Book Reviews

Descriptive Studies of Primate Behavior

Primate Ethology. DESMOND MORRIS, Ed. Aldine, Chicago, 1967. x + 374 pp., illus. $10.75.

Ethology, defined by Tinbergen as "the objective study of behavior," concentrated in its formative years on insects, fish, and birds. Only in the past decade have ethologists turned their attention to primates. As Desmond Morris writes in his introduction to this book, "They have approached monkeys and apes from the humbler side of the evolutionary scale, looking up at them from simpler, less brainy species, rather than down from the dizzy behavioral heights of man. In so doing they have, I think, illuminated the subject in a new and exciting way."

Many of the major concepts presented in this book have appeared before in publications by the same authors (as in the case of Van Hooff, Hinde, and Spencer-Booth, Van Lawick-Goodall, and Moynihan) or in earlier books on primates edited by DeVore, Altmann, Buettner-Janusch, Schrier and Harlow, and others. There are, however, some new and controversial points in several chapters. Clearly some of the authors wish to press the issue of innate behavior, as, for example, Rowell, who writes that "Social groups are maintained by communication between individuals, which is brought about by a series of largely innately determined gestures and responses." In view of the fact that no systematic cross-fostering studies have ever been done on different species of nonhuman primates, and only a few analyses of natural development within a species have ever been made, this seems to be a premature statement.

The book is composed of nine chapters following the editor's introduction. All the contributors represent the European school of ethology, and all received their graduate training from Tinbergen, Morris, Hinde, or Lorenz.

In chapter 2, Van Hooff presents a descriptive catalog of facial displays, primarily in Old World primates. He prefaces this with an interesting discussion of phylogenetic origins of facial expressions in vertebrates, including a brief consideration of musculature and innervation. He then considers methodological approaches to the study of facial displays, raising the problems of motivational analysis, causation, and functions. Thirteen major compound facial expressions are described, and each is analyzed in terms of "expression elements." These are recognizable separate movements and configurations of the eyes, eyelids, eyebrows, upper head skin, ears, jaws, mouth corners, and lips. Postures, autonomic responses, and vocalizations are also considered, and the entire pattern is then discussed with respect to the circumstances under which it has been observed. Some of the displays are illustrated in photographs and line drawings, but in general these illustrations are not adequate.

Van Hooff concludes his chapter with a discussion of derivation and evolution. He finds that the derivation of facial displays is clear in a few instances (as in the case of the lip-smacking face, which may be considered an intention movement of one component of grooming behavior), but is not evident in many others. He discusses human smiling and laughing and finds homologies in the silent bared-teeth face and the relaxed open-mouth face, respectively. Much of the material in this chapter was published in 1962 in a symposium of the Zoological Society of London.

In chapter 3, Wickler describes sociosexual signals of Old and New World primates. Emphasis is placed on the comparative anatomy of external genitalia in relation to perineal presentations and genital displays. Wickler correctly points out that many of these signals function as greetings, appeasement, or status indicators without any direct sexual context. The viewpoint is developed, however, that the social function of these signals is secondarily derived from the sexual function. Wickler attempts to show the predominant role of socio-sexual signals in maintaining primate social behavior. His attempts are reminiscent of Zuckerman's concepts in the 1930's.

He points out that the arguments against Zuckerman's hypothesis are "not entirely watertight." However, Zuckerman's hypothesis (that continual sexuality is the primary basis of primate group life) is refuted by modern data, not solely on the basis of reproductive seasonality as is suggested by Wickler but, more directly, on experimental and observational evidence on the effects of sexual behavior on group dynamics. Recent studies have shown that the effect of sexual behavior on group integrity in primates is fundamentally more disruptive than cohesive. I think there is at least some possibility that most primates live in permanent heterosexual groups despite sexual behavior rather than because of it. The sociosexual link discussed by Wickler as a major mechanism of reducing intragroup agonistic tendencies does not emerge as a convincing case.

Wickler's review provides comparative observations on fish, birds, and nonprimate mammals. This extensive purview, which is handled in a capable and scholarly manner, adds considerable value to his chapter.

In chapter 4, John Sparks reviews allogrooming: the "behavior observed when one individual grooms or preens another." The distribution of allogrooming throughout the animal kingdom is considered and its forms in primates are discussed. Both its social and its cleansing functions are considered. Sparks develops some interesting generalizations about the frequency and direction of allogrooming in primates in relation to the dominance hierarchy. He notes that it is most pronounced in species with sharply defined hierarchies such as macaques and baboons and that it is usually initiated upward against the slope of the dominance hierarchy.

In chapter 5, Caroline Loizos provides an interesting and valuable review of play behavior. She considers the nature of play, pointing to several characteristic attributes (sequential reordering, exaggeration, repetition, fragmentation, and irrelevance). This is followed by discussions of the origins, functions, and causation of play. Consideration is given to the effects of play in social integration and behavioral de-

velopment. Loizos feels that "play at certain crucial early stages [may be] necessary for the occurrence and success of all later social activity."

I found the most controversial generalization in Loizos's review to be the statement that "Patterns of social play are largely derived from those of agonistic behavior, consisting of chasing, wrestling, tumbling, biting, dragging and chewing." Certainly social play resembles agonistic behavior, but since it is expressed much earlier than agonistic behavior, I question the validity of saying that it is derived from agonistic behavior.

Social Systems

T. E. Rowell discusses variability in social organization in chapter 6. She points to the important role of observer bias as a filter in determining the types and frequencies of social behavior which are recorded. Perhaps her fears on this point are excessive—examples of interobserver agreement in field studies are certainly more abundant than examples of disagreement. She also emphasizes the key role of habitat factors such as cover, space, food, and topography as main influences on social organization. These are clearly valuable points to emphasize. In discussing variability of social organization within and between primate species, however, she does not draw upon many outstanding examples in primate literature. No mention is made of paternal behavior in Japanese macaques, pair-bonding in gibbons and marmosets, the great variability in social groupings in lemurs, or the complex social variability of chimpanzees.

Two of her final contentions, (i) that "there may be no such thing as a normal social structure for a given species," and (ii) that nonhuman primates may have a range of variability in social organization of the same order as that of man, could surely be counted on to provide a lively quarrel among primate biologists. To me both seem to carry a good idea too far.

Moynihan's chapter, "Comparative aspects of communication in New World primates," provides a valuable review of signaling systems in platyrrhine monkeys. Tactile, olfactory, visual, and acoustic signals are summarized for marmosets, squirrel monkeys, whitefaced monkeys, howlers, spiders, and several other New World forms. Moynihan gives strong attention to evolutionary trends and selective forces acting upon communication systems. He engages in considerable speculation, however, which may or may not approximate the truth; for example, the discussion of grooming is concluded by the statement that "Selection has favoured the replacement of allogrooming by patterns not involving physical contact in species whose social organization and other habits are such that noncontact patterns can usually be perceived without difficulty." It seems to me that much of what we know about grooming in the Old World primates refutes this idea. In noting that the smaller species of New World primates such as *Cebuella pygmaea* and *Saguinas* sp. have few facial expressions, he writes, "Presumably their faces are so small that many types of expressions would be useless because they could not be seen at a distance." This is a peculiarly human point of view; it says nothing about the range of distances at which social interactions occur. It is also striking that Moynihan discusses many of these communicative systems without reference to their broader biological significance. For example, the unique vocal patterns of *Alouatta* sp. and *Callicebus* are described without reference to their temporal patterning or ecologic significance in spacing and territoriality.

Mothers and Infants

Chapter 8, by Hinde and Spencer-Booth, presents data from an experimental study of mother-infant relations in captive rhesus. Four mother-infant pairs were kept in isolation from before parturition until the infants were one year old, and nine mother-infant pairs were in small social groups, of usually one adult male and three or four other adult females. The study was mainly concerned with the role of "aunts," that is, adult or adolescent females other than the infant's own mother (no blood relationship implied). These aunts often took a great interest in infants and tried to hold and groom them. The data showed that the aunts apparently caused the mothers to be more restrictive. Infants in the isolated mother-infant pairs spent more time not in contact with their mothers in their first six months than did infants living in groups. In their second six months, the isolated infants returned to their mothers more frequently than the group-living infants. This in turn resulted in a greater proportion of rejections by isolated mothers. The phenology of motor development in the two groups of infants showed that isolated infants achieved various motor acts (walking, climbing, grasping, and the like) at a later age than did the group-living infants. Unfortunately, the authors do not relate their data to the excellent studies of mother-infant relations in free-ranging rhesus on Cayo Santiago.

The maternal-infant social relationship in chimpanzees is analyzed in chapter 9 by Jane Van Lawick-Goodall. The mother-offspring social group is especially important in chimps because it is "the only unit which remains stable over a period of several years." Chimpanzee infants differ from those of many monkeys in that: (i) they are dependent upon the mother for a longer period of time (3 years as compared to 1 year); (ii) there is apparently no period of rejection at weaning; (iii) the infant is rarely punished physically by its mother; (iv) the infant at birth is unable to support its own weight by clinging and must be supported by the mother continually for several days and occasionally for several months; (v) maternal behavior may be inadequate, and this may contribute to the high infant mortality rate of 35 percent; and (vi) the maternal-offspring social bond is even more important in chimps than in most primates, since there is no stable social group in chimps. "Instead, every adult is, basically, an independent unit, and the growing child . . . must remain close to [the mother] until it is able, itself, to become an independent unit."

All of these observations emphasize "the strength and long-term duration of the tie between a mother and her offspring." This is a social bond which persists throughout the juvenile (3 to 6 years) and adolescent periods (6 to 12 or 13 years) into adulthood.

This chapter is an outstanding study of animal personality and individuality, as are many of the previous writings of Van Lawick-Goodall. Her patient long-term work is a remarkable achievement. The only methodological objection that might be raised is the fact that most observations were made on provisioned animals, some of which are virtually free-ranging pets. By mid-1964, 45 chimps came to her camp for artificial feeding. Nonetheless, this provisioning has permitted more detailed observations than could have been obtained by any other method.

Human Behavior

The final chapter, by N. G. Blurton-Jones on social behavior of nursery-school children, is a preliminary attempt to apply methods of ethology to human

social groups. Blurton-Jones obtains quantitative data on certain fixed action patterns in small groups of children 4 to 5 years old. The patterns studied were a combination of gross behaviors (run, jump, wrestle, and the like), and facial expressions (laugh, low frown, pucker brows, fixate, red face, cry, and the like). Tabular data on correlative frequencies are given but are not clearly explained or discussed. In fact, some of the first rules of ethology are violated in the presentation. There is not an accurate identification of group sizes or sex and age ratios, and no data are given on classroom size, physical conditions, observation times, or individual differences.

Blurton-Jones points out various problems of ethologic studies in children, but also discusses strengths and potential values of these methods. He notes, for example, that the rough-and-tumble play is accompanied by a rich array of signals which differentiate it from hostile behavior. This leads to speculations on the role of rough-and-tumble play in social development, and to the possibility of direct comparisons with nonhuman primates. Though this comparative study is commendable, it was only a pilot effort of seven months' duration. It does not present a strong or effective case for ethologic methods in human sociology. The great need for descriptive studies of human behavior is generally recognized, and all objective efforts in this direction are certainly desirable, but they must be done with at least the same care afforded the best animal studies.

Despite the fact that many of the individual chapters are good, this book does not leave one with a satisfactory general view of primate behavior, nor does it add up to significantly new concepts of primate characteristics. Many specific topics are well covered, but others of equal importance are totally neglected. For example, there are no general discussions of grouping patterns, activity rhythms, movements, home ranges, food habits, habitat preferences, behavioral profiles, social traditions, or subcultural differences within primate species. Although other topics such as territoriality, dominance hierarchies, adaptive capacities, and ecologic limitations are occasionally mentioned, they do not receive sufficient attention to appear in the index. Nearly 50 percent of the book (171 pp.) is devoted to facial displays, socio-sexual signals, and communication. Another 40 percent (150 pp.) is devoted to mother-infant relations, play, and grooming. Only 17 pages are given to social organization. This book will be useful to primate behaviorists, but it neglects, in my view, too many important aspects of primate behavior to be a good introduction for the general scientific reader.

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New Results in Qualitative Dynamics

Problèmes Ergodiques de la Mécanique Classique. V. I. ARNOLD and A. AVEZ. Gauthier-Villars, Paris, 1967. iv + 243 pp., illus. Paper, 48 F. Monographies Internationales de Mathématiques Modernes.

This review begins on a scolding note.

At the present time the earnest student of the foundations of classical statistical mechanics could peruse most of the existing review articles, summer school proceedings, and advanced textbooks in English and never realize that in the last 14 years there has been a revolution in analytical mechanics. Perhaps this is to be attributed to the natural arrogance of theoretical physicists who believe that physicists make the discoveries and mathematicians make theorems out of them afterwards. But whatever the cause of this cultural lag in mechanics, there is no doubt of its existence. Not only do the statistical mechanics books show no trace of the era ushered in by Kolmogorov's address at the International Congress of Mathematicians in 1954, but none of them even mentions the important discoveries of E. Hopf on the qualitative nature of flows in phase space responsible for the phenomena of "irreversibility." (The main theorems on mixing flows were proved in the period 1932–34.)

The book under review will change all that. Based on lectures given in Paris in 1965 by its first author, it is a veritable catalog of the beautiful new results in qualitative dynamics accompanied by a choice collection of illustrative examples. The whole is put out in the elegant typography and layout one expects from Gauthier-Villars.

The format is a bit unusual. There are four chapters which, together with a bibliography, occupy 104 pages, but there are 34 appendices occupying another 144 pages. The proofs of the majority of the theorems are in the appendices. Chapter 1, "The notion of a dynamical system," defines the classical (concrete and smooth) and abstract dynamical systems to be considered. Chapter 2, "Ergodic properties," introduces the standard definitions of true average, ergodicity, and mixing as well as the new (1958!) notions of K(olmogorov)-system and entropy. This notion of entropy should not be confused with that used in thermodynamics. It is a measure of the rate at which information is lost by the mixing action of the flow in phase space. A K-system is one which has a characteristically "irreversible" behavior. (Incidentally, these two ideas are explained very clearly and in much more detail in another context, that of probability theory, in P. Billingsley's *Ergodic Theory and Information*, Wiley, 1965.) Chapter 3, "Unstable systems," introduces the notion of C-system, a classical dynamical system whose flow displays a characteristic instability: in a neighborhood of a given segment of orbit there is a family of orbits that run away from the given one with exponential rapidity as well as one of orbits that approach it with exponential rapidity. The great theorem of Anosov, which says, roughly, that every C-system is a K-system, is discussed. Chapter 4, "Stable systems," studies the structure of the flow associated with a classical dynamical system, with special emphasis on periodic orbits and invariant tori.

The authors have taken for granted that the reader understands a little of the jargon of modern mathematics. For example, within a few pages one encounters without explanation "le fibré unitaire tangent d'une variété riemannienne compacte," "une bijection," "une automorphisme." To the younger prospective reader still capable of learning new languages without agony, the reviewer can only say that the contents of the book make such an effort worthwhile.

It may be helpful to note that an English translation of the book will be off the press within a few weeks (to be published by W. A. Benjamin, New York). Also, the address by Kolmogorov referred to earlier is translated into English as an appendix in R. Abraham's *Foundations of Mechanics* (Benjamin, 1967).

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