# Inductive Primatology

**Primate Social Relationships**. An Integrated Approach. ROBERT A. HINDE, Ed. Sinauer, Sunderland, Mass., 1984. xvi, 384 pp., illus. $40; paper, $21.

Research in the last two decades has revealed that the social relationships among the members of nonhuman primate groups are as intricately structured as the relationships among the characters in television soap operas. Such complexity has stimulated interest in the form and function of primate social behavior at the same time it has frustrated efforts to describe, interpret, and explain observed patterns of behavior. A decade ago, Hinde sketched a conceptual framework for the study of social relationships. The premise was straightforward: social behavior must be described before it can be explained. Thus, the first step is to describe social behavior at each of several inter-related levels of organization: interactions, relationships, and social structure. Once this empirical foundation is established, general principles of behavior should be sought. The next necessary task is to attempt to explain the proximate cause, development, function, and evolution of observed patterns of social behavior.

In *Primate Social Relationships*, Hinde reconstructs the conceptual framework he first outlined a decade ago, elaborating on conceptual issues and integrating recent empirical findings and theoretical developments. The organization of the book mirrors Hinde's conceptual framework. Description proceeds from the simplest levels of social organization to the most complex. Thus, the first portion of the book is concerned with the patterning of dyadic social interactions among individuals, and the second portion describes factors that influence the dynamics and development of social relationships among individuals. Next, dyadic and polyadic social relationships are considered in the broader context of the social structure. According to Hinde, description must be followed by explanation, and the book includes several theoretical contributions that explain how proximate and ultimate factors influence social behavior.

At each step, conceptual issues are directly related to empirical phenomena. Each chapter begins with an introductory essay in which conceptual issues related to the study of behavior are defined and discussed. These essays are followed by one or more empirical or theoretical contributions that serve several related purposes. Most important, they help to clarify the conceptual issues discussed in the introductory essays. However, the empirical contributions also provide examples of the kind of empirical data from which these concepts were originally abstracted. The theoretical contributions demonstrate how general principles about behavior are derived from empirical data and offer explanations of some of the patterns of behavior that have been described.

From the outset, it will be clear to the reader that Hinde's approach to the study of social behavior is an inductive one. Generalizations about behavior and principles of explanation are induced from observations and analysis of the behavior of individuals. In this volume, evolutionary theory is invoked to explain patterns of observed behavior that have been documented through observation but is not used to generate predictions about what will be observed. It is not clear what role evolutionary theory is supposed to play in the design of empirical studies and the collection of behavioral data.

A decade ago, questions about the evolution of social behavior were not often asked; descriptive studies were the rule. Today, however, many studies are explicitly designed to test predictions derived from evolutionary theory. Descriptions of social behavior are often judged incomplete without adaptive explanations. The inductive approach that Hinde describes is clearly at odds with the deductive approach of contemporary evolutionary biology. Readers who espouse the latter approach are likely to consider Hinde's conceptual approach outmoded. Certainly, many will wonder why a purely inductive approach is useful in the study of social behavior. Hinde does not address this issue in this volume. This is a surprising and unfortunate omission—surprising because it is clearly a fundamental issue that must be resolved if a synthetic "science of social behavior" (Hinde, p. xii) is to be created, and unfortunate because Hinde's silence on this point may dilute the impact the book will have among those committed to deductive approaches.

The 48 empirical and theoretical contributions included in this volume are a diverse lot. They were written by 20 individuals, many of whom have been Hinde's students at Cambridge University. Although most of the contributions are based upon studies of rhesus macaques, vervet monkeys, and savannah baboons, the behavior of elephants, apes, other baboon species, and humans is also discussed. These contributions encompass a wide range of topics, ranging from mother-infant interactions to models of the evolution of social groups. Some authors summarize results previously published elsewhere, and others present detailed treatments of new work. This diversity was apparently encouraged by the editor, who hoped that the contributions would retain "something of the several interests and personalities of the authors" (p. xiii).

Nearly all the contributions included in this volume succeed in clarifying the concepts they are intended to illustrate. The diversity among them precludes any intelligent attempt to generalize further about them. At the risk of failing to distribute credit fairly among the authors, I wish to single out the contributions of one author that demonstrate the usefulness of Hinde's approach in unraveling the complex patterns of social behavior among nonhuman primates.

Although it has been known for some time that female macaques form linear dominance hierarchies in which the adult members of each matrilineal unit share a collective rank, the process by which immature females acquire their rank is poorly understood. Drawing on extensive observations of dominance interactions among macaques on Cayo Santiago Island, S. B. Datta traces this process from the level of dyadic interactions to the level of the social structure. It emerges from her analysis that the outcomes of dominance interactions are influenced by the relative age and maternal rank of the opponents and the form and effectiveness of support received from others. The same parameters influence the direction and timing of changes in dominance rank as young monkeys mature. From these analyses, Datta concludes that dominance is determined by the "relative power" of opponents, which is a function of their intrinsic

qualities and extrinsic support received from others. She also demonstrates that the concept of relative power can be invoked to explain how rhesus macaques maintain their adult rank positions.

These contributions are important for several reasons. First, they demonstrate the utility of studying behavioral phenomena at several different levels of organization. Second, they show how emergent properties, such as relative power, may be identified. Third, they identify a set of behavioral principles that can be applied in other contexts and may apply to other species with similar forms of hierarchical organization. Finally, they demonstrate the usefulness of Hinde's inductive approach. In the absence of a cogent theory of the function and evolution of linear matrilineal dominance hierarchies, dominance interactions among macaque females might not have been studied by Datta or others before her, and our understanding of the dynamics of macaque social organization would be much less complete.

Ecological influences upon social behavior are neglected in Hinde's conceptual framework. Few of the empirical or theoretical contributions in this book assess the relationship between environmental conditions, social behavior, and social structure. Among the exceptions are several contributions that indicate that environmental conditions are related to patterns of activity, frequencies of social interactions, and characteristics of social relationships within groups (Lee); participation in intergroup encounters (Cheney); and social structure (Dunbar; Wrangham; Moss and Poole). Clearly, social behavior is influenced by environmental conditions. Perhaps in the next edition of *Primate Social Relationships* ecological factors will be more fully integrated into Hinde's conceptual framework.

This book is an important addition to the animal behavior literature. Conceptual, empirical, and theoretical issues are thoughtfully integrated, and the emphasis upon proximate, developmental, and functional approaches is carefully balanced. In addition, a number of the empirical and theoretical contributions are important independent contributions to our knowledge of primate social behavior. In short, the book will stimulate readers to think critically about the form and function of social behavior, an exercise many of us will profit from.

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## Successors to Newton

**Optics after Newton.** Theories of Light in Britain and Ireland, 1704–1840. G. N. CANTOR. Manchester University Press, Dover, N.H., 1984. x, 257 pp., illus. $25.

In *Optics after Newton*, G. N. Cantor provides a synthesis of what obviously has been painstaking research into 18th- and early 19th-century optics as practiced in Britain and Ireland. Cantor adds new detail to previous histories of the topic, but the most important aspect of his work is not the data but his interpretation of them.

Cantor labels William Whewell's 1837 sketch of the topic (*History of the Inductive Sciences*) oversimplified and "Whiggish" and contends that Whewell's perspective has been widely and uncritically followed by historians to the present day. He analyzes several "uncritically" accepted "Whewellian" dogmas: (i) that in the 18th century "while nothing was added to our knowledge of optical laws, the chemical effects of light were studied to a considerable extent" but that since the "chemical speculations" belonged to "other subjects" optical theory remained a "blank"; (ii) that Newton's dominance sustained the corpuscular theory in the 18th century; (iii) that 18th-century optical theories can be usefully classified into two dichotomous varieties—either wave or particle; (iv) that Thomas Young is the revolutionary hero in establishing the 19th-century wave theory; and (v) that Henry Brougham's uninformed castigation of Young's work destined the latter's efforts to oblivion until rescued by Augustin Fresnel.

To the first contention Cantor allows some validity, but also argues that its acceptance has led historians to overlook important forms of activity: the transformation of "Newton's hints" into a popular pedagogical format; the extension of the projectile theory to its limits; and the connecting of optical investigation with theology and with theories of heat, electricity, chemistry, and acoustics within the framework of natural philosophy. In regard to Newton's dominance, Cantor shows that 17th-century authors other than Newton put forth corpuscular theories that had some influence, that there was more than one Newtonian optical theory, and that various individuals of the 18th century modified these to suit their individual propensities. With respect to the classification of light theories, Cantor regards their categorization into particle and wave as inadequate for any kind of refined assessment of the situation; there were at least four types of theories: the projectile theory, the fluid theory, the vibration theory, and the wave theory, each of which he examines.

The division between vibration theories and wave theories is critical to Cantor's revision of the assessment of Young and Brougham. The major differences between the theories, according to Cantor, were that vibrationists were concerned primarily with the analogy between vibration in ether and sound in air and were concerned with the ether as an element in a theory of matter, whereas wave theorists concentrated on the mathematical theory of waves, particles, and forces and considered the ether only in terms of mathematically expressible models employed within a hypothetico-deductive methodology. In addition, Young concentrated on the behavior of rays whereas Fresnel developed the subject of wave propagation. On the basis of this fine-line analysis, Cantor concludes that Young was upholding an already rejected "vibration theory" more akin to that of Euler than to the "wave theory" of Fresnel. This rather than the viciousness of Brougham's attacks was the primary reason Young failed to make converts, and Young's law of interference (his true innovation according to Cantor) was initially rejected because his critics, including Brougham, could not abstract the law of interference from the vibration theory because of Young's aphoristic style, which was inadequate for conveying clearly a complex subject.

There can be no doubt that Fresnel was "more modern" than Young. Mathematical physics had come to dominance in France and was coming into dominance in Britain, at least among Cambridge wranglers and British mathematicians elsewhere. Undoubtedly also, mathematics generated a greater reliance on the hypothetico-deductive methodology in physics. But by these standards it was Young's critics who were anachronistic. Most of them were not mathematically oriented, and most of them were skeptical of the hypothetico-deductive approach. Conversely, Young did employ mathematics, albeit inadequately, and to some extent the hypothetico-deductive method. Moreover, Whewell, like other supporters of the wave theory in Britain, was a mathematician, did not view Young as anachronistic, and did not conceive the ether as simply a mathematical model. Who can be said to have "read history backwards," Young's advocates, Young's detractors, or Cantor? Is it possible that Young was simply an