leological explanation such as to say that the mind controls the body, but there is not yet an answer to the question of just how the idea of wanting something is translated into the actions that lead to the attainment of the goal, or of what the underlying physical properties of a memory are. We are looking for functional and causal explanations to explain the human mind and consciousness. And because science has a track record of providing such explanations, we turn to science—not just the methodology of science but its subject matter, too—to help us explain the human mind.

But we are Darwinians (Ruse, 1986) and we have to place the human brain in the context of all brains: fly brains, fish brains, bird brains. Here is a feature that many organisms have in common, so it seems natural that we should look for some evolutionary explanation. This leads to questions about fly intentionality, fish intentionality, bird intentionality, and human intentionality: Are they on a continuum? Is there no such thing as intentionality? Perhaps intentionality is what distinguishes humans from the rest of the animal kingdom? (Although it is hard to deny intentionality to a ferret, e.g., when it scampers up one's pant leg.) How do we explain chimp behavior? The tool use of Galapagos finches? The web spinning of spiders? We tend to shy away from beliefs and desires except as metaphors for blindly programmed genes. The thrust of evolutionary theory has been to move us from the notion that we have a special place in the universe to the notion that natural selection has to explain all life in the universe, including us humans. We also look for the underlying physical causes of beliefs and desires, as evidenced by the success of the pharmacology industry. Depressed? Knock back some Prozac. Can't get it up? Have some Viagra (but not too much).

When the questions change it is an indication that the epistemology, too, is changing. Incest avoidance is not a universal belief or a social convention, it is a way in which we are genetically programmed to act to prevent inbreeding, which increases the incidence of (harmful) heterozygous recessive genes. It may be that we see incest avoidance manifest as a belief that incest is wrong or the lack of desire to have sex with one's parent, but it is then a desire we are incapable of forming (and so it is impossible to explain in terms of beliefs or desires, which necessarily admit some underlying ideas of free will); or it may be that we see it as a social proscription, which, quite coincidentally, seems universal. But it is the evolutionary explanation that provides universality and the basis for the prediction that in all sexually reproducing species incest will be extremely unlikely.

The avowed goal of (human) evolutionary psychology is to study the mind as an adapted organ, selected because of its ability to solve evolutionary problems. It is because science comes up with the goods in terms of explanation and prediction that evolutionary psychology becomes a science.

Note

Alan Belk, Department of Philosophy, University of Guelph, Guelph, ON, Canada, N1G 2W1. E-mail: abelk@uoguelph.ca

References

Daly, M., & Wilson, M. I. (1999). Human evolutionary psychology and animal behaviour. *Animal Behaviour, 57*(1), 509–519.

Durkheim, E. (1982). *The rules of sociological method* (S. Lukes, Ed. & W. D. Halls, Trans.). New York: Free Press. (Original work published 1895)

Rosenberg, A. (1988). *Philosophy of social science*. Boulder, CO: Westview.

Ruse, M. (1986). *Taking Darwin seriously: A naturalistic approach to philosophy*. Oxford, England: Blackwell.

Metatheories, Evolution, and Psychology: Once More With Feeling

Linnda R. Caporael
Department of Science and Technology Studies
Rensselaer Polytechnic Institute

Marilynn B. Brewer
Department of Psychology
Ohio State University

In a previous commentary in *Psychological Inquiry* (Caporael & Brewer, 1995), we took issue with Buss's (1995) claim to represent *the* evolutionary psychology and tried to make the point that critiquing his version of evolutionary theory in psychology is not tantamount to rejecting evolutionary explanation for human social

behavior. The target article by Ketelaar and Ellis (this issue) convinces us that this is a point that must be made again.

In their adaptation of Buss's (1995) Figure 1, Ketelaar and Ellis go even farther than the original article in laying claim to the "basic metatheoretical assumptions of modern evolutionary theory" (this issue). To understand what they mean by this, however, one must go back to the original article where it is clear that Buss equates modern evolutionary theory with inclusiveness fitness theory, the hallmark of sociobiology. The issue here is what constitutes a truly broad-based scientific consensus and what metatheoretical assumptions are made about human evolution. The consensus that selfish gene theory constitutes evolutionary theory seems to be limited to a small band of self-proclaimed evolutionary psychologists. Among biological evolutionists, the idea that a single level of selection—the genetic level—is adequate to the complexity of biological systems is a matter of considerable debate, if not already discredited. Lloyd (1992), author of *The Structure and Confirmation of Evolutionary Theory,* characterized the evolutionary theory used by evolutionary psychologists as "just amazingly naïve" (Callebaut, 1993, p. 409). Although Lloyd would like to see evolutionary psychology given a chance, she is critical of its use of outdated theory, empirically inadequate work, and repetition of "classic and old" mistakes that have been made by sociobiologists since the mid-1970s (Callebaut, 1993, pp. 408–412).[1]

The Philosophical Issues

Ketelaar and Ellis have confused Lakatos's description of scientific practice with prescriptions for evaluating scientific programs. Lakatos characterized research programs as developing a "protective belt" around scientific theories. However, he did not advocate that scientists should erect such belts to shield them from competition with other research programs. In fact, he saw competition as driving progress in science.

We find it odd that Ketelaar and Ellis turned to Lakatos, a philosopher of mathematics and methodology in science, for philosophical justification for evolutionary psychology's program of research. Without undermining Lakatos's achievements, the fact is that traditional philosophy of science has undergone significant changes (e.g., Cartwright, 1983). In a sense, the reductionist model of science associated with physics has been given up, and a significant amount of work has been done in other sciences, with biology being the lead science. A large part of the interest in biology is because of the novel element introduced by having to incorporate history into evolutionary science. Thus, we find it even more puzzling that Ketelaar and Ellis have ignored those philosophers who most exemplify modern philosophy of science—contemporary philosophers of biology (e.g., Brandon, 1990; Hull, 1988; Lloyd, 1992; Sober, 1984, 1994).

Whether evolutionary explanations are unfalsifiable is not the central concern of critics of evolutionary psychology. No one doubts that humans are animals or that they have evolved. Rather, the issues are what the significant concepts in evolutionary biology are and how they operate in the derivation and testing of causal claims based on evolutionary theory. Evolutionary explanation is necessarily historical explanation (Richardson, 1996). It is one thing to work out causal details on fruit flies or toxic-tolerant plants where a considerable amount of experimental control can be established. It is quite another thing to work out the evolutionary history for humans where there are no close phylogenetic comparisons and where development and culture cannot be black boxed as they typically are in the study of plants or animals. With few exceptions (e.g., Griffiths & Gray, 1994; Oyama, 1985; Wimsatt, 1986, 1999), neither biologists nor philosophers of biology have dealt with these difficulties. (It is interesting to note, however, integrating development and culture with evolutionary theory is being explored in research on artificial life [see Clark, 1997; Hendriks-Jansen, 1996]).

The difference between the adaptationist program defended by Ketelaar and Ellis and a modern evolutionary approach can be illustrated by considering language. The infant's species-typical capacity to produce babbling sounds is the stimulus around which the mother and other adults produce primitive dialogues and culturally ritualized games. Language is a product of situated activity—the material conditions of infant, objects, and people—that provides the scaffolding for language development. No appeal to "mental organs" or to an internal "language acquisition device" is necessary. Language emerges through interaction with a reliably present, species-typical environment. Deacon (1997) argued that language evolves under selection pressure of children's best guesses about how language works. Language "fits" the minds of children, which is the selective environment of language.

The Naturalistic Turn

Ketelaar and Ellis also seem unaware that, since Lakatos's time, philosophy of science has taken a naturalistic turn (Callebaut, 1993; Hull, 1988). Part of the shift has been away from a view of scientists as neutral and detached observers possessed of pure reason to a view of scientists as humans with the corollary that

[1] Readers are referred to Lloyd (1999), a discussion of the "burdens of proof" for evolutionary psychology, which appeared after this commentary was submitted.

whatever is generally true of humans must also be true of scientists. We know from empirical research that science is influenced by its social context and that research conforming to "common wisdom" is not held to the same standards as research producing counterintuitive results. Data that confirm preexisting beliefs are difficult to evaluate as evolutionary products. The most useful tests of evolutionary theory are novel predictions and the ability to explain otherwise anomalous data.

How have sociobiology and evolutionary psychology fared by this criterion? Male aggression, gender roles, and nepotism are all obvious social facts that most people, lacking any evolutionary training, already suspect are "natural." Evolutionary psychology simply relabels these phenomena in the language of adaptive mechanisms. Some of the illustrations provided by Ketelaar and Ellis are a bit more interesting than the usual evolutionary psychology. However, they are not necessarily derivations from their model of evolutionary psychology. Any theory that supposes that human cognition is fundamentally social cognition will predict a difference between reasoning on social rules compared to reasoning about abstractions such as numbers and vowels (e.g., Caporael, 1987, 1997).

The problem is not that evolutionary explanations for everyday observations are wrong; they could be right. The problem is the existence of "gray zones" where human psychology, science, and social life converge. In these zones, it is difficult to tell if evolution explains something about human nature, or if human nature explains something about the appeal of sociobiological accounts. In this light, we are disappointed that Ketelaar and Ellis fail to cite the accomplishments of scholars such as Donald (1991), Deacon (1997), Sheets-Johnstone (1990), Gottlieb (1992), and Varela, Thompson, and Rosch (1991), all of whom bring new perspectives to theorizing about psychology from an evolutionary point of view.

Modern Evolutionary Theory: Multilevel Selection

We claim that the philosophy of science and the metatheoretical assumptions of evolutionary theory that Ketelaar and Ellis appeal to are outdated. The "selfish gene" theory is by no means an agreed-on hard core of evolutionary theory. It is being challenged by multilevel selection theories (Maynard Smith & Szathmáry, 1995; Sober & Wilson, 1998). *The Evolution of Individuality* by Leo Buss (1987) is a compact technical work on the evolution of multicellular organisms that provides a good starting point for multilevel theory that can be extended to human social organization.

Multilevel selection theory has arisen from one direction out of research in molecular biology, and in another direction, from new developments in macroevolutionary processes (e.g., speciation). Its most distinctive feature is the replacement of a single level of explanatory significance (the gene or the individual), with a hierarchy of levels from interactions among DNA molecules to species and regional ecosystems. Three important themes emerge: a renewed emphasis on context, be it a cellular medium or a social medium; a new focus on contingency as the interactive relation between events, including relations over different scales of time; and construction, a view of entities (gametes, organisms, ecosystems, etc.) reconstructed generation to generation through the self-organizing properties of recurrent resources. Some of these resources may be genetic, others may be nongenetic (zygotic machinery, the social environment for normal psychological development), and yet other resources are the results of previous interactions. Instead of "reproduction machines" as a metaphor is the idea of ecological succession, where a barren field may go from weeds, to brush, to pines, to hardwood trees, each phase depending on the changed conditions created in the previous phase and on the availability of component resources.

Where Do We Go From Here?

One point we need to make is that an evolutionary account of human social behavior must be multidisciplinary. In this sense, the term evolutionary psychology is problematic because it supposes that a model of evolution can be discipline specific. But evolutionary explanations for human behavior must be consistent not only with available research in psychology, but also primatology, anthropology, linguistics, ethology, neuroscience, and artificial life. Because no one person can master these areas as disciplines, we need to encourage much more in the way of collaborations focused on specific problem topics.

A second point is that the mechanisms and processes that have evolved to support social life are unlikely to resemble the behavior that they produce (Brewer & Caporael, 1990). Hendriks-Jansen (1996) proposed that models in the form of artificial agents can contribute to a better understanding of how behavior emerges from the dynamic interplay of internal mechanisms and situation. For example, a simple robot programmed with four low-level sensor feedback loops (e.g., noise sensors) in an office environment can produce the behavior of wall following. What is important about the example is that none of the programming refers to walls, either through definitions of walls or instructions to follow walls. Wall following emerges as a result of the interaction between the feedback loops and the environment. Because there are variations in the interactions (e.g., approaching a wall), a particular wall may not be followed the same way, but the behav-

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

We thank Mike Fortun and Nancy Nersessian for their helpful insights on the history and philosophy of science.

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

References

Brandon, R. N. (1990). *Adaptation and environment.* Princeton, NJ: Princeton University Press.

Brewer, M. B., & Caporael, L. R. (1990). Selfish genes versus selfish people: Sociobiology as origin myth. *Motivation and Emotion, 14,* 237–242.

Buss, D. M. (1995). Evolutionary psychology: A new paradigm for psychological science. *Psychological Inquiry, 6,* 1–30.

Buss, L. W. (1987). *The evolution of individuality.* Princeton, NJ: Princeton University Press.

Callebaut, W. (1993). *Taking the naturalistic turn, or, how real philosophy of science is done.* Chicago: Chicago University Press.

Caporael, L. R. (1987). Homo sapiens, Homo faber, Homo socians: Technology and the social animal. In W. Callebaut & R. Pinxten (Eds.), *Evolutionary epistemology: A multiparadigm program* (pp. 233–244). Dordrecht, The Netherlands: Reidel.

Caporael, L. R. (1997). The evolution of truly social cognition: The core configurations model. *Personality and Social Psychology Review, 1*(4), 276–298.

Caporael, L. R., & Brewer, M. B. (1995). Hierarchical evolutionary theory: There is an alternative, and it's not creationism. *Psychological Inquiry, 6,* 31–34.

Cartwright, N. (1983). *How the laws of physics lie.* Oxford, England: Oxford University Press.

Clark, A. (1997). *Being there: Putting brain, body and world together again.* Cambridge, MA: MIT Press.

Deacon, T. W. (1997). *The symbolic species: The co-evolution of language and the brain.* New York: Norton.

Donald, M. (1991). *Origins of the modern mind.* Cambridge, MA: Harvard University Press.

Gottlieb, G. (1992). *Individual development and evolution.* New York: Oxford University Press.

Griffiths, P. E., & Gray, R. D. (1994). Developmental systems and evolutionary explanation. *Journal of Philosophy, 91,* 277–304.

Hendriks-Jansen, H. (1996). *Catching ourselves in the act.* Cambridge, MA: MIT Press.

Hull, D. L. (1988). *Science as a process.* Chicago: University of Chicago Press.

Lloyd, E. A. (1992). *The structure and confirmation of evolutionary theory.* Princeton, NJ: Princeton University Press.

Lloyd, E. A. (1999). Evolutionary psychology: The burdens of proof. *Biology and Philosophy, 14,* 211–233.

Maynard Smith, J., & Szathmáry, E. (1995). *The major transitions in evolution.* New York: Freeman.

Oyama, S. (1985). *The ontogeny of information.* New York: Cambridge University Press.

Richardson, R. C. (1996). The prospects for an evolutionary psychology: Human language and human reasoning. *Minds and Machines, 6,* 541–557.

Sheets-Johnstone, M. (1990). *The roots of thinking.* Philadelphia: Temple University Press.

Sober, E. (1984). *The nature of selection.* Cambridge, MA: MIT Press.

Sober, E. (Ed.). (1994). *Conceptual issues in evolutionary biology.* Cambridge, MA: MIT Press.

Sober, E., & Wilson, D. S. (1998). *Unto others: The evolution and psychology of unselfish behavior.* Cambridge, MA: Harvard University Press.

Varela, F. J., Thompson, E., & Rosch, E. (1991). *The embodied mind.* Cambridge, MA: MIT Press.

Wimsatt, W. C. (1986). Developmental constraints, generative entrenchment, and the innate-acquired distinction. In W. Bechtel (Ed.), *Integrating scientific disciplines* (pp. 185–208). Dordrecht, The Netherlands: Nijoff.

Wimsatt, W. C. (1999). Generativity, entrenchment, evolution and innateness. In V. Hardcastle (Ed.), *Biology meets psychology: Constraints, connections and conjectures* (pp. 139–179). Cambridge, MA: MIT Press.

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