The Continuing Question of Animal Awareness

Cognitive Ethology. The Minds of Other Animals. Essays in Honor of Donald R. Griffin. CAROLYN A. RISTAU, Ed. Erlbaum, Hillsdale, NJ, 1991. xx, 332 pp., illus. $49.95; paper, $22.50. Comparative Cognition and Neuroscience. From a symposium, Williamstown, MA, June 1987.

Early in the 1940s Donald Griffin demonstrated that bats use an ultrasonic sonar system to navigate and to locate prey. For nearly four decades thereafter Griffin's work on bat sonar and on mechanisms of bird navigation ranked among the most technically sophisticated and intellectually exacting research on animal behavior. Then in 1976 Griffin published a small book, *The Question of Animal Awareness* (Rockefeller University Press), which was followed in 1984 by *Animal Thinking* (Harvard University Press). Had this hard-nosed scientist gone soft, or had he discovered a new research area that would be as significant as his prior research had been? *Cognitive Ethology*, a collection of essays to honor Griffin, debates this question.

Griffin contends that nonhuman animals are capable of consciousness, awareness, intentionality, and complex thinking—that is, they have many of the same mental experiences as human beings. This contention is reminiscent of some late-19th-century writing. Lindsay's *Mind in the Lower Animals* (1880) argued that the mental differences of man and animals were a matter of degree. Insects were said to appreciate beauty, to exchange ideas, and to utilize tactics and stratagems. Behaviorism arose, in part, in response to the mentalism proposed by Lindsay and others. Some cognitive ethologists in this book, including Griffin, argue that a strict adherence to behaviorism inhibits its creative examination of animal capabilities, whereas others argue that alternative noncognitive hypotheses must be evaluated and rejected before one accepts that nonhuman animals are capable of consciousness and complex thinking.

There are two major philosophical implications of Griffin's cognitive ethology. First, cognitive ethologists are essentially renouncing Ockham's razor or Lloyd Morgan's canon that we should search for the simplest explanation of a phenomenon. Second, common sense and personal experience are used as the starting points for the study of animal minds. This "folk psychology" has been defended by some contributors in this book (see Griffin, Beer, Burghardt, and Ristau) and criticized by philosophers and psychologists (see Bennett and Michel). Burghardt proposes a "critical anthropomorphism," arguing that anthropomorphism is an excellent source of creative research ideas. However, one must constantly test these ideas against reality and against alternative explanations. Michel argues that folk psychology and anthropomorphism can corrupt the attempt to develop a cognitive ethology.

What are the phenomena that support a cognitive ethology? Deception is argued to be an indicator of consciousness and intention, and therefore it has an important role in this book. Injury-feigning by plovers (Ristau) and death-feigning by hognose snakes (Burghardt) are highly adaptive means to protect an organism or its offspring from predation. These are highly variable behaviors, and the animal appears to respond in a creative way to changes in the behavior of a potential predator. Behavioral flexibility, attention to the behavior of another organism, and rapid changes in response along with the deceptive behavior are said to be hallmarks of cognition.

Communication signals provide another source of evidence. Both vervet monkeys (Cheney and Seyfarth) and cockerels (Marler *et al.*) give alarm calls at different rates according to whether a conspecific is present and if so what type. Cockerels also give "food calls" at different rates with different audiences, and often "food calls" are given in the absence of food. The ability of animals to withhold signals or to give referential signals in the absence of the referent is argued to be deceptive. However, vervet monkeys learn rapidly to ignore calls from an unreliable signaler (Cheney and Seyfarth), so deceptive signals are unlikely to be effective for very long or will be effective only if used infrequently. Chimpanzees display behavior that is interpreted as concealment from others, distraction and lying, and creating social images to distract others from certain social interactions (Jolly).

Smith provides an alternative view to these examples of deception. He argues that communication signals rarely have a single referent such as food or a predator but communicate about internal states, individual identity, and probabilities of engaging in certain behavior as well as external referents. A responder must constantly be attentive to changes in behavioral and environmental contexts in order to respond appropriately. If cockerel "food calls" do not have food as their sole referent, but are instead part of courtship behavior (as Smith argues), then the failure of males to call in the presence of another male or a member of another species or calling in the absence of food can make sense without deception or intentionality being involved. The calls simply indicate that a male is seeking contact with a female and may or may not have food to offer her.

Smith also argues that playback techniques are useful for showing that animals can discriminate among different signals in the absence of other contextual cues, but these techniques may be limiting in trying to determine referents of calls. Since all other contextual cues are removed in a playback study, animals can only respond on the basis of a "worst case" model. Responses to playbacks also indicate the nature of inferences that respondents make about a signal, and these may be more cognitively complex than the information contained in the signal. Listeners can form inferences about a probable referent on the basis of contextual cues even if the communicator did not "intend" to communicate about a referent or did not even possess symbolic signals.

The death-feigning and injury-feigning behavior of snakes and plovers and the "audience effects" of calling in monkeys and cockerels indicate that animals are not merely robots but have capacity for great behavioral flexibility. This remains true whether or not one believes that these behaviors indicate consciousness, intentionality, or deception. One can still be impressed by the ability of animals to form inferences based on the behavior of others even without assuming that communication signals are necessarily symbolic.

There are other approaches to animal cognition. Pepperberg shows that an African gray parrot can understand and use words in spoken English, including the relational concepts "same" and "different," and apply these to attributes of color, shape, and matter with both familiar and novel objects. However, Pepperberg makes no claims that the parrot understands language.

or that concepts of consciousness or awareness are needed to explain the parrot's skills.

Yoerg and Kamil provide a variety of other examples in arguing that cognitive ethology must use the rigorous methods of human and animal cognitive psychology in combination with an ecological and evolutionary perspective. I agree completely with Yoerg and Kamil. It is possible to explore the cognitive capacities of nonhuman animals without recourse to mentalistic concepts such as consciousness, intentionality, and deception. Studies that avoid mentalistic terminology are likely to be more effective in convincing other scientists of the significance of the abilities of nonhuman animals.

Cognitive Ethology is a particularly well-edited book. The authors of individual essays actually appear to have read each other's chapters, and Ristau provides an excellent overview and integration of the issues raised in the book in her epilogue. It is a tribute to the editor and to Griffin himself that a book of essays in his honor does not contain only essays sympathetic to Griffin's views but an equal number that take issue quite vigorously with many of his ideas. *Cognitive Ethology* is an excellent forum for learning about one of the most controversial and exciting issues in animal behavior research.

CHARLES T. SNOWDON
Department of Psychology, University of Wisconsin, Madison, WI 53706

The Dinosaurs of '47

The Age of Reptiles. The Great Dinosaur Mural at Yale. VINCENT SCULLY, RUDOLPH F. ZALLINGER, LEO J. HICKEY, and JOHN H. OSTROM. Abrams, New York, 1990. 48 pp., illus., + foldout plate. $19.95.

Within a museum the ratio of creative to mundane endeavors is always small, and operational pressures tend to reduce it further still. Thus one of the heroes behind the famous mural of prehistoric life in the Yale Peabody Museum of Natural History was surely its director, A. E. Parr, who found the talent and budgeted the funds and time for the creation of this powerful synthesis of art and science. The other hero is, of course, the artist, Rudolph Zallinger, who by tapping the traditions of art, existing paleontologic expertise, and his own genius created a painted poem of epic proportions which spans 110 feet and 300 million years.

The mural was completed more than four decades ago, and the object of this small volume is to situate the work within the history of art (V. Scully), to describe its fabrication (Zallinger), and to relate it to the history of life on Earth as currently understood (L. J. Hickey and J. H. Ostrom). The text will help scientists to appreciate their contribution to human civilization, as well as the labor that is involved in great art. Conversely, some of the paleontologic comments, particularly those relating to ancient plantscapes, are beautifully written. However, the primary contribution of the volume is a foldout color reproduction (on a scale of about 1:23) of the mural itself, as photographed by W. K. Sacco and J. Szaszfai.

The mural is painted with courageous precision. Because it dared to depict what was not known as well as what was known, it illustrates a history of land life during the Mesozoic as that history was understood in 1947. Somewhat paradoxically, links to one point in time enhance the quality of timelessness, for the mural provides a gigantic and beautiful yardstick against which subsequent (and future) changes in our view of the past can be assessed.

The dinosaurs, which dominate the mural, are no longer the dinosaurs we know. They obey an unwritten law that the tail must drag upon the ground and often bear a coarsely serrated fleshy crest along their backs. Few would so restore dinosaurs today. Where are the indications of trampled soils or browsed vegetation that figure so largely in recent research? How many viewers of the mural realize that, although good skeletons were then known from Canada, East Africa, and Europe, most of the dinosaurs illustrated are American forms? And that only three dinosaurian assemblages are depicted (these being of late Triassic, late Jurassic, and terminal Cretaceous age)? Rising up on the left margin of the mural are mighty volcanoes that appear to represent the great Laramide interval of mountain-building and the disappearance of the dinosaurs. In 1947 there was no debate on whether or not the impact of an asteroid exterminated the dinosaurs.

The artist, however, was conceptually ahead of his time in combining extinct plants and animals into ancient landscapes. The juxtaposition naturally posed the kinds of questions on dinosaurian ecology that have since been so profitably examined. Indeed, a synthesis of an even higher order is suggested, as Scully (p. 17) perceptively concludes: "[The mural] is the habitat of more than mythical creatures. . . we seem to recognize some ancient truth in them which the more recent paintings of dinosaurs may not touch upon so closely; perhaps we remember something basic to our nature, hear once again the old authentic tread of the divine."

DALE A. RUSSELL
Earth Sciences Division, Canadian Museum of Nature, Ottawa, Ontario K1P 6P4, Canada

The photographing of the dinosaur mural, summer 1988. [From *The Age of Reptiles*]