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ON THE USE OF MENTAL TERMS IN BEHAVIORAL ECOLOGY AND SOCIOBIOLOGY

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ABSTRACT: Sociobiologists' use of mental and anthropomorphic terms such as manipulation is best understood as species-level descriptive, rather than individual- or gene-level explanatory.

Among the reasons that behavioral ecology and sociobiology have been controversial is their use of mentalistic and anthropomorphic language in accounts of behavioral and morphological evolution. This usage was explicitly sanctioned in George Williams' (1966) *Natural Selection and Adaptation*:

Whenever I believe that an effect is produced as the function of an adaptation perfected by natural selection to serve that function, I will use terms appropriate to human artifice and conscious design. The designation of something as the *means* or *mechanism* for a certain goal or function or purpose will imply that the machinery involved was fashioned by selection for the goal attributed to it. (Williams, 1966, p 9, italics in original).

Contemporary sociobiologists and behavioral ecologists have taken Williams practice as their own and regularly use mentalistic and anthropomorphic language to describe evolutionary phenomena. The traditional justification for using such terms is that they are a convenient shorthand for much longer expressions and that readers can easily avoid misunderstanding by bearing in mind their full translations. Textbook writers John Krebs and Nicholas Davies defend the practice stoutly, appealing for support to no less an authoritative text than George Orwell's *Politics and the English Language* (1946).

While we cannot hope to emulate the clarity and brilliance of the writer of Ecclesiastes or indeed of George Orwell, we hope we have avoided the worst excesses of the Orwellian parody and represent our ideas in simple but precise language (Krebs and Davies, 1994, p. 3.)

Thus, for Krebs and Davies, the use of anthropomorphic, mentalistic terminology is not only economical, it is also precise.

AUTHOR'S NOTE:

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Nowhere has this usage been more enthusiastically deployed than in the works of Richard Dawkins. A perusal of Dawkins's classics, *The Extended Phenotype* and *The Selfish Gene* finds at least twenty-three mentalistic or anthropomorphic terms, including "altruism," "aphrodisiacs," "arms races" (including the idea of "winning"), "blackmail," "hypnosis" (of bird song), "cheating," "deception," "dirty tricks" (of male insect copulatory anatomy), "coyness" (of females), "double bind," "experience" (of a gene), "intelligence" (of a gene), "mimicry," "optimizing," "outlaws," "parliament" (of genes), "philandering," "prediction" (by genes), "selfish" (genes), "spite," "strategy," "war" (as in "war of attrition"), and "manipulation."

In this essay, we will consider the use of mentalistic and anthropomorphic language in sociobiological arguments by evaluating the term "manipulation" as it is used by Richard Dawkins with respect to cuckoo nest parasitism. We think this arena is a fair one in which to test the use of such language because (1) Dawkins is arguably the field's most brilliant and influential writer, (2) the term "manipulation" is central to sociobiological explanations of such diverse subjects as behavioral interactions between parents and offspring, between members of mated pairs, and between parasites and hosts and (3) the cuckoo is an especially intricate and undoubted case of manipulation in the sociobiological sense.

"Manipulation" makes its first appearance in Dawkins's theorizing in a incisive attack on use of the concepts communication and information in accounts of animal behavior (Dawkins and Krebs, 1978).

Because of the way natural selection works, it is reasonable for us to picture an animal as a machine designed to preserve and propagate the genes which ride inside it (Dawkins, 1976). As a means to this end, it will often manipulate objects in its world, pushing them around to its own advantage. Some of these objects will themselves be living creatures—mates, parents, prey, rivals—each one a machine designed to propagate its own genes in similar ways. When an animal seeks to manipulate an inanimate object, it has only one recourse—physical power. A dung beetle can move a ball of dung only by forcibly pushing it. But when the object it seeks to manipulate is itself another live animal there is an alternative way. It can exploit the senses and muscles of the animal it is trying to control, sense organs and behavior machinery which are themselves designed to preserve the genes of that other animal. A male cricket does not physically roll a female along the ground and into his burrow. He sits and signs, and the female comes to him under her own power... (p. 282)

Thus, Dawkins extends the use of the word manipulation from its base meaning, *to artfully control with the hands* to include *causing another to act in one's own interest through making sounds, odors, or motions to which the other animal responds in specific ways*. Thus, when one animal manipulates another, the latter becomes an implement for the purposes of the former.

The cuckoo case is as follows. The European cuckoo is a nest parasite. It defends no territory of its own nor makes a nest, but manipulates another species into providing a nest for its young. The female cuckoo simply lays her eggs in the nests of another species of bird. When the young cuckoo hatches out, it expels the eggs or nestlings of its foster parents and becomes the sole product of the nest. The parasitism works despite the fact that many host species have very elaborate and

individual patterns of their eggs and are capable of recognizing eggs that are dissimilar from their own. It works because the population of cuckoos is divided into races called "gentes". Each gens has a preferred host whose egg pattern is closely matched by their own. The cuckoo's behavior is manipulation in the sense that it "induces the effectors of another individual to work against its own best [short term] interests, and in favor of the interests of the manipulator" (Dawkins, 1982, p. 56).

The problem with this usage is not, as a few philosophers have maintained (Midgeley, 1979; Stove, 1992), that it commits sociobiologists to the idea that cuckoos are in anyway aware of what they are doing when they manipulate their hosts. To say that organisms manipulate one another is to use our everyday knowledge of manipulation as a *heuristic model* for some relation between organisms—just as, e.g., Niels Bohr used our knowledge of the solar system as a *heuristic model* for the relationship between electrons and atomic nuclei. Thus, accusations of mentalism are based on a misunderstanding of the role of mentalistic terms in sociobiological argument. But it opens a deeper issue about the use of mentalistic and anthropomorphic terminology.

The use of models to explain structures, events or processes is standardly understood to involve the entailment of three sets of consequences (M. B. Hesse, 1974; I. Lakatos, 1978). One class of statements implied by the model will already be known to be true (for example, statements predicting the events one is explaining). This is called the model's positive analogy; in Bohr's case, it included the prediction that electrons would move in elliptical orbits. A second class of statements implied by the model will already be known to be false (for example, the statement that organisms as manipulators must be conscious and purposive). This is called the model's negative analogy; in Bohr's case, it included the prediction that electrons could absorb or emit any (non-quantized) amount of energy.

The third and most important class of statements implied by the model will not be known to be true or false. These are called the model's neutral or "surplus" analogy, and in Bohr's case included the startling prediction that electrons could spin. If many of these statements turn out to be true (as did Bohr's, in the Zeeman effect) scientists will praise the model's "fertility" and "heuristic power"; if not, they will move on to other, more promising models.

These three classes of model-driven implications can be easily found in Darwin's theory of evolution by natural selection. Darwin used the model of a pigeon fancier improving his line of pigeons to account for phylogenetic adaptation. The theory says, in effect, that organisms, as they have descended through the ages, have adapted to the particular circumstances of the ages in which they have lived by much the same means that the pigeons in a pigeon coop might adapt over time to the eugenic concepts of the pigeon fancier that keeps them. Organisms that fit Nature's eugenic concept (i.e., adapted organisms) have had more offspring than their alternatives, just as pigeons that fit the pigeon fancier's eugenic concept would be allowed to have more offspring than pigeons that did not.

Applying this model to evolution generates the three kinds of implications described above. Its positive analogy implies that phylogenetic descent has been adapted descent. At the time that it was originally proposed, its surplus analogy included the prediction that adapted (i.e., well-designed) organisms should have more

offspring than less well adapted organisms. Had subsequent research refuted these elements of the positive or neutral analogy, the consequences for Darwin's theory would clearly have been disastrous. The negative analogy of Darwin's model includes the claim that there is a coherent entity named "Nature" that is "doing" the selecting. This last implication is clearly false, yet its falsity does not count *against* the model because those who employ it never proposed it as part of the positive or neutral analogy.

Now let us bring this analysis to bear on focal issue of this essay. Using "manipulation" as a model for the relationship between organisms also generates three sorts of implications. Amongst these are the implication that organisms are aware of their goals when they manipulate. The question is not whether Dawkins intended this (or any similar) implication to be counted as part of his model's positive or neutral analogy: He clearly did not. The deeper question is rather this: After all the illicitly mentalistic and anthropomorphic implications contained in the model's *negative* heuristic have been carefully set aside—thus blocking misguided accusations of mentalism—does the *residual* concept of manipulation (i.e., the concept specified by the model's positive and neutral analogy) still have any explanatory force? We will argue that it does not.

While Dawkins may safely push aside the inference that manipulation must be conscious, he may not so easily push aside the implication that it must be the purposive act of an agent. Manipulation has a purposive design that is manifested in the feedback between the behavior of the manipulator and the behavior of the manipulated object in relation to the goals of the manipulator. When I manipulate a screw driver to remove a recalcitrant screw I make variations in the position of the screwdriver with respect to the screw and observe the effects of these variations in relation to my goal, the anti-clockwise movement of the screw. This feedback is essential to the idea of manipulation. To move the screwdriver around the screw in a goal-less sort of way would not be manipulating the screw but fiddling with it.

No such feedback exists between the behavior of the individual cuckoo and the behavior of its host. The individual cuckoo, in the course of placing her eggs in the nest of her victim, uses many features of her victim's behavior—its song, and its habit of leaving the nest periodically to forage for food. But remarkable though this behavior may be, it is NOT a case of manipulation because the manipulator does not modulate the behavior of the victim in a purposive manner. The individual cuckoo's behavior is purposive and the host serves the purposes of the cuckoo, but the individual cuckoo does not make successive adjustments in the behavior of the host to achieve her purposes. She just lays the egg and leaves. She does not return to the host nest to see how her egg is coming along. She does not lay a smaller egg, or a different colored egg, if perhaps the first is rejected. Nor does she return to coach her nestling on begging behavior if its hosts seem reluctant to feed it. There is no manipulation by the individual cuckoo because there is no purposive regulation of the host's behavior by the individual cuckoo (Wickler, 1968).

Dawkins might object at this point that indeed the various "tricks" by which the host is induced to care for the eggs of the cuckoo—the laying of the eggs in the nest, the matching of the eggs to the eggs of the host, the matching of the gape of the nestlings to the gape of the host, and the ejection of the eggs of the host by the

nestling—are usefully analogous to the various movements that one might make with a screwdriver to extract a screw: They are techniques to a common end. But this objection is not effective because of the problem of agency. The design of the eggs and of the gape are not acts and the laying of the eggs and the egg ejection are acts of different agents. So, while these are all techniques with a common end, as our understanding of manipulation would require, they are not all acts and not all acts of the same agent and hence not manipulation by anybody. It is as if a series of individuals had come by and independently performed a series of movements on the stuck screw which, in company with some random vibrations, resulted in its removal. While we could happily regard these as common antecedents to a shared end, we could not call them manipulation because there is no identifiable manipulator.

Given that the individual cuckoo is not manipulating the reed warbler, it seems hardly plausible that cuckoo genes are manipulating the reed warbler. In Dawkins's selfish gene system, it would not be the genes in general that manipulate the organism in general, but specific genes that govern the specific manipulative behavior. In one passage does Dawkins unambiguously assign to the genes the role of manipulating the organisms they reside in: "[The gene] leaps from body to body down the generations, manipulating body after body in its own way and for its own ends, abandoning a succession of mortal bodies before they sink in senility and death (Dawkins, 1976, p. 36)." Only by misreading this passage, in the context of Dawkins' much later (Dawkins, 1982) discussions of manipulation, can critics wrongly charge Dawkins with attributing manipulative agency to individual genes. But when we examine the activity of individual genes, we find that no purposive regulation is taking place here, either. A gene that governs a behavior does not vary its own activity depending on the success or failure of the behavior it governs. It does not have a host of proteins it can make nor does it switch from one protein to another depending on its achievements. It either makes its protein or it doesn't, and its level of activity is regulated not by itself but by other genes. More to the point, the regulated variables are metabolic activities of cuckoo cells, not Reed Warbler behaviors. In short, neither the cuckoo nor the cuckoo's genes are manipulating the reed warbler.

Indeed, is *anything* manipulating *anything* in this situation? Is there *anywhere* in this situation evidence of *purposive variation* on the part of *one* entity that *causes* the behavior of *another* entity to *vary* in ways appropriate to the needs of the first?

At the *individual* level, clearly, there is not. And to concede this is to admit that all the mentalistic and anthropomorphic content of the concept of manipulation must be assigned to the model's negative analogy. But because manipulation is a *thoroughly* mentalistic and anthropomorphic concept, this means that, as an individual-level explanation, the concept of manipulation has *no* positive or surplus analogy. It is, in principle, a sterile model and will never drive the development of genetic theory ahead of the available empirical data—in the way, for example, that Bohr's fertile model drove the development of atomic theory ahead of the empirical confirmation of the Zeeman effect. As an individual-level explanation, the manipulation model, when handled carefully enough to avoid imputations of mentalism, has no surplus analogy and hence no explanatory force.

Does this mean that ethology and sociobiology should abandon their use of the

concept of manipulation? Should we say that there is no manipulation in any sense? On the contrary, we believe it would be correct to say that there *is* manipulation taking place, but that it is far removed from Dawkins' preferred level of analysis, the selfish gene. Recall that among European cuckoos, there is a precise relationship between the different "gentes" of cuckoo and the species they parasitize. Each "gens" of cuckoo orients to different host species and the form of the egg each gens lays is adapted to the form of its host's. So, by studying cuckoos as a species across all their "gentes" and studying their hosts across all species, we get the impression of variation on the part of the cuckoo in the face of variable circumstances presented by the various hosts producing a common end, i.e., successful nest parasitism. It is as if the cuckoo species had a variety of techniques for getting different host species to raise its eggs. Such a variety of techniques all converging on a common end constitutes the essential formal property that is purposive regulation. Thus, "manipulation"—used here as a *descriptive* rather than an *explanatory* concept—does take place at the species level.

As a sociobiologist inclined to prefer low-level genetic explanations, Dawkins might well be disinclined to accept this usage because it appears to offer a species-level explanation of the cuckoo's behavior. But having rejected manipulation as an explanatory model at the genetic level, we are not proposing it be adopted as an explanatory model at the species level; rather, we suggest that manipulation can properly function as a descriptive concept at the species level.

Dawkins need not abandon his sociobiological reductionism, nor need he abandon the concept of manipulation. What is necessary is only to give up the use of manipulation as an explanatory model at the individual level. The concept of manipulation may be very useful for the purpose of describing the formal properties of the relationship between the cuckoo as a species and its hosts. One might even say that manipulation is a design feature of that relationship—a design feature ultimately to be explained as the result of selection on the assemblage of genes that control the suite of characters that bring each race of cuckoo to drop eggs successfully in the nests of each host species. This conclusion licenses sociobiologists to use the term "manipulation" to describe species-level relation, e.g., that between the cuckoo and its hosts. This conclusion is consistent with our argument, in earlier papers contributed here, (Thompson and Derr, 1993; Derr and Thompson, 1992, Thompson, 1994) that mental terms are most fruitfully deployed when they are used to describe higher order design properties of behavior rather than lower order causes of behavior.

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