Comparative Cognition & Behavior Reviews

2007 Volume 2, pp 139-144

Anthropomorphism Revisited

William Timberlake
Indiana University

The MIT scientist Donald Griffin, widely-recognized for his experimental confirmation that bats use echo location in tracking insects and avoiding obstacles in the dark (Griffin, 1958/1974), later wrote widely defending the view that other animals are consciously aware and intelligent, like humans (Griffin, 1976, 2001). Based on the assumption that an example of possible human-like cleverness in another animal species establishes the presence of both consciousness and intelligence, Griffin extended the continuum of human-like consciousness to many other species. For example, Griffin believed the assassin bug was conscious and intelligent because it could be viewed as disguising itself (by sticking the drained bodies of prey on its exoskeleton) before lying in wait for new victims. Griffin's focus on the anthropomorphic inference of presumed intentional cleverness in other animals provided an important impetus for similar inference of human-like animal consciousness in areas ranging from cognitive ethology to animal personality.

Given the extreme diversity of opinion in this area of thinking and research, it is not surprising that Griffin's (1976, 2001) view has not been universally accepted. In a recent *Nature* note titled, "The Perils of Anthropomorphism," Clive Wynne (2004) strongly objected to Griffin's approach, warning that "…the reintroduction of anthropomorphism risks bringing back the dirty bathwater as we rescue the baby." In the present follow up article ("What are animals? Why anthropomorphism is still not a scientific approach to behavior"), Wynne supports his argument further with historical details about the concept of anthropomorphism, and critical attention to the views of scientists who have offered modified versions of anthropomorphism, including Gordon Burghardt's (1991) concept of critical anthropomorphism, Franz de Waal's (1997, 2001) animal-centered anthropomorphism, and Marc Bekoff's (2000) biocentric anthropomorphism.

I thank Holly Stocking and Carolina Tamara for their questions.

Correspondence concerning this article should be addressed to William Timberlake, Department of Psychological and Brain Sciences, Indiana University, 1101 E. 10th Street, Bloomington, IN 47405. E-mail: timberla@indiana.edu.

In this commentary I focus on the question of whether the scientific community should completely reject the concept and practice of anthropomorphism as subjective story-telling, or if there may be aspects of anthropomorphism worth integrating with current scientific approaches. For example, Burghardt, de Waal, and Bekoff support components of seeming anthropomorphic-like inferences, so it appears they think there is something worth saving about attempts to enter an animal's world. Further, as several authors have noted, the British naturalist Lloyd-Morgan, long credited with an Occam's razor view of consciousness, clearly felt anthropomorphism was suitable in some cases. Even Wynne's (2004) concern (in the quote above) with rescuing the baby from the bathwater suggests the possibility that he also finds something potentially worthwhile in this area. Finally, based on the history of ideas, it seems clear that calls to abandon completely a concept with a long history of use, like anthropomorphism, may profit from a more careful analysis of its contributions.

Anthropomorphism and Social Tool Kits

Webster's (1975) defines anthropomorphism as "an interpretation of what is not human or personal in terms of human or personal characteristics." This is usually understood to mean the assignment of human emotions, cognitions, intentions, and planning to whatever species we are observing. Perhaps the most interesting question about anthropomorphism is why it remains so frequent and widespread? The simplest answer appears to be Colin Beer's (1980) argument that during the evolution of our species, our gene pool has given rise to a social tool kit consisting of tendencies to attribute beliefs, perceptions, emotions, and intentions to other human and nonhuman animals, presumably allowing us to predict as well as manipulate their behavior.

To my eye, the observational and experimental literatures suggest that many social vertebrates share elements of a mental attribution tool kit, but that social primates, particularly baboons and the great apes, show greater complexity in attributing and successfully behaving so as to manipulate the intentions, goals, and beliefs of other species members. These attribution capabilities appear to have been further enhanced in *Homo sapiens*, probably because of selection pressures resulting from our combination of group hunting, migration, and defense with the emergence of complex vocal communication and relatively monogamous reproduction. There are questions about the independence and order of emergence of these capabilities and the extent of their dependence on cultural beliefs and artifacts, and environmental resources, but it seems evident that humans extensively attribute to other animals attention, beliefs, and goals related to resources (e.g., food, sex, and shelter) and dangers (e.g., predators, loss of food, illness, and social aggression). These tendencies toward anthropomorphic attribution appear to persist despite being of mixed benefit, arguably facilitating our successful but potentially disastrous rise in numbers, and enhancing our flexibility in relating to each other by exaggerating, distorting, or denying current information.

Rapid and broad engagement is a highly salient aspect of this human social tool kit (Beer, 1980). For example, Michotte (1963) showed that humans instantaneously and largely unavoidably perceive and attribute agency (social relations, motivations, and intentions) to stimuli in their environment, even artificial stimuli such as the movement of small, colored squares of light on a screen. In a potentially related phenomenon, humans throughout history have tended to attribute their success and failures to the influence of powerful supernatural beings whose wishes and allegiances are inferred from environmental events and ambiguous signs. In the present era, many young males (and some females) invest small pixilated smudges on video game screens with a full suite of human beliefs, motivations, and goals.

It seems apparent that humans can be characterized as the species most trigger-happy in attributing mental states to objects, living entities, and display pixels that move, the species most likely to view significant environmental and social events as caused by the intentions and beliefs of another mind, and the species most likely to blame or credit our own or others' minds for things that are arguably outside our control. As if these biases were not enough, we not only use anthropomorphic labels to explain our own behavior, but we use anthropomorphic labels for inferred mental events to explain the behavior of other species. Because most species seem much less likely to have identifiable beliefs and goals in the same sense that we do, it seems almost like a conflict of interest (from the point of view of being unbiased) that we should insist on analyzing their behavior using our interpretive anthropomorphic framework.

It is as though naked mole rats decided among themselves that the critical means for interpreting events in other organisms and themselves was the correct labeling of odors. Suppose whenever a mole rat scientist established a correlation between a labeled odor and a behavior (or an odor and a reliable brain activity), the existence of that behavior (or activity) was taken as evidence for the causal power of the label that we gave it. It seems important to show caution in using species-ready perception kits and causal labels to explain the causation of behavior, perhaps recalling the still useful adage, "If you have a hammer, everything looks like a nail."

In short, I believe the appropriate conclusion is that primary dependence on unshackled anthropomorphism for our knowledge about other species is not a promising direction for science to go. It may look attractive to some when placed alongside a caricature of the century-old behaviorist-experimentalist approach. However, when compared to more recent work in learning, cognition, and neurophysiology, a primary dependence on anthropomorphic attribution appears to lead toward automatically adjusting and confirming just-so stories. At the least, observers using unconstrained anthropomorphism should develop and apply a form of signal detection analysis to their attribution of intentions, emotions, goals, and beliefs. Such an analysis should consider rates of false alarms and misses, as well as apparent hits. However, it seems to me more appropriate to continue to work on clarifying a more empirical grounding for understanding the world and predicting the behavior of other animals.

Empirically-Grounded Approaches to the World and Behavior of other Animals

Burghardt, de Waal, and, to an extent, Bekoff have argued for a more empirically grounded approach to anthropomorphism, where the grounding is informed by specific knowledge we have acquired about the behavior, ecology, evolution, development, genetics, and neurophysiology of particular species. The acquiring of knowledge is scarcely a novel idea, the question is the form in which it arrives, and how such knowledge can be integrated in a way that predicts behavior. Laboratory approaches focus on operational definitions, precise procedures, common apparatus, and quantitative data. Part of what is missing is a commitment to understanding the animal in its world, its ecological (evolutionary) niche. As Burghardt (1991) noted, if scientists are going to work with snakes, they ought to try to "…walk in the shoes of the snake." This admonition simultaneously highlights the difficulties and importance of dealing with the world from the point of view of other animals. Snakes neither walk nor wear shoes, yet we must provide a framework in which we can do the equivalent of walking in the snake's shoes in order to appreciate and predict its behavior. In this section I will briefly examine several contexts in which humans have acquired and used knowledge about other species (and in which other species have simultaneously learned about us), and suggest an analytic framework that tries to combine successful elements of these approaches.

Farmers, hunters, naturalists, and trainers

This disparate group typically develops their knowledge of other species by interacting with particular animals over and over again in circumstances where it is important to predict the behavior of both species and individuals. The economic livelihood, personal safety, and effectiveness of these humans depend on developing and using an accurate model of the likely behavior and motivation of animals they deal with. It is interesting that many small farmers frequently classify (and even name) cows on the basis of human-like characteristics that correlate with their behaviors: for example, bossiness, meanness, cleverness, wariness, hysteria, stubbornness, and placidity. But these human-like characteristics are usually limited to the farmer's observations of the cows' reactions to the imposed environment, rather than an appreciation of the cows' behavior as cattle. The result tends toward a meliorated anthropomorphism. Not unexpectedly, the cows appear much less inclined to interpret the farmer's behavior, and that of his canine assistant, as though they were other cows (*bovinomorphism*--the attributing of cow goals, intentions, beliefs, and emotions, to other animals). Instead the cows appear to adjust to the contingencies and environmental support provided by the farmer within their world as cows.

Wild animals reliably show similar pragmatism within their own characteristic worlds in their interactions with other species. They quickly learn to respond to predictive environmental and behavioral cues that signal the availability of food, or the likelihood of unwelcome attention, danger, or constraint. In some cases, a form of mutualism approaching parasitism can arise between species, seemingly without relation to anthropomorphism. For example, rove beetles may over-winter in the nests of particular ant species. The beetles beg for regurgitated food from the ants by using their front legs and antennae to produce a copy of the tactile begging patterns of young ants, but with little indication that the beetles attribute goals, intentions, or motivations to the ants or to other rove beetles. Each species seems to have a simple but sufficient predictive model of how the behavior of the other species interacts with their own.

Ethologists and motivational systems

Ethologists, in many respects, were experimental naturalists who attempted to account for the observed behavior of domestic and wild animals by developing a general framework (comprised of perceptual-motor units and regulatory systems) to typify the sensory world and behavior of each species appropriate to particular motivational systems (Tinbergen, 1951). Three factors set ethologists apart from naturalists: their explicit interest in evolution, their use of systematic experimental manipulations to analyze the stimuli controlling particular behaviors, and their organization of these perceptual-motor structures within the context of motivational (behavior) systems that helped regulate behavior and the internal environment.

In a classic analysis, ethologists determined the key stimulus characteristics that triggered and controlled food begging by gull chicks expressed as pecking directed at a contrasting spot on a parent's lower mandible. Ethologists showed this pecking behavior was initially so strongly controlled by this stimulus that a young chick would repeatedly beg from a knitting needle striped with three bands near the tip and held vertically by the experimenter while moving it back and forth (Tinbergen, 1951). In such analyses, ethologists often demonstrated how development, learning, and instinctive aspects of behavior fit together within motivational systems to produce complex stimulus sensitivities and strings of search behavior. Thus, any attribution of goals, beliefs, and intentions occurred within the context of a motivational system and involved experimental analysis based on stimulus models developed from previous observations and experiments.

Experimental psychology and neurophysiology

Early experimental psychologists working with animals overtly rejected anthropomorphism to emulate physics and physiology by developing reliable apparatus and procedures that provided general tests of motivation and learning problems suitable for testing the psychophysics of sensory reception and the effect of reinforcement variables on behavior within and between species (e.g., Warden, Jenkins, & Warner, 1935). These experimenters developed models capable of producing behavior from combinations of reflexes, motivation, and basic associative laws. The result was information about thresholds and discrimination capacities along dimensions ranging from color hue to numerosity, and measurements of the apparent response-strengthening effects of deprivation, and reward amount, delay and intermittency.

A shortcoming of this approach, in producing information that could be used to construct a functional model of the animal, is that the sensory, motor, and motivational information produced for each species was embedded in the design of procedures and apparatus rather than integrated within a model of the functional world of each species (e.g., Timberlake, 2002). In a sense, the data were interpreted as though each species represented a different falling body encountering the same general gravitational field in a vacuum, instead of a living organism with markedly different surface-to-weight ratios related to flying, gliding, swimming, and drifting capabilities, each suited to different wind and surface conditions and motivational functions.

Experimenters interested in neuroscience also focused initially on abstract causal concepts like motivation, reinforcement, intelligence, control centers in the hypothalamus, cortical organization, and critical neuronal transmitters. More recently, neurophysiologists have begun to approach the brain more functionally by studying specific survival problems, like how targeting of sounds occurs in barn owls (e.g., Carew, 2000), and the integration of information streams in the brain involving sensory input, memory, and interoceptive information (e.g., Singer, 1998). The extent of integration of this information in different species, orders, and phyla may eventually provide a basis for judging the coherence of motivational systems and their integration with activities such as planning and awareness.

Theromorphism and Behavior Systems

All these approaches have provided us with knowledge about the sensory, motor, and motivational worlds of animal species, knowledge that is relevant to grounding our inferences about the causality of behavior in other species. The difficulty is that the data are not well integrated even within a particular level of analysis, much less across several such levels. In an effort to facilitate the combination of expert knowledge from practitioners, the evolution-based functional sensory-behavior models from ethology, the paradigms and results of experimentalists, and the reductionist accounts of neuroscientists, I previously introduced the concept of theromorphism (literally animal-centered knowledge--Timberlake, 1994, 1997, 1999; Timberlake & Lucas, 1989). The root *thero*- comes from the Greek word for animal (*therio*), which I modified in an attempt to signal that the approach applies to human as well as nonhuman animals (for historical reasons the Greek word applies only to nonhuman animals).

A theromorphic approach attempts to discover and represent important aspects of an animal's sensory and motivational worlds, thus allowing a human experimenter/observer to enter the animal's world and predict, using descriptive, deductive, and inferential abilities, the effects of a given set of environmental conditions on short and long-term behavior of a particular individual and species. In this way, inferences and attributions of motivation and function, intentions, and predictions of behavior are grounded in the knowledge embodied in a behavior system model. This approach relates to those of Burghardt and de Waal in being animal-centered, but it attempts to specify a general framework to guide acquiring, storing, and testing knowledge of an animal's world. This approach by no means answers all problems in accounting for behavior, but I believe it is useful in structuring our knowledge.

A major potential advantage of theromorphism is that any attribution of mental state and prediction of behavior must be specifically constrained by what is currently known about the sensory-motor and motivational systems of the species and animal involved. This is intended to help the observer limit the use of inference and prediction capabilities to circumstances in which something of the perceptual-motor and motivational components and mechanisms are known and specifically considered. For example, in many experimental paradigms, a behavior systems model clarifies why specific combinations of stimuli and responses produce results and others do not, and how motivational state may change over time or distance from the goal. This approach allows immediate integration of the results of current experiments into a functional framework that relates to other experimental data by providing a common framework for predictions and attributions of similarities and differences among individuals and species.

An obvious obstacle to the use of a theromorphic framework is the time needed to establish it. Naturalists often prefer more anthropomorphic frameworks, while experimentalists prefer procedural frameworks relating abstract concepts of stimuli, responses, and reinforcers. Developing a behavior system seems like a great deal of unnecessary bother compared to intuiting the intentions and beliefs of an animal, or manipulating associative variables that control learning in a well-known apparatus. However, anyone who has worked with an animal in an applied setting constructs at least a rudimentary version of an applicable behavior system, consisting of motivational, perceptual, and motor information, along with some notion of what behavior switching take place. Similarly, experimentalists who develop and alter laboratory apparatus and procedures rapidly become aware that a great deal of knowledge about the functioning of a species has been built into the apparatus and procedures used with them. Speaking from my experience, scientists who modify common apparatus and procedures often become painfully impressed with the species-specific knowledge of the people who originally fabricated the apparatus and designed the procedures.

In a brief review of the relation of maze paradigms and procedures to behavior in the rat, Timberlake (2002) examined important species knowledge built into common maze apparatus and procedures by using a procedure similar to reverse engineering in the physical sciences. Based on the assumption that experimenter tuning of apparatus and procedures has been an important contributor to the results, it follows that systematically modifying (detuning) the apparatus and procedures should reveal those aspects of the system that contributed the most to a particular outcome. For example, in a series of studies analyzing the mechanisms determining the behavior of rats in a standard radial arm maze, we showed that the food reward typically placed at the end of each arm is not a necessary condition for efficient search of the maze. A more important environmental contributor appears to be the presence of edges for the arms (that can be contacted by whiskers), and equal spacing between the arms (see Timberlake, 2002). Based on these and other manipulations and data, it seems evident that specific perceptual-motor and regulatory components of species-typical behavior systems often (if not always) underlie the reliable learned behavior occurring in common effective laboratory paradigms.

Anthropomorphism Reconsidered

I agree with Burghardt's (1991) observation that anthropomorphism will always (automatically) be with us. We are an unusually social species with complex and changeable alliances and interactions, and mobile faces that advertently and inadvertently reveal emotions, beliefs, and likely future actions. These characteristics play important roles in social status, reproduction, and defense, so humans are unlikely to quit using them entirely, based either on personal decision or evolutionary change. However, given the important advantages of an analytic approach to an animal's world demonstrated by naturalists, ethologists, and others, it appears that it might be profitable to constrain our attributional tendencies within a behavior systems framework that provides a systematic way to select, contextualize, and compare our knowledge about particular species, as well as to efficiently guide knowledge that we subsequently gain.

Such a framework can allow experimenters and practitioners to model an animal's world in a way that coordinates its behavior with apparatus, procedures, function, and evolution. Most importantly, it should allow us to ground our powerful anthropomorphic abilities in specific perceptual motor and regulatory mechanisms of another species so we can take their point of view in interactions with and within less constrained social and physical environments.

Could a theromorphic approach help us decide on the consciousness of a species with a world as remote from us as that of an assassin bug? Based on the comparison of human and assassin bug neurophysiology, there appears little possibility the assassin bug has an integrated and flexible state of simultaneous attention to sensory input, memory, and body state. This suggests our small assassin cannot be conscious in ways similar to higher vertebrates. However, by acquiring knowledge of the assassin bug's neurophysiology, perceptual-motor modules, search states, and regulatory systems, we should be able to use our conceptual and anthropomorphic abilities to enter the world of the assassin bug in a more grounded way. Not based on attributions of cleverness and planning, or on the assumed presence of an undefined continuum of consciousness (or, for that matter, based on associations to the English word, assassin), but through knowledge of an assassin bug's sensory-motor and regulatory mechanisms and the support and contingencies present in the current and evolutionary environment.

As noted above, the apparent drawback of such a theromorphic approach, with its dependence on behavior systems, is the considerable work involved in developing the information necessary to take an animal's view. Why should we limit ourselves to the development of a cumbersome conceptual-empirical framework when we can intuit what is occurring? This question is particularly pertinent when we look at cases where reflexive anthropomorphism appears both easy and effective, as in the case of the domestic dog.

Taking a theromorphic view, the intuitive and instantaneous accuracy we have with respect to judging the attention and motivation of dogs should be based on similarities in evolved (and selected) mechanisms of experience, perceptual-motor organization and motivational systems. Such shared mechanisms should be based in similarities in vertebrate neurology, mammalian perceptual-motor organization, and our predatory and social behavior systems. Consider that the ancestors of both humans and dogs hunted, visually tracked, chased, and ambushed prey in groups. To a degree, humans and dogs are both pack animals that live by their wits, hard work, effective social behavior, and rank. (As an aside, if you are the alleged pack leader of several dogs, you may wish to discover whether one of them actually outranks you. According to some trainers, a key sign is whether the dog places a foot on yours as it sits or stands beside you).

Perhaps most importantly, dogs and humans are well equipped to share attention based on following the direction of a gaze, a head turn, or a pointing arm, attending to small gestures and what is often called body language, and by making loud noises to call attention. It follows that dogs and humans should find it relatively easy to interpret and respond to many of each other's signals and behaviors, certainly a common observation. Many humans and dogs like to roam around outside together, go for car rides, chase, play-fight, and watch other animals. We share with dogs the ability to sing in groups (though dogs are intentionally slightly off key, humans, at least current humans, usually try to stay on key).

There are also other differences that make building a theromorphic model worthwhile. *Canids* are typically uninterested in books, photographs, or pixel smudges on display screens, and the mating system of a stable wild hunting pack typically involves independent male and female dominance orders and a single breeding pair. For their part, humans lack a dog's fascination with squirrels and desire to roll in excrement and the remains of dead animals. Finally, most hunting dogs have humans beat when it comes to predicting the path of prey and reading the postures, weight shifts, and preparatory movements of other animals. I lived for many years with a female sight-hound who had studied me carefully, and who knew, before I did, when I had given in to her unspoken request and was ready to take her for a "walk." Try as I might, I could not fool her. I think it would be profitable for science if researchers produced models of the animals they study as accurate as the model this dog developed of me.

References

Beer, C. G. (1980). Perspectives on animal behavior comparisons. In M. H. Bornstein (Ed.), *Comparative methods in psychology* (pp. 17-64). Hillsdale, NJ: Erlbaum.

Bekoff, M. (2000). Animal emotions: Exploring passionate natures. *Bioscience, 50*, 861-870.

Burghardt, G. M. (1991). Ethology and critical anthropomorphism: A snake with two heads and hognose snakes that play dead. In C. A. Ristau (Ed.), *Cognitive ethology:*

The minds of other animals: Essays in honor of Donald R. Griffin (pp. 53-90). Hillsdale, NJ: Erlbaum.

Carew, T. J. (2000). *Behavioral neurobiology: The cellular organization of natural behavior*. Sunderland, MA: Sinauer Associates.

de Waal, F. (1997). Are we in anthropodenial? *Discover, 18*, 50-53.

de Waal, F. (2001). *The ape and the sushi master: Cultural reflections of a primatologist*. New York, NY: Basic Books.

Griffin, D. R. (1974). *Listening in the dark* (Facsimile Edition). Dover Publications. (Reprinted from Listening in the dark, 1958, New Haven, CT: Yale University Press).

Griffin, D. R. (1976). The question of animal awareness: Evolutionary continuity of mental experience. New York: Rockefeller University Press.

Griffin, D. R. (2001). *Animal minds: Beyond cognition to consciousness*. Chicago: University of Chicago Press.

Michotte, A. (1963). *The perception of causality*. New York: Basic Books.

Singer, W. (1998). Consciousness and the structure of neuronal representations. *Philosophical Transactions of the Royal Society of London B., 252*, 1829-1840.

Timberlake, W. (1994). Behavior systems, associationism, and Pavlovian conditioning. *Psychonomic Bulletin & Review, 1*, 405-420.

Timberlake, W. (1997). An animal-centered, causal-system approach to the understanding and control of behavior. *Applied Animal Behaviour Science, 53*, 107-129.

Timberlake, W. (1999). Biological behaviorism. In W. O'Donohue & R. Kitchener (Eds.), *Handbook of behaviorism* (pp. 243-284). San Diego: Academic Press.

Timberlake, W. (2002). Niche-related learning in laboratory paradigms: The case of maze behavior in laboratory rats. *Behavioural Brain Research, 134*, 355-374.

Timberlake, W., & Lucas, G. A. (1989). Behavior systems and learning: From misbehavior to general principles. In S. B. Klein & R. R. Mowrer (Eds.), *Contemporary learning theories: Instrumental conditioning theory and the impact of biological constraints on learning* (pp. 237-275). Hillsdale, NJ: Erlbaum.

Tinbergen, N. (1951). *The study of instinct*. Oxford: Clarendon Press.

Warden, C. J., Jenkins, T. N., & Warner, L. H. (1935). *Comparative psychology: A comprehensive treatise* (Vol. 1). New York: Ronald Press.

Webster's New Collegiate Dictionary. (1975). Springfield, MA: G. & C. Merriam Co.

Wynne, C. D. L. (2004). The perils of anthropomorphism. *Nature, 428*, 606.