

A critique of evolutionary psychology

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Abstract

Evolutionary psychology is a relatively new paradigm and an interdisciplinary one that has engendered considerable debate, conflict and controversy among scholars of various disciplines. The purpose of this paper is to examine the sources of this conflict and to articulate the contested issues. Emerging from methodological and inferential differences among the relevant disciplines is the question of whether or not falsifiability need be a prerequisite for theories to be considered 'scientific.' Although universal consensus may substitute for falsifiability, the assumptions underlying the evolutionary psychology paradigm are neither falsifiable nor do they command universal consensus. Assumptions addressed in this paper include the nature of natural selection, the unit of selection, sources of variation, and the structure of the evolved human brain. Furthermore, the paradigm suffers from inherent contradictions: (a) the claim by evolutionary psychologists that knowledge of ultimate causes is necessary to accurately predict the consequences of proximate causes is contradicted when their hypotheses mimic those of learning theory; (b) when evolutionary psychologists conduct empirical research, results that contradict the paradigm are dismissed as invalid with the justification that current environments differ from ancestral ones; (c) although stating that data from non-human species are irrelevant, evolutionary psychologists utilize these data when convenient; (d) evolutionary psychologists acknowledge the role of ideology and politics in the formation and support of scientific paradigms but deny this influence in their own paradigm. Exacerbating the conflicts, some evolutionary psychologists present their paradigm as replacing,

rather than coexisting with, current paradigms, alienating advocates of epistemological diversity. An alternative explanatory model is presented – one that is grounded in evolutionary theory, reflects recent advances in cognitive neuroscience and developmental psychology, and achieves a dialectical balance between nature and nurture.

Keywords: evolutionary psychology, evolution, natural selection, sex differences, critique

Introduction

In 1975, E.O. Wilson, a well-known expert on the social behavior of insects, published *Sociobiology*. The publication of this book represented an extension of his interest to the biological basis of social behavior in all species including the human one. Because species other than humans are easier to obtain, breed, and manipulate, the majority of studies on social behavior utilized insects and mammals as research subjects, and Wilson speculated as to the relevance of these findings to the human species. Wilson, as well as other sociobiologists, researched not all social behavior; rather the focus was on social behavior that was related, or thought to be related, to reproduction. Initially, these behaviors included, but were not limited to, parental investment, sex differences in reproductive strategies, kin selection, and altruism. However, the basic assumption underlying sociobiological theory is that, in all living forms, the primary reason for existence is to perpetuate one's genes (Dawkins 1976). One implication of this assumption is that any and all social behavior is related to reproduction and thus, relevant to the paradigm. The popular and media appeal of the discipline lay in the implications for sexuality and the tempting generalization to human behavior.

Sociobiology has been the target of much criticism primarily because of its assumed generalizations from animals to the human species. Many scientists and the lay public prefer the view of humans as distinctly different from animals; human behavior is perceived as subtle, indirect, and the product of psychological processes. Consequently, some scientists in the disciplines of anthropology and psychology developed the essence of sociobiology into a new theoretical model that has been labeled 'evolutionary psychology.' This was designed specifically to model human behavior. Essentially, evolutionary psychology assumes that, via sexual selection, our evolutionary history has provided the context for the evolution of sexual strategies designed to solve particular adaptive problems. 'Each psychological mechanism is sensitive to information or cues from the external world, such as physical features, signs of sexual interest, or hints of potential infidelity' (Buss 1994: 6). The goal of evolutionary psychology is

to identify the psychological mechanisms that have evolved as highly specialized cognitive modules, to examine the influence of these mechanisms on current behavior, and to demonstrate that, because these mechanisms enhanced reproductive success, they were selected in the human ancestral past.

Since its introduction, evolutionary psychology has been controversial. Debates between proponents and opponents have appeared in journals and on television talk shows. These discussions are not the stuff of typical scholarly debate. Instead, hostility and name-calling characterize the discourse with the consequence that 'sides' are reinforced and stabilized, impeding a dialectical resolution that would facilitate forward movement in a scientific and logical manner. My goal is not to ferret out the 'truth' but to further an understanding of the sources of the conflict with the goal of facilitating resolutions.

Evolutionary psychology as science

The cornerstone of science, according to logical positivism, is falsifiability: 'The mark of a scientific theory or hypothesis was its refutability . . . ' (Longino 1990: 33). This criterion is adopted by most social scientists whose traditional methods of testing hypotheses and theories employ analyses and conclusions of a probabilistic nature. In contrast, according to Mayr (1997), this approach is particularly inappropriate in evolutionary biology ' . . . in which historical narratives must be constructed to explain certain observations . . . [and] it is often difficult, if not impossible, to decisively falsify an invalid theory' (p. 49). Thus, a portion of the controversy concerns the importance of falsifiability in the evolutionary psychology paradigm: social scientists tend to insist on falsifiability as a criterion, whereas those proponents of evolutionary psychology whose scholarly origins are evolutionary biology do not agree.

Philosopher of science, Helen Longino (1990) has noted that the criterion of falsifiability is relevant not only to theories, but also to specific hypotheses emerging from theory and to particular assumptions that must be true in order to interpret the data as evidence of the theory. A frequent criticism of evolutionary psychology is that its theories and assumptions are not falsifiable. One theory, for example, asserts that human social behavior is guided by specific evolved predispositions that were selected because they enhanced reproductive success during human evolutionary history. An instance of this theory, recently the focus of a book by Thornhill and Palmer (2000a), states that men have specific predispositions, selected in human ancestral history, to engage in rape behavior. As a test of this theory, Thornhill and Thornhill (1990a) hypothesized and found that rape victims are concentrated among those women whose age is within the

normal span of fertility. There are at least two assumptions, however, that need to be valid in order to accept these data as evidence for the theory.

The first assumption is that rape behavior was a specific target of evolution. Because adequate evidence in favor of this assumption or opposed to this assumption is not available or identifiable, the assumption is not falsifiable. The second necessary assumption is that rape increases man's reproductive success. Although this statement is not true in current society, the Thornhills maintain that rape increased men's reproductive success in human ancestral history – but this assumption cannot be tested. Thus, whereas the hypothesis is falsifiable (i.e., the age of rape victims), the assumptions and, therefore, the theory are not. In the absence of clearly valid background assumptions, these data are open to numerous interpretations. For example, women in the fertile age range are more likely than the very young and the very old to engage in activities that increase their vulnerability to rape such as being outside their homes in the evening.

A primary criticism of evolutionary psychology theory is that advocates excel at developing conjectures, speculations, and hypotheses in a theoretical context requiring assumptions of questionable validity. However, they neglect to adequately test hypotheses and assumptions, and, consequently, theories – even those that are testable or falsifiable. The problem of untestable assumptions is often side-stepped by presuming them to be true. For example, McKnight (1997) states that ‘... if a characteristic as seemingly pointless as nonreproductive sex survives for as long as homosexuality has, then it has some significant evolutionary function’ (p. 4). Similar logic characterizes Thornhill and Palmer's (2000a) statement that ‘... there is no scientific reason for assuming that consciousness is anything other than an aspect of our evolved biology’ (p. 29). In both instances, the absence of evidence is used as evidence.

The focus of much of the criticism of evolutionary psychology is in questioning those assumptions required in order to appreciate the theories and in accepting available evidence as support of the theories (Grace 2001). Key assumptions in evolutionary psychology are as follows: (1) the selective mechanism of evolution has designed the human brain as ‘... composed largely (or perhaps even entirely) of innate, special-purpose computational mechanisms or “modules”’ (Samuels 2000: 13) yielding psychological adaptations that process specific information; (2) the primary driving force of evolution is natural selection through which specific adaptations are formed that lead to greater and greater efficiency, economy and precision in accomplishing specific functions; (3) the unit of selection in the evolution of the human species is the individual; group selection does not occur (Thornhill 1999); and (4) reproductive success, rather than survival, is the mechanism underlying evolution by natural selection. Each of these assumptions is considered below.

Assumptions underlying evolutionary psychology

Reproduction versus survival

Darwin claimed natural selection to be one mechanism of evolution and defined natural selection as the preservation of adaptations via differential death rates. Lacking knowledge of genes and DNA, Darwin articulated a theory that remains accepted today: ‘ . . . “selected” individuals are simply those who remain alive after all the less well adapted or less fortunate individuals have been removed from the population’ (Mayr 1997: 189). Darwin also recognized a second but, according to him, less important mechanism of selection which he labeled sexual selection; i.e., those individuals most likely to reproduce, for whatever reason, are those whose traits will continue in future generations. These two forms of selection could act in a contradictory manner, such as the peacock’s tail feathers which may appeal to peahens but render the male more vulnerable to predators, or in a complementary manner such as skill at hunting indicating an individual with resources to share and one likely to survive.

A crucial assumption in evolutionary psychology is that all selection is sexual selection. Although Darwin’s original formulations were clear and unambiguous, Thornhill and Palmer (2000a), rather arrogantly, claim that recent theorists have ‘ . . . clarified what Darwin meant . . . ’ and conclude ‘ . . . “good” traits are those that promote an individual’s reproductive interests’ (p. 5). Concurring, Buss, Haselton, Shackelford, Bleske, and Wakefield (1998) state ‘Differential reproductive success, by virtue of the possession of heritable variants, is the causal engine of evolution by natural selection’ (p. 534). Although evolutionary psychologists present their theory of natural selection as sexual selection as if it were fact, they provide no evidence for this claim. Nevertheless, the assumption of truth is evident in their writing: ‘Nor should we be surprised at the lack of survival benefits while brain size was tripling. The brain’s benefits were mainly reproductive’ (Miller 2000: 20); and ‘Such pain [death of a relative, loss of social status, desertion by one’s mate] is thought to be an adaptation that helps people guard against circumstances that reduce their reproductive success . . . ’ (Thornhill and Palmer 2000b: 34).

According to evolutionary psychology theory, the overriding motivation of all social behavior is reproduction and maximizing the number of and subsequent reproduction of one’s own offspring. Consequently, intrasex competition and aggression are viewed as ‘natural’ whereas altruism and cooperation are viewed as a sort of ‘twisted’ self-interest – ‘I’ll save your life because someday you may save mine.’ Extending this theory, evolutionary psychologists have coined the term ‘kin selection’ to refer to the kindness, altruism or cooperation extended to those in one’s family. Promoting the

survival and reproduction of an individual who shares some of one's genes is, in essence, perpetuating one's genes. However, the research cited as evidence for kin selection, such as step-parents being kinder to their biological children than to their stepchildren and siblings helping one another financially, are readily open to competing interpretations (Rose 1997).

Although research designed to conclusively demonstrate kin selection is lacking, and in many species, ethically untenable, anecdotal data suggest absent or weak kin selection. Turnbull (1972) wrote a fascinating account of his study of the Ik, an African tribespeople, who were forbidden by their government to continue their tradition of hunting and were forced to survive by farming and foraging a land incapable of producing the necessities of life. Turnbull describes the changing behaviors and relationships among a people who are gradually starving. Contrary to the predictions of kin selection, ' . . . those who live close to each other are likely to see each other as effectively related, whether there is any kinship bond or not. Full brothers . . . who live in different parts of the camp . . . may have little concern for each other' (p. 28). Furthermore, these individuals did not invest all of their resources into facilitating the survival of their biological children. Rather, at the age of 3 years, children were barred from the household and abandoned to make their way the best they could. According to Turnbull, the Ik accepted the ' . . . natural determination to survive as an individual before all else. This they consider to be man's [*sic*] basic right . . . ' (p. 182). While the story of this people clearly favors selection for survival over selection for reproduction, interestingly, survival was not the sole motivating force. 'They prefer to die of starvation and thirst rather than move out of their mountain homeland' (p. 162).

Although evolutionary psychologists have claimed universal scholarly agreement on this issue among evolutionary biologists, some of the more prominent continue to view survival as the key mechanism of natural selection with reproduction being a 'side-effect' of survival. Indeed, Mayr (1997) describes the sole focus on reproductive success as being a limitation of evolutionary psychology. He notes ' . . . characteristics that favor survival include increased tolerance of adverse climatic conditions, a better use of food resources, a greater competitive capacity, higher resistance to pathogens, and an increased ability to escape enemies' (p. 191). 'For each characteristic, the questions that must be asked are: Was the evolutionary emergence of this characteristic favored by natural selection, and what was its survival value that has led to its being favored by natural selection?' (p. 191).

Eldredge (1995) maintains Darwin's original distinction between the two perspectives – sexual selection being the competition for reproduction and natural selection being the competition for economic resources.

From an evolutionary standpoint, there is clearly a connection between the economic and reproductive worlds of organisms. But to spell out the nature of that connection we first must accept the separateness of the economic and reproductive aspects of life. All organisms lead economic lives. Most organisms reproduce, and all organisms, of course, owe their existence to parental reproductive behavior. But the converse is not true: reproduction cannot go on in the absence of successful economics. When stressed, most organisms quickly stop reproducing, conserving energy and waiting for better times [p. 187].

He concludes that the limiting factors are economic (i.e., survival) rather than reproductive.

One could argue, as evolutionary psychologists have done, that traits selected solely on the basis of their reproductive value, as opposed to their survival value, would be a more 'efficient' system than that described by Darwin. In other words, maximizing reproduction, rather than survival, would, perhaps, be a more sure method for ensuring the perpetuation of a species. Natural selection, however, was not selected by an efficiency expert. The driving force behind evolution was not chosen over others as the most efficient or the most desirable – the theory was not subjected to natural selection. The theory of evolution as articulated by Darwin was his explanation of his observations – not a statement of what 'should be' if the world of living organisms had been designed.

Individual versus group selection

The unit of selection in the evolutionary program of the human species has been and continues to be controversial. Although the concept of the 'selfish gene' has become so popular as to be a media term, Mayr (1997) points out that '... no gene is ever directly exposed to selection, but only in the context of its entire genotype, and since a gene may have different selective values in different genotypes, it would seem highly unsuitable as the target of selection' (p. 201). Setting aside the gene as a possibility, the scholarly debate continues between individual and a combination of individual and group selection.

The individual as the sole target of selection is a crucial assumption for the theories of evolutionary psychology. The presentation of the evidence, however, takes the form of a circular argument. 'Presumably, all evolution leading to adaptation has been driven by interindividual selection, and not by intergroup selection. Evidence for this is vast, and is seen in the functional designs of adaptation' (Thornhill 1999: 143). However, in order to conceptualize human behaviors as adaptations, one needs to assume inter-individual selection. Traits that appear to promote group success are

dismissed as mere by-products of evolution. Labeling certain traits and behaviors adaptations and others by-products is arbitrary since a methodology has not been developed with which to determine if a trait or behavior is a direct adaptation or a by-product of other evolved traits. In the absence of direct evidence, evolutionary psychologists have assumed individual selection to be the 'default option.'

In promoting the view of individual selection, Thornhill and Palmer (2000a) suggest that the 'majority' of biologists agree with this view. Nevertheless, the minority are not easily dismissed. Among those that favor including group selection are Darwin who believed that some traits may be selected because they are advantageous for populations (Sperling and Beyene 1997) and the prominent evolutionary biologist Ernst Mayr (1997) who distinguishes two versions of group selection. The first is 'soft' group selection which ' . . . occurs whenever a particular group has more (or less) reproductive success than other groups simply because this success is due entirely to the mean selective value of the individuals of which the group is composed' (p. 202). This is simply another version of individual selection. The second version, 'hard' group selection, ' . . . may reward genuine altruism and any other virtues that strengthen the group, even at the expense of the individual . . . behavioral norms will have the longest survival that contribute the most to the well-being of the cultural group as a whole' (p. 254). Mayr suggests that this type of ' . . . selection occurs only when there is social facilitation among the members of the group or, in the case of the human species, the group has a culture which adds or detracts from the mean fitness value of the members of the cultural group' (p. 202). Mayr goes on to explain that evidence for hard group selection includes a division of labor and other forms of mutual cooperation such as a group that posts sentinels to warn of predators. 'For truly social species, interdependence at the group level serves as the primary strategy for survival . . . ' (Caporael and Brewer 1995: 32).

Those who advocate hard group selection do not propose all selection is targeted at the group level. Instead, the hypothesis is that both individual and group selection proceed in a synergistic manner. Not only are these two forms of selection difficult to tease apart methodologically, conceptual distinction is difficult as well. In social species, many individual adaptations promote group survival and many group adaptations promote individual survival.

Natural selection

The role of natural selection in the evolution of species was initially described by Darwin. Selection refers to the differential survival and reproduction of individuals in a population. The observation that more

organisms are born than survive was articulated in the early nineteenth century by Malthus (Eldredge 1999) and was crucial to Darwin's thinking. Those who survive and reproduce pass their genes to the next generation. In this way, traits that facilitate survival and reproduction are more likely to occur in the next generation than traits that are neutral or hinder survival and reproduction. These traits are referred to as adaptations. Although the theory of natural selection is simple and explicit, scholars disagree on the interpretations and implications.

One area of conflict is the identification and description of specific adaptations. How can one distinguish between an adaptation – a trait selected for its survival value – and a by-product – a trait, adaptive or not, emerging due to its genetic connection to a selected trait. Evolutionary psychologists claim that an adaptation can be distinguished from a by-product because adaptations show 'sufficient precision, economy and efficiency' (Thornhill and Palmer 2000a: 10). These criteria follow directly from their interpretation of evolution.

The evolutionary psychology interpretation of evolution through natural selection is the competition among individuals for reproductive opportunities so that those who are the smartest, strongest, and most attractive to the other gender will be those who pass on their genes. Thus, over evolutionary time, species increasingly progress in an optimal fashion and natural selection leads to greater and greater perfection; that is, precision, economy, and efficiency. Interestingly, this interpretation is identical to that of scholars who perceive the process of evolution to be guided by a 'creator' (Wells 2002). 'These qualities [precision, economy, and efficiency] . . . point to special design instead of evolving by chance alone' (Grace 2001: 291).

Skeptics, nevertheless, maintain that adaptations and by-products of adaptations cannot be distinguished with any reasonable degree of certainty. While acknowledging sexual selection as a weak force, others view natural selection as the survival and reproductive success of those individuals who have traits that enable them to survive and reproduce in changing environments (Mayr 1997; Gould 1996a; Eldredge 1999). Thus, selected traits are not those that enhance reproductive success but, rather, are those that are favorable in the changing local environment. During one epoch, the primary threat to survival might be decreasing temperatures so that those with more body fat would survive and reproduce; in another epoch, predation may be the limiting factor and speed would be selected. 'The sequence of local environments in any one place should be effectively random through geological time. . . . If organisms are tracking local environments by natural selection, then their evolutionary history should be effectively random as well' (Gould 1996a: 139–40). There would be no general progress towards optimality, no enhancement of precision, economy,

and efficiency. As Dupre (2000) comments: 'One does not need a jet engine to escape predators: one just needs to be faster than one's fellows' (p. 20).

And, from a 'common sense' perspective, it is difficult to understand what Thornhill and Palmer mean by 'sufficient precision, economy, and efficiency.' Natural selection yielded humans that are bipedal but certainly did not do so with precision, economy, and efficiency. Numerous and widespread physical problems have emerged as a consequence of our stature, such as lower back pain, vertebral crush fractures, varicose veins, haemorrhoids, hypertension, and circulatory disorders (Morgan 1990).

The optimality debate is further complicated by disputes over the nature of natural selection. In order for selection to occur at all, there must be variation among individuals. Evolutionary psychologists consider the only source of this variation to be natural selection: 'The other evolutionary agents (mutation, drift, and gene flow) – cannot produce adaptations; they lack the necessary creativity, because their action is always random with regard to environmental challenges . . . ' (Thornhill and Palmer 2000a: 6). The implication here is that ' . . . natural selection is unopposed, or only weakly opposed, by other forces of evolution, with the consequence that it always achieves the optimal result' (Matthen and Ariew 2002: 65). In contrast, the traditional perspective is that four phenomena contribute to variation: natural selection, genetic recombination, gene flow, and mutation (Mayr 1997). Since the latter three are random processes, evolutionary change is random rather than progressive; the best is selected but the best of random variation. There is no assurance that any of the available variation is necessarily characterized by improvement or optimization of the species.

Thus, evolutionary psychologists advocate a particular and unique view of natural selection – one that relies on the assumptions that natural selection operates by preserving the genetic configurations of those who successfully competed in the reproductive contest, that natural selection is the primary or the only source of variation in the evolutionary process, and that natural selection optimizes physical and behavioral traits. These assumptions provide the authority and logic for the basic elements of the paradigm: adaptations can be recognized by their functionality; historical narratives are legitimately used as evidence to establish an adaptation; and traits problematic in our current environment (e.g., rape), were selected in an environment in which they were adaptive. Yet, these assumptions claim neither scholarly consensus nor empirical support.

General versus specific brain: modularity

Historically, the specificity of the human brain has been a source of controversy among cognitive psychologists. Continued experimental failures in precisely locating specific cognitive function in the human brain led to the conclusion that mental function cannot be localized. Consequently, mid-century theories were based on principles of mass action and equipotentiality (Posner and Di Girolamo 2000). In contrast, evolutionary psychologists are firmly committed to the view that the human brain consists of highly specific and complex evolved adaptations. Indeed, this is an essential assumption upon which their theory is based. However, the method of argument has not been scientific but rhetorical. Specificity is referred to as 'the modern view' (Thornhill and Palmer 2000a: 23) and a view held by 'all' evolutionists. Analogy, rather than evidence, is used as a form of persuasion: 'There is no such thing as a "general solution" because there is no such thing as a "general problem"' (Buss 1995a: 7).

To fully appreciate the level of specificity assumed, consider that Thornhill and Palmer (2000a), in advancing their evolutionary theory of rape, claim the existence of specialized brain circuits for the following: (a) discriminating health and age-related cues as well as parenting ability in a potential mate (p. 16); (b) the human males' preference to invest only in chaste mates (p. 158); (c) women's use of sex '... and promises of sex to manipulate men and get resources from them' (p. 160); (d) a '... "beauty-detection" mechanism, designed specifically for rape, that would motivate males to prefer to rape females at the age of peak fertility ...' (p. 71); and (e) the human female's predisposition to feminist sentiments as a method of avoiding rape (p. 103). It is difficult to imagine the complexity and size of the brain that would make this possible. Indeed, these are not empirically supported statements, but rather, speculations based on questionable assumptions. They do, however, have the form and language of 'scientific' statements that, when published in scholarly texts, take on an undeserved legitimacy.

Consistent with their cognitive theories, evolutionary psychologists

... defend a *massively modular* conception of mental architecture which views the mind – including those parts responsible for such 'central processes' as belief revision and reasoning – as composed largely or perhaps even entirely of innate, special-purpose computational mechanisms or 'modules' that have been shaped by natural selection to handle the sorts of recurrent information-processing problems that confronted our hunter-gatherer forebears ...

(Samuels 2000: 13)

The massively modular hypothesis is not only informed by evolutionary psychology's essential theories but has been used to explain data in conflict with the theories. For example, the assumption that reproductive success is the prime motivation for human behavior is contradicted by the observation that men are not lined up for miles to donate to sperm banks. Evolutionary psychologists explain these data by assuming that the naturally selected modules are informationally encapsulated; since sperm banks were not present in the Pleistocene era, they were not part of the evolved adaptation. Thus, hypotheses generated by the theories are not falsifiable because contradictory data derived from the current environment are easily dismissed as irrelevant to the hypothesis if not part of the ancestral environment; and we do not know, with any acceptable level of certainty, the conditions of the ancestral environment. The massively modular organizational structure is defended, not on the basis of evidence, but as a necessary (but untested) assumption for the interpretation of human cognitive function within the evolutionary psychology paradigm.

Those who favor a plastic and flexible human brain span decades and disciplines. From the biological sciences: '... the existence of general adaptations that further survival and reproduction make special ones seem superfluous (Ghiselin 1992: 388); '... our "adaptedness" consists of a capacity to grade and modify responses in relation to socioenvironmental circumstances, a highly evolved phenotypic plasticity that is central to Darwinian behavioral biology, human and other ...' (Dickemann 1989: 19) – to the sciences of evolution: '... highly specific brain structures are not needed for the perception and understanding of our world' (Mayr 1997: 76); 'What would be more adaptive for a learning and thinking animal: genes selected for aggression, spite, and xenophobia; or selection for learning rules that can generate aggression in appropriate circumstances and peacefulness in others?' (Gould 1996b: 361) – and to the social sciences:

... while both sexuality and nutrition are grounded in biological drives, these drives are extremely plastic in the human animal. ... Left to himself, man may attach himself sexually to just about any object and is perfectly capable of eating things that will kill him. Sexuality and nutrition are channeled in specific directions socially rather than biologically ...

(Berger and Luckmann 1967: 181)

Thus, one side of the controversy claims that human behaviors are specific adaptations that evolved because the behaviors were selected in the past as a means to facilitate reproduction; on the other side, human behaviors are the consequence of a general adaptation selected to maximize the probability

of survival and reproduction and whose expressions are determined by the specific socioenvironmental milieu.

A recent paradigm is 'connectionism' as articulated by Elman et al. (1998). Connectionism is a model integrating associationist models and developmental neurobiology in which genes are species-specific constraints acting in conjunction with experience and environment at all levels and throughout life. According to this model, even the visual and auditory areas of the brain are not pre-wired as such:

Current evidence suggests that there are no intrinsic, predetermined area maps in either the cortex or the thalamus; instead, both develop their area specializations as a consequence of their inputs and the temporal ('chronotropic') dynamics of neural growth. This . . . permits a considerable degree of cortical plasticity [p. 268].

These authors view plasticity as a characteristic of normal development.

Similar conclusions have been proposed, apparently independently, by Buller and Hardcastle (2000: 307):

. . . while the adult human mind/brain typically contains a degree of modularization, its 'modules' are neither genetically specified nor evolutionary adaptations. Rather, they result from the brain's developmental plasticity, which allows environmental task demands a large role in shaping the brain's information-processing structures. The brain's developmental plasticity is our fundamental psychological adaptation, and the 'modules' that result from it are adaptive responses to local conditions, not past evolutionary environments. If different individuals share common environments, however, they may develop similar 'modules,' and this process can mimic the development of genetically specified modules in the evolutionary psychologist's sense.

Although a scientific methodology required to resolve this question directly is lacking, increasing numbers of scholars from a range of disciplines are adopting connectionism or a similar paradigm as the best fit to their observations of the developing human brain (Edelman 1992; Langer 1988; Longino 1990). The assumption of massive modularity, as with the other assumptions that are similarly required by evolutionary psychology in order to allow interpretation of data to support their theories, require validation rather than blind acceptance. In the face of substantial scholarly disagreement and the lack of empirical support, the 'scientific' assumptions of evolutionary psychology become beliefs or wishes.

The purpose of the discussion above is not to demonstrate that the assumptions underlying evolutionary psychology are false, but rather that

there is serious doubt among scholars that the validity of these assumptions can be established. Critics consider such unfalsifiable and questionable assumptions to be one, or perhaps the primary, difficulty in accepting evolutionary psychology: ‘ . . . theories that are said to be objectionable because they contain “unobservable” or “redundant” quantities are simply theories containing central assumptions that cannot be tested from recognized kinds of evidence . . . ’ (Glymour 1980: 143). According to Coyne (2000) this is not because they are bad scientists but because their discipline places limitations on the type of available data: ‘Unlike bones, behavior does not fossilize, and understanding its evolution often involves concocting stories that sound plausible but are hard to test’ (p. 27). When Coyne labels evolutionary psychology as not scientific, he is doing so within the context of the social sciences – a discipline whose shared methodology requires that theories, assumptions, and hypotheses be falsifiable. Those evolutionary psychologists whose scholarly training is in the disciplines of evolutionary biology or anthropology adhere to their discipline’s paradigmatic methodologies and rules of logic. Conflict is, perhaps, inevitable.

Epistemological issues

Ultimate and proximate causes

Evolutionary psychology is interdisciplinary, incorporating aspects of biology, psychology, and anthropology. While interdisciplinary endeavors are, in general, applauded as being creative, innovative, and, often, ground breaking, conflicts often emerge as a consequence of methodological and inferential differences among individuals whose scholarly traditions vary. The controversial nature evolutionary psychology may be due, in part, to differences among those who identify with the new paradigm and members of traditional disciplines in their definition and interpretation of the ‘scientific method.’

Commenting on two of the relevant disciplines – biology and psychology – Cacioppo, Berntson, Sheridan, and McClintock (2000) observe: ‘The differences in levels of analysis have resulted in distinct histories, research traditions, and technical demands . . . ’ (p. 829). Traditionally, psychology has relied on logical empiricism as the basis for their research endeavors. This requires that theories be provisionally accepted while being evaluated through repeated empirical testing; the results are interpreted as evidence for provisional acceptance or rejection as well as to inform modifications of the theory. In contrast, evolutionary biology relies on the historical narrative which, according to Mayr (1997), ‘ . . . is perhaps the only scientifically and philosophically valid approach in the explanation of unique occurrences’ (p. 64).

Because psychologists have been concerned, not with unique occurrences, but rather with accurately predicting common behaviors, they have not accepted the historical narrative as a legitimate methodology in their own discipline. For example, in Thornhill and Thornhill (1992), the authors presented their theory of the 'rape-adaptation hypothesis' as a historical narrative and, assuming the truth of their narrative, they predicted a variety of present-day social consequences. Neither the theory nor any of the predictions were empirically tested. Research traditions in psychology would label this work as speculative and, perhaps, interesting but not completed, publishable research. This is not to accuse the Thornhills of being inferior researchers but of expecting those grounded in a different methodology to accept their practices and conclusions. Traditional psychologists may accept historical-narrative as a valid methodology when true experiments cannot be conducted such as in studying the small group process in ancestral hunting-gathering groups 50,000 years ago. However, data appropriate to the study of the associations between present-day male sexuality and rape are available. Consequently, the traditional methodology of psychology seems more powerful and rigorous than does historical narrative for studying present-day human behaviors.

Historical narratives as constructed by evolutionary biologists require descriptions of the 'environment of evolutionary adaptedness' (EEA). For humans, the EEA is assumed to be the Pleistocene era. To illustrate, Kurzban and Leary (2001) describe an EEA that could have yielded reciprocal altruism: '... if the successful hunter gives the other individual a share of the kill and the other individual returns the favor at a later time when he or she has had a lucky hunt, both are better off' (p. 192). Similarly, Wright (1994: 391) describes an EEA that could have yielded a predisposition for men to rape:

... rape or abduction of women was once a common feature of war
 ... the rewards were large enough, in Darwinian terms, to justify
 substantial risk ... it is likely that the men who demonstrated the
 most valor during war were rewarded most richly. [Rape] ... is
 the product of mental organs that once served to maximize inclusive
 fitness ...

Hypotheses, such as these, are supported (or not) by bits and pieces of anthropological and archaeological records, but they are not amenable to empirical verification or falsification.

In spite of dramatic epistemological differences, psychologists and biologists have traditionally viewed one another's work with respect. Conflicts seemed to have emerged when evolutionary psychologists began to utilize current empirical data as support for historical narrative. In Buss's

(1989) 'Sex differences in human mate preferences: evolutionary hypotheses tested in 37 cultures,' he predicted that women would select mates based on their real or potential resources (money, property, status) whereas men would select mates based on their reproductive potential. In general, his predictions were supported. These are interesting and valuable data which describe current conditions in various cultures. The controversy arose when these data were interpreted as clear evidence of historical adaptations. Eagly and Wood (1999) analyzed the same data but in a manner designed to test the hypothesis that sex differences in mate preferences resulted from women's and men's social position in the economical and political superstructure. The results of their analyses supported their hypothesis. One difference between the two paradigms – one of considerable appeal to social scientists – is that the social structure model, but not the evolutionary model, relies on assumptions that can be tested. For example, the social structure model assumes that sex differences in mate selection would lessen as cultural equality between the genders is approached. In contrast, Buss assumes the presence of particular contingencies in ancient cultures – cultures that are no longer available for direct study.

The evolutionary and social explanations of Buss's cross-cultural data could be conceptualized as identifying differing causal phenomena – ultimate and proximate, respectively. Social scientists are typically concerned with proximate causes (e.g., a man rapes because he has been raised in a patriarchal culture) whereas evolutionary biologists are typically concerned with ultimate causes (e.g., the cause of a patriarchal culture) (Jones 2000). 'The determination of proximate causations is usually facilitated by experimentation, of ultimate causations by inference from historical narratives' (Mayr 1997: 119).

The search for proximate determinants of behavior has been a primary focus of social scientists, particularly psychologists, for over a century. Although some researchers have sought to understand the neuroanatomical and neurophysiological bases of learning, the majority of learning researchers have focused on describing the contextual variables that influence the speed, strength, and persistence of learned behavior. This emphasis has been intentional:

The hypothetical nature of causative entities is exactly the reason that B.F. Skinner elected a different model of explanation – one that did not constrain him to go searching for hidden hypothetical entities but that instead allowed him to develop a descriptive science that related inputs to outputs very directly.

(Hendrick 1995: 48)

In contrast, ' . . . ultimate explanations have to do with why particular

proximate mechanisms exist' (Thornhill and Palmer 2000a: 4). According to these authors, evolution by natural selection is an ultimate causation that requires explication before we can fully understand human behavior. While learning theory is admittedly a theory of proximate causation, the predictive advantage of ultimate causation is unclear. (This topic is discussed further below under 'Redundancy'.)

Epistemological diversity

Philosophers of science make a distinction between what we know and how we know it. Ontology refers to what we know or the manner in which we define the nature of reality. Epistemology refers to the method of knowing. Epistemology encompasses the focus of analysis (e.g., organisms, cells, ecosystems), the method of study (e.g., observation, experimentation), the methods of evaluation (e.g., statistics, interpretation), the quantity and quality of evidence required for definitive conclusions, and the standard for certainty. Typically, epistemologies vary among academic disciplines. For example, if one wishes to study why women live longer than do men in Western societies, psychologists may study gender differences in levels of lifetime stress, sociologists may study health consequences of gender-related roles, physiologists may study long-term health benefits and risks of sex hormones, and evolutionary psychologists may study health benefits and risks of characteristics likely to facilitate the reproduction of offspring. Is the variation in epistemology competitive, contradictory, confusing or complementary? Is the goal of science to reduce all disciplines to one level and focus of analysis, to one 'correct' way to do science, and to one truth? Or is the goal of science to maintain diversity in epistemology placing value on all levels and types of information? The answer is a major source of conflict between evolutionary psychologists and their critics.

Historically, a variety of views of reality have peacefully co-existed side-by-side. There is nothing essentially contradictory in one individual's describing a disagreement between friends in terms of autonomic nervous system activity while another's explanatory model centers on the role of friendship in society. The outcomes describe different aspects of the same situation – they could both be true, relevant, and valid and, together, contribute to an overall understanding of nature. Of course, there have been and continue to be disagreements among and within disciplines, particularly if their conclusions contradict one another. However, recognition by most scholars that the differences are due more to diversity in methodology and levels of observation and analysis than correct and incorrect ways to do science has limited and minimized the intensity of disagreement. Furthermore, scientists often appreciate the intellectual challenge and stimulation that emerges from other disciplines.

Science philosopher, Longino (1990) claims paradigmatic diversity is crucial in maintaining the goals of science. She notes

The dichotomy in . . . approaches should be seen not so much as a contradiction to be resolved in favor of one or the other position, so much as reflective of a tension within science itself between its knowledge-extending mission and its critical mission [p. 34].

Similarly, Rose (1997) emphasizes the importance of diversity, within and across disciplines, as a necessary precursor to progress: ‘. . . we require epistemological diversity in order to understand the ontological unity of our world’ (p. 296); ‘. . . levels are fundamentally irreducible; ecology cannot be reduced to genetics, nor biochemistry to chemistry . . . the levels are epistemological, relating to different ways of knowing the world, each in turn the contingent product of its own discipline’s history’ (p. 305).

In contrast, adherents of evolutionary psychology often insist that their paradigm is the only legitimate one for understanding and studying human behavior. The theoretical predecessor of evolutionary psychology, sociobiology, was initially introduced by E.O. Wilson in the 1970s. Recently, ‘. . . Wilson . . . crystallized this view when he called for concilience that will reduce all knowledges to one epistemological unity for understanding ourselves and the world around us’ (Porter 2000: 78). This view has been adopted by evolutionary psychologists. Specifically, Thornhill and Palmer (2000a) predict, ‘. . . efforts [of evolutionary psychologists] will eventually establish the evolutionary approach as *the* paradigm for the social sciences’ (p. xii, emphasis added). These authors, in a later article, (2000b) claim that the choice of scientific paradigms is limited to politics or evolutionary psychology and conclude, ‘. . . we sincerely hope that truth will prevail’ (p. 36).

Psychology has been and is characterized by a diversity of paradigms. Major academic departments of psychology boast of research training in clinical psychology, social psychology, physiological psychology, learning, memory, and cognitive neuroscience. Adding evolutionary psychology to this list is unlikely to be viewed with hostility or argument. Replacing this list with only evolutionary psychology – the apparent goal of the paradigm’s advocates – would conflict with many scientists’ advocacy of epistemological diversity. Coyne (2000) has characterized the unitary epistemology advocated by evolutionary psychology as the ‘. . . scientific equivalent of megalomania’ (p. 27).

Problematic methodologies of evolutionary psychology

Validity of design and procedures

The three disciplines underlying evolutionary psychology – biology, anthropology, and psychology – do not share common methodologies, data sources, or logic structures. Consequently, an individual trained to do research in one discipline does not necessarily understand or comprehend the methodology of the other disciplines. Perhaps this lack of familiarity with adopted methodologies explains why much of the research in evolutionary psychology suffers from procedural flaws that preclude adequate evaluation of the basic paradigm. To illustrate, below is a critique of two studies on rape published by the Thornhills (Thornhill and Thornhill 1990a, 1990b).

These studies were based on one sample which consisted of 790 victims of attempted or completed rape between the ages of 2 months and 88 years in Pennsylvania. The goal of the studies was to provide evidence that the motivation of rape is to enhance reproductive success. Consistent with this goal, participants were divided into three groups on the basis of age: 2 months to 11 years (pre-reproductive), 12 to 44 years (reproductive), and 45 to 88 (post-reproductive). All of those who agreed to participate (approximately half of those contacted) were interviewed within five days of the assault. Caretakers provided answers for very young victims. 'Psychological pain' was the dependent construct and was operationalized as (a) fear of being out on the street alone; (b) fear of being home alone; (c) change in social activities; (d) change in eating habits; (e) change in sleeping habits; (f) frequency of nightmares; (g) change in heterosexual relationships (non-sexual relations with men); (h) change in negative feelings toward known men; (i) change in negative feelings toward unknown men; (j) change in relations with husband/boyfriend; (k) change in sexual relations with partner; (l) insecurities concerning sexual attractiveness; (m) change in relations with family (not husband).

The first difficulty in accepting these data for the stated purpose is that they were collected within five days of the rape. The psychological consequences of severe trauma often do not manifest for weeks or months after the trauma; indeed, post-traumatic stress syndrome, a frequent consequence of sexual assault, is defined as having an onset months after the event. Furthermore, the psychological literature is replete with research documenting the role of childhood sexual abuse in the development of adult psychological disorders such as borderline personality disorder and chronic depression. The second difficulty in accepting these data as representative of the consequences of rape is that they are based on those who were alive and sufficiently physically intact to be questioned five days post-trauma.

Automatically eliminated from the sample are those women who were killed during or after the rape and those women whose injuries prevented them from participating. Thus, the sample is unquestionably biased towards victims of less violent rapes.

The third criticism of these data is that most of the items of psychological distress are inappropriate for young children. The authors note that they did not include (j) change in relations with husband/boyfriend and (k) change in sexual relations with partner in the data for the pre-reproductive group. However, they did assess (a) fear of being on the street alone, (b) fear of being home alone, and (l) insecurities concerning sexual attractiveness in this age group. These data were obviously invalid indicators of psychological distress in children who are never on the street or at home alone and who certainly do not worry about being sexually attractive.

In the first study (Thornhill and Thornhill 1990a), the authors proposed that psychological pain in response to rape is an evolved adaptation; that is, rape reduces a woman's reproductive fitness because of (a) possible injuries associated with the rape, (b) the absence of choice in selecting partners with good genes, (c) the loss of sexual bribery to persuade men to invest in their offspring, and (d) the potential loss of the partner's resources if the partner suspects collusion on the part of the victim. The authors hypothesized that reproductive-aged women had the most to lose and would, therefore, report the most psychological pain. The three groups were compared on the eleven variables common to all three groups. According to their tabled data, for the three variables, fear of being home alone, change in social activities, and insecurity about sexual attractiveness, the post-reproductive women reported the greatest negative change and the largest pair-wise group differences were between the pre- and post-reproductive groups. Yet the authors reported that ten of the eleven variables yielded significant results supporting their hypothesis and that, in all but two cases, the '... statistical significance is most influenced by the magnitude of difference between prereproductive girls and reproductive-aged women' (1990: 164). Their narrative and data as presented noticeably disagree. In addition, although the indicators of psychological pain clearly underestimated the trauma to children for the reasons stated above, the authors concluded that pre-reproductive girls are relatively non-traumatized by sexual abuse.

The authors hypothesized that married women would experience more psychological pain than non-married women because of their risk of losing resource support from their partners. Although the authors acknowledge that they do not have the necessary data to test this hypothesis (i.e., they included separated women in the married category because they did not know if the victims lived with their husbands; they included women living with non-married partners as single because they did not have information on their living arrangements), they proceeded. The results indicated that six

of the thirteen variables were significant in the predicted direction. However, the variables most relevant to this hypothesis – change in relations with husband/boyfriend, change in sexual relations with partner, and insecurities about sexual attractiveness – were not significant. The authors did not address this but claimed that the results supported their hypothesis.

Finally, the authors hypothesized that reproductive more than non-reproductive, reproductive more than pre- and post-reproductive, and married more than unmarried women would be more likely to feel that their futures would be affected by the rape. While the authors stated that the data supported these hypotheses, the data they presented did not. A greater percentage of reproductive women, compared to non-reproductive women, and a greater percentage of married women, compared to unmarried women, reported that their futures would not be affected. Furthermore, the study was not designed to eliminate other explanations. For example, reproductive-aged women might be more concerned about their future because they could be pregnant.

Another study in this series (Thornhill and Thornhill 1990b) examined the correlates of force and violence accompanying the rape. Each of the 790 rapes was scored for the presence or absence of seven variables: coercion (verbal threats), intimidation (threatening physical gestures but no weapon), intimidation with an object (e.g., gun, stick), roughness, non-brutal beating, brutal beating, and choking/gagging. The authors do not address the meaninglessness of assessing verbal coercion of a year-old child or the intimidation of a 2-month-old baby with a gun. The authors also do not acknowledge that their sample is not representative of the population of rape victims with regard to force/violence parameters because interviews of victims who were severely injured would not have been possible within five days of the rape and because rape victims who experienced the most severe violence – murder – were excluded from the sample.

The authors hypothesized that reproductive-aged women would be subjected to more violence than non-reproductive-aged women because these women are more desirable to the rapist who, it is assumed, is motivated by his desire to reproduce. They further hypothesized that reproductive-aged, compared to non-reproductive-aged, women have more to lose (i.e., the trust of their partners, their choice of paternity) by being raped than do non-reproductive women, so they will offer more resistance. Although four of seven of the variables were significant in chi-square analyses, the interpretation of these results are unclear. First, the analyses are not statistically or conceptually independent – the more severe categories of violence subsume all lesser ones; i.e., a victim who had been brutally beaten by a rapist would undoubtedly also have experienced intimidation, roughness, and non-brutal beating. Second, the most straightforward interpretation of these data – one not considered by the authors – is that women aged

12–44 are stronger and in better shape than children and older women so would be capable of greater resistance and, therefore, more likely to experience violence.

The authors acknowledged that the higher rate of force/violence among reproductive-aged women, compared to non-reproductive-aged women could account for the higher degree of psychological pain experienced by this group. To address this potential confound, they re-analyzed the three groups (pre- and post-reproductive, reproductive) on ten of the psychological pain variables for those victims in whom force and violence were absent. Unfortunately, their analyses did not test this. They performed seven series of ten analyses each (i.e., seventy chi-square analyses). Those victims who had had a particular force/violence experience were eliminated from each of seven series in which the ten psychological pain variables were analyzed. For example, one series of ten chi-squares eliminated those who had experienced coercion but included those who had experienced any other type of force/violence; another eliminated those who had experienced choking/gagging but included those who had experienced any other type of force/violence. Despite the authors' stated intention, in none of the analyses did the authors eliminate victims who had experienced any type of force/violence. Not surprisingly, the results were similar to those using the entire sample. The authors inappropriately concluded that reproductive-aged women experienced more psychological pain, *even in the absence of force/violence*, than did the non-reproductive-aged women.

Finally, the authors predicted that rape victims' psychological pain would be inversely proportional to their physical injuries because the injuries, as proof to the partner that the victims had been unwilling, would ameliorate the psychological pain. In other words, the authors predicted that rape victims who were also victims of violence (violence other than the rape) would experience less psychological distress than those who had been raped in the absence of violence. They compared reproductive-aged victims who had experienced brutal beating to those who had not experienced brutal beating on the thirteen psychological pain variables. They did not include other force/violence variables because '... using all violence variables could confuse the results ...' (1990b: 314). Thus, although they stated that they were comparing victims who had experienced no violence with those who had, they were, in fact, comparing those who had experienced brutal beating with those who had not; those who had not experienced brutal beating included all other violence categories. Two of the thirteen reached statistical significance but the differences were in the direction opposite to that predicted. They then repeated these analyses with only married rape victims. They found two of the thirteen variables to be significant. Yet, they concluded 'Married reproductive-aged rape victims ... seem to be less psychologically traumatized when the rape includes violence' (p. 318).

Clearly, the analyses, and therefore the results, were not a test of their hypothesis and were interpreted inappropriately.

These studies illustrate the major difficulties that many psychologists encounter when attempting to evaluate the validity of the evolutionary psychology paradigm. The research is overwhelmed with methodological, statistical, and logical errors. Unfortunately, the inappropriate and unsupported conclusions reached in the Thornhills' studies are perpetuated unchallenged because few readers of later works have read the original research. In Thornhill and Palmer (2000a), the authors concluded, based on the studies described above, that reproductive-aged rape victims experience more psychological pain than pre- or post-reproductive-aged women (p. 90), the psychological trauma of pre-reproductive rape victims is relatively low (p. 90), married women are more traumatized by rape than unmarried women (p. 90), and reproductive-aged rape victims who had not experienced violence reported less psychological pain than those who did experience violence (p. 93). None of these conclusions is supported by data that were valid, properly analyzed, and appropriately interpreted. As Coyne (2000) has noted, 'It is not science, it is advocacy' (p. 31).

The authors of the studies described above are biologists or anthropologists whose disciplinary methodologies differ significantly from those of psychologists. Research psychologists are highly, perhaps overly, trained in the importance of establishing validity and reliability of measures and the proper use of and interpretation of statistical techniques. Consequently, these studies, characterized by poor measures and incorrect use of statistical methods, would not be convincing – not because of ideology – but because of poor science. Kitzing (1998) has noted that, 'Although other disciplines recognise psychology's commitment to empirical research in criticising the discipline, it seems they are often less ready to seek out psychologists' expertise when . . . they decide to conduct an empirical study or two of their own' (p. 205).

Not only has Thornhill misrepresented his own research, but he has misrepresented the research of others as well. Herz and Cahill (1997) hypothesized that women select sexual partners on the basis of olfactory stimuli because these stimuli indicate genetic quality. They predicted that ' . . . olfactory stimuli would be relatively more important for female mate choice and sexual interest than for male mate choice and sexual interest' (p. 277). They developed a questionnaire to measure the importance of sight, hearing, touch, and smell to the individual's behavior in the following circumstances: lover choice, arousal during sexual activity, arousal during non-sexual activity. For choice of lover, women, on average, gave higher ratings for smell than other senses while men rated smell and looks equally high. The actual question, however, was 'How someone smells can make a big difference to me.' This could well mean that women reject male lovers

who do not bathe frequently rather than that women select males who smell of high genetic quality. Regarding sensory cues during sexual activity, males rated sight and touch the most highly whereas women rated touch most highly and body smells as the least important. Illogically, the authors concluded that 'Our survey results show that female sexual interest is more affected by body odor than any other sensory stimulus' (p. 281). Thornhill and Gangestad (1999) interpreted this research as: 'Herz and Cahill found that women report olfactory information to be the single most important sensory input in mate selection and sexual arousal . . . ' (p. 176).

In the introduction to the study by Thornhill and Gangestad (1999), the authors stated: ' . . . women's sexual interest . . . changes across the menstrual cycle. Their sexual desire . . . appear[s] to peak during the . . . interval during which fertility reaches a maximum' (p. 176). As support, these authors cited Regan (1996). However, Regan's conclusion derived from her extensive review of this research area is that some women experience no cyclic peak of sexual interest, some experience two peaks of sexual interest, and some experience one peak. Those who report one peak do so during ovulation, the mid-follicular phase, or the late luteal phase. Again, the scholarship of others was not accurately reported.

While our ideal science relies on the integration and synthesis of information from all scholars in all disciplines across all time, this ideal, although impossible to achieve, provides clear goals – one that demands accuracy and adherence to scientific standards. The frequent misuse, misinterpretation, and neglect of previous research in areas clearly relevant to the topic of study leaves readers of evolutionary psychology publications feeling distrustful and skeptical. Few consumers of the research literature on human behavior have the time or desire to check the accuracy and validity of the citations upon which theory is built and support massed. Evolutionary psychologists lament that they are denied credibility for political and ideological reasons. Perhaps they are denied credibility for scientific reasons.

Contradictions and inconsistencies

According to evolutionary psychologists, the genetic configurations of those individuals in the Pleistocene era who had the greatest reproductive success were preserved in human evolution through natural selection, and these same genetic configurations or psychological adaptations are assumed to underlie human social behavior today. Clearly, the historical points of the theory are not amenable to empirical verification. Nevertheless, current data are available to test predictions now emerging from the historical narratives. Unfortunately, the published research by evolutionary psychologists designed to test predictions of current behavior is inherently contradictory in several ways.

The evolutionary psychology theory of rape proposes that during our evolutionary history, men increased their reproductive fitness (i.e., produced more offspring) by rape. Consequently, a psychological predisposition to rape was selected and influences men's behavior today. Although there is no way to evaluate the validity of the historical narrative, researchers have determined that, in current time, the hypothesis is not supported; that is, rapists do not produce more offspring than non-rapists (Baron 1985). Nevertheless, Thornhill and Palmer (2000a) interpret those data consistent with their theory – the preponderance of rape victims are within the age span of fertility – as supporting their theory while dismissing those data contradicting their theory – rape does not increase men's reproductive success as irrelevant: 'Adaptations do not necessarily increase reproductive success in current environments if those environments differ significantly from past environments' (p. 7). This is not hypothesis testing. Instead, the data are tested and then labeled as valid or invalid on the basis of whether or not they support the researcher's prediction.

According to Buss (1995a), specific psychological adaptations selected in our evolutionary history motivate men to select mates on the basis of their fertility and women to select mates on the basis of their ability to provide resources for the offspring. He presents cross-cultural data as a test of his theory; some of the data are supportive, others not. Again, the author accepts as valid the supportive data and dismisses the contradictory data. Buss concludes that these psychological mechanisms

... are activated by current manifestations of ancestral cues, such as the smell of cooked meat, the sight of a particular landscape painting, or a conversation with a person showing healthy skin and cues to kindness. These adaptations are executed in real time in current environments, regardless of whether or not they currently lead to fitness or reproductive success [p. 10].

In defense of these arguments, Conway and Schaller (2002) claim that evolutionary psychology is not the only theoretical perspective to rely on historical origins that are not amenable to verification. They suggest that a social role theory of gender differences posits early divisions of labor as historical background. The salient distinction between the two perspectives, however, is that observed gender differences are taken as support or lack of support for social role theory; i.e., the validity of social role theory is being tested. In contrast, observed gender differences that do not support predictions derived from evolutionary psychology are not taken as evidence against the theory; data that are not supportive are explained away by positing a difference between past and current environments. The theory is assumed to be true, the theory is not tested.

Creating historical narratives based on anthropological and archaeological data is appropriate science for evolutionary biologists (Mayr 1997). The difficulty comes when these narratives are assumed to be useful in understanding human behavior today or solving today's problems. However one wishes to define science and scientific methodology, an essential criterion common to all is basic consistency, rather than convenience, in identifying the information that serves as evidence. Consistency in the evolutionary psychology paradigm demands that current data are relevant to the hypothesis or not. Apparently, the theory as presented and evaluated cannot be tested in the past because we cannot observe the past and cannot be tested in the present because the present may not be relevant. Collecting, analyzing, interpreting, and publishing data that may or may not be useful in evaluating a theory or hypothesis do not advance our understanding.

A second source of contradiction in evolutionary psychology is the utilization versus dismissal of data from species other than human. The salience of data collected from or observed in non-human species in understanding the human species has been a major source of controversy throughout the history of numerous disciplines, including psychology. Resolution of this issue seems to vary with the discipline, the subject, and the researcher. Nevertheless, a reasonable expectation is that a particular researcher be consistent in her/his use of these data.

Thornhill (1999) accepts behavior of other species as relevant when acceptance supports his thesis and rejects it when it does not. He claims that the '... notion that the behavior of non-human primates contains the data about evolved human psychology and behavior' (p. 140) is erroneous, and '... the human psychological adaptation responsible for rape can be fully demonstrated only by the study of humans ...' (pp. 140–1). Yet, three pages later, the same author, in arguing the existence of a human psychological adaptation responsible for rape, states,

Direct selection for rape in non-human species is known to have given rise to rape-specific adaptation. This is seen in the abdominal clamp of male scorpion flies ... this organ is functionally designed for rape. ... In fact, rape-specific morphological adaptations are known in other kinds of male insects as well [pp. 144–5].

In their 1992 article, Thornhill and Thornhill devote considerable space to describing copulation behavior in insects as relevant to their evolutionary theory of rape. In an invited commentary to this article, Brownmiller and Mehrhof (1992) note that, of the non-human primates, only among orangutans has forced copulation been observed and no reported case has resulted in pregnancy. In response, the Thornhills state: 'Orangutans and people are the end products of different evolutionary lines' (p. 415) and

'Orangutans do not give insights into the selective forces that were acting during the evolution of *H. sapiens*' (p. 416). Yet, on the same page, the authors claim the sexual behavior of the male scorpionfly to be evidence for their theory.

In their most recent publication, Thornhill and Palmer (2000b) continue in a similar vein. After describing the male scorpionfly's rape clamp, the authors note that because human males have no clamp, 'One must therefore look to the male psyche – to a potential mental rape organ – to discover the special-purpose adaptation of the human male to rape' (p. 33). They then comment that the human's males 'ability' to '... maintain sexual arousal and copulate with unwilling women' (p. 33) is not common to the males of all animal species. Therefore, 'Its existence in human males could signal that they have evolved psychological mechanisms that specifically enable them to engage in forced copulation ...' (p. 34). In the first instance, the authors use the presence of an insect behavior as evidence for their paradigm whereas, in the second instance, the authors claim the absence of a behavior in non-humans as evidence for a specific adaptation in humans. A consistent and logical scientific method is not apparent.

A fundamental criticism of generalizing from non-human to human species is the overwhelming diversity of behavior found in non-human species. An analogue of any human behavior that one wishes to claim is 'natural' in humans can be found in some other species. Scorpionflies with their rape clamp and chimpanzees who engage in aggression with other males over sexual access to females are obvious favorites among those who claim rape and male aggression to be psychological adaptations in the human male. Bonobos, on the other hand, whose culture is characterized by female centeredness, non-reproductive sex, unknown paternity, cooperation, homosexuality, rare physical violence, the capacity for empathy and care, and flexible status (and whose genetic similarity to humans matches that of chimps) are not cited as a 'relevant' species. Interestingly, DeWaal and Lanting (1997) comment: 'Had bonobos been known earlier, reconstructions of human evolution might have emphasized sexual relations, equality between males and females, and the origin of the family, instead of war, hunting, tool technology, and other masculine fortes' (p. 2). As an interesting aside, neither proponent nor critic of evolutionary psychology has claimed as salient a finding of Darwin's eight-year study of barnacles. The female barnacle "'... had two little pockets, in each of which she kept a little husband'" (Darwin, quoted in Browne 1995: 477).

Redundancy

Evolutionary psychologists tend to articulate their paradigm, theories and studies in contradiction to, and as ultimately replacing, social science

perspectives on behavior. They have supposed that the lack of acceptance of their paradigm by mainstream social scientists to be due, in part, to the skeptics' ignorance of evolutionary theory. Indeed, evolutionary psychologists often advocate for their paradigm with intense criticism of learning theory – criticism clearly reflecting a basic unfamiliarity with the target. Thornhill and Palmer (2000a: 124) claimed that

... learning theory has many similarities to a religion ... it proposes a supernatural (or at least a 'superorganic') 'creator' of all human behavior: culture. Another similarity to religion is that this 'creator' is often alleged to work in a mysterious way ('learning') through arbitrary environmental experiences to make human brains and thus human behavior.

They then proceeded to reduce a century of theoretical development and empirical validation in the area of learning to a single variable – instruction. They suggested that if learning theory were valid, one need only instruct others to behave in desirable ways: '... competitors could quickly reduce the reproductive success of such individuals to zero by telling them not to be sexually attracted to desirable members of the opposite sex' (p. 131). The authors argued, instead, that cost–benefit analyses would yield accurate predictions of behavior seemingly unaware that their 'costs and benefits' lie at the very foundation of learning theory and are known as 'reinforcement and punishment.'

The criticisms of learning theory are quite simply misconceived and based on inadequate knowledge. For example, Thornhill and Thornhill (1992) state: 'According to both [social learning theorists and feminist theorists], rape is primarily or solely caused by arbitrary differences in the way men and women are socialized about heterosexual conduct' (p. 364). The dictionary definition of 'arbitrary' is 'not governed by principle,' and no social scientist or feminist would claim that the learning associated with socialization is arbitrary. Apparently, evolutionary psychologists define 'arbitrary' as 'not genetic.' Nevertheless, learning theorists do not deny genetic influences, nor do they deny biological substrates of behavior. A genetic, biological need is assumed and learning dictates the means and goals of that need. For example, all organisms are motivated to sustain life with nutrients but food choice, table manners, and methods of acquisition are learned.

The essence of learning theory is that behavior is determined by the consequences of one's actions. If a particular behavior results in the reduction or termination of danger, threat, or distress (negative reinforcement) or if a behavior results in pleasure, the gratification of needs, or the enhancement of enjoyment (positive reinforcement), then the organism is

likely to repeat the behavior. If the behavior more-or-less consistently yields these consequences, the behavior will become part of the individual's behavioral repertoire; i.e., a high probability that the individual will exhibit this behavior in the future. Similarly, if a behavior results in threat, injury, or distress (punishment), the individual is likely to eliminate or reduce the frequency of this behavior in the future. Evolutionary psychologists theorize the identical end behavior but simply apply different labels – costs for punishment and benefits for reinforcement. The primary difference lies in the hypothesized underlying mechanism: learning theorists attribute these behavioral probabilities to hypothetical brain structures called the reward and punishment areas, whereas evolutionary psychologists attribute these to hypothetical specialized adaptations emerging in evolutionary history because they were selected to generate the greatest number of offspring. Although evolutionary psychologists claim that knowledge of ultimate causation is necessary to accurately predict the consequences of proximate causes, the advantage is not apparent as the proximate predictions of evolutionary psychology mimic the predictions of learning theory.

Evolutionary psychologist Nesse (2000), for instance, notes that depression is common in people pursuing unreachable goals: 'The simplest untested prediction is that depression should be common in people who are unable to disengage from unreachable goals' (p. 18). Although presented by Nesse as emerging from evolutionary theory, this hypothesis is the cornerstone of, perhaps, the most widely researched theory of depression popularly known as 'learned helplessness.' Since the research spans the last three decades, the label 'untested' is inaccurate and misleading.

Thornhill and Palmer (2000a) describe what they refer to as '... an explicit evolutionary developmental model of men's sexual coercion' (p. 69). 'The developmental experiences felt to be most important are reduced parental investment (resulting from poverty or from the absence of the father) and a rearing environment in which social relationships in general are not enduring or committed' (pp. 68–9). 'Men emerge from this developmental background with a perception of reduced ability to invest in women, an expectation of brief sexual relationships with women, a reduced ability to form enduring relationships, a coercive sexual attitude toward women, and an acceptance of aggression as a tactic for obtaining desired goals' (p. 69). This is a clear and accurate description of the learning history and developmental context of a potential rapist as researched and articulated by the very social scientists that the authors dismiss. Similarly, Thornhill (1999) notes that there is '... anecdotal evidence that men pay attention to costs when they rape' (p. 145). And '... many men will rape when the perceived benefits exceed the perceived costs' (p. 146). Indeed, there is 100 years of learning-based experimental evidence that all species pay attention to costs and benefits of all behavior.

Buss is probably best known for his research on sex differences in human mate preferences. An evolutionary perspective predicts that women value wealth in a man in order to ensure her children's needs are met, whereas men value fertility in a woman because he wishes to maximize his number of offspring. Buss's 'biological' perspective contrasts with that of Eagley and Wood (1999) whose social science perspective suggests that Buss's predictions would hold only in a culture where men monopolize the resources and power. While the two theories may appear incompatible, Buss (1989) notes that his ' . . . prediction should apply only in contexts where resources can be accrued, monopolized, and defended, where males tend to control such resources, and where male variance in resource acquisition is sufficiently high . . . ' (p. 2); i.e., in capitalistic, patriarchal societies. The reasons may differ, but the predictions do not. As noted by Conway and Schaller (2002), 'It seems clear that people are unlikely to be excited by evolutionary psychological theories that appear merely to explain previously observed phenomenon or to offer alternative conceptual structures within which to locate previously articulated hypotheses' (p. 163).

Buss, Larsen, Westen, and Semmelroth (1992) predicted and found that most men reported greater distress over sexual infidelity, whereas most women reported greater distress over emotional attachment of their partner to another woman. These results, the authors claim, support an evolutionary perspective. On the other hand, these results are readily interpretable in a learning context; i.e., individuals learn the contingencies that exist in their culture and behave accordingly. Our culturally imposed sex roles predict that men's emotional attachments and women's sexual attachments determine loyalty to a partner. Similarly, Thornhill and Thornhill (1992) note that ' . . . the pornographic magazine and movie business caters to the "average" man and not just men with "anomalous" sexual preferences. This implies that many men are sexually motivated by vicariously assuming physical control over their sexual partners while fantasizing with pornographic material' (p. 373). The learning theorist would interpret the identical information as evidence of learning in a culture in which masturbating to pornographic material is a common experience for developing men.

Evolutionary theory as an ultimate causation may or may not be accurately portrayed by current evolutionary psychologists. However, the verity of this theory is irrelevant to the accuracy of learning theory and the quality of the social science research. The two perspectives are articulated to explain distinctly different phenomena, utilize different methodologies, and, if appropriately conducted, answer different questions. Their compatibility or incompatibility is irrelevant to the validation of either. If the goal is to discover why Mary is afraid of John, the hypothesis that the fear is based on Mary's past experiences with John can be tested within the theory and methodology of learning. The hypothesis that the fear is based

on Mary's assessment of reproductive opportunities can be supported or not through historical narrative. Nevertheless, any conclusions reached in this manner need not validate or contradict the conclusions reached in the context of a learning paradigm.

Evolutionary psychologists have accused their critics within the social sciences of 'defending their turf' and 'trying to maintain their power' as reasons for their lack of enthusiasm for evolutionary psychology. I think it more likely that social scientists do not view evolutionary psychology as relevant to their turf or to their power or to their science. Accordingly, social scientists defend the considerable explanatory power of their paradigm regardless of the validity of evolutionary psychology, '... evolution and ultimate causality cannot help us understand the complexity and variation within our own and other species in many reproductive events, which are reflective of changing proximate environmental and ecological factors, and cultural realities' (Sperling and Beyene 1997: 139).

The rhetoric of scientific discourse

Although disagreement and debate have been the cornerstone of scientific challenge and creativity, evolutionary psychologists responded to their critics by removing the debate from the scientific arena. Buss (1995b) stated that psychologists reject evolutionary psychology because they are threatened by the blurring of disciplinary boundaries implied by interdisciplinary work (p. 86); La Cerra and Kurzban (1995) suggested that the evolutionary psychology paradigm threatens the status of those who have built their reputation on opposing paradigms; Thornhill and Palmer (2000a) claimed that evolutionary psychology threatens those who have achieved success with research based in the context of the 'wrong' theories, and that the evolutionary psychology paradigm threatens the ideology of 'Christians, Marxists, and New Age pagans' (p. 107). Furthermore, debate discourse favored by evolutionary psychologists has often been argumentative and incendiary. Evolutionary psychologists have accused their critics of close-mindedness (Hendrick 1995), ignorance of evolutionary theory (Buss et al. 1998), and misunderstanding (Thornhill and Palmer 2000a). In other words, evolutionary psychologists have argued for their paradigm, not from a position grounded in science, but by accusing opponents of being driven by ideology and of being misguided, misinformed, scientifically illiterate, ignorant, uninformed, and fundamentally inaccurate. Traditionally, these have not been the standard or convincing methods of persuasion within the realm of science.

Perhaps evolutionary psychologists engage in adversarial forms of discourse because they consider their critics to be politically and ideologically, rather than scientifically, motivated. Thornhill and Palmer (2000a) have

labeled all social science as feminist: 'Because the phrase "feminist psychosocial analysis" is a bit awkward, we will refer to it as "the social science explanation"' (p. 123). Since feminist social scientists believe support for their ideology to be minimal among those of their disciplines, they are, at best, amused by this claim. Nevertheless, the consequences are not amusing. Thornhill and Palmer (2000a) accuse Eleanor Smeal (President of the National Organization of Women) of 'false science.' A more accurate label would be 'not science'; Eleanor Smeal is not a scientist, nor does she claim to be, and her ideology is not meant to be argued on scientific grounds. There may, however, be method in this madness. By equating feminism and social science, the advocates of evolutionary psychology have effectively placed the controversy in the realm of politics – a realm in which their paradigm is not subjected to scientific scrutiny. The media have cooperated in this effort by pitting evolutionary psychologists against political feminists rendering the former as the only one in the debate with scientific credentials (Coyne 2000; Pozner 2000).

The methods of disagreement and the discourse of controversy popular among evolutionary psychologists can be characterized as 'absolute' or 'dichotomous' thinking. This 'either-or,' 'black-white,' 'right-wrong' mode of thinking is viewed by developmental psychologists as immature. Indeed the forms of discourse that characterize evolutionary psychology force conceptualizations into dichotomies – those who disagree are threatened or ignorant. In discussing why men and women respond differently to a woman smiling at a man, Buss (1995b) comments, 'There is only one way . . . to account for these differences in responses . . . ' (p. 83). Similarly, Thornhill and Palmer (2000a), arguing for an evolutionary view of rape, state ' . . . in the absence of an explicitly Darwinian approach, the only alternative ultimate explanations are supernatural explanations . . . ' (p. 111). All-or-nothing statements in the absence of evidence and with the obviously express purpose of persuasion are common. Masters (1995) commented that, 'All studies of personality support the view that it is heritable . . . ' (p. 66). Not only does Masters fail to support this statement with referenced research but seems to be unaware that there is probably no statement about personality that one could claim agreement by all studies. Thornhill and Palmer (2000a) argue that all evolutionists ' . . . are in agreement' (p. 20) with their view of evolution and, later in their book, ' . . . people everywhere understand sex to be something that women have and that men want' (p. 160). The rhetoric is, perhaps, appealing to the media and to the public but not to scientists.

In a recent essay, Diamond (2001) speculated on the differences and similarities between Darwin and Freud. He views both historical individuals as uniquely indispensable in the history of science in the sense that their contributions had tremendous and long-lasting impact, their genius was

multifaceted, their contributions required synthesized knowledge from a wide range of disciplines, they created new conceptual frameworks, and they were prolific writers and forceful communicators. The crux of his essay, however, is revealed in the subtitle: 'Why we revere Darwin and give Freud a hard time' (p. 20). 'Today we seem much more inclined to castigate Freud for his omissions and errors than Darwin for his' (p. 23). Diamond suggests that one of the reasons for this lay in their relations with their peers. 'While Darwin came in for severe criticism from other scientists and in turn often expressed his disagreement with their views, he responded courteously, used scientific arguments, and completely avoided personalizing disputes' (p. 23). 'Freud, on the other hand, was outstandingly ungenerous: he denied credit to others, was intolerant of rivals, hated many people, and surrounded himself with unquestioningly loyal admirers' (p. 23). Evolutionary psychologists, while revering Darwin, have apparently adopted Freud's methods of persuasion.

Ideology and politics

Sociologists distinguish internal and external factors in the development of scientific theory and in the collection and interpretation of evidence. Internal factors are data, technology, and methodology, whereas external factors are politics, ideology, values, and beliefs. The association between internal and external factors is one of reciprocity and mutual causation. External framing

... includes the economic and political logic which drives society to fund some types of research and not others, and more subtly it includes the cultural and social forces which shape our metaphors, constrain our analogies, and provide the foundations for our theories and hypothesis-making.

(Rose 1997: 70)

Evolutionary biologist Mayr (1982) notes '... the change and replacement of individual scientific theories is far less important in the history of science than the waxing and waning of the major ideologies that may influence the thinking of scientists' (p. 835).

Historically, scholars have maintained that 'good' scientists are those able to maintain an objective, ideologically-free focus, whereas 'bad' scientists allowed their beliefs and values to shape their work. Feminist scientists and sociologists are the forerunners of the postmodern movement in the social sciences – a movement that emphasizes the relative nature of all scientific theories, methodologies, interpretations, and directions (Longino 2002). Today, the increasingly accepted opinion is that ideologies, values, and past

experiences as well as the cultural, social, and political contexts inform the science of all practitioners. Those scientists who maintain the belief that only internal factors impact their science are naive.

Evolutionary psychologists readily perceive the influence of ideology in other paradigms while denying this force in their own. They claim that traditional social science research is driven by ideology rather than by science, does not conform to scientific standards, and is metaphysical. In a provocative twist of Wilson's (1999) consilience, Buss (1995b) claims that the evolutionary psychology paradigm is the appropriate context within which to understand the motivation of those who do not follow the evolutionary psychology path: '... evolutionary psychology, in principle, should be able to provide the tools to understand these forms of resistance' (p. 86). In a later article, Thornhill and Palmer (2000b) assert that the scientific community must choose between politically motivated views of the biological world and the 'truth' of evolutionary psychology.

Needless to say, examples of underlying assumptions, values, beliefs, ideologies, and training influencing all aspects of a research program are as numerous in evolutionary psychology as in any other area. A few of the more obvious instances are given here. (a) Bonobos are primates whose social sphere is female centered and female dominant. Because the idea of a female-centered culture is so foreign, and perhaps aversive, to many individuals, the bonobo culture is labeled an aberration: 'Since female mammals almost never dominate adult males of their species, it is safe to assume that bonobos started out with male dominance' (DeWaal and Lanting 1997: 138). (b) According to Buss (2000), '... humans have evolved psychological mechanisms designed to inflict cost on others, to gain advantage at the expense of others, to delight in the downfall of others, and to envy those who are more successful at achieving the goals toward which they aspire' (p. 18); not only is this author unfortunate in his choice of friends but he ignores the research from non-Western cultures in which individuals have been found to be cooperative and to denigrate their own achievements and abilities so as to not appear egotistical (Nisbett, Peng, Choi, and Norenzayan 2001). (c) The ideological orientation is, at times, obvious simply by examining vocabulary. Simpson (1995) asks '... why do some men display a *restricted* sociosexual orientation (i.e., have few sexual partners and establish long-term, committed relationships), and why do some women evince an *unrestricted* sociosexual orientation (i.e., have many sexual partners and enter short-term less committed relationships)?' (p. 73, emphasis added); the author reveals ideological influence by implying that men who have few sexual partners and women who have many require explanation. (d) Taking a rather transparent male view, Thornhill and Thornhill (1992) claim, without supporting research or references, that '... rape is not about a terrifying experience in women's

lives, but rather a men's mating strategy' (p. 380); they also argue that, in the context of rape, '... there may be an evolved intuition that women sometimes lie for their own gain' (Thornhill and Thornhill 1990a: 160) while failing to analyze the motivation to lie among men faced with a prison sentence. Thus, while accusing their critics of being motivated by ideology, evolutionary psychologists seem unaware of or unwilling to examine the impact of ideology on their own paradigm, arguments, theories, and language.

Whereas the term 'evolutionary psychology' is new, the paradigm is not. Porter (2000) has studied the role of external factors in the popularity of evolutionary explanations over the last 200 years. The '... ideological influence [of evolutionary theory] has depended upon the extent to which it has either legitimated or was legitimated by dominant social and political ideological values ...' (p. 68). Social Darwinism assumed '... that social progress could be achieved if human society could just be brave enough to ensure that nature took its true course by recognizing that biological laws determined social and individual behaviour' (p. 69). In the early twentieth century, criminality and poverty were considered hereditary traits, and several countries, including the US, adopted policies to restrict reproduction among individuals deemed to be undesirable. Prior to WWI, the US instituted compulsory sterilization of various criminal categories. After WWI, eugenic ideas aided in restricting immigration of certain nationalities. 'Widely varying ideologies of political reform in this period embraced the idea that national and economic success and social progress were linked to the control of human evolution through biological and racial engineering' (p. 72). However, in mid-twentieth-century Nazi Germany's extension of such policies to ethnic groups and political opponents caused feelings of revulsion against such biological theories.

Nevertheless, according to Porter (2000) interest re-emerged by the late 1960s. In the US, Jensen proposed that African and European Americans be educated to perform jobs according to their differential innate intelligence. In Britain, Eysenck was in favor of restricting immigration of Asians and Africans on the basis of their genetic IQ. The '... revival in the hegemonic fortunes of biological determinism ... depended upon economic, political and social transformations in the late twentieth century' (Porter 2000: 75). Dawkins promoted the selfish gene '... that replicated the neo-liberal economic philosophy of the New Right' (1976: 78) and that justified the current mores of sexuality among middle-class Westerners. The views of evolutionary psychology on rape, spousal jealousy, paternity certainty, homosexuality, and parenting are consistent with a backlash against a socially and economically successful feminist movement. Indeed, Miller (2000) justified his disapproval of the recently developed rules and regulations regarding sexual harassment on the grounds that the rules

contradict the theories of evolutionary psychology: 'Scientists are required to provide intellectual displays to young single people (through undergraduate teaching, graduate advising, and colloquium giving), but are discouraged from enjoying any sexual benefits from these displays, so are kept in a state of perpetual quasi-courtship until retirement' (p. 425).

The recent interest in genetics has culminated in the Human Genome Project – a politically correct version of biological determinism. The term 'eugenics' has been bad politics since Nazi Germany. The definition of eugenics, however, is simply the improvement of races through the control of hereditary factors. In the early twentieth century, this was achieved by restricting reproduction; in the late twentieth century, the proposed goal was to accomplish this through technological manipulation of the genes. Throughout, advocates have denied any ideological influence on the definition of 'normal,' 'improvement,' and 'health.' 'Eugenic normalcy was a normative value masquerading in the human genome project as an objective, value neutral fact. Perfect health, and by implication physiological or genetic normalcy, has never been a neutral or objective value' (Porter 2000: 76). The Human Genome Project and evolutionary psychology continue '... to deny the normative basis of belief in a way that has characterized all biological determinist argument throughout its history' (p. 79).

Opposition to eugenics has been widespread and has included public health officials, educators, philosophers, religious leaders, politicians, and scientists. When responding to their critics, evolutionary psychologists '... lump together feminist, alternative medicine, cultural constructivism, creationism, post-modernism, science studies and other evils as belonging to an effort on the part of the academic left to replace academic reason with ideology' (Fausto-Sterling 1997: 235). They are, however, blind to the role of ideology in their own science.

At a time of social and economic crises, when people are experiencing cutbacks in employment, health care, and salaries hereditarian arguments serve a special social and political function . . . hereditarian theories suggest that the victims, not the social system, are the cause of their own problems.

(Allen 1994: 166)

Applications

The ultimate worth of any psychological theory is the success of its applications to everyday life. Behaviorism has enjoyed considerable success as a method of treating anxiety and depressive disorders, not to mention as a tool in house-breaking one's canine companion. Theories originating in

social psychology have been applied successfully to educational, industrial, and family environments. Neuropsychological theories are utilized in diagnosing the location of brain damage. Applications of evolutionary psychology have been proposed but not tested.

Thornhill and Palmer (2000a) believe that their evolutionary perspective on rape has implications for the prevention, or at least the reduction, of rape behavior. They suggest that young men should receive instruction on the evolutionary reasons why men are easily aroused, why they are tempted to demand sex from an unwilling partner, and why they may interpret certain stimuli (e.g., tight clothing) as an invitation to have sex. Thornhill and Palmer argue that '... if he understands and adamantly resists his evolved desires, a young man may be able to prevent their manifestation in sexually coercive behavior' (p. 180).

There is little evidence, however, that this proposal would be effective. Although cited as *support* by Thornhill and Palmer, Quinsey, Chaplin, and Varney (1981) reported data that argue against the recommendation. In their study, a group of community men who had received permissive instructions (i.e., 'sexual arousal to unusual sexual stimuli is normal') showed significantly greater sexual arousal to rape narratives than did the community men who had not received permissive instructions; the 'permissive' group did not differ in their response to rape narratives from that of rapists. Instructing young men that a desire to rape is 'in their genes' is clearly a 'permissive' instruction. Therefore, the outcome of implementing this recommendation seems likely to have an effect opposite to that desired.

Although Thornhill and Palmer (2000a) insist that their intention in explaining rape in evolutionary terms is not to justify, rationalize, or encourage rape, these are possible consequences if their recommendations are followed. Popularizing genetic explanations for other behaviors has not resulted in a demonstrated change in the rate of the target behavior. Genetic explanations of obesity have failed to reduce obesity in individuals or in populations, genetic explanations of sex differences have not reduced gender discrimination, genetic explanations of greed and revenge have not reduced white-collar crime and gang wars. Why would we expect genetic explanations for rape to reduce rape?

Thornhill and Palmer (2000a) also provide recommendations to women on the prevention of rape. They suggest that women should be careful about their clothing, make-up, and behavior: '... they should be made aware of the costs associated with attractiveness' (p. 181). These authors claim that feminists deny that variables such as being out alone at night, dressing in provocative clothing, and dancing in a sexualized manner influence the probability of their being raped. A more careful reading of feminist views on rape, however, reveals that feminists do not deny the influence of victim

variables. They have advocated, through legal, rather than scientific, means, a culture in which a victim is not blamed for her own victimization. Feminists active in this area are not arguing from a scientific perspective but from an ideological perspective. Their goal has been to prevent victim attributes from being used as 'attenuating' factors in rape trials.

Koss (2000) notes that, in legal rape cases,

Among the actions that have been viewed as unreasonable to which comparative fault was assigned were going outside alone at night to hail a cab, walking to a car in a hotel parking lot, taking five steps inside a door before closing it, and failing to double check door or window locks. . . . In contrast, many states do not allow the failure to wear a seatbelt to be considered comparative fault in tots involving vehicular injury [p. 1335].

The goal is gender equality and, in order to achieve equality, women must be free to dress and behave as they wish without fear of sexual assault. Feminist views of rape are expressions of political goals rather than empirical hypotheses or scientific conclusions.

David Buss (2000) suggested applying the principles of evolutionary psychology to the pursuit of happiness. He promised that 'An evolutionary psychological perspective offers unique insights into some vexing barriers to achieving happiness and consequently into creating conditions for improving the quality of human life' (p. 15). These 'unique insights' consist of twelve recommendations. Ten of these routes to happiness are: (1) stay in touch with family; (2) develop deep friendships; (3) develop good communication skills; (4) belong to groups composed of individuals who will value your skills; (5) choose a mate similar to yourself; (6) live near kin; (7) promote cooperation rather than competition; (8) be sincere when making commitments; (9) strive for equality; (10) develop a reputation as a reciprocator rather than an exploiter.

I would certainly not argue that each is a good and valid recommendation. However, for at the last several decades, psychologists have extensively documented the importance of these behaviors and goals in facilitating psychological well-being; Buss has cited none of this research. Indeed, the previous research is so extensive and so consistent that most of these recommendations can be found in numerous self-help books sold at the local book shop. Two of Buss's recommendations are 'new.' One is to design 'critical tests' for friends in order to evaluate their willingness to be available when you need them; those who pass are worthy of your friendship. Buss does not mention how the one being tested may respond to having their sincerity or commitment questioned – perhaps those worthy of friendship may no longer want your friendship. The final recommendation,

and one that is certainly innovative but sadly lacking in empirical support, is to educate yourself on evolved psychological mechanisms.

An alternative

Biological and genetic bases of human behavior are central to the evolutionary psychology paradigm. Unfortunately, advocates of this paradigm, as well as those who identify with other biological and social science perspectives have contributed to considerable confusion surrounding the uses and meanings of the terms 'genetic' and 'biological.' These terms are commonly used interchangeably, implying equivalent meanings, and both are pitted against 'environment' as the primary etiology of human behavior. While the confusion between 'biological' and 'genetic' might be understandable in lay individuals, scientists should know better. Thornhill and Palmer (2000a) repeatedly confuse, and often equate, 'genetics' and 'biology': ' . . . any phenotypic trait of an organism is biologically, or evolutionarily, determined . . . ' (p. 21). Yes, any phenotypic trait of an organism is biologically determined but not necessarily evolutionarily determined. And 'The realization that culture is behavior places it clearly within the realm of biology, and hence within the explanatory realm of natural selection' (p. 25). Yes, culture and biology influence and determine one another but this does not necessitate or necessarily suggest a role for natural selection.

The biology, and, therefore, the behavior, of any organism is changed throughout life as a consequence of experiences, learning, injury, illness, diet, exercise, and climate. Cells impacted by such developmental phenomena are referred to as the 'soma.' These soma cells are sequestered from the gametes so that the gametes, the target of natural selection, are not influenced by experience and environment (Eldredge 1999). Consequently, biological similarity does not imply or mean or necessitate genetic similarity. An example might be the individual who suffered severe brain injury in an automobile accident who is unable to speak intelligibly: the individual's behavior is a consequence of biology but not of genetics. Or, consider the individual who experienced severe trauma during war combat and suffers from post-traumatic stress disorder. The individual's behavior (flashbacks, depression, dissociation) is a consequence of biology; i.e., memories that are encoded in the brain. While, 'All human behavior, at some level, is biological . . . ' (Cacioppo et al. 2000: 829), all human behavior is not necessarily the product of evolution.

Evolutionary psychologists argue that the primary emphasis on biology and evolution is unique to their paradigm. To the contrary, several major scientific paradigms with both theoretical and empirical support assume a biological substrate for all behavior and incorporate an evolutionary

focus. An explanatory model that may not only bridge the opposition between traditional social science paradigms and evolutionary psychology and replace simplistic dichotomies of nature and nurture, but also stimulate the development of dynamic and researchable models of human behavior is 'Neural Darwinism.' Developed by neuroscientist Gerald Edelman (1987), Neural Darwinism represents a synthesis of nurture and nature, of ultimate and proximate causes, and of evolutionary biology and developmental psychology. This is a dialectical paradigm in that a mutually oscillating influence between nature and nurture begins at conception and continues throughout life.

Edelman's (1987, 1992) biological theory of mind is grounded in evolutionary theory. The basis for the theory is the assumption that, at birth, the human brain consists of neuronal groups with the groupings within and between groups characterized by strong and weak connections, respectively. This initial structure is genetically determined but largely unspecified, partially redundant (identical structures with identical functions) and partially degenerate (different structures with the same function). This initial structure provides the basic building materials for Neural Darwinism, so called because of a 'somatic selection' system – a system that evolves in one lifetime and in one body. The term 'Neural Darwinism' is, perhaps, misleading as the 'selection' is not the selection underlying evolution but one that selects the most appropriate somatic structure and connections for a given developmental history, one that occurs within one lifetime and is relevant only to one individual.

During development, a neuroanatomical primary repertoire is formed which is prototypical for a given species. This species-specific neuroanatomy has enormous individual variation since the genetic code provides constraints rather than determination: the range of possible responses is limited but the structure does not come prewired. The wiring is determined by the specific signals or stimuli available to the developing and experiencing organism. A secondary repertoire emerges from the primary repertoire as the individual experiences and interacts with the world. The underlying process is one of strengthening and weakening of synaptic strength as a consequence of functional adaptation to the environment. Both the primary and secondary repertoires are selection systems in which some neuronal groups are retained and strengthened, others are destroyed or weakened. Clearly, the potential for individual variability is enormous. While the developed brain has less potential for diversification than the infant brain, the formation of both primary and secondary repertoires are intermixed and occur throughout life. Since soma constitute the repertoires, they are not subjected to or available to the evolutionary program.

Several aspects of this paradigm are unique and relevant to the purposes of this paper. First, the neuroanatomical basis for learning is described as

somatic selection which allows ‘ . . . behaviors that proved adaptive [to be] stabilized by selection within a single animal’s lifetime’ (Edelman 1992: 206). This and related epigenetic features of the model yield a highly imprecise genetic specification. The body is a continually changing biological system; the initial structure is genetically determined but unspecified. The specifics are individual and largely determined by experience in various environments and contexts. Second, because humans differ from other animals in that the acquisition of language and culture alters the somatic selection process, the developmental and experiential stimuli of the developing human occur in a social context; the selection of neuronal groups for retention and elimination as well as the strengthening and weakening of synaptic connections have social consequences. Thus, the human has, for better or worse, a socially constructed self (Edelman 1992). Rose (1997) has labeled this process autopoiesis: ‘ . . . the dialectic of specificity and plasticity during development, the dialectic through which the living organism constructs itself’ (p. 18). Similar conceptual systems have been proposed by Elman et al. (1996) and Buller and Hardcastle (2000); both are discussed briefly above. A major difference between Neural Darwinism or connectionism and evolutionary psychology is that the former has emerged within an empirical context and continues to generate impeccable empirical research. Consequently, Neural Darwinism has considerable credibility among scholars in those disciplines that rely on and demand falsifiable theories and empirical verification.

Conclusions

Evolutionary psychology is a new paradigm and an interdisciplinary one. While interdisciplinary endeavors are frequently applauded as being creative, innovative, and, often, ground breaking, this has not been the case with evolutionary psychology. Instead, the paradigm has been subjected to considerable criticism. The emerging conflicts can often be traced to variation in methodology and inferential logic among the contributing disciplines. Rather heated conflicts center on the issue of falsifiability as a prerequisite for theories, assumptions, and hypotheses to be considered ‘scientific’ – a premise adhered to by social scientists but not by biologists. In some instances, such as the theory of evolution, universal consensus may substitute for falsifiability. Nevertheless, the assumptions required to advance the evolutionary psychology paradigm are neither falsifiable nor do they command universal consensus. Strong disagreements as to the mechanism of evolution, the nature of natural selection, the unit of selection, the source of variation, and the structure of the evolved human brain continue among and within disciplines. Exacerbating the conflicts, evolutionary psychologists present their paradigm as replacing, rather than

co-existing with, current paradigms, alienating a considerable segment of the scientific community who are committed to epistemological diversity.

The methodological problems of evolutionary psychology extend beyond those emerging from disciplinary differences. Some evolutionary psychologists have misused the methodologies and logic structure of the social sciences by employing invalid measurement, improperly using statistics, reaching conclusions of questionable validity, ignoring or misusing previous research, and interpreting empirical data in a self-serving style. Rather than utilizing this criticism to improve their science, evolutionary psychologists have responded by disparaging learning research and researchers. They have displayed an essential ignorance of learning theory by referring to it as mere 'instruction' and by being unaware that their proposals, presumably derived from evolutionary theory, are often indistinguishable from predictions derived from learning theory. These matters have left much of the scientific community questioning that evolutionary theory and ultimate causation are necessary components of a valid theory of human behavior.

The discourse of much of the literature in evolutionary psychology is hostile and inflammatory – characteristics atypical of scientific discourse. Critics of evolutionary psychology are accused of foregoing science in the interest of their egos and in the pursuit of ideological and political agendas. Yet, the motivation of those who promote evolutionary psychology is assumed to be a selfless pursuit of the 'truth' in spite of their frequent choice of the political, rather than the scientific, arena to argue their cause. Furthermore, evolutionary psychology is often promoted and defended in a manner commonly referred to as immature or, in the context of the model of Kramer, Kahlbaugh, and Goldston (1992), 'absolute thinking.' If concepts of individual cognitive development can be applied to paradigm development we might do well to seek a theory approximating Kramer's most mature stage – dialectical thinking – described as mature, complex, and wise and characterized by the confrontation and integration of contradictory ideas and by the growth of knowledge through the synthesis of new information in a continuous and creative process. 'Many of the long-standing controversies in science were caused by the failure of opponents to see that the two opposing viewpoints did not exhaust the number of possible explanatory choices' (Mayr 1982: 844). 'Truth' is not the opposite of 'ideology' but a moving target with unrestricted disciplinary boundaries and an infinite number of possibilities.

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