

VOLUME I: INTERPRETATION,  
INTENTIONALITY, AND  
COMMUNICATION

# **Interpretation and Explanation in the Study of Animal Behavior**

edited by  
**Marc Bekoff and  
Dale Jamieson**



**A Westview Special Study**

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Intentionality, and Communication

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These volumes are dedicated to the memory of Milton E. Lipetz, who strongly supported interdisciplinary behavioral research when he was a senior administrator at the University of Colorado, Boulder, and to Everly B. Fleischer, who, as Dean of the College of Arts and Sciences, introduced us to each other, supported our initial efforts to teach together, and provided the initial support that helped get this project off the ground.

# Foreword

Donald R. Griffin

The stimulating chapters in these two volumes are a highly heterogeneous assembly, ranging from critical analyses of how investigators of animal behavior can best minimize the hazards of erroneous interpretations to thoughtful philosophical discussions. The latter include arguments based on deeply held convictions that many animals deserve better treatment by members of our species. A significant development reflected in several chapters is the increased concern with both cognition and mental experiences in nonhuman animals. For example, Patrick Bateson tentatively concludes that animals have preferences and make choices, Robert Mitchell infers that animals sometimes act intentionally, and W. John Smith accepts the presence of expectations. This relatively recent trend to reopen the old and long neglected questions of animal mentality presents us with extremely difficult scientific challenges; but many contributors to these volumes share at least a tentative belief that these questions are important and that they can be studied profitably by scientific methods. This is a welcome change from the puritanical behaviorism that used to repress all consideration of animal minds.

Yet despite this liberalization of viewpoint, stubborn residues of positivistic behaviorism are still evident. They seem to center on an excessive fear of anthropomorphism, apprehension that one may be accused of uncritical sentimentality if one suggests that any nonhuman animal might experience subjective emotions such as fear, or think consciously in even the simplest terms, such as believing that food is located in a certain place. This widespread taboo might be called by the tongue-twisting name of "*anthropomorphophobia*," or *A-phobia* for short. The "A word" has had frightening connotations among scientists, and we have customarily taken it more or less for granted that only uncritical thinkers would suggest that nonhuman animals might experience subjective emotions or simple conscious thoughts.

But as John Fisher points out, there is no solid logical basis for the belief that anthropomorphism is a fallacy. Only if one assumes in advance that our species has an exclusive monopoly on

mental experiences is it unsound to consider to what degree members of other species may think and feel, as I have discussed elsewhere (Griffin 1977, 1984, 1990). It may therefore be helpful to outline an alternative cognitive perspective that is equally compatible with critical scientific inquiry and analysis:

A. As materialists who accept the fact of biological evolution, we take it for granted that mental experiences, that is, subjective feelings and conscious thoughts, result from the functioning of central nervous systems.

B. All central nervous systems consist of quite similar neurons and synapses; and, as far as we know, they function in much the same way.

C. We know firsthand that mental experiences occur in one species, although they accompany only a small fraction of the information processing that takes place in the central nervous system.

D. It is therefore parsimonious to infer that the central nervous systems of all animals give rise at times to some sort of subjective feelings and conscious thought.

E. Inference D does not require, or even imply, that the mental experiences of all species are alike or equal in complexity. Indeed they differ to some extent among members of the one species where we know they occur, for instance, between children and grown-ups, men and women, and members of different cultural groups. Interspecific differences are almost certainly greater than intraspecific differences. Thus recognizing the likelihood that animals experience simple thoughts and feelings need not detract from a full recognition of the enormous superiority of human mentality and its many potent ramifications.

F. Because the mental experiences of one group differ from those of others does not mean that those of either group are nonexistent.

These statements are quite generally accepted by scientists concerned with neurophysiology and behavior, except for inference D, probably because it conflicts with deep-seated beliefs that human mentality is qualitatively different in kind from the results of nonhuman brain function. Of course human thinking is

astronomically more complex and versatile than that of other species, but even this enormous quantitative superiority does not, in principle, require that there must be basic differences in kind between the mental experiences resulting from the functioning of human and nonhuman brains.

This brings us back to the "A word," and its baggage of negative connotations among scientists. If we recognize that the views outlined above are at least plausible and should not be rejected out of hand, it follows that there is no valid reason to dismiss as fallaciously anthropomorphic the suggestion that nonhuman animals may experience simple feelings or conscious thoughts. There are often good reasons to doubt that a particular mental experience could occur to a given animal, for example because it lacks the necessary information or is incapable of organizing such information into the appropriate pattern. Finding answers to such challenging questions as those discussed in this book is not facilitated by dogmatically negative prejudgments. Yet this basic consideration tends to be overlooked. For example, behavioral scientists often qualify any cognitive interpretations of animal behavior with disclaimers that they are suggesting the occurrence of *human* fear, belief, intention or the like. This customary wording implies that human emotions or thoughts are the only possible kind.

Just how similar or different are the mental experiences of other species? Recognizing that they may differ greatly across species makes it more difficult to identify them than would be the case if they were necessarily the same as ours. But it would probably be an overreaction to jump to the conclusion that fear, affection or, say, the belief that a certain animal is a dangerous predator differ substantially between various species. Insofar as they occur, such mental experiences must play an equivalent functional role in a wide variety of animals; and their emotional impact is presumably much the same regardless of the specific sensory or perceptual processes by which they are established. Thus it would be prematurely pessimistic to assume in advance that the ingenuity of scientists cannot eventually reduce significantly our present ignorance about these important matters.

Another important aspect of several chapters in these volumes, as well as similar discussions of animal behavior elsewhere, is a demand for premature perfectionism. Scientists pondering the questions of animal mentality yearn for clear-cut formulations by which cognitive processes and mental experience

can be unambiguously identified. Ideally we would like such identifications to permit predictions that could then be confirmed or disconfirmed to provide empirical tests of the validity of our interpretations. Because such ideal litmus tests are not immediately available, many behavioral scientists tend to throw up their hands, figuratively speaking, and dismiss the whole enterprise as hopelessly beyond the reach of scientific inquiry. This may result, in part, from a deep-seated nostalgia for a satisfyingly simple philosophical outlook from which qualitative human uniqueness and inherent superiority are taken for granted.

In this situation it is helpful to remind ourselves that many if not most major scientific advances have begun by tentative explorations of possibilities that could initially be little more than shrewd guesses. The investigation of animal mentality is in a very early stage of development, where tidy theories and definitive evidence are not yet available. Therefore cognitive ethology must grope inquisitively through tangled thickets of uncertainty, and gradually reduce our current ignorance by gathering and evaluating evidence that can increase or decrease the plausibility of specific hypotheses rather than settling definitive questions once and for all by simple predictions that are then confirmed or not. Several chapters exemplify this constructive endeavor. To insist at the outset on tidy packages of totally consistent and universally applicable theories would be at best unrealistic, and at worst a repressive inhibition of a significant area of scientific investigation.

An additional impediment to scientific investigation of animal mentality is a political or quasi-religious sort of claim that narrowing the perceived gulf between human and animal mentality would threaten fundamental human values. Adler (1967) argued at length that if people were persuaded that animals differ from men only in degree and not radically in kind, this would destroy our moral basis for holding that all men deserve equal treatment in matters of ethics and law. His view is summed up in the following quotation (Adler 1967: 263):

If in the future we should discover that man differs from other animals *only in degree*, the line that divides the realm of persons from the realm of things would be rubbed out, and with its disappearance would go the basis in fact for a principled policy of treating men differently from the way in which we now treat other animals and machines.



Recently Allen (1987: 158-160) has reiterated a similar argument, adding the charge that cognitive ethologists are proto-fascists:

Sociobiologists and students of animal awareness, though coming from different directions, arrive at the same end: they blur the distinction between animals and humans by setting up an evolutionary continuum...students of animal awareness see fully developed human awareness existing in rudimentary form in lower animals....[T]o blur the distinction between animal and human especially by distorting the biological reality (or by claiming for the biological reality more than it can offer), is to play into the hands of a political mood that leads ultimately to fascism....[B]lurring the distinction between humans and other animals, whether by evolutionary, genetic, or neurobiological arguments, paves the way for relegating some people to the sub-human category on the basis of their biology. Once there, the usual moral restraints and considerations cease to apply, and fascism has arrived.

These political views entail a belief that certain scientific subjects must not be investigated, because if the truth should turn out in one conceivable way, our moral standards would be seriously undermined. Such arguments are highly reminiscent of the outrage that greeted Darwin's conclusion that animals have evolved over geological time, and that our species was part of this evolutionary continuum. Biological continuity is now generally accepted (even Adler and Allen speak of human and nonhuman animals), but mentality is still viewed by some as a sort of sacred area where evolutionary continuity must be denied at all costs. Just as the suggestion that genetic background exerts some influence on behavior was greeted with quasi-religious outrage, so now a few ardent advocates of radical human uniqueness see cognitive ethology as a threat to human morality, following in the footsteps of Bishop Wilberforce and other religious opponents of evolution.

Fortunately these imagined threats are remote and absurd. Religion and ethics have survived the Copernican and Darwinian revolutions, strengthened rather than weakened by the correction

of factual errors. The astronomical differences in degree of mental capability is quite sufficient to distinguish our species from others. As Whitehead (1938: 27) put it succinctly, "The distinction between men and animals is in one sense only a difference of degree. But the extent of the degree makes all the difference." It would surely be tragic to base our morals and ethics on erroneous scientific conclusions. And although scientists have no special license to advocate ethical standards, it is appropriate to question the soundness of basing them on exclusion of supposedly inferior creatures. In any event the increasing realization that the extent and nature of animal mentality has fundamental philosophical implications has stimulated many philosophers, including those represented in this book and others such as Midgley (1983) and Radner & Radner (1989), to reexamine the ramifications of cognitive ethology. Such thoughtful consideration is now limited by our lack of knowledge of the actual mental experiences of nonhuman animals, and it will be greatly facilitated by learning as much as we can about what various animals think and feel. We have a very long way to go in this endeavor, but several chapters in these volumes represent important milestones at the beginning of this road.

#### LITERATURE CITED

- Adler, M.J. 1967. *The Difference of Man and the Difference It Makes*. New York: World Publishing.
- Allen, G.E. 1987. Materialism and reductionism in the study of animal consciousness. In: *Cognition, Language, and Consciousness: Integrative Levels* (ed. by G. Greenberg & E. Tobach), pp. 137-160. Hillsdale, New Jersey: Lawrence Erlbaum Associates.
- Griffin, D.R. 1977. Anthropomorphism. *BioScience* 27, 445-446.
- \_\_\_\_\_. 1984. *Animal Thinking*. Cambridge, Massachusetts: Harvard University Press.
- \_\_\_\_\_. 1990. *Animal Thinking*. Revised Edition. Cambridge, Massachusetts: Harvard University Press.
- Midgley, M. 1983. *Animals and Why They Matter*. Athens, Georgia: University of Georgia Press.
- Radner, D. & M. Radner. 1989. *Animal Consciousness*. Buffalo, New York: Prometheus Books.
- Whitehead, A.N. 1938. *Modes of Thought*. New York: Macmillan.

## Preface

In these two volumes, numerous and previously unacquainted thinkers meet one another in settings that probably none would or could have predicted - Paul Grice meets Gregory Bateson, Charles Lloyd Morgan meets Daniel Dennett, Charles Darwin meets Ludwig Wittgenstein, and Aristotle meets Niko Tinbergen. The original essays in this collection, written by biologists, psychologists, philosophers, an anthropologist, and a historian, are each concerned in their own way with the interpretation and explanation of animal behavior.

Many books and articles have been written on interpretation and explanation (see, for example, Cummins 1983; Miller 1987; Dretske 1988; Giere 1988; Pitt 1988; Humphreys 1989; Kitcher & Salmon 1989; Packer & Addison 1989), and we would not be so foolish as to attempt to provide full analyses of these concepts here. And anyway, different contributors have different conceptions of these notions. However, we can say this: Problems of interpretation arise in the neighborhood of observation, while those of explanation arise in the vicinity of theory. Both interpretation and explanation involve empirical and conceptual dimensions. In order to understand better nonhuman animals, we need to know more about what they do and about our own concepts and the grounds for attributing them.

Problems of interpretation generally concern *how* we know what an animal is doing; whether, for example, two dogs are playing or fighting, whether a ground squirrel recognizes another individual, whether a Japanese quail chooses a specific individual with whom to mate, whether an evening grosbeak selects a particular area in which to breed, or whether a dog goes to a door because it wants a human to let it out (and perhaps intends to accomplish this by going to the door). These and other problems of interpretation are taken up in different chapters in this collection.

Problems of explanation generally concern *why* something occurs. Traditionally, explanation has been thought to be logically related to prediction (Hempel & Oppenheim 1948); both involve the deduction of a particular observable event from a universal covering law. Without endorsing any particular view, we can say that an explanation makes a behavior intelligible to us by assimilating it to a larger pattern. Contributors to this collection

are concerned with such questions as why birds respond differently to various song dialects, why helping behavior has evolved, and why there appears to be a predictable relationship between social group size and antipredatory (vigilance) behavior in some birds and mammals. One recurring theme concerns whether an animal's behavior can ever be explained by reference to its mental states.

Our own interests in these areas of inquiry originate from different perspectives on animal behavior and from different experiences with animals. Yet it was obvious to us from the beginning that these interests and experiences complement and reinforce each other and that it was quite natural for an ethologist and a philosopher to converge on problems of interpretation and explanation in animal behavior (Bekoff & Jamieson 1990a,b). Since our graduate school days, in different fields in different universities, we have both been fascinated by questions about "what it is like" to be a nonhuman animal (Nagel 1974).

In recent years there has been a revival of interest in the study of animal minds (e.g. Mitchell & Thompson 1986; Blakemore & Greenfield 1987; Richards 1987; Byrne & Whiten 1988; Montefiore & Noble 1989; Radner & Radner 1989; Robinson 1989), an area pioneered by Charles Darwin (1871/1946, 1872/1965) and his immediate followers (see Burghardt 1985). Zoologists such as Griffin (1976, 1984, 1990), psychologists such as Walker (1983) and Kamil (1988), and historians such as Haraway (1989) have all made contributions. Philosophers have been mainly concerned with producing general theories of mind, but in many cases these theories have implications for animal minds. For example, some philosophers have argued that "folk psychological" notions such as "believe," "desire," and "intend" apply to both humans and some nonhumans (e.g. Dennett 1983, 1987; Searle 1983; Fodor 1987; Rollin 1989). Other philosophers have claimed that such notions apply to neither humans nor nonhumans (P. M. Churchland 1981; Stich 1983; P. S. Churchland 1986). Still others have held that such notions apply to some humans but not to languageless creatures such as nonhumans (Davidson 1985).

This growing interest in animal minds is not merely academic. In Western societies, generally, a reevaluation is occurring with respect to the cognitive and affective capacities of animals, and what this may mean for our relations with them. Just one example of this is the May 23, 1988, issue of *Newsweek* magazine. Pictured on its cover was a "thinking dog," and the

caption boldly stated: "How smart are animals? They know more than you think."

Despite this flurry of activity there has been a great deal of insulation (both social and intellectual) between different scientific disciplines, different research programs, and those studying different animals. Moreover, very little of the philosophical work (Daniel Dennett's being the main exception) has had much effect on behavioral biologists and comparative psychologists, and, similarly, very little work in these latter fields has had much impact on philosophers (the work of Donald Griffin being the main exception). This lack of communication, both between and among disciplines, has inhibited progress in the study of animal minds and behavior, and this may explain the surprising fact that there was no comprehensive, truly interdisciplinary collection that addressed the issues of interpretation and explanation in the study of animal behavior. When we discovered that there was no such collection, we decided to invite a few friends and colleagues to help us fill this gap. This two-volume work, which borders dangerously on 1,000 pages in length, is the result.

The main purpose of this collection is to make accessible to a wide audience diverse and interdisciplinary views of the study of animal behavior. We wish to show how various concerns in different fields can be brought together to provide a more coherent picture of animal lives and our relation to them. Despite the varying backgrounds and views of the contributors, some common themes and concerns emerge. These include questions about how behavior is categorized; anthropomorphism; the role of values in behavioral and other types of research; levels and methods of analysis; intervening and confounding variables; critical experiments; units of selection; perceptual worlds, or *umwelts*; the meaning of key terms such as "social relationship," "recognition," "choice," and "play"; communication and language; questions about adaptation and optimality; cognitive skills and affective states; intentionality; mental continuity; the scientific legitimacy of animal mentation; and ethical issues about animal welfare. Our belief is that views on these matters are interrelated - sometimes by logic, sometimes by culture, psychology, and temperament. What we do in our analyses of animal behavior, how we do it, and how information is interpreted, explained, and disseminated all hang together. The picture that we have of a prairie dog's cognitive and affective states influences our views about how prairie dogs ought to be treated. Theoretical concerns

about what a dog is doing, or believes, desires, or intends when it goes to a door are only artificially separated from more practical issues concerning our responsibilities to our animal companions (Regan 1983; Bekoff & Jamieson 1990a,b; Singer 1990).

In this collection we have tried to encourage, and sometimes almost compel, communication among the contributors. Rather than just stapling together contributions from different authors, we have circulated manuscripts for review among scholars from many different fields. We also have critically read each manuscript several times in the belief that if an author can communicate with both of us, her or his chances of reaching a broad, diverse audience are pretty good.

This is not the sort of project that two people can accomplish on their own. Indeed, in retrospect, we would probably rather try invading Russia in winter or riding mountain bikes across Antarctica than edit another camera-ready anthology with 37 chapters and 51 authors, who assaulted us with discs of various sizes containing manuscripts prepared on 34 different word-processing programs. We have had a lot of help along the way, and although defects remain, there are many fewer due to the support and advice of many good people.

When we first floated the idea of this anthology, Kellie Masterson of Westview Press was immediately receptive. Spencer Carr, Lynn Arts, and Lindsay Schumacher, also at Westview, provided helpful advice at various crucial stages. Perhaps most importantly, the folks at Westview managed to retain their composure, at least in our presence, when the manuscript weighed in at twice its anticipated length.

We also have been very fortunate that our university has permitted us to teach together a unique course on philosophical issues concerning animal behavior. We have even been provided with financial support to bring some of our contributors to Boulder to take part in our seminar. For this we thank the President of the University of Colorado, E. Gordon Gee, Chancellor James Corbridge, Associate Vice-Chancellor Mark Dubin, Dean Everly Fleischer (now Vice-Chancellor at the University of California, Riverside), Dean Charles Middleton, and our department chairs, Michael Breed and John Andrew Fisher. We would also like to thank Oscar and Beatrice Bekoff for financial support.

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Cleland, Thomas Daniels, Randolph DiDomenico, John Dupré, Margaret Dussault, Robert Eaton, John Fentress, Sandra Mitchell, Allen Moore, W. John Smith, Randy Thornhill, and Hugh Wilder. Students in our seminars also contributed comments on drafts of many of these essays, and Eric Ervin also helped track down references. For somehow transforming discs into drafts we are grateful to Phyllis O'Connell. Laura Heigl also helped with processing unmanageable manuscripts. Michael Breed and Elizabeth Owen graciously permitted their staff to spend an inordinate amount of time helping us to complete these volumes.

Anne Bekoff and Toby Jacober put up with our self-indulgence as we worked (and worked and worked) on this project. We hope they'll continue to put up with us in the future. Finally Sasha Bekoff and Gretta Jacober-Jamieson - two prototype examples of canid cognitive machinery - provided invaluable inspiration and insights. Why, they asked us, do we question not only the existence of their minds, but also their higher-order intentions? Unfortunately, however, not everyone has been able to hear their questions and even fewer have been able to understand them (see John Dupré's chapter in section IV, Volume I).

We have divided this collection into two complementary volumes. The first deals mainly with problems of *interpretation, intentionality, and communication*. Issues that are discussed include how behavior is categorized; the role of anthropomorphism in comparative analyses of behavior; gender-related issues in the study of behavior; how social relationships are studied; recognition; choice; play; animal communication and cognition; "language" in nonhuman primates; animal mentation; psychological continuity; what it means to speak of animal minds; and why animal minds seemed to disappear from behavioral science from the latter part of the nineteenth century to the middle of the twentieth century. In the second volume *explanation, evolution, and adaptation* are highlighted. It includes discussions of early natural history studies; adaptation; the nature of evolutionary explanations; methodology in neuroethology; the application of artificial intelligence to studies of animal behavior; comparative analyses of behavior and phylogeny; and methodological issues in various areas of research including bird-song, vigilance (antipredatory) behavior, helping behavior, and life-history studies. Ethical issues are also discussed, including those relating to domestication, genetics research, and the use of animals in behavioral and other types of research.



The study of animal behavior requires careful observation and sampling in a wide range of conditions and also the application of rigorous methods of analysis. Detailed studies of nonhumans will allow us to assess not only what they do when we ask them to do things in conditions that we control, but also will expose what they *can* do when permitted to express themselves in more permissive environments. However, the reliability of the information we collect must be assessed carefully and critically so that we do not fool ourselves into thinking that we know something when we do not. Questions about how behavior is categorized, how to study animals, where to do it and when all demand careful consideration, for these matters color how we interpret and explain the behavior of our nonhuman counterparts. Animal minds, animal cognitive abilities and affective states, and animal behavior in general are difficult to study. Too often we have studied what is easy and denied the existence of what is difficult. We have been like the man who searches for his keys under the streetlight because that is where the light is good.

Taken together, these volumes present original discussions of key issues in the study of animal behavior. While each volume can be read on its own, each informs the other. Collectively, these essays serve as a broad interdisciplinary introduction to wide-ranging questions about the animals with whom we share the planet. We hope that these volumes will set the standard for future research.

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#### LITERATURE CITED

- Bekoff, M. & Jamieson, D. 1990a. Reflective ethology, applied philosophy, and the moral status of animals. *Perspectives in Ethology* 9, in press.
- \_\_\_\_\_. 1990b. Cognitive ethology and applied philosophy: The significance of an evolutionary biology of mind. *Trends in Ecology & Evolution* 5, 156-159.



- Blakemore, C. & Greenfield, S. (eds.) 1987. *Mindwaves: Thoughts on Intelligence, Identity, and Consciousness*. New York: Basil Blackwell.
- Burghardt, G.M. (ed.) 1985. *Foundations of Comparative Ethology*. New York: Van Nostrand Reinhold.
- Byrne, R. & Whiten, A. (eds.) 1988. *Machiavellian Intelligence: Social Expertise and the Evolution of Intellect in Monkeys, Apes, and Humans*. New York: Oxford University Press.
- Churchland, P.M. 1981. Eliminative materialism and propositional attitudes. *Journal of Philosophy* 78, 67-90.
- Churchland, P.S. 1986. *Neurophilosophy: Toward a Unified Science of the Mind/Brain*. Cambridge, Massachusetts: MIT Press.
- Cummins, R. 1983. *Psychological Explanation*. Cambridge, Massachusetts: MIT Press.
- Darwin, C. 1871/1946. *The Descent of Man and Selection in Relation to Sex*. London: Watts & Company.
- . 1872/1965. *The Expression of the Emotions in Man and Animals*. Chicago, Illinois: University of Chicago Press.
- Davidson, D. 1985. Rational animals. In: *Actions and Events: Perspectives on the Philosophy of Donald Davidson* (ed. by E. LePore & P. McLaughlin), pp. 473-480. London: Basil Blackwell.
- Dennett, D.C. 1983. Intentional systems in cognitive ethology: The 'Panglossian paradigm' defended. *Behavioral and Brain Sciences* 6, 343-390.
- . 1987. *The Intentional Stance*. Cambridge, Massachusetts: MIT Press.
- Dretske, F. 1988. *Explaining Behavior: Reasons in a World of Causes*. Cambridge, Massachusetts: MIT Press.
- Dupré, J. (ed.) 1987. *The Latest on the Best: Essays on Evolution and Optimality*. Cambridge, Massachusetts: MIT Press.
- Fodor, G. 1987. *Psychosemantics: The Problem of Meaning in the Philosophy of Mind*. Cambridge, Massachusetts: MIT Press.
- Giere, R.N. 1988. *Explaining Science: A Cognitive Approach*. Chicago, Illinois: University of Chicago Press.
- Griffin, D.R. 1976. *The Question of Animal Awareness*. New York: Rockefeller University Press.
- . 1984. *Animal Thinking*. Cambridge, Massachusetts: Harvard University Press.
- . 1990. *Animal Thinking*. Revised Edition. Cambridge, Massachusetts: Harvard University Press.