions of rest postures and other so-called maintenance behaviors, yet notably absent is any mention of the problems of thermoregulation or dehydration faced by animals. Koford's 1957 study of the vicuña is perhaps the best example of description for description's sake with little or no consideration of the ecological significance of the behaviors described. There is certainly ample documentation in these selections that detailed descriptive natural histories do not necessarily produce any fundamentally important insights into either behavior or ecology.

Lists of "plant species eaten" are dispersed across the pages of these selections like acorns beneath an oak tree, but no mention is made of optimal diet, foraging strategies or foraging efficiency—several of the most important areas in behavioral ecology today. The single exception is the thoughtful comment in a 1966 article by Murton et al. that "Birds (animals) have presumably evolved some mechanism enabling them to relate searching effort to the amount of food found. . . ." Compared to the sophistication and widespread use of statistical techniques and mathematical modeling in ecology today, the level of quantitative sophistication in these papers is extraordinarily low. By all appearances, it was not until 1950 that anyone discovered correlation techniques or that the slope of a regression line might be biologically meaningful in itself.

Also surprisingly absent from these papers is any mention of evolutionary theory or population genetics. Two exceptions are the very important 1948 paper by Lack on natural selection on brood size in starlings and the 1946 paper by Guhl and Warren on reproductive success of cockerels in relation to social dominance. These papers clearly demonstrate