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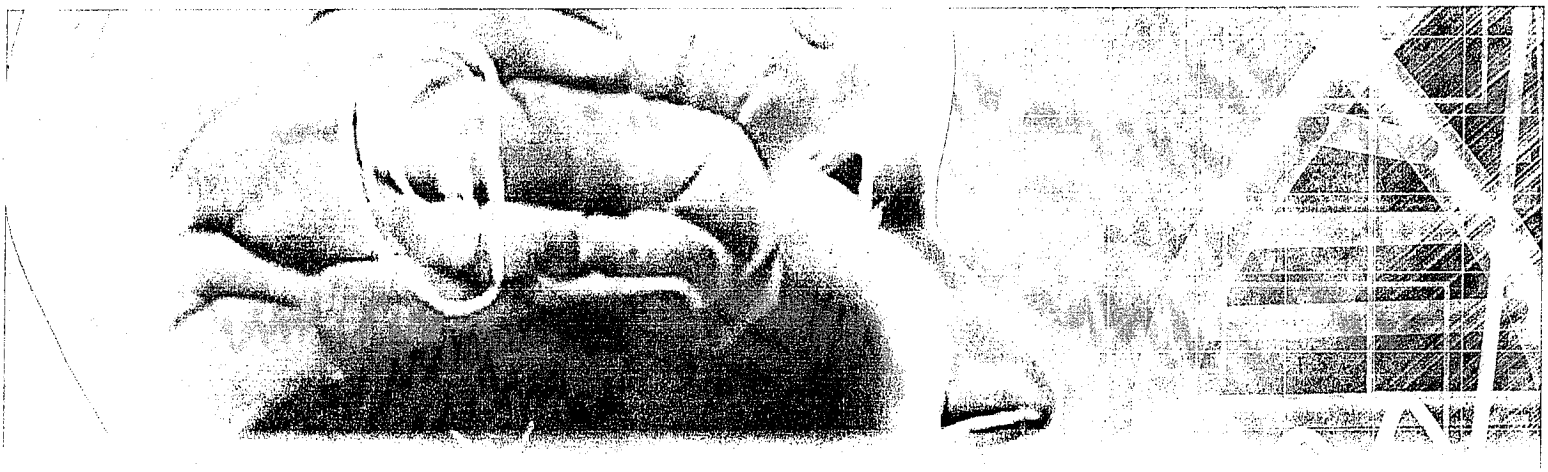

WHY STUDENTS LOVE EVOLUTIONARY PSYCHOLOGY . . . AND HOW TO TEACH IT

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I've been teaching evolutionary psychology for more than 15 years, and it is by far the most popular course I teach, as it is for many who teach evolutionary perspectives on human behavior. Judging from student evaluations and spontaneous feedback, I think there are several reasons for this. One is that it has real-world applicability; it deals with topics central to students' lives, such as mate selection, conflict between the sexes, aggression, cooperation, parent-offspring relationships, and status hierarchies. Another is that evolutionary psychology provides a compelling "meta-theory," a framework for understanding why all of the diverse topics within psychology truly belong within the covers of an introductory psychology text. Students spontaneously offer comments such as "I've taken half a dozen psychology courses, and this is the only one that puts it all in perspective" and "Evolutionary psychology should be the first course psychology majors should take." I like to think that a third reason students love evolutionary psychology is that the leading textbook in the field, *Evolutionary Psychology: The New Science of the Mind* (Buss, 2011), now in its fourth edition, provides an engaging and accessible introduction to the discipline, an endeavor I have personally invested a considerable amount of pedagogic effort into.

MAIN TENETS OF EVOLUTIONARY PSYCHOLOGY

The fundamental basis of evolutionary psychology dates back to Darwin's (1859) theory of natural selection, which contains three key components: Variation, inheritance, and differential reproductive success. Variation, or individual differences within a species, provides the raw materials on which selection operates. Only variations that are heritable, passed down reliably from parents to children, can evolve—that is change in frequency over generations. Natural selection is the

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process by which heritable variants that have beneficial effects on survival and reproduction are passed on in greater numbers. The primary products of this selective process are adaptations—inherited characteristics that reliably solve problems that contribute to survival or reproduction better than alternatives during the period of time during which they evolved. Examples of adaptations include fears of dangerous spiders, preferences for calorically rich food, and preferences for habitats containing resources and refuge.

Although evolutionary principles historically have been applied to anatomy and physiology, there is now widespread recognition that they provide powerful tools for explaining psychological, strategic, and behavioral adaptations. Just as physiological adaptations solve specific problems of survival and reproduction (e.g., the immune system is an evolved defense against disease), psychological adaptations, too, have evolved because they solved problems of survival (e.g., fear of heights) and reproduction (e.g., a preference for mates displaying cues to health and fertility). Psychological adaptations are information-processing circuits that take in delimited units of information and transform that information through cognitive procedures into functional output designed to solve a particular adaptive problem. Relatively uncontroversial psychological adaptations include evolved fears of snakes, heights, and strangers; preferences for cues to youth and health in mate selection; "adaptive memory" systems that have especially good recall of information relevant to survival (e.g., food, predators, shelter) and reproduction (e.g., mating); and adaptations for cooperation and reciprocal altruism (see Buss, 2011).

Although there exists legitimate scientific debate about the existence of relatively more domain-general adaptations such as fluid intelligence, evolutionary psychologists all share the view that many adaptations will be somewhat specialized. An adaptation that solves a problem of food selection, for example, will not be very good at solving the problem of mate selection or habitat selection. Because what qualifies as a successful solution differs across the many specific adaptive problems humans and their forebears had to solve, evolutionary psychologists believe that the mind contains a large number of specialized psychological adaptations (in addition to whatever more general psychological adaptations exist).

In summary, the main tenets of evolutionary psychology are these:

1. All manifest behavior is a function of psychological mechanisms, in conjunction with environmental and internal inputs to those mechanisms;
2. All psychological mechanisms owe their existence, at some basic level of description, to evolutionary processes (scientifically, no other known causal processes exist for creating complex organic mechanisms);
3. Natural selection and sexual selection (Darwin's theories) are the most important evolutionary processes responsible for creating psychological adaptations (other evolutionary forces, such as genetic drift, are too weak to fashion adaptations);
4. Evolved psychological mechanisms can be described as information processing devices (input, decision rules or other transformation procedures, and outputs);
5. The output of psychological adaptations can be physiological activity, information that serves as input to other psychological mechanisms, or manifest behavior;
6. Psychological adaptations are housed in the brain; and
7. Psychological adaptations are functional, that is "designed" to solve statistically recurrent adaptive problems confronted by our ancestors over deep evolutionary time.

COMMON MISUNDERSTANDINGS ABOUT EVOLUTIONARY PSYCHOLOGY

For many reasons, such as a lack of evolutionary courses in teaching curricula and erroneous depictions in the popular press, there are many misunderstandings about evolutionary psychology. I'll describe a few of the more common ones (see Confer et al., 2010 for a more extended discussion of these).

Misunderstanding #1: Evolutionary hypotheses cannot be tested or empirically falsified. This misunderstanding is especially puzzling, since there is a tremendous body of published empirical work, now involving thousands of studies, that has tested evolutionary psychological hypotheses (Buss, 2011). Some have been confirmed, such as those involving "adaptive memory," specialized fears, predictable gender differences in mate preferences, cheater detection adaptations in social exchange, adaptations entrained to the ovulation cycle, adaptations for aggression, and many others. Some have been disconfirmed by empirical studies, such as the kin altruism hypothesis about male homosexuality and the "competitively disadvantaged male" hypothesis about sexual coercion. Like all hypotheses within psychology, evolutionary psychological hypotheses differ in quality and precision. Well-formulated evolutionary hypotheses that generate specific predictions are eminently testable and capable of being refuted.

Misunderstanding #2: Human behavior is a product of learning, not evolution. This is a

misunderstanding because it creates the false dichotomy between "learning" and "evolution." In fact, learning requires evolved learning mechanisms, and evolved learning mechanisms are turning out to be more specialized than earlier generations of psychologists anticipated. To provide a few concrete examples: (a) people learn to avoid eating foods that may contain toxins (food aversion learning); (b) people learn to avoid mating with their close genetic relatives (incest avoidance learning); (c) people learn from their local culture or subculture which actions lead to increases in status and reputation, in part through the attention structure—those high in status are those to whom the most people pay the most attention (learned prestige criteria). In short, "learning" and "evolutionary psychology" are not competing explanations; learning requires evolved learning adaptations, at least some of which are specialized for solving distinct adaptive problems.

Misunderstanding #3: If human behavior is a product of evolved psychological adaptations, it means we cannot change it. This misunderstanding stems from a failure to understand that evolutionary psychology provides a truly interactionist framework, with environmental input needed at each and every step in the causal chain. The environment over deep evolutionary time provides the selection pressures responsible for creating psychological adaptations. The environment during development is needed for psychological adaptations to "come on-line," and different developmental environments can shunt individuals down different adaptive tracks (e.g., father absence while growing up tends to shunt individuals toward a short-term mating strategy, whereas growing up with an investing father tends to shunt individuals toward a long-term mating strategy). And immediate environmental input is required for the activation of psychological adaptations, just as repeated friction to the skin is needed for the activation of physiological callus-producing adaptations. Humans show such enormous flexibility precisely because of the large number of evolved psychological adaptations they possess. Change, where change is desired (e.g., reducing bullying or other forms of aggression in schools), requires a deep understanding of psychological adaptations and the inputs that trigger or suppress their activation (Confer et al., 2010).

TEACHING TOOLS FOR EVOLUTIONARY PSYCHOLOGY

Over the years, I've developed a set of teaching tools designed to draw students in and engage active thinking about pertinent topics. The full set of 17 teaching tools can be found on my website **www.davidbuss.com**. I'll elaborate on a few of them here.

Teaching Tool #1: Convey to Students an Understanding of "Deep Time." This is critical because all of the adaptive problems humans have evolved to solve occur in brief time periods—seconds (e.g., avoiding a bee sting), minutes (e.g., deciding what to eat), hours (e.g., attending a party), days (e.g., planning one's work and exercise schedule), months (e.g., negotiating status hierarchies), and occasionally years (e.g., raising one's children). Evolution, by contrast, is a glacially slow process that occurs in small increments over thousands and millions of years.

To convey a sense of deep time, I use two teaching tools. One is providing a table of "milestones in human evolutionary history," including the first emergence of life on earth (3.7 billion years ago), the evolution of sexual reproduction (1.2 billion years ago), the first vertebrates (500 million years ago), the first placental mammals (114 million years ago), the first primates (85 million years), the first apes (35 million years), bipedal locomotion (4.4 million years), stone tools (2.5 million years), successive migrations out of Africa (from 1 million years ago to the most recent, roughly 50 thousand years ago), the extinction of our Neanderthal cousins (25 thousand years ago), and the subsequent colonization of the entire planet by modern humans (25 thousand years to the present).

A second teaching tool I use to convey deep time is to provide the spatial metaphor of a football field to stand for the evolution of life on earth. If life first evolved at one end of the football field and the present moment is at the other end, you have to travel a full 99 yards down the field before apes evolved. The genus Homo did not emerge until the last foot of the field. And truly modern humans, Homo sapiens (Cro-Magnons) did not colonize Europe until the last tenth of an inch! These tools help to give students a sense of awe about deep time.

Teaching Tool #5: Use Sexual Selection Theory to Explain the Logic of the Evolutionary Process. The three components of evolution by selection are variation (individual differences), inheritance, and differential reproductive success. Variation (originally caused by mutations) provides the raw materials on which selection operates. Only variants that are inherited, reliably transmitted from parents to offspring, can be selected. If you spray blue paint on the tail of a squirrel, the acquired blueness will not be transmitted to the squirrel's offspring because it does not meet the criterion of inheritance. And differential reproductive success because of heritable variants is the "bottom line" of evolution by selection. This is where explaining sexual selection comes in handy.

Darwin originally focused on differential survival, and of course survival is necessary for reproduction. He was deeply troubled, however, by characteristics that could not be explained by so-called "survival selection." The brilliant plumage of a peacock, for example, seemed downright damaging to survival. It's like a neon sign to predators advertising fast food! Darwin once commented that, "The sight of a feather in a peacock's tail, whenever I gaze at it makes me sick!" The solution to Darwin's troubles came when he hit upon the theory of sexual selection—the evolution of characteristics not because of the survival advantage, but rather because of the mating advantage those characteristics afforded organisms. The

gigantic antler rack of a male elk gives it an advantage in competing with rivals for mates (intrasexual competition, the first process of sexual selection). And the luminescence of the peacock gives it an advantage in being selected by females as a mate (intersexual selection, the second process of sexual selection). The theory of sexual selection brings home the point that differential reproductive success is the final arbiter of which characteristics evolve (i.e., increase in frequency over time) and which ones bite the evolutionary dust. An organism could survive for a hundred years, but if it fails to reproduce, its genes die with it.

Teaching Tool #7: Hammer Home the Critical Distinction Between Proximate and Ultimate Causation. Proximate causation deals with the immediate causes—the underlying mechanism and the stimuli or events that trigger its activation. Ultimate causation deals with the evolution of the mechanism and its adaptive function. If we ask "Why did Sally develop calluses on her hand?" the proximate cause involves a callus-producing physiological mechanism and the stimuli of repeated friction to her skin. The ultimate cause involves explaining why the callus-producing mechanism evolved, or its adaptive function—to protect the anatomical and physiological structures beneath the skin. If we ask, "Why did John get jealous?" a proximate explanation might invoke a stimulus (e.g., a "mate poacher" was flirting with his girlfriend) and the underlying psychological mechanism of sexual jealousy. An ultimate explanation would involve why humans have evolved the emotion of jealousy—the adaptive problem it evolved to solve—for example, to guard against threats to a valued romantic relationship. Proximate and ultimate causes are complementary, not competing, levels of explanation. Both are necessary for a complete explanation.

The distinction between proximate and ultimate explanations is critical to teach because students often think in proximate terms: Why did Marco eat the pizza? Answer: Because he was hungry and he smelled the aroma emanating from the pizza parlor. Why did Karin have sex? Answer: Because sex gives her pleasure. As scientists, we want to know the adaptive functions of hunger and sexual motivation to complement an understanding of the proximate causes. I sometimes use a true story to illustrate this distinction. In a class, after explaining the distinction between these two key modes of explanation, one student had difficulty understanding it. So I asked him: Why do you think men are taller, on average, than women? After thinking for a minute, he responded "Because they have longer bones"! In a proximate sense, he was right—men do have longer bones, and in some weak sense, this fact "explains" why men are taller than women. But most people feel that this explanation is incomplete. We want to know the evolutionary process by which men came to be taller, as well as the adaptive functions of greater male height—it was sexually selected because height historically gave males an advantage in intrasexual competition, or because women preferred to mate with taller men (the empirical evidence currently supports both modes of sexual selection as likely explanations for the gender difference in height).

Teaching Tool #10: Bring in Animal Examples. In teaching evolutionary psychology, I find that it helps to gain some distance from the human species. It is sometimes easier to see things in other species. As an example, many insect, mammalian, and primate species have evolved adaptations for "mate guarding." Some male insects will maintain physical proximity to their mates, conceal them from other males, build a fence around them, take them away from locations containing rival males, emit scents that conceal the attractant signal of the female, and physically jostle other males away. After providing a few nonhuman examples of mate guarding, it is easier for students to see similar strategies in humans. Drawing parallels helps students to see the similarities as well as the differences. Indeed, studies of human mate guarding have identified some 19 tactics, ranging from vigilance to violence, many of which have direct analogs in other species (Buss, 1988; Kaighobadi et al., 2010). It is important to emphasize that these parallels do not imply that humans are just like other species. Each species is unique, and humans might be "uniquely unique" in qualities such as our ability to communicate through language or our deep capacity for culture. So although most sexually reproducing species exhibit some form of mate guarding, only humans do it through cultural inventions such as burkas, check-up phone calls, and monitoring of a mate's e-mail.

Teaching Tool #12: Use Thought Experiments. I use these in practically every lecture. To help students understand the logic of inclusive fitness theory, for example, I have them do what I call the "mission impossible" exercise: "Imagine that you are a gene residing within a body: Your mission is to increase your own replicative success (making many copies of yourself) relative to competing genes. What would you do?" Students are usually good at coming up with excellent answers: Influence the body in which you reside to survive (e.g., get food as fuel for the body; protect the body from environmental dangers such as predators and parasites); ensure that the body in which you reside reproduces (e.g., make it attractive to those of the opposite sex; motivate it to select fertile mates; increase the organisms' sexual motivation). Occasionally, perceptive students provide a third answer, which is the key to inclusive fitness: Help other organisms that contain copies of you—genetic relatives—to survive and reproduce.

Other thought exercises are specific to topic areas. For mating, I ask students to list all the qualities women want in a long-term mate, and I write their responses on the blackboard (students love this one, and it can go on for 20 or 30 minutes, filling up all available blackboard space). Then I ask them to list all the qualities men want in a long-term mate. For the topic of conflict between the sexes, I start by asking students to list all the things that men they know have done to irritate, anger, annoy, or upset women. Now what do women do that has the effect

of irritating, angering, annoying, or upsetting men? These exercises really get students engaged in the topics and set the stage for tackling them scientifically. Can evolutionary theories shed any light on gender differences and gender similarities in mate preferences? Here I bring in the theory of parental investment (Trivers, 1972) and sexual strategies theory (Buss & Schmitt, 1993). Can evolutionary theories shed any light on conflict between the sexes? At this point in teaching, I bring in a fascinating branch of evolutionary theory known as sexual conflict theory (Arnqvist & Rowe, 2005). Toggling among the student responses to the exercises, evolutionary theories, specific evolutionary psychological hypotheses, and scientific evidence creates deeper understanding and increases long-term retention of the material.

CONCLUSIONS

Evolutionary psychology has the combination of a powerful big-picture theoretical perspective, real-life applicability, and topical intrigue that captures students' interest. They can see how it applies to their own lives, the lives of their friends, and the issues they grapple with on a daily basis. Many report discussing the course's content (sometimes heatedly) with their roommates, friends, and parents. Some students experience a paradigm shift, commenting on the class evaluations that it has fundamentally changed the way they understand people. From an educational perspective, teaching evolutionary psychology is highly rewarding and should be a fixture in psychology curricula worldwide. **PTN**

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