

ior is still reliably produced. What matters is the overall configuration of entity and environment in the production of behavior. The model also illustrates that internal mechanisms may have little relation to the behavior produced.

To repeat ourselves (once more with feeling), “the transition from evolutionary theory to evolutionary psychology is not a simple derivative process” (Caporael & Brewer, 1995, p. 33). The agenda for research and theory on the evolutionary origins of human behavior must be much better informed by modern evolutionary studies and philosophy of biology than the example given to us by Ketelaar and Ellis.

### Notes

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Linnda R. Caporael, Science and Technology Studies, Rensselaer Polytechnic Institute, Troy, NY 12180–3590. E-mail: caporl@rpi.edu

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## The Content of Their Discontent: How Do the Folk Interpret Evolutionary Psychology?

Laurence Fiddick

Center for Adaptive Behavior and Cognition  
Max Planck Institute for Human Development

It is slightly ironic that evolutionary psychologists should choose to defend their research program by invoking domain-general norms—the general standards of practice for science—when the program

they are defending has distinguished itself by proposing domain-specific, bounded rationalities and questioning received normative standards. Although Ketelaar and Ellis (this issue) do an admirable job of

arguing that evolutionary psychology conforms to the standards of scientific practice, such success only raises doubts about whether this defense of evolutionary psychology is what was called for. Accepting Ketelaar and Ellis's argument that evolutionary psychology is a proper science raises a further question: Why is evolutionary psychology in particular singled out as being "unscientific"? Why not other branches of biology or psychology as well? Perhaps it isn't the general logic of evolutionary psychological research that has prompted the objections, but instead it is the specific content of such research that has caused concern.

Turning evolutionary psychology back on itself, I'd like to propose a domain-specific, adaptationist account of evolutionary psychology that addresses the specific concerns of the skeptics. Typically, the skeptics have a constellation of concerns including both that evolutionary theorizing about humans is genetically deterministic and that it is sexist and racist (e.g., Lewontin, Rose, & Kamin, 1984). Although humans appear to possess an evolved competence for understanding the biological world in terms of types with inherited essences that determine their nature, Darwin had the insight to replace this folk theory of biological types with a radical new theory of populations of individuals. Precisely the point I wish to make is that the failure to appreciate this difference between the folk and scientific conception of biological groups lies at the heart of the debate between human evolutionists and their critics (cf. Mayr, 1982).

Recent work in cognitive anthropology and cognitive development suggests that humans possess a domain-specific competence for understanding the biological world (Atran, 1990, 1998; Keil, 1989; Lopez, Atran, Coley, Medin, & Smith, 1997; Simons & Keil, 1995; Springer & Keil, 1989, 1991). Two of the key characteristics of this "folk biology" are a tendency to view the biological world in terms of types or kinds of organisms and a tendency to attribute an unalterable essence to members of a kind (Atran, 1998). For example, several studies have demonstrated that young children tend to make inferences about an animal's behavioral and physiological characteristics on the basis of its kind label alone (e.g., Gelman & Markman, 1986, 1987). Other studies of young children have demonstrated that they persist in identifying an animal by its kind despite radical changes in the appearance and behavior (Keil, 1989). Children believe that it is the "insides" of an animal that determines what it is and how it will behave (Gelman & Wellman, 1991; Keil, 1989) even though they might not have any clear idea what those insides are (Simons & Keil, 1995). In short, children appear to think about biological things in terms of their kind, which is unalterably determined by the internal essence of the kind.

Children, however, are not alone in their view of the biological world. Cross-culturally, adults without formal education in scientific biology share this same tendency to view the biological world in terms of essence-based kinds (Atran, 1998). Within scientific biology, this kind-based or typological thinking has only recently been replaced by Darwinian theory in which populations of individuals are substituted for kinds.

The replacement of typological thinking by population thinking is perhaps the greatest conceptual revolution that has taken place in biology. Many of the basic concepts of the synthetic theory, such as natural selection and that of the population, are meaningless for the typologist. Virtually every major controversy in the field of evolution has been between a typologist and a populationist. Even Darwin, who was more responsible than anyone else for the introduction of population thinking into biology, often slipped back into typological thinking, for instance in his discussions on varieties and species. (Mayr, 1970, p. 5)

Moreover, this typological way of thinking is fairly difficult to overcome in the classroom. Even university students explicitly instructed in population thinking still fall prey to typological thinking, leading them to misunderstand evolutionary theory (Bishop & Anderson, 1990; Greene, 1990). In fact, Bishop and Anderson found that, even after 2 or more years of study in biology, only 17% of students recognized that evolutionary change "involves changing proportions of individuals with discrete traits" (p. 424)—a simple population concept that is central to evolutionary thought.

Why are people so prone to thinking of the biological world in terms of types with unalterable essences? One proposal is that this way of thinking about biological things is an evolved competence for understanding the biological world that people spontaneously invoke when reasoning about biological phenomena (Atran, 1998). This does not mean that this way of thinking is inescapable, for surely many evolutionary biologists have learned to do otherwise. Still, it is a tendency that would appear to take specific training to eliminate, and even then with a surprisingly low success rate (Bishop & Anderson, 1990). What this view of our evolved competence for biological thought does suggest is that those who are not specifically educated in how to think of the biological world in terms of populations, as orthodox Darwinians do, will be prone to interpreting biological theorizing in default folk-biological terms. Perhaps the concerns provoked by evolutionary psychology stem from a spontaneous tendency to view biological matters, including evolutionary theorizing, in terms of typologies. This could lead people to misattribute to evolutionary theory a tendency to argue in terms of types (be they species, sexes, or races) de-

terminated by an unalterable essence—genetic determinism. Of course, as alluded to in the aforementioned quote by Mayr (1970), even evolutionary biologists can fall prey to typological thinking. This leads to the prediction that evolutionary typologists, who are critical of orthodox Darwinism, will be more prone to attribute racist and sexist tendencies to evolutionary theorizing about humans.

Far from promoting sexist and racist beliefs, modern evolutionary theory radically undermines it.

The outstanding conceptual revolution in physical anthropology, as in biology, was the replacement of typological thinking by population thinking. This shift has affected every concept in anthropology, although none as strongly as the concept of race. The typological race concept of the racists is thoroughly odious; the statistical defined race of the botanist and zoologist is a fact of nature. The basis for race formation is the same for all sexually reproducing organisms and consists in the fact that no two individuals are identical nor are any two local populations. No individual can therefore be “typical” of a race. Indeed, in polymorphic races different individuals may be strikingly different. To speak of “pure races” is sheer nonsense. (Mayr, 1970, p. 398)

Not only do evolutionary psychologists question the value of racial comparisons, but they have also questioned the value of comparing species as types, and instead have called for comparisons based on specific adaptations as illustrations of specific evolutionary principles that are up for empirical scrutiny (Tooby & DeVore, 1987). Humans are not naked chimpanzees. We possess many distinctive features, as do chimps, that distinguish our species. Comparative studies are useful, but only so long as they test well-specified evolutionary theories about specific adaptive problems.

Completing the overthrow of folk biology, Darwinism also undercuts essentialism. Darwinism is a historical science. It stands in direct opposition to the essentialist view that biological entities have a timeless and enduring nature.

In laying hands on the sacred ark of absolute permanence, in treating forms that had been regarded as types of fixity and perfection as originating and passing away, the “Origin of Species” introduced a mode of thinking that in the end was bound to transform the logic of knowledge, and hence the treatment of morals, politics, and religion. (Dewey, 1909/1985)

In the “ultra-adaptationist” view of life that evolutionary psychologists adopt, no aspect of the organism’s nature is taken as given. Everything is open to explanation as the historical product of natural selection working in specific environments—there are no “skyhooks” as Dennett (1995) would say.

Biological theorizing about humans has been used to justify undemocratic, caste-organized societies in a variety of cultures (Brown, 1988) so it is reasonable to worry about the social implications of evolutionary psychology. However, it is specifically a typological way of thinking, which mutes individuality and essentializes group differences, that racist ideologues have employed (Brown, 1988; Mayr, 1982). Darwinian theory, a recent cultural invention, undermines this folk biological way of thinking by stressing the importance of the individual. Furthermore, because evolutionary psychology is, as the authors argued, a science, its concrete findings are open to dispute, revision, and refutation unlike the racist mythologies of caste-organized societies. The critics of human evolutionary theorizing might do well to question their ontological assumptions and throw off the intellectual shackles of folk biology as Darwin did over 100 years ago. Once they do, they might begin to see that they have been sniping at their natural ally.

#### Note

Laurence Fiddick, Center for Adaptive Behavior and Cognition, Max Planck Institute for Human Development, Lentzeallee 94, D-14195 Berlin, Germany. E-mail: fiddick@mpib-berlin.mpg.de

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## Evaluating Scientific Theories

**Garth J. O. Fletcher**

*Department of Psychology  
University of Canterbury*

One would have thought that doubts about the testability of evolutionary theory (and, by association, evolutionary psychology) would have been laid to rest a long time ago, most decisively by Darwin himself. Yet, such doubts seem to have remarkable staying power. I can testify (as doubtless can others) that in conversations with fellow academics one of the most common criticisms launched at evolutionary psychology is its lack of testability. Moreover, it typically becomes clear in the subsequent (sometimes heated) debate that lying behind such a criticism is a particular conception of what “science” amounts to, which is all too often either naively empiricist or Popperian in nature.

Hence, I welcome the target article by Ketelaar and Ellis (this issue), which presents a splendidly argued and cogent analysis. First, they unpack the different senses in which it might be claimed that evolutionary psychology might be untestable. Second, they present a conception of scientific progress by Lakatos that represents a considerable updating and improvement over Popper’s falsificationist framework. Applying both strategies they convincingly show that, no matter how the notion of testability is unpacked, the program of evolutionary psychology is both testable and represents a paradigmatic case of science in action. In short, this article will almost certainly add to my own argumentative armamentarium when indulging in vigorous debates over evolutionary psychology.

Any concerns I do have about Ketelaar and Ellis’s arguments revolve around their use of a Lakatosian framework, which they describe variously as representing contemporary philosophy or as embodying principles drawn from modern-day philosophy of science. Well, Lakatos is not the only contemporary game in town; indeed, my sense is that Lakatosian models have been superceded in philosophy of science circles,

to some extent, by models that both adopt a realist perspective and exploit the notion that there exist a wide range of criteria by which theories are evaluated (see, e.g., Fletcher, 1996; Laudan, 1996; McMullin, 1984). I make clear from the outset that my aim is to reinforce the general argument offered by Ketelaar and Ellis. That is, I wish to show that even if a Lakatosian framework is replaced by an alternative and popular contemporary approach, the conclusion remains fast that evolutionary psychology is eminently testable from top to bottom.

Models of scientific inference or methodology embody a rather curious dual role. On the one hand, they offer normative frameworks that essentially give advice as to how science (or theory evaluation) should proceed in a rational fashion. On the other hand, they offer descriptive accounts that should, at least roughly, fit how science actually does proceed. Theoretically, of course, one could offer a normative framework that specifies how science should proceed in an ideal world that is miles away from what actually happens in the real scientific world. However, such a large gap would immediately raise severe suspicions and invite close scrutiny about the status of the normative standards. Indeed, I suspect this is the basic reason that led to Popper’s falsificationist approach being more or less abandoned.

The major weakness of a Lakatosian approach, in my view, is that it remains a little too close for comfort to Popper’s model of scientific inference. More specifically, it remains too wedded to the role and centrality of prediction as the major tool of theory evaluation. Thus, metatheories that generate novel predictions and explanations, and have the resources to deal with and solve apparent anomalies, are regarded as progressive. In contrast, those theories that fail to generate novel predictions and explanations, and have difficulty with dealing with anomalies, are regarded as degenerative.