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Introduction: Fear and Loathing of Evolutionary Psychology in the Social Sciences

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When one looks at the intellectual landscape of the modern university, at the scholarly and scientific interests of its faculty, the panorama is seamless. There are no discontinuities. The interests of physicists transmogrify into those of chemists, those of chemists into those of biologists, and so on. The lines, the divisions, between departments have been created out of administrative, not intellectual, necessity.

For example, consider the divide between chemistry and biology. There is a set of chemical processes that are characteristic of living systems. Is the study of these processes chemistry or biology? This is a meaningless question. To be a really good biochemist, one must be both a biologist and a chemist. After all, biochemistry is the study of chemical processes as carried out by biological systems.

Now consider the divide between biology and psychology. Psychological processes are produced by organisms and are the result of biological systems. The nature of psychological processes, therefore, must be understood, at least in part, in terms of biology. But biology is a huge, diverse discipline whose subject matter ranges from

molecules to ecosystems and from the present to the deep past. So to say that psychological processes need to be understood biologically is a tall order. However, psychology has long embraced parts of the biological panorama, namely neurophysiology and endocrinology. We have organized this symposium in recognition of our belief that many questions that have interested psychologists can benefit from contact with other areas of biology, particularly those that deal with populations over long spans of time: ecology and evolution.

One only need read the newspaper to be aware of the tremendous advances that are taking place in contemporary biology. At the molecular level, these advances are revealing the power of the information contained in the four-letter alphabet of DNA. Although we must not succumb to simple-minded genetic determinism (so common in the newspaper stories), it is clear that molecular biology will transform our understanding of many arenas of human existence, including psychology.

The advances at the level of the whole organism are equally impressive. The power of the modern synthesis of Darwinian thought is proving itself again and again. Although sometimes surrounded by controversy, evolutionary ideas are leading to a revolution in how we understand the world and our own place in that world. Thus, evolutionary psychology, defined as the study of psychological topics in the light of Darwinian ideas, such as natural and sexual selection, is beginning to have an important influence on our understanding of psychological processes, an influence that will grow dramatically in the next 25 years.

The primary reason that this growth will occur is that *Darwin was right* when he proposed fundamental continuity between humans and all other species that exist on earth. Evidence from every level—DNA, development, morphology, paleontology, behavior—is congruent with this idea. Humans are part of, and must be understood as part of, the biological world.

Nonetheless, the road to understanding human psychology as the product of natural selection is rough to say the least. Courtwright (1996), a historian, summarized this nicely: "The idea that human behavior is shaped by an underlying animal nature determined by millions of years of evolution is roughly as popular among contemporary historians as it is among Baptists" (p. 7). We would add that most psychologists would side with the historians and Bap-

tists. The antievolutionary sentiments of many social scientists stem from misunderstandings whose origins reach back to the centuries-old nature/nurture debate. These misunderstandings have acted as barriers to full acceptance of Darwinian thinking in psychology. Our goal in this chapter is to briefly describe some of the most common misunderstandings of evolutionary psychology and to offer remedies to them.

Five Misunderstandings of Evolutionary Psychology

Although a large majority of psychologists believe in evolution in general and of the human species in particular, evolutionary psychology has been slow to take root. Moreover, criticisms of evolutionary psychology are often shrill—reminiscent of the complaints of creationists when addressing evolution in general—which suggests that there is a "gut level" hostility toward evolutionary psychology that needs to be understood and tempered before progress can be made. We believe there are five main reasons why evolutionary psychology has encountered resistance.

The naturalistic fallacy. Evolution is a natural process, but "natural" implies wholesome and good. According to this thinking, much about human behavior that we find objectionable (for example, rape or infanticide) would have to be condoned if we accept evolutionary hypotheses of human behavior. This is the kernel of the naturalistic fallacy. We wish to add our voices to the chorus that eschews the naturalistic fallacy. We agree with Buss (1995): "The metatheory of evolutionary psychology is descriptive, not prescriptive—it carries no values in its teeth" (p. 167). Evolution is neither moral nor immoral. It is purely pragmatic. That which has worked in the past persists to the present. But the values that we may attach to natural events are completely separate. Tornadoes, floods, and earthquakes are all natural, too, but we do what we can to guard against them and to minimize the suffering they may cause. Diseases are also natural and disruptive, so biomedical researchers are working feverishly to eliminate them. Evolutionary psychologists are sometimes accused of condoning rape or murder, or of, at least, providing an argument in the legal defenses of those who commit such crimes. We find it odd that those scientists who study socially disruptive behaviors from a traditional social science framework are never accused of "aiding and

abetting" but that evolutionary psychologists are. Injurious behaviors must be understood in order to combat them, and evolutionary analyses can contribute substantially to that understanding.

The study of evolution does not provide grounds for unjust treatment of individuals. For example, evolutionary psychologists are often accused of sexism (Travis & Yeager, 1991). But the evolution of sex differences is widespread in the animal kingdom. The selection conditions that faced our male human ancestors differed from those that faced our female human ancestors. Consequently, a host of morphological, physiological, and behavioral differences have evolved (Geary, 1998). Does this imply that girls and women should be limited to different paths than those that are made available to boys and men? No. Given less protection under the law? Certainly not. Treated as though they are members of a totally disjointed category? Preposterous. The observation that males and females differ quantitatively on some traits, but do so with much overlap in their distributions, has been caricatured as meaning that all men differ from all women. This is absurd. Despite claims that evolutionary psychology is sexist or racist (Fairchild, 1991), the discipline merely seeks to understand, not to prop up, deplorable sexist and racist practices and ideologies.

Evolved means inflexible. Many psychologists (and even biologists) have a mistaken idea of what an evolved behavior looks like. Their thinking goes something like this: Evolution means genetics and genetics means reflexive, instinctive behavior. We do not see much pure instinct in humans, so evolutionary psychology, although perhaps of value for animal studies, is of little value for understanding humans. Buunk, Angleitner, Oubaid, and Buss (1996) described this thinking and offered a correction to it: "Evolutionary hypotheses are sometimes misinterpreted as implying rigid, robotlike, instinctual behavior that suggests that the individual is oblivious to the social environment. In fact, evolutionary psychology postulates psychological mechanisms that were designed to respond to the social environment" (p. 363).

The theme of the symposium, motivation, fits nicely into an evolutionary approach to human behavior. What we posit is that natural selection has led to the evolution of motivational processes, ones that goad one to action. Actions themselves are often learned and their expression is situationally flexible. Evolutionary psychology seeks

to understand these motivational processes as they exist in *Homo sapiens* by examining the historical, selective conditions that drove their evolution into their present forms. Evolutionary psychology is less concerned with the particular behavioral patterns used in achieving motivated goal states than with the reasons for the motivational processes themselves.

Evolutionary psychologists have embraced the notion of developmental plasticity and are linking plasticity with its environmental "switches" and underlying genetic mechanisms. Phenotypic outcomes, including behavior, may vary markedly depending on environmental conditions. Developmental psychologists, of course, have been keenly interested in such processes; indeed, psychology as a whole has staked out the landscape of behavioral plasticity as its domain. But biologists have also long recognized developmental plasticity. For example, in many reptiles and other vertebrates an individual can develop either as a male or as a female, depending on such environmental conditions as temperature during early development (Bull, 1985). Larval tiger salamanders can develop into one of two different morphs depending on population density. In high-density conditions, most individuals become cannibalistic and are equipped with specialized carnivore-like mouth parts quite different from those of the low-density morph, which is specialized for eating small invertebrates (Pfennig & Collins, 1993). Many vertebrates adopt different mating systems (for example, monogamy versus polyandry) or parental care patterns (female only, male only, or biparental care) as a function of such environmental conditions as food abundance (reviewed by Lott, 1984). Psychologists who think that biology is concerned just with rigid, instinctive, and otherwise inflexible processes are ignorant of the biology that has developed during the last 40 years.

But surprisingly, there is substantial resistance among psychologists to certain hypothesized cases of developmental flexibility. For example, recent studies assert that puberty may be accelerated in girls exposed to unstable and stressful family environments (Belsky, Steinberg, & Draper, 1991) or to poor relationships with their fathers (Ellis, McFadyen-Ketchum, Dodge, Pettit, & Bates, 1999). This work has drawn considerable ire and disbelief despite its solid evidentiary base and its consistency with comparative findings in life history. Hypothesized relations between childhood familial environments—which are admittedly complex and difficult to quantify—and a va-

riety of human life history strategies are emerging as important in evolutionary psychology, as well they should. Daly and Wilson's chapter in this volume, for example, presents evidence that young men living in economically disadvantaged conditions, especially if they live near more advantaged individuals, may be especially likely to take risks, even risks having life-and-death stakes. Their analysis hints at the operation of flexible developmental outcomes, and they would certainly agree that analyses of the developmental histories of the individuals involved would shed much light on the issue of male violence.

Interestingly, another form of male-initiated violence—rape—may be sensitive to early family environment (Thornhill & Palmer, 2000). So why do evolutionary accounts of human violence draw such vicious attacks? After all, violence is being viewed in contexts that mainstream psychologists have embraced for decades, namely, flexible, environmentally contingent responses. What is the problem? Probably the naturalistic fallacy. The critics of evolutionary approaches to violence—whether rape, homicides among men, child abuse or infanticide—seem to be more concerned with culpability than with understanding the phenomenon. Again, understanding a phenomenon is not equivalent to condoning it.

Confusing proximate and ultimate causes. Another common misunderstanding of evolutionary psychology is the mistake of confusing ultimate causes of behavior with proximate causes. Those who make this error correctly deduce that evolutionary psychology differs from the rest of psychology by being selectionistic. Indeed, Daly and Wilson (1999 and this volume) define evolutionary psychology as the application of selectionist thinking to psychological phenomena. Unfortunately, some have mistakenly placed the naturally selected consequences of the behavior as it occurred in previous generations into the role of proximate motivator of the behaving individual. For example, sexual intercourse is seen as being motivated by the desire to have children. But because many people take steps to have sexual intercourse without having children, the critic claims that evolutionary psychology cannot be correct. But this is backwards. The reason why sexual motivation is manifest at all is because of the reproductive success garnered by ancestral individuals whose psychologies operated in such a way as to produce sexual motivation.

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The decision not to have children at all, which seems to be especially common among academics and other highly educated individuals (Vining, 1986), is similarly regarded as evidence against evolved psychology. But offspring production is not the proximate motive for sexual intercourse. Offspring are the *consequence* of engaging in sexual intercourse. The fact that recent technologies permit sexual intercourse without reproduction is no threat to evolutionary psychology, because until very recently obtaining the proximate goal would have led to the ultimate consequence.

The nature of adaptation. Evolutionary psychology differs from the rest of psychology in its application of selectionist thinking. Most psychologists are comfortable with the environment in its ontogenetic role, that of influencing and shaping individual development, but they are not accustomed to identifying the selective role of the environment, that is, the conditions and events that differentially affect reproductive success. Traffic accidents, diseases, judicially imposed incarceration, and marital choices are all selective processes to the extent that they nonrandomly influence reproductive success. As evolutionists, we are keen on identifying behavioral/psychological attributes that influence reproductive success. Some forms of these attributes reduce reproductive success and are therefore said to be maladaptive, while other forms increase reproductive success and are said to be adaptive.

But adaptation is a complex concept that is frequently misunderstood. There are three main methods to the study of adaptation (Caro & Borgerhoff Mulder, 1987). First, we can measure morphological, physiological, or behavioral traits along with fitness (such as number of surviving offspring) in individuals in contemporaneous populations. This leads to insights into the current utility of the trait of interest. But this method tells us nothing of the trait's history. Second, we can investigate the selective history of a trait by employing comparative methodologies (Harvey & Pagel, 1991). Third, we can analyze traits themselves to find evidence of "special design." The notion of special design depends on a "reverse engineering" analysis of a trait. That is, a trait's attributes are examined in order to generate hypotheses about what the trait does. For example, noting that pupils open and close in concert with changes in light intensity leads to hypotheses about visual responses to light. This is an obvious example,

but the ones that we find of interest in evolutionary psychology can yield to the same basic approach (Pinker, 1997). McClintock's chapter describes women's endocrine responses to a molecule found in perspiration that can advance or delay the recipient's next menstrual cycle. Gangestad's chapter claims that women exhibit preferences for male facial symmetry and even prefer the odors of more symmetrical males, especially when women are most fertile. Applying reverse engineering to these processes can tell us how they may have contributed to reproductive success in previous generations.

However, we must note that the reverse engineering approach does not test the assumption of adaptation. Furthermore, it is most useful where the natural history of the species under study is well known, which may never be the case for *Homo sapiens*. We suspect that the most important challenge facing evolutionary psychology is the development of methods to rigorously test hypotheses about the evolutionary history and adaptive significance of specific traits.

Misconstruals of adaptation have been used by critics in an effort to undermine evolutionary interpretations of human behavior. First, adaptation has been misunderstood to mean that all individuals should be adapted, meaning that their behavior should contribute to survival and reproductive success. The failure to behave adaptively is seen as evidence against evolutionary views. Such reasoning is faulty. Individual maladaptation may result from several causes, including developmental errors. Brains are complex structures and they are subject to the vagaries of complex construction. No one claims that the heart is not adapted for pumping blood on the grounds that valves are sometimes misshapen and therefore maladaptive. So why should we conclude that psychological processes are not evolved and (generally) adaptive for their bearers even though some individuals may be psychologically maladapted?

Second, current selective environments often differ from those that existed during most of the history of the trait. Adaptation results from previous generations of individuals interacting with their selective environments. But if the selective environment in those generations differed from those now, we might find that typical individuals alive today demonstrate maladaptations. For instance, our tastes for certain foods—sugar, salt, fat—may contribute to various health problems, but these tastes evolved in earlier times when such diets were not as readily obtained as they are now and when few

people led sedentary lives. Although there is no doubt that some individuals possess characteristics that make them less fit than others, the question of whether or not the environments in which most people live today are generally ill suited to typical phenotypes is debatable. With a global population rapidly approaching six billion, it looks as though our current environments are quite congenial to our traits. Certainly, there is mortality associated with overindulgence, but most of it occurs in postreproductive years and therefore is only weakly selected against. Certainly there are many unhappy people in the world, but there is no way of knowing whether they would have been happier in a forager lifestyle, and in either case, natural selection is not about happiness; it is about reproductive success.

Another complaint that is directed at evolutionary psychology concerns the evolutionary history of the behavior of interest. Those who seem most hostile to evolutionary thinking (for example, Eagly & Wood, 1999) point to inconsistencies and disagreements among evolutionary biologists regarding the nature of adaptation. First among these is the difference between traits whose original function was the same as its current function versus those traits whose function has changed. The former are termed *adaptations* and the latter are *exaptations*. Natural selection has given rise to both. An exaptation is merely an adaptation whose function has changed.

Another distinction is between adaptation/exaptation and incidental by-products of selection. Buss, Haselton, Shackelford, Bleske, and Wakefield (1998) have written a wonderfully clear exposition of these concepts. A by-product is a phenotypic feature that itself is not associated with reproductive success but which is present because of some other feature which is. Buss et al. give the example of the human navel as a nonadaptive by-product of the adaptive umbilicus. The rumbling sounds of digestive systems doing their work is another example. In behavioral or psychological terms, remembering telephone numbers may be a by-product of naturally selected, adaptive memory processes, and driving a car is a by-product of a host of adaptive perceptual and motor skills that evolved for very different applications.

It is important to note that natural selection has operated in all of these cases, either producing the adaptive (or exaptive) feature or the feature that has spun off the by-product. The error made by antievolutionists is in thinking that if a phenotypic feature is not an

adaptation (in the strict sense of the term), then it is not evolved. This is critical for evolutionary psychology because what we hypothesize to have evolved are mental modules (cognitive, motivational, and emotional operations; see Gigerenzer, this volume), but *not* specific behavioral outputs. So, for example, young men might attempt to impress young women by showing off their material possessions or social status. The fact that they do so by driving up in a shiny new car or by bragging about their promotion at work is simply the expression of this evolved psychological process in its current cultural context. Analyses of evolved behavior operating in a very new environmental context is fundamentally no different from noting that heart rate increases while climbing a long flight of stairs (instead of chasing mobile prey) or that the vestibular system maintains balance while one is rounding a corner in a car (instead of turning around to evade a predator). In other words, we put to use all manner of traits in dealing with recently encountered environmental conditions. Psychological traits are no different from morphological or physiological traits in this regard.

The study of evolutionary adaptation has also provided useful insights into the origins and etiology of significant psychological disorders. From the perspective of the traditional biomedical model, disorders such as depression, anxiety, schizophrenia, and substance abuse and addiction are viewed as pathologies, and certainly as maladaptive behaviors, at least from the perspective of the functioning of a single individual. However, the application of evolutionary analyses to these phenomena has yielded further insights into these psychological states. These insights include information regarding the proximate mechanisms underlying the pathological disorders, and the potential selective environments that lead to their expression, and those that may be promoting the maintenance and elaboration of these traits in current populations (McGuire, Marks, Nesse, & Troisi, 1992; Nesse & Berridge, 1997; Nesse 1999; Nesse, this volume). Further, these analyses also suggest the ways in which some states that are considered to be pathological according to the biomedical model may simply reflect by-products of selection for other traits (for example, Crow, 1995,1997).

An interesting task confronting evolutionary psychologists is determining whether a trait is now a "spandrel," a feature that originated as a by-product but which is currently correlated with repro-

ductive success (Gould & Lewontin, 1979; Buss et al., 1998). A possible example is reading and writing, both of which are recent in human history and undoubtedly arose as by-products of spoken language, visual acuity, and manual dexterity. Are reading and writing still by-products or have they become spandrels? In other words, are reading and writing correlated with reproductive success? In modern, selective environments they probably are, but that discussion would lead us astray from our main point: Regardless of whether the phenotypic feature is or was adaptive, and if so, whether its function has changed, the phenotypic feature is still evolved.

But there is one issue regarding adaptation that we still need to address, and it concerns the human mind and whether human mental processes are the by-products of selection, which have not yet been selected, or whether these processes have undergone direct selection. If they have been selected, then we expect to find evidence of "special design," the notion that selection results in efficiencies, functional specializations, speed, precision, and so on, that would not be expected if the trait were merely a by-product. These issues are addressed in the next section.

The general-purpose mind. The final reason why some psychologists have not embraced evolutionary concepts is a pervasive misunderstanding of what evolution has wrought. Although most psychologists are not creationists, they are social scientists, and acceptance of what is often called the "traditional social science model" is pervasive indeed. The basic tenet of the model is that natural selection of humans has produced a sophisticated problem-solving device, the human brain/mind, whose abilities are capacious but which depend on individual experience for their expression. Further, this device can be brought to bear on myriad diverse problems, ranging from the intricacies of social dynamics (Seyfarth & Cheney, this volume), to mathematical problem solving, to strategizing in sports and games, and planning what to wear to work. What evolution has wrought, therefore, is so unconstrained in its use that it has curtailed further evolution! This device has permitted us to shape our environments to suit our needs, rather than us being selected by our environments. In brief, most social scientists seem to acknowledge human evolution while at the same time declaring it irrelevant.

This widely held position regarding the place of evolution within

modern psychology deserves careful consideration. Its rebuttal is one of the major themes running through the chapters of this symposium. To what extent is human psychology dependent on a flexible general-purpose cognitive device as opposed to a (large) number of more specific devices? Further, how would we know which view is more likely to be correct?

One way of approaching the problem is neuropsychologically. If the human brain/mind is indeed a general-purpose device, we would expect losses of function to be diffuse when the device becomes damaged, as through injury or stroke. In contrast, if there are numerous, highly specialized devices, one would expect losses to be much more restricted. Neuropsychological data clearly support the multiple-devices view. Aphasias, for example, not only take the forms of the classic expressive (Broca's) and receptive (Wernicke's) forms but of even more singular losses of function, such as the inability to generate nouns while other parts of speech remain intact; or the inability to use common nouns even though proper nouns are used normally (Gazzaniga, 1989). We would not expect to find facial agnosia—the loss of ability to recognize familiar people by facial features alone—if facial recognition was but one of many processes controlled by the general-purpose device.

Studies of nonclinical brain processes are also supporting the multiple-device view of brain organization. The recent finding that second languages learned after early childhood utilize brain tissue distant from that which is most active in the native language (Kim, Relkin, Lee, & Hirsch, 1997) is an interesting example of this approach. Noninvasive imaging techniques are becoming more commonly used by cognitive neuroscientists, and we expect that the trend toward more precise localization of function will continue.

But evolutionary psychologists are behavioral scientists, and it is from studies of behavior that most of our insights (and controversies) are generated. What do we look for in patterns of behavior that would distinguish between the general-purpose and multiple-specialized-devices views of human behavior? This question has parallels to those asked about learning processes beginning in the 1960s when "preparedness" began to be recognized. In short, if a single process is at work, we expect uniformity in the performance of the system. We would not expect to find some tasks that are inordinately easy (or difficult) to learn or remember. We would not expect to find marked

changes in performance when the content of a problem-solving task switches from ecologically neutral to ecologically relevant.

The recognition and appreciation of numerous, domain-specific devices is a trend with a long history in psychology. Most of the early work along these lines concerned learning. Is learning a general process, or is it, as Shettleworth (1993), Kamil (1988), and others have argued, a box of tools, each of which is specialized for performing certain tasks? Closely related ideas have been voiced by Sherry and Schacter (1987), who have made a convincing case that multiple memory systems have evolved with properties that make each one quite adept at one task (for example, remembering song features in birds) or another (remembering the locations of food caches), but not both. Finally, cognitive psychologists have widely embraced the notion that intelligence is not a single capacity, but several (Sternberg, 1985). In sum, the specialized, modular organization of cognitive systems that is being advocated by evolutionary psychologists is consistent with a trend that has been underway in mainstream psychology for at least 40 years.

In conclusion, we have discussed five misunderstandings that have acted as obstacles to widespread acceptance of evolutionary, selectionist thinking in modern psychology. All five persist because some psychologists seem threatened by this "new" way of thinking. But there is nothing to fear. Studies of development and of proximate mechanisms—the historical core of psychological research—will not and should not go away. Rather, they will now be cast into a broader, richer framework, one whose history goes back much further than that of the behaving individual's life span. We will see, for example, why certain developmental processes are favored in some selective environmental contexts but not in others. We will see that environmentally contingent phenotypic plasticity is not unique to our species and that such flexibility tends to occur in specific conditions. We will see that the foibles of human cognition make perfect sense when cognitive processes are viewed as the products of the selection problems that faced ancestral humans. In short, evolutionary psychology takes nothing away from traditional psychology. Instead, it adds bridges to other disciplines that also wish to understand the human condition.

Evolutionary psychology is here to stay. Its principles and findings are appearing in many recent books dealing with such topics as parental behavior (Hrady, 1999), sex differences in behavior (Low,

1999), the operations of multiple cognitive processes (Pinker, 1997), rape (Thornhill & Palmer, 2000), and many others. We believe the contributions to this symposium will take the field forward another step and hopefully introduce many to this emerging and exciting discipline.

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