Book Reviews

Behavior as Evolutionary Strategy

The Evolution of Behavior. JERRAM L. BROWN. Norton, New York, 1975. xxii, 762 pp., illus. $15.95.

Animal Behavior. An Evolutionary Approach. JOHN ALCOCK. Sinauer, Sunderland, Mass., 1975. xii, 548 pp., illus. $14.

Students of ethology have always talked about evolution, but until recently they haven't done very much about it. However, with the realization that natural selection operates upon all genetically influenced phenotypes has come the epiphanic insight that behavior—even complex social behavior—has evolved and is therefore adaptive. The excitement among behavioral biologists has become almost palpable as newly discovered analytic tools are applied to previously intractable problems such as the existence of sterile worker castes among the Hymenoptera or the bewildering diversity of avian mating systems. Evolution is the unifying concept of all biology, and its incorporation into ethology is providing this field with much-needed coherence. It has also provided Brown and Alcock with the integrative principle for these two textbooks.

Textbooks are not usually reviewed in *Science*, and the selection of these two is itself testimony to the conceptual revolution they represent. It had become fashionable, particularly in North American ethology, to decry the old nature-nurture dichotomy and to embrace comparative psychology as a misunderstood and only slightly errant brother. However, in burying the hatchet we may have buried some valuable notions as well, and one in particular—the adaptive nature of species-typical behavior—is now firmly resurrected. As Brown points out, "Psychology, and its subdivisions such as physiological psychology, developmental psychology, and psychophysics, are basically concerned with the *individual* and processes that go on within the individual." By contrast, evolutionary ethology is ultimately concerned with populations, "the population biology of behavior." This study proceeds largely by the "analysis of comparisons" rather than by the comparative method heretofore employed by the Heinroth-Lorenz school. Emphasis is thus placed upon the adaptive significance of behavioral phenotypes and upon their function as evolutionary strategies, as opposed to the relatively sterile construction of phylogenies and behavioral homologies. Most social scientists and even many biologists still consider evolution to be a phenomenon of history, a musty-dusty explanation of how things got to be the way they are (or were). The new approach, ably demonstrated by Brown and Alcock, recognizes it as a powerful analytic and predictive tool, of enormous value to the study of behavior.

This approach is not without its weak spots, however. Inclusive Darwinian fitness emerges as the ultimate currency in which to evaluate alternative behaviors; although this may be theoretically impeccable, in practice we must often settle for such measures as energetic efficiency, predator avoidance, longevity, and fecundity. There may be many a slip 'twixt such accessible characters and true fitness, and precious few studies have directly evaluated the latter.

Neither of the volumes under review gives much attention to the formulations of classic European ethology. Instead, they emphasize the functional approach of evaluating differential responsiveness and degrees of neural preprogramming as strategies geared in each specific case to maximize fitness of the participants. For example, Brown simply defines releasers as "structures and actions that are particularly effective in eliciting specific behavior patterns."

Alcock assumes less background on the part of the reader than does Brown and provides a basic introduction to evolutionary principles. Beginning students often have difficulty grasping precisely how behavior can evolve and by what mechanism genes can influence behavior. Alcock's lucid treatment of these difficult matters should be especially valuable.

Brown's book is heavier, with greater verbal density and more depth and detail in coverage and bibliography. Unfortunately, however, his treatment of relevant literature often suffers from a curious tunnel vision: a discussion of emigration as a response to population increases, specifically using rodents as an example, ignores the work of C. Krebs and students. And how can one discuss sage grouse lekking without Wiley or long-distance migration without Matthews's sun-arc hypothesis? Also there is no mention of Trivers's important formulation of parental investment theory.

Despite the lapses, however, Brown has a good eye for graphic models and a fine knack of categorizing otherwise indistinct notions in coherent and conceptually satisfying ways. Accordingly, dominance and territorial behavior are both viewed as devices for the partitioning of space—the former by sharing, the latter by dividing. Social behavior is seen to influence population parameters by either subordination effects or exclusion effects. A valuable classification of animal grouping patterns into kin, mating, colonial, survival, and coincidental groups emphasizes the prospects for evolutionary analysis. On the other hand, it seems unfortunate to discuss the evolution of reproductive rates and parental care in a chapter on "aid-giving behavior," thereby diluting and confusing the biological interest peculiar to personal reproductive strategies on the one hand and altruism on the other.

Unlike E. O. Wilson's massive tome (*Sociobiology: The New Synthesis*, Harvard University Press, 1975), both Brown's and Alcock's books deal directly and extensively with proximate mechanisms: "Evolutionary theory suggests that the nervous systems of animals have been specialized through natural selection for the performance of tasks relevant to the way of life of each species" (Brown, p. 537). But it remains to be seen whether an evolutionary approach will stimulate profitable research on sensory and integrative processes in a way comparable to its galvanizing effect on studies of complex social phenomena. Physiological mechanisms may simply be more conservative (genetically canalized) than behavior, in which case such phenotypes may not reflect precise adaptive adjustments. Alternatively, studies of proximate phenomena have received precious little scrutiny from evolutionary biologists, according with the domination of physiology by medical science. Brown's three-chapter excursion into the "development of species-typical behavior" also suggests potential for an evolutionary approach to behavioral ontogeny.

Certainly, one of the pleasures of writing a book is the opportunity to indulge in special interests: hence Alcock's discussion of tool use and an entire chapter devoted to the "ecology of anti-predator behavior"—which may reflect his early tutelage under L. P. Brower more than crucial relevance

of the subject in a text of this sort. Similarly, Brown devotes a chapter to social parasitism. Whereas Wilson apparently considers the biology of altruism to be crucial to sociobiology theory, Alcock gives it only cursory attention. Certainly, altruism and the breakthroughs associated with its evolutionary analysis were central to the renaissance of sociobiology, evolutionary ethology, or whatever one prefers to call the discipline. Whether altruism really warrants a continuing central position is uncertain at present, but it would have been nice if Alcock had indicated the basis for his de-emphasis.

Alcock's two concluding chapters deal with human behavior, persuasively arguing for consideration of possible genetic predispositions, and forthrightly facing the possible moral dilemmas. By contrast, Brown avoids the issue of *Homo sapiens*—a legitimate decision perhaps, but one that would be more palatable if accompanied by a justification. Insofar as evolutionary approaches continue to yield profitable insights into animal behavior, we can expect the issue of human sociobiology to gain momentum, cogency, and adherents in the near future. Most ethologists are committed to the proposition that a stickleback fish is worth knowing in its own right. But we are only human and cannot be blamed for wanting to test our just-forged tools against that ultimate dilemma, ourselves. Psychologists and sociologists particularly may find this new approach confusing and distasteful. However, there will be some hope for mutual understanding and beneficial exchange if the critics recognize that behavior is not claimed to be somehow encapsulated within genes, waiting to spring fully armed like Athena from the head of Zeus. Rather, genes code for a variable range of potential phenotypes, within which specific outcomes are influenced by the individual's experiences and the proximate mechanisms available.

Ethology is certainly astir these days, and anyone seeking introduction to the evolutionary approach now has two excellent, well-illustrated books from which to choose. Indeed, a field once lacking textbooks now boasts a goodly number of competent ones, each with its own approach: the classic European viewpoint (Eibl-Eibesfeldt), a substantial synthesis of ethology and comparative psychology (Hinde), a somewhat dated but still powerful exposition of proximate mechanisms (Marler and Hamilton), a historical view (Klopfer), an advanced treatment of the evolutionary biology of social behavior (Wilson), and now these two introductions to the functionalist approach, incorporating social behavior but conspicuously not limited to it. Perhaps it is time for one of the "structuralists" to enter the fray with their pitch. In any case, ethology instructors are increasingly hard put to indulge that familiar complaint of academicians, the forlorn claim that no good textbooks are available.

DAVID P. BARASH
Departments of Psychology and *Zoology, University of Washington, Seattle*

Environment and Politics

The Florida Experience. Land and Water Policy in a Growth State. LUTHER J. CARTER. Published for Resources for the Future by Johns Hopkins University Press, Baltimore, 1975. xviii, 356 pp., illus. $15.

Historians of matters of environmental concern can sympathize with Gibbon's sentiment that "history is indeed little more than the register of the crimes, follies, and misfortunes of mankind." Much of *The Florida Experience* supports such a view. Florida was the first of the United States to be discovered and colonized by Europeans, but it presented more obstacles to early conquest and dominion than any other. For three centuries following Ponce de Leon's 1513 voyage, the European physical impact on the territory was negligible. In south Florida, Indians hostile to Europeans and an environment hostile to any who did not understand it and would not adapt their life style to its demands destroyed or excluded most outsiders until late in the 19th century. Indian wars were still being fought in the area long after they had become distant memories throughout the rest of the eastern half of the continent.

Florida was clearly a different frontier, and it was one that inspired considerable hyperbole. Some early writers described it as a wasteland fit only for reptiles while others wrote reverently of an awesome and mysterious earthly paradise. Lack of understanding of what Florida was had great influence on its development.

Florida contains many uniquely sensitive delicate environments, and a substantial fraction of the state's land is either submerged or periodically inundated. As confidence in man's engineering ability grew, vast drainage schemes were envisioned and undertaken. These "reclamation" projects resulted in perhaps the most significant changes in the Florida landscape, but were just another in a series of exploitative perturbations that grew at a rate that more than compensated for the centuries of intimidation.

As is often the case when poorly understood complex systems are manipulated, drainage created at least as many problems as it solved. In reviewing the development of water policies in south Florida, Carter does a remarkable job of describing the natural systems, tracing and evaluating the forces behind the drainage schemes, and analyzing the diverse aggregation of resulting diseconomies. He chronicles the years of political activity that resulted in the creation of Everglades National Park, a relict area that now encompasses a mere 7 percent of the original area of the biome it represents.

The Everglades story and that of south Florida drainage are only two of the scenarios that Carter uses to highlight the development of the state's conflicts between growth and preservation. His case studies of the ill-conceived Florida Jetport, the growth of Dade County, the preservation of the Big Cypress Swamp, and the conflict over the Cross-Florida Barge Canal are masterpieces of measured reportage and analysis.

Despite the sadness one feels for what so recently has been lost, a sense of inexorability, the essence of tragedy, does not dominate Carter's style. He is at his best in analyzing the political forces that have evolved in modern Florida, and here one senses optimism. He reviews the revitalization of an anachronistic governmental structure and the curious homeostasis that a change in beliefs and values is bringing about. Environmental destruction may have created an environment in which newcomers who further perturb natural systems can comfortably live, but it is these very newcomers who are most vocal in support of preserving what is left of primeval Florida. They have become a potent political force.

Carter's evaluation of the recent innovative environmental legislation that has become law in Florida is a perceptive analysis of how governments deal with environmental matters and what political and constitutional problems they face. He identifies the strengths and shortcomings of new land and water laws in terms of both the bureaucratic framework in which they have to operate and the individuals upon whom their administration depends.

What Carter has done, in essence, is artfully weave together history, natural history, and politics into a work that gives the reader a feel not only for what Florida was, what it is, and what it might become, but for what he thinks it should become, and why. The readability of the book and its careful separation of fact and opinion argue well for the encouragement of such research and writing projects by able journalists. The book is thus also a credit to Resources for the Future, the organization that supported Carter's research, whose