

## Scientific Approaches to Animal Consciousness<sup>1</sup>

DONALD R. GRIFFIN<sup>2</sup>

Concord Field Station, Harvard University, Old Causeway Road, Bedford, Massachusetts 01730

**SYNOPSIS.** In a marked departure from past inhibitions about scientific consideration of conscious mental states in animals, the other papers in this symposium review a variety of evidence about what the *content* of animal consciousness is likely to be. Although fully convincing evidence is not yet available, there are promising opportunities to reduce our current ignorance of what life is like, subjectively, for various animals. For example, recent neurophysiological experiments provide objective evidence about what monkeys are, and are not, conscious of. Versatility of behavior when animals cope with novel and unpredictable challenges strongly suggests simple conscious thinking about alternative actions. Finally, animal communication provides direct and objective, though incomplete and imperfect, evidence about some of their conscious thoughts and feelings.

A striking aspect of this symposium is that almost all the participants take it for granted that some animals *are* conscious—not all animals all the time, but at least some animals on some occasions. I will use the words “conscious” and “aware” interchangeably to mean subjective, mental experiences such as thinking about some object or event or feeling emotions such as anger, fear or affection. We all know what consciousness experiences are, and the symposium addressed the important question of nonhuman consciousness, that is, whether other species have any conscious experiences, and if so what these are like to the animals themselves.

Instead of the resistance to considering such questions that used to be customary among behavioral scientists, there was stimulating and constructive discussion of the *content* of animal consciousness, that is, what particular animals may feel or think. Cartmill recommended that we avoid the “temptation of skepticism”—the feeling that to be rigorous and critical scientists we must deny that any animal is conscious or that the question can be studied scientifically. For thoughtful inquiries into deeply challenging problems does not require any

lowering of critical standards, and most of the participants tended to agree that an adequate understanding and appreciation of animals requires consideration of what their lives are like, to them.

This change in climate of opinion does not make the analysis of animal consciousness easy. All the difficulties and uncertainties which led behaviorists to ban the subject from scientific psychology remain in place. But difficulties are not impossibilities, and the participants in this symposium discussed some of the approaches that are beginning to reduce our ignorance. Insofar as animals are conscious the content of their conscious experiences probably differs in many ways from human consciousness, so that investigating it requires more than merely inquiring whether particular kinds of human awareness occur in other species.

Biologists are seldom fortunate enough to have ideally perfect evidence that leaves no shadow of a doubt that a particular hypothesis is correct. We therefore deal with incomplete evidence and evaluate as best we can a variety of interpretations. But when questions about animal consciousness arise we have tended to feel that if we cannot prove with total certainty that an animal is conscious it is a mistake even to study the question. This double standard inhibits scientific investigation. Such “paralytic perfectionism” would certainly have impeded progress if it had been applied in other areas of science.

<sup>1</sup> From the Symposium *Animal Consciousness: Historical, Theoretical, and Empirical Perspectives* presented at the Annual Meeting of the Society for Integrative and Comparative Biology, 6–10 January 1999, at Denver, Colorado.

<sup>2</sup> E-mail: cfs@oeb.harvard.edu

As evolutionary biologists we are interested not only in whether animals are conscious, and if so what the content of their consciousness is, but what adaptive advantages conscious experience may afford. Many have doubted that there are any such advantages, and two arguments have been advanced to support this opinion, as reviewed by Baars (1988, 1997); Allen and Bekoff (1997); and Searle (1998): (1) whatever an animal does *might* be done unconsciously, and (2) consciousness is an epiphenomenon that has no effect on behavior and therefore cannot have any adaptive value. The first argument claims that because we are unaware of the great majority of human brain functioning animals are never conscious of anything, or more conservatively that there is no way to tell whether they are or not. But this conclusion does not logically follow from the premise. The proportion of brain functioning of which an animal is conscious is a quite different matter from the question whether consciousness is limited to one species. The ratio of conscious to unconscious neural functioning might differ widely in either direction among various species.

The second argument presupposes that whatever neural processes lead to conscious awareness also produce overt behavior directly, without the consciousness having played any role. This claim is intuitively difficult to accept in our own case, which at the very least warns us not to assume that it is generally valid. Although neither of these two claims can be conclusively disproved, the likelihood of their correctness has been significantly diminished by recent scientific discoveries. These include increasing appreciation of the versatility of animal behavior, especially their semantic communication, and the similarity of neural structures and functions between human and nonhuman mammals, as recently reviewed by Georgopoulos *et al.* (1989), Cowey and Stoerig (1995), Crick and Koch (1998), Frith, *et al.* (1999), Milner, *et al.* (1998), and Tong *et al.* (1998).

Ritvo reviewed the great variety of views about animal consciousness that have prevailed at different times, and suggested that sociological factors are influential in shap-

ing contemporary views about animal consciousness. Kimler emphasized that Conwy Lloyd Morgan never intended his famous canon to mean that no animal is ever conscious of anything; it was taken over by others as a sort of cudgel used against any suggestion that animals experience even the simplest thoughts or emotions. He made this clear in his original statements (Morgan, 1894), and he was even more explicit in some of his later writings, for example Morgan (1932). Bickerton claimed that “the limitless creativity and adaptability” of our cognition is uniquely human, implying a quantitative rather than a qualitative distinction. Of course there is an enormous difference between human and nonhuman cognition, but even the astronomical magnitude of this difference does not mean that animals are totally incapable of even the simplest conscious thoughts and feelings. Nor are human language and cognition literally limitless; for example many of us are quite incapable of mathematical or artistic insights that others relish fluently.

One participant did dissent from the general acceptance of animal consciousness as a significant subject for scientific investigation. For Staddon “the very ground-rules of science, its concern only for public knowledge, preclude its finding an explanation” for consciousness, human or animal. Since consciousness can only be inferred from data about some sort of behavior, including language or communication, he holds the essentially behavioristic view that scientists should limit their consideration to the behavior and the factors that affect it. This implies that consciousness is epiphenomenal at best, or in nonhuman animals presumably nonexistent. But this pessimistic claim overlooks how much scientists have managed to learn about other processes that are not directly observable, by patiently building up indirect evidence and gradually reducing ignorance. Of course proofs are never totally perfect, but avoiding the paralytic perfectionism has led to significant progress of a sort that behaviorists rule out *a priori*. Scientific investigation of human consciousness has experienced a striking renaissance in the 1990s, as reviewed by Crick and Koch (1998), and

Hameroff *et al.* (1996, 1998). This renaissance is now expanding to include other species.

Turning to participants who presented positive evidence of at least simple levels of animal consciousness, Dawkins emphasized that our most intense emotional experiences such as pain, hunger and fear do not involve any complex cognition or intricate conscious thought. Most animals certainly behave as though experiencing hunger, pain or fear, and she suggests that animal thinking may often entail learning how to attain or to avoid situations likely to produce pleasant or unpleasant emotional experiences. Thinking about frightening experiences may well arouse emotions similar to actual injury, and there may be a similar correspondence for highly pleasurable experiences. This in turn indicates a close linkage between emotions and simple thinking about how to achieve desirable states of affairs and avoid the opposite.

Pepperberg has developed as effective method to induce African grey parrots to use their imitations of human speech in a meaningful fashion. Her star pupil Alex, and to a lesser degree two other younger parrots, ask for things they want and answer questions about shapes and colors. Alex can tell in so many words whether unfamiliar objects presented to him are the same or different, and if different whether in shape, color or material. In her earlier papers she has cautiously refrained from any discussion of the subjective experiences, if any, of her parrots. But in their paper at the Denver meeting she and S. K. Lynn concluded that these parrots are sometimes perceptually conscious, that is, aware of what they are doing and saying but not necessarily aware that they are aware.

Alex certainly expresses simple thoughts and strong emotions, and his use of imitated human speech is often spontaneous and clearly much more than rote learning of specific responses to familiar stimuli. If humans uttered the same words under comparable conditions, we would have no doubt that they were reporting conscious experiences of some sort. Therefore unless we cling to a prejudgment that human speech is different in kind from any possi-

ble animal communication, it is very difficult to avoid the conclusion that Alex means what he says.

Savage-Rumbaugh summarized the extensive observations and experiments that she and her colleagues have reported elsewhere in detail showing that chimpanzees, and especially bonobos, can learn to use artificial keyboard devices to express their desires, identify pictures of familiar objects and to answer questions. One must go through almost ridiculous mental gymnastics to justify denial that these apes are consciously thinking and feeling something approximating the content of their communicated messages.

Seyfarth and Cheney emphasize the degree to which monkeys who spend their lives in stable social groups seem to be aware of the individual identities and social relationships of their familiar companions. In some cases monkeys not only recognize their companions individually, and know their matrilineal kin relationships and linear dominance ranks, but also place themselves appropriately in these networks. Thus although in laboratory experiments monkeys fail to recognize themselves in mirrors, they are quite capable of social self-awareness. Yet Seyfarth and Cheney conclude that monkeys do not consciously “know that they know” and cannot attribute mental states to others.

The examples listed briefly above, and other recent discoveries about the versatility of animal behavior, have opened up what used to be forbidden territory where scientific inquiry was frowned on so severely that investigation was severely handicapped. Simple conscious thinking about likely results of alternative actions and selecting those the animal believes will get what it wants or avoid what it fears is a very effective way to use a central nervous system. As Karl Popper (1978) put it, trying out alternative actions in ones head is far better than performing them blindly and learning about their effectiveness by trial and error. In the real world of many animals doing the wrong thing can easily be fatal. A simple level of “if-then” thinking may well be a core function of central nervous systems that is highly effective. This in turn

suggests that simple conscious awareness and selecting actions expected to yield emotionally satisfying results may be at least as important for animals with limited volume of nervous tissue. As I have suggested elsewhere (Griffin, 1992, 1998), it is perhaps only in the largest and most complex brains that most of the information processing takes place without any conscious awareness.

Skeptics ask how we can ever hope to learn whether a particular animal is or is not conscious under given conditions, in view of the fact that much of their behavior, and indeed much of ours, occurs without conscious awareness. I suggest that we recognize the impossibility of quick and perfect answers to this basic question and proceed instead in a cautiously critical step by step approach, making use of whatever evidence is available to weigh the likelihood of conscious awareness. It is reasonable to hope that gradual progress can be achieved in reducing our ignorance about what it is like to be animals of various kinds under various conditions.

Neuropsychologists have made substantial progress in identifying physiological and electrical correlates of cognition in a wide variety of animals, as recently reviewed by Milner *et al.* (1998). Modern methods of detecting localized activity in human and monkey brains during normal waking states have demonstrated striking similarities in the areas active during cognitive tasks requiring specialized learning. These developments have been reviewed by Sheinberg and Logothetis (1997), Crick and Koch (1998), Gallese and Goldman (1998), Lumer, *et al.* (1998), Rosen, *et al.* (1998) and Farah and Aguirre (1999). And finally, significant evidence is available from analysis of animal communication which often appears to express simple thoughts and emotional experiences. This "window" on animal consciousness is not perfectly transparent, but it does provide substantial evidence of conscious awareness and emotional feeling.

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