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Fictions and Facts about Evolutionary Approaches to Human Behavior

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Abstract: Six misconceptions about evolutionary approaches to human behavior are exposed. Evidence is adduced to support the assertions that evolutionary approaches do not (a) adopt a reductionistic "gene-centered" level of analysis, (b) assume that natural selection is the only process that creates and designs ontogenetic processes and phenotypic outcomes, (c) assume that genes are the only agents responsible for the transgenerational inheritance of phenotypic traits and characteristics, (d) assume that genes are self-contained and impervious to extragenetic influences, (e) posit a strong form of genetic determinism, or (f) pay lip service to the role of the environment. Building straw men and knocking them down is an inherently destructive enterprise; integrating different approaches is a more constructive way of contributing to the growth of knowledge.

How many times, in how many ways, must scholars who are guided by an evolutionary framework be called upon to dispel misconceptions of their approaches? In the paper, *Developmental Dynamics: Towards a Biologically Plausible Evolutionary Psychology*, Lickliter and Honeycutt (2003) build a straw man model of evolutionary approaches, knock the stuffing out of it, outline an idealized version of a model they prefer, and mischaracterize their model as a "biologically plausible *evolutionary* approach" (p. 1, emphasis added). The field of psychology would have been better served if they had fleshed out their model so readers could evaluate it on its merits and resisted the temptation to contrast it with a misrepresentation of an alternative approach that no informed scholar from any discipline would adopt. In this paper, I will identify six straw man caricatures of evolutionary approaches created by the authors, correct the mischaracterizations, and try to explain where the authors went wrong.

Strawman 1: Evolutionary approaches adopt a theoretically reductionistic "gene-centered" level of analysis

According to the authors, evolutionary approaches "represent an unnecessarily reductionistic view of the emergence and maintenance of phenotypic traits by treating genes as causal agents with closed programs" (p. 39). The authors argue that this "unidirectional, bottom-up" view is misguided because it overlooks evidence that "the functional significance of genes or any other influence on behavior can be understood only in relation to the developmental system of which they are a part" (p. 39).

Levels of analysis in theoretical approaches. Phenotypic characteristics are the product of a vast array of interacting factors. Called upon to explain phenotypic behaviors, scholars from different disciplines and theoretical perspectives focus on different types of determinant at different levels of analysis. As examples, epigenetic theorists focus on the interactions between genes and biochemical factors in the development of physical and mental mechanisms; behavior geneticists focus on the relative contributions of genes and environment to the determination of individual differences in phenotypic behaviors; developmental psychologists focus on ontogenetic changes in mental mechanisms throughout the life-span; learning theorists focus on changes in behavior with experience; anthropologists and sociologists focus on culture; and evolutionary theorists focus on naturally selected characteristics. Within evolutionary theory, there are many schools of thought. As examples, behavioral ecologists focus on the ways in which behavioral strategies influence the survival and reproductive success of animals in current environments, whereas evolutionary psychologists focus on the ways in which mental mechanisms that were selected because they solved adaptive problems in ancestral environments are designed and executed in current environments. The main unit of analysis in evolutionary psychology is evolved psychological mechanisms, or adaptations. Many prominent evolutionary psychologists eschew discussions of genes. For example, the word gene is referenced on only one of the 400 pages in Buss's (1999) introductory text, *Evolutionary psychology: The new science of the mind.*

In another introductory text, Barrett, Dunbar and Lycett (2002, pp. 5-6) make several points about levels of analysis. First, they point out that "an understanding at one level does not… commit us to any *particular* explanation at any of the other levels." Second, they warn that "the thing to be avoided at all costs… is confusing one level of explanation with another." And finally, they suggest that although no one theorist or approach can account for the host of interacting factors that contribute to the determination of any phenotypic characteristic, "being able to provide answers at two or more levels at the same time can be helpful."

When Lickliter and Honeycutt characterize evolutionary approaches as "reductionistic," they confuse micro-genetic levels of analysis with macro-evolutionary levels of analysis. Evolutionary theorists have gone to considerable lengths to avert this confusion. Consider two examples.

> The claim that the evolutionary approach is necessarily reductionist rests on a misunderstanding of what evolutionary explanations entail, probably because of the significance attached to genes in all evolutionary explanations. However, reference to the (genetic) fitness of traits (or behaviour) does not necessarily imply that the trait (or behaviour) is genetically determined, but rather that it has genetic consequences in terms of the numbers of extra offspring it allows the bearer to produce. In effect, the reductionist argument confuses two different levels of explanation: ontogenetic arguments (genes as developmental determinants of behaviour) with functional arguments (gene replication as a measurable consequence of behaviour)… evolutionary explanations are never couched solely in terms of lower level phenomena such as genes or other chemical processes. (Barrett, Dunbar & Lycett, 2002, p. 7)

> The genetic studies immediately relevant to sociobiology are not developmental genetics but population genetics… Sociobiologists deal directly with the consequences of populational changes in the frequencies of the different variants (alleles) of given genes, not with the physiological means by which particular alleles shape or influence the biochemical pathways of developing individuals. The failure to distinguish between ultimate and proximate research in biology is at the heart of the unfair charge that sociobiologists are trying to establish Genes-R-Us (Alcock, 2001, p. 42-43).

The implications of theoretical focus. Because no approach can focus on all levels of analysis, all approaches must ignore some of the factors that influence the characteristics they seek to explain, much like experimenters must ignore intervening factors when they manipulate independent variables and assess their effects on dependent variables. If variations in the independent variable (i.e., the alleles inherited by individuals or the genomes that characterize species) produce variations in the dependent variable (i.e., phenotypic characteristics), it is safe to conclude that the independent variable is exerting a causal influence on the dependent variable. Experimenters can reach this conclusion without any knowledge of intervening mental processes, though they usually have some in mind. Reaching such a conclusion would in no way equate to assuming that the independent variable was the only cause of the behavior, that it was not mediated by a host of internal processes, that no other variables were as important, that we could not evoke the dependent behavior in other ways, or that we could not improve our explanatory power by learning more about the intervening variables. Obviously, genes cannot guide the development of organisms by themselves, but this does not mean that they do not play a central role.

The appropriate questions for those who encourage the consideration of factors other than those attended to by other investigators or theorists are: (a) to what extent will these factors help me explain the phenomena (dependent variables) I am attempting to understand, and (b) to what extent will failing to attend to them induce me to reach invalid conclusions? In the present context, this entails asking what evolutionary theorists would gain by attending to epigenetic interactions, and what they lose by failing to attend to them. In general, the answer to both questions is little or nothing.

Understanding epigenetic interactions among genes, cytoplasm, and enzymes contains little potential to help evolutionary theorists answer questions such as, why do the male members of most species adopt more promiscuous mating strategies than the female members, and why are there exceptions to this rule; why do people tend to favor their kin; how did cooperative dispositions evolve in the human species and how are such dispositions designed; why have the same moral norms evolved in different cultures?

Straw man 2: Evolutionary theorists attempt to explain ontogenetic processes or outcomes by appealing to the creative or designing role of natural selection.

The authors impute to evolutionary theorists the belief that "the creative, novelty generating power of genetic mutations and natural selection is adequate to account for the range and nature of adaptations found within a population" (p. 28). However, suggest the authors, the role of natural selection is inherently limited, because "natural selection is not a creative force capable of producing phenotypic variation" (p. 28). "The novelty-generating aspects of evolution are thus primarily the result of the developmental dynamics of living organisms, situated and competing in specific ecological contexts..." (p. 28).

I think this mischaracterization of evolutionary approaches, like those that follow, stem from the failure to distinguish between epigenetic and phylogenetic levels of explanation and from a confusion between the specific process of natural selection and the more general process of evolution by natural selection. Evolutionary theorists assume that a large number of processes at many levels of analysis produce variations in the phenotypes displayed by individuals. Most evolutionary theorists assume that processes such as genetic mutation, crossing over, and genetic recombination produce variations in genes and gene complexes that, in interaction with other factors, give rise to variations in phenotypes. However, in order for such variations to matter—that is to say, to evolve and help design a species—they must be selected and transmitted to subsequent generations. Although natural selection is not responsible for mutations or crossing-over of genetic material during conception, and in this sense does not produce the variations on which it performs its selective function, it still plays an important role in designing "complex functional organic mechanisms" (Buss, et al., 1998, p. 26) at a more ultimate level. Natural selection helps "design" mechanisms in much the same way dog-breeders "design" dogs. Dog breeders select the dogs that have inherited the phenotypic characteristics they have targeted and breed them with those that have inherited similar phenotypes. I would assume that if dog breeders were able to identify the genomes of the dogs they breed, they could select the characteristics they have targeted more efficiently than by selecting on the basis of phenotypic characteristics, but even if this assumption were incorrect, it would not invalidate the conclusion that selection—artificial or natural—can play an important role in the creation and design of phenotypic characteristics.

Straw man 3: Evolutionary theorists believe that "genes provide the only reliable source of transgenerational inheritance of phenotypic traits and characters" and the "sole source of developmental information transmitted across generations" (p. 33).

Virtually all evolutionary theorists assume that genes are an important source of transgenerational inheritance, and many believe that for their purposes it is sufficient to focus on this source. Most evolutionary theorists also believe that most genes are passed from generation to generation unaltered. As Dawkins (1989) has explained, stability is one of the defining features of genes. When evolutionary theorists make this assumption, they are thinking of the genes in sex cells at the moment of conception. Does anyone deny that these units are passed on relatively unaltered? We establish maternity and paternity by comparing DNA, or genes. Indeed, it is possible to trace the intergenerational transfer of genes back historically to origins in particular individuals. As an example, investigators have traced a recessive gene for haemophilia back to a X chromosome in Queen Victoria (see Badcock, 2000, pp. 50-51). Does anyone question the fact that individuals who inherit the same complement of alleles (e.g., identical twins) are more similar phenotypically than individuals who inherit a different complement? Assuming that genes are transmitted from one generation to others relatively unaltered is in no way

inconsistent with also assuming that "gene activity (or inactivity) is determined by multiple influences from other levels of the developmental system" (pp.17-18), at a more proximate level.

The significance of genes notwithstanding, most evolutionary theorists acknowledge other sources of transgenerational inheritance, and many evolutionary theorists include such sources in their models. Janicki and Krebs (1998) review several such models, including one advanced by Lumsden and Wilson (1981) that is attentive to "epigenetic rules" at a broader level of analysis. In the text, *Human evolutionary psychology*, Barrett, Dunbar, and Lycett (2002) go so far as to state,

> It is important to notice here that we have deliberately avoided mentioning the terms DNA… and gene or anything suggesting [that] the mechanism of inheritance… entails a particular biochemical process… Any mechanism that allows fidelity of copying ensures that natural selection will take place. In so far as the theory of natural selection is concerned, learning is as much a bona fide mechanism of evolutionary inheritance as the genetic code" (pp. 3-4).

Most evolutionary theorists who attend to transgenerational sources of inheritance other than genes focus on social learning and cultural evolution—a level of analysis notably neglected in the target article (see Barkow, Cosmides, & Tooby, 1992; Boyd & Richerson, 1985; Dawkins, 1989; Janicki & Krebs, 1998; Krebs & Janicki, 2003; Sober & Wilson, 1998).

Straw man 4: Evolutionary theorists believe that genes are self-contained and impervious to extragenetic influences.

The authors suggest that evolutionary theorists assume that genes are "encapsulated and immutable to extragenetic influences"; that genes "contain evolved, innate features that… develop in the absence of any explicit instruction or direct experience in the problem domain for which it is specialized." In contrast, argue the authors, "no single element or level in the system necessarily has causal primacy or privilege, and the functional significance of genes or any other influence on behavior development can be understood only in relation to the developmental system of which they are a part" (p. 32). In fact, evolutionary theorists believe that,

> genes do not do anything by themselves because the information they contain cannot be expressed in the absence of many other chemicals, all of which are environmentally supplied. A host of factors external to a cell's nuclear DNA shape the chemical environment in which a cell's genes operate, producing the gene-environment interactions that regulate the development of all organisms, a point that was accepted by all biologists, including sociobiologists, by the 1970s (Alcock, 2001, p. 42-43)

As implied in the discussion of levels of explanation, few evolutionary theorists attend to the molecular function of genes or to epigenetic development, because attending to such interactions does not help them answer the questions they pose. All models developed by scientists are simplifications. No one can study how everything interacts with everything else. At the level of analysis adopted by most evolutionary psychologists, it would be appropriate to substitute the words "genetic and other stable correlated extragenetic factors" for "genes." No evolutionary theorist assumes that genes could perform their function in the absence of extragenetic influences on development.

To support the assertion that evolutionary psychologists believe that genes are impervious to extragenetic influences (and that they contain closed programs), the authors cite Tooby and Cosmides' (1990) statement that "genetically based programs regulate the mechanisms governing development" (p. 22). However, assuming that genes *regulate* mechanisms is a far cry from assuming that they can accomplish this on their own or that they accomplish this task by using "closed programs." Clearly, genes contain codes, programs, or recipes that guide the construction of mechanisms; equally clearly, most of the programs contained in genes are open programs. Acknowledging the openness of genetic programs and the role extragenetic influences play in development in no way diminishes the functional importance of genes. What would we, or any animal, be without genes? Nothing; we wouldn't exist.

Straw man 5: Evolutionary approaches are genetically deterministic.

The authors repeatedly suggest that evolutionary theorists believe that we inherit "preformed phenotypic units or traits, somehow specified in the genome"; that "genes contain the programs or instructions for the prespecification of phenotypic traits"… "in advance of individual ontogeny" (p. 33); and that genes "preexist individual development and lie dormant somewhere in the structure of the organism, awaiting activation by some (usually unspecified) experiential events" (p. 16). In contrast to such assumptions, the authors insist that, "the development of any individual organism is the consequence of a unique web of interactions between the genes it carries, the complex, mutidetermined molecular interactions within and across individual cells, and the nature and sequence of the physical, biological, and social environments through which it passes during development" (p. 5).

Evolutionary theorists assume that genes, in interaction with other factors, play an important role in the determination of phenotypic behaviors, but they have gone to great lengths to make it clear that they do not adopt the genetically-deterministic model of gene influence the authors attribute to them. In a chapter devoted to the role that genes play in the development of organisms, Badcock (2000) makes the following statements, "The problem is, many people today still think of genes in preformationist terms… such erroneous thinking probably fuels much of the heat that is generated by genetics in people's minds today… .[but] neither physical development nor behavior is or can be preformed by genes" (p. 56-57). Badcock then goes on to explain why "DNA is no more able to preform an organism than is a homunculus" (p. 58) and to argue for an epigenetic approach. In this chapter, Badcock makes most of the points about epigenetic development made by the authors, explains why genes could not possibly produce preformed phenotypes, and situates epigenetic development within the framework of evolutionary psychology. It is a constructive approach designed to integrate levels of analysis.

In his introductory text, David Buss (1999) characterizes the genetically deterministic position the authors misattribute to evolutionary psychology as "Misunderstanding 1" about evolutionary psychology: "notions of genetic determinism—behaviors caused by genes without input or influence from the environment—are simply false. They are in no way implied by evolutionary theory" (p. 18). A large number of other evolutionary theorists have attempted to correct the misconception that they endorse genetic determinism.

> Genetic determinism implies that the genes received by an organism can absolutely determine some aspect of its behavior, no matter what subsequently happens to the organism. The effect of this argument is to exclude environment…[meaning] all contingencies except genes; so it is a ridiculous argument. (Alexander, 1979, p. 99)
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> [The idea of genetic determinism] is largely irrelevant, because it is not held by anyone, or at least not by a competent evolutionary biologist" (Maynard Smith, 1997, p. 528).
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> [T]he proposition that "alleles present in human populations have been winnowed by natural selection" (a point that sociobiologists do accept) differs fundamentally from the idea that "these alleles 'determine' our behavior in some preordained manner", a point that *no* biologist of any sort accepts…Yet the myth of the deterministic sociobiologist has been carried forward by some opponents who avoid acknowledging… the long history of rebuttals to this caricature. Why? Because the genetic determinist is too convenient a strawman to be discarded… In reality, however, all biologists [and evolutionary psychologists] know that every visible attribute of every organism is the product of a marvelously complex and all-pervasive interaction between genes and environment (Alcock, 2001, pp 43-44).
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> [A]n evolutionary perspective on human behaviour and psychology, far from promoting the view that we are automatons driven relentlessly by our genes, actually highlights our inherent

> flexibility or 'phenotypic plasticity'—the ability to vary responses according to circumstances, to learn from experience, to recognize and exploit opportunities as they arise" (Barrett, Dunbar & Lycett, 2002, p.2).

But, it could be argued, if evolutionary theorists believe that phenotypes are the product of complex interactions between genes and other factors, isn't it rather foolish to assume that one can predict anything about any phenotypic characteristic from an individual's (or species') genotype? No; we do it all the time. We can predict with great accuracy that members of our species will have two eyes and two ears; we can predict that the eyes and ears of offspring, as well as a host of other phenotypic characteristics, will resemble those of their parents more than those of other children's parents (for evidence, see Plomin, DeFries, & McClearn, 1997). The main reason why we are able to predict accurately from genotype to phenotype is because the aspects of epigenetic development and experience that affect gene expression are relatively stable and constant and because genotypes constrain phenotypes. No extragenetic influence is capable of turning a human embryo into a goat. However, if you alter epigenetic experiences radically, for example by exposing a fetus to toxins, or if you alter an environment radically, for example, by depleting it of oxygen, the *expression* of the genes that have been passed down through thousands of generations will be altered.

Finally, the assumption that instructions flow outward from genes (p. 22) is in no way inconsistent with the assumption that "the activation or expression of genes is regularly subject to influences from higher levels in the organism system during the course of development" (p. 22). It is recipes from genes that guide the construction of influences from higher levels. Accepting the incontestable fact that parents pass replicas of their genes to their offspring and that this is a significant agent of intergenerational stability in no way equates to denying that epigenetic factors activate or inhibit gene *expression* during development or that, at a proximal level, "what a given gene does in terms of what it provides the developmental process depends on its context" (p. 19).

Straw man 6: Evolutionary theorists play lip service to environment.

Although the authors acknowledge that evolutionary psychology espouses interactional assumptions, they characterize the interaction as "one-sided" and based in the "dichotomous idea that individual development is determined by either (a) phylogenetic factors…*or* (b) ontogenetic events…" (p. 11). The authors go on to claim that evolutionary psychologists assume that "environment or experience simply provides the trigger for these [genetic] programs to be expressed."

It is worth noting that it is logically impossible for an interaction theory to espouse the type of either-or model the authors attribute to evolutionary psychology. Interaction implies "both." To suggest that individual development is determined by phylogenetic factors, but not ontogenetic factors would be as ridiculous as suggesting that individual development is determined by ontogenetic but not phylogenetic factors.

In fact, evolutionary theorists are fully cognizant of the important role played by environmental factors in ontogenetic development and the determination of phenotypic characteristics. Indeed, Crawford and Anderson (1989) characterize sociobiology as an "environmentalist discipline." Evolutionary models are attentive to several sources of environmental influence. First, the "nature" in natural selection equates to the environment; environmental events and problems (in interaction with phenotypic characteristics) determine which individuals survive and reproduce and transmit characteristics to future generations. Second, as explained, evolutionary theorists acknowledge that epigenetic environments play an important role in the development of organisms. Third, as the authors acknowledge, evolutionary theorists assume that the environment serves as an important trigger in ontogenetic development. Evolutionary theorists frequently talk about facultative phenotypes—phenotypes that are expressed one way in one environment and another way in other environments. Ironically, the authors adduce a classic example of environmental triggers—the role of temperature in the determination of sex in reptiles—to support of their model. I have used this very example to illustrate one of the types of

gene-environment interaction attended to by evolutionary psychologists, but when I use this example, I point out that a single gene, sensitive to temperature, has been found to play a central role in this gene-environment interaction. I go on to illustrate the kinds of questions evolutionary theorists pose at their level of analysis by asking what adaptive advantages such a gene could have given reptiles in ancestral environments. (The answer probably lies in the fact that temperature during incubation is related to body size in most reptiles, which mediates different kinds of adaptive benefits in males and females.)

Fourth, evolutionary theorists are attentive to the role that the environment plays in regulating behavioral decisions. When evolutionary psychologists suggest that evolved psychological mechanisms are designed in terms of "if-then" types of decision-making strategies (Buss, 1999, p. 47-49), they assume that the "ifs" in question include environmental contingencies. Finally, as explained by Barrett, Dunbar, and Lycett, (2002), evolutionary psychologists are attentive to the fact that,

> the genetic fitness of behaviour is the outcome of a decision (which requires some kind of cognitive machinery to support it) in the context of a whole range of ecological, demographic and social factors. The latter are crucial to a proper evolutionary understanding of behaviour because they determine the costs and benefits that the organism assesses when choosing between two or more courses of action. As a result, the behavioural strategies of most higher organisms… are very flexible and are fine-tuned to the particular circumstances in which the individual finds itself. (p. 7)

Ironies in the position advanced by Lickliter and Honeycutt

In closing, it is worth noting several ironies in Lickliter and Honeycutt's paper. First, it is ironic that the authors advance as aspects of their own approach assumptions made explicitly by evolutionary theorists, then argue that evolutionary theorists have it all wrong. Second, it is ironic that after diminishing the significance of the role genes play in the development of psychological mechanisms, the authors advance an epi*gene*tic model. You can't have an epigenetic model without genes. Although statements such as, "the development of phenotypes emerges not from genetic programs, but from the structured, bidirectional dynamics of a developmental system" (p. 24) and "empirical evidence… suggests that there are no programs or blueprints for phenotypes, only dynamic and contingent processes that involve a complex array of endogenous and exogenous features" may seem to imply that development is not dependent on genes, they actually implicitly acknowledge genetic influences. When the authors allude to bidirectional epigenetic dynamics, they mean interactions between genes and extra-genetic factors. When they refer to "endogenous factors", they mean genes. Indeed, in statements such as, "[genes] are necessary conditions for developmental outcomes", and "genes and a host of extragenetic factors operating over the course of individual ontogeny [regulate the development of an organism]", the authors explicitly acknowledge the contributions of genes.

Third, it is ironic that the authors accuse evolutionary approaches of reductionism. Though the authors advertise their approach as offering "an explanation of human behavior and development which draws from all relevant levels of influence, from molecular to environmental", they focus almost exclusively on epigenetic interactions. Such characterizations actually are more applicable to evolutionary approaches than to the approach the authors offer. Evolutionary theory supplies an overriding framework that encompasses epigenetic interactions and a host of other variables that range from the selection of genes in ancestral environments through the ways in which evolved mechanisms are activated in current environments to relations between biological and cultural evolution. It is no coincidence that one can find evolutionary models in virtually all disciplines that study human behavior—behavioral genetics, biology, ecology, economics, political science, cognitive science, psychology, sociology, anthropology, and philosophy, to name a few. Related to this point, it is ironic that, after focusing almost exclusively on an epigenetic level of analysis, the authors characterize their approach as moving toward "a

biologically plausible *evolutionary* psychology [emphasis added]."

In conclusion, integrating different levels of analysis and mapping interactions between different types of cause are constructive ways of contributing to knowledge. Extolling the virtues of your approach and misrepresenting approaches employed by others are not.

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