Behavioral Ecology

Ecological Aspects of Social Evolution. Birds and Mammals. DANIEL I. RUBENSTEIN and RICHARD W. WRANGHAM, Eds. Princeton University Press, Princeton, NJ, 1986. x, 552 pp., illus. $65; paper, $23.50. Based on a symposium, Philadelphia, Dec. 1983.

Studies in behavioral ecology have sharpened in focus as the field has grown in scope. Whereas 20 years ago biologists would tramp back from several years in the field and publish a descriptive monograph on a species's social system, perhaps briefly considering the natural selective forces responsible for that system, today's studies more often begin with several adaptational hypotheses about specific behaviors, and fieldwork serves to evaluate those hypotheses. Investigative rigor has been gained by the shift in approach, but a sense of social behavior as an integrated and potentially understandable whole has been lost.

This volume returns to a consideration of whole social systems. Key features in the social relations of some of the world's most meticulously observed birds and mammals are summarized, then interpreted from the perspective of the selective regimes presumed to be responsible for their evolution. The editors' stated aim is to examine "the extent to which social evolution in different taxonomic groups can be understood through a series of common principles."

By and large, these are long-term studies. About half are now in their second decade, and a few are in their third. Therefore the extent of knowledge about each focal species is not as surprising as the coherence with which it is presented. Thus, subtle issues such as the differences and similarities between mobs of Eastern gray kangaroos and chimpanzee communities are clear, as is the complex issue of social structure of gelada "baboons," which live simultaneously in harems, herds, and bands.

I suppose it is a sign of scientific progress when each new research generation slays the simple hypotheses of the previous one. In this volume, it happens repeatedly. For instance, Packer disposes of the notion that African lion sociality evolved as a consequence of the advantages of group hunting. Replacement hypotheses are successively more complex, and probably realistic. The new hypothesis on lion sociality combines the advantages for carcass defense with occupation of open habitat and high lion density.

If there is a series of common principles through which social evolution can be understood, they are likely to be complex. The direction of social evolution depends upon the interplay of several (at a minimum) selective forces operating upon certain inherent constraints. In such a complicated causal matrix, one would expect that in different systems the magnitude of any single variable might have manifold effects. Therefore it is not surprising that polygyny in yellow-rumped caciques, sex role reversal in moorhens and spotted sandpipers, and communal breeding in mongooses are all attributed at least in part to high predation risk.

Inherent constraints have always been the *mafiosi* of sociobiology—everyone acknowledged their existence but hardly anyone took them seriously. However, probably because this book concentrates on whole social systems where simplicity is not expected, constraints are generously acknowledged. For instance, evolutionary options are putatively limited by adult sex ratio in spotted sandpipers and dabbling ducks, body size in hornbills, and male dominance in Florida scrub jays. Particularly provocative is Moehlman's analysis of the Canidae, showing that body size in that family correlates with adult sex ratio, mating system, frequency of cooperative hunting, and sex-specific dispersal tendency. Certainly not everyone would agree on what are, and are not, inherent constraints, but constraints are obviously out of the closet.

Three selective forces, resource distribution, predation risk, and social competition, receive most attention by the authors. Scenarios of social evolution derived from both their observations and comparative data are presented in most chapters. All the scenarios are plausible, but by far the most convincing are those supported by evidence from "natural" experiments within a species, such as Rubenstein's analysis of variation in horse social structure in relation to habitat variation and Dunbar's and Wrangham's interpopulational syntheses of gelada and chimpanzee sociality, respectively. Clearly, well-planned and well-performed field experiments would greatly accelerate our understanding of social structure—a fact not lost on the book's authors, at least several of whom are now proceeding with such experiments.

Even though this is a multi-authored book, it is marked by uniform clarity of figures and text. There is also a minimum of specialist's jargon, so that the book will be accessible to general scientific readers with an interest in animal behavior. The editors have provided a prefatory chapter tracing the development of sociobiological thought and a closing chapter synthesizing the major influences on social evolution and the conclusions of the various authors. These chapters are models of concision and coherence and should be suitably adapted for opening and closing lectures of courses in behavioral ecology.

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Muscle Measurements

Electromyography for Experimentalists. GERALD E. LOEB and CARL GANS. University of Chicago Press, Chicago, 1986. xx, 373 pp., illus. $60; paper, $22.

Electromyography, the measurement of voltage gradients produced by a contracting muscle, is a technique that is widely used in studies of kinesiology, muscle mechanics, and motor neurophysiology. Loeb and Gans acknowledge that electromyography is as much an art as a science and demands not only a knowledge of its technology but an ability to discriminate meaningful from irrelevant measurements. The purpose of the book is "to provide the experimentalist with bases for the design and conduct of experiments that facilitate the solution of problems and minimize the chance of serious error." By accomplishing this, the authors have done us and our students a service. Heretofore it has not been possible to direct a student to a source or even a limited set of sources wherein practical guides to the effective design of the components of electromyography could be found.

This book will serve as a practical and useful source not only for the techniques of electromyography but also for other techniques used in the analysis of neuromuscular and musculoskeletal design. The authors make clear that electromyography, no matter how sophisticated, is only one indicator of musculoskeletal performance and place it in perspective relative to other important factors of muscle function, including whole muscle design, motor unit organization, and motor unit recruitment.

Perhaps not apparent from the title is the inclusion in the first third of the book (Part 1) of some important basic concepts of electronics and neuromuscular anatomy. In keeping with most of the book, these sections are written so that students with little background will be able to follow them.

Also included in this section are informative chapters on electrode configuration, the response of body tissues to implanted materials, and the problematic issue of recording site verification.

Part 2 has chapters devoted specifically to the mechanics of doing electromyography with experimental animals. In addition to clearly presented instructions of how to design, construct, and implant electrodes, proven techniques for transferring information from the animal to the signal processing and storage instruments are discussed. A helpful guide to selection of the major electronic instruments necessary for electromyography is followed by hints for detecting and trouble-shooting extraneous signals and recording artifact. The remaining chapters summarize specific techniques for correlating electromyograms with limb position and forces, for signal processing and display, for single-unit electromyography, and for surgery. A final chapter is devoted to helping the uninitiated get started. Appendixes devoted to techniques of anatomy and sources of materials are included.

I am enthusiastic about this timely contribution. Loeb and Gans's collective expertise and laboratory experience come through clearly and will make the book useful to any student contemplating, or actively using, electromyography.

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Children's Narrative Skills

Event Knowledge. Structure and Function in Development. Katherine Nelson in collaboration with 11 others. Erlbaum, Hillsdale, NJ, 1986. xii, 277 pp. $32.50.

Telling stories is an important way in which human beings represent and organize their experiences. Jerome Bruner in his recent book *Actual Minds, Possible Worlds* (Harvard University Press, 1986) argues that narrative is one of the two major modes of thought and that it has been ignored in our obsession with logical, Cartesian, or "paradigmatic" thought. Katherine Nelson and her colleagues and students have engaged over the last several years in a series of studies probing the development of children's abilities to recount the events they experience and the role such narratives play in the children's growing cognitive and linguistic systems. *Event Knowledge* reviews and synthesizes that research: although much of the research has been published in greater detail as journal articles or book chapters, this volume provides the opportunity to make explicit the full scope of the undertaking and the connections among the various studies.

It would seem on first reflection that talking about the events of their lives is not one of the things young children are very good at. Anyone who has tried to extract from a three-year-old a report of the events of the day can confirm that the telling is likely to be fragmentary, incoherent, and insufficiently responsive to the needs of a listener who did not share the experience. The results reported in *Event Knowledge* demonstrate, however, that young children can give very good reports about events they are familiar with if they are asked in the right way. Consider the following description of a birthday party at day camp, offered by a three-year-old: "She just ate the cake. And then we ate it. And then we sat down. And then, we were done with our snack" (p. 110). While considerably less complete or complex than a five-year-old or a seven-year-old would provide, an event description like this reveals remarkable sophistication and provides grist for a variety of analyses of how children understand, remember, and recount their experiences.

The most remarkable central finding of the research program is the young child's preference for and skill at generic, abstract event representations rather than representations of specific episodes. When asked about birthday parties, a child of four years nine months produced the following report: "Well, you get a cake and some ice cream and then some birthday [unclear] and then you get some clowns and then you get some paper hats, the animal hats, and then you sing 'Happy Birthday to you' and then then then they give you some presents and then you play with them and then that's the end and they go home and they do what they wanta" (p. 27). This account obviously draws on memories of particular birthday parties, but it is presented as a generic description, showing the child's capacity to use linguistic markers of generic statements (impersonal "you," timeless present, indefinite reference) and, more important, to abstract from a few personal experiences with birthday parties to a set of "rules" for such events. This set of rules is often referred to in cognitive psychology as a "script," though in the later chapters of this book (representing the later stages of her research efforts and her thinking), Nelson opts for the term "generalized event representation."

Many aspects of children's generalized and specific event representations are explored in the various studies reported in this book. It is argued that event representations constitute the basis for children's understanding of the world and for the organization of their memory. Nelson argues, for example, that taxonomic concept systems (banana, apple, and orange all grouped under fruit; fruit, cheese, and bread all grouped under food; and so forth) emerge from groupings established during experiences with events in which a variety of fillers can satisfy certain slots (for example, the various foods one can eat at breakfast constitute alternate fillers for the food slot in the generalized representation of the breakfast event). Furthermore, event representations themselves are organized into a hierarchy (McDonald's and Kentucky Fried Chicken events provide fast-food restaurant scripts, related to a generalized restaurant script that is higher up in the taxonomy but less fully specified). Thus, event representations form the basis of more sophisticated cognitive and conceptual systems.

Beyond the demonstration of children's preference for generic over specific event representations, the work presented in this book makes a strong case that asking the right questions about matters that children know something about enables them to reveal skills and abilities not accessible to the traditional researcher who relies on more "decontextualized" tasks and topics. Not only are children's memories longer and better organized than we have believed, their ability to deal cognitively and linguistically with abstraction, hypotheticals, temporal sequencing, and logical relations is surprisingly advanced. Children are limited not so much by their age or stage of development as by their knowledge—the amount of experience they have had with various events and the amount of help they have had in understanding and learning how to talk about the events they have experienced.

The event-representation–based view of children's cognitive development provides novel insights into their collaborative play, often based on shared scripts, their fantasy play, the made-up stories they tell, and their autobiographical memories. Nelson and her colleagues argue that children are much like adults in their autobiographies; episodes stand out as individual only if they depart from generalized event representations through the presence of some deviant or surprising factor. Many memories are reconstructed with the help of generalized event representations rather than truly remembered. Furthermore, although the role of culture and the nature of cultural differences are not discussed in this book, it is clear that the event knowledge that children acquire so efficiently constitutes socially shared and agreed-upon knowledge that has great power to explain how children become members of their cultures. So the next time a seven-