Learning from the Immune System About Evolutionary Psychology

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Evolutionary psychology (EP) has come a long way since its inception as a recognized discipline in the late 1980s. Science is supposed to progress, but some kinds of progress are easier to acknowledge than others. Ideas that initially appeared central sometimes must be amended for the field as a whole to move forward. It can be hard for proponents of the idea and people speaking for the field as a whole to acknowledge that they were in some sense wrong and their critics were in some sense right.

That is the kind of change that has marked progress in EP. In this essay, I will focus on the contrast between EP and the "Standard Social Science Model" (SSSM) that was influential in establishing EP as a recognized discipline but now must be amended for the field as a whole to move forward. A new paradigm is needed that combines elements of EP and the SSSM. The mammalian immune system provides a model for the new paradigm.

Defining Evolutionary Psychology

Before continuing, it is important to distinguish the field of EP from particular positions that come and go within the field. EP is straightforwardly defined as the study of psychology from an evolutionary perspective. A particular position is that brains are massively modular and must be to solve the problems of survival and reproduction in any particular environment. This particular position might be right or wrong, but the outcome does not bear upon the definition of the field as a whole.

A problem occurs when the term "Evolutionary Psychology" becomes associated with a particular position within the field. The fortunes of the entire field then appear to rise and fall with the fortunes of the particular position and critics of the position are impelled to avoid using the term, even though they are manifestly studying psychology from an evolutionary perspective. This problem has plagued the field of EP, which became associated with the position articulated by John Tooby

and Leda Cosmides (1992) and impelled other people who fully qualify as evolutionary psychologists to avoid using the term. It is essential to rectify this problem by reclaiming the term EP for the field as a whole, so that the changing fortunes of particular positions can be properly seen as a form of progress.

Massive Modularity and the SSSM

According to Tooby and Cosmides (1992 and elsewhere), all species are confronted with many problems impacting survival and reproduction. Each problem requires a separate cognitive solution. Brains therefore consist of many specialized "modules" for addressing specific problems. Metaphorically, they are like a swiss army knife with different tools for different tasks, or like a jukebox that play many records depending upon which button is pushed. In the jukebox metaphor, each record is a cognitive adaptation that evolved by genetic evolution to solve a particular adaptive problem such as cheater detection, and the buttons are environmental stimuli that cause a given module to be expressed. A third metaphor is computer software designed for specialized purposes, such as tax preparation software, which requires substantial environmental input and information processing to calculate the taxes of any particular person, but can't do anything else.

All of these metaphors convey an interesting and seemingly paradoxical concept of *rigid flexibility*. Swiss army knives, jukeboxes, and specialized software are all flexible, but in a way that is rigidly prescribed, beyond which they become useless. Insofar as cognitive modules evolve by genetic evolution, they are designed to work well in the "Environment of Evolutionary Adaptedness (EEA)" and can tragically misfire in other environments, a problem that only subsequent genetic evolution can solve. Thus, humans do not necessarily behave adaptively in their current environments. To explain current human behavior, we must ask how the psychological mechanisms generating the behavior functioned in the relevant EEA.

All of this is in contrast to the Standard Social Science Model (SSSM), which emphasizes the open-ended capacity of individuals and cultures to change over short time scales. Metaphors representing the SSSM include the venerable blank slate, upon which anything can be written, and a computer that can be used for a great variety of specific purposes. A blank slate conveys an image of both *simplicity* and open-ended *flexibility*. A computer is much more *complex* than a blank slate but retains its open-ended *flexibility*. Thus, the main problem with the SSSM, according to Tooby and Cosmides, is the claim that people and societies have virtually unlimited potential in what they can become over time scales that are short compared to genetic evolution.

B.F. Skinner—Evolutionary Psychologist

Against this background, it is interesting to revisit the work of B.F. Skinner and the tradition of behaviorism that stands at the center of the SSSM. In his influential paper titled "Selection by Consequences", Skinner (1981) explicitly described operant conditioning as an adaptation that evolved by genetic evolution and an

evolutionary process in its own right. Organisms are genetically endowed with a variety of psychological "reinforcers" that cause them to select among behaviors that are initially undirected. This fast-paced process of "blind variation and selective retention", as the social psychologist Donald Campbell (1960) famously phrased it, leads to the evolution of behaviors that are biologically adaptive on average, albeit with numerous exceptions. For example, Skinner famously showed that pigeons placed on a random reinforcement schedule would develop "superstitious" behaviors that they acquired on the basis of spurious initial correlations.

In a conversation between B.F. Skinner and E.O. Wilson that they taped and has become the basis of a recent book (Naour 2009), Skinner complained that he had been left out of the sociobiology movement. In part, he had himself to blame by claiming too much for operant conditioning and by refusing to open the "black box" of psychological mechanisms that transform environmental input into behavioral output. Nevertheless, in a more moderate form and accompanied by the detailed study of proximate mechanisms, Skinner's position is fully reasonable from an evolutionary perspective. Moreover, even though the tradition of behaviorism lost influence as the broad field of psychology became more mechanistic, it has remained central in the applied behavioral sciences. In other words, "selection by consequences" has proven to be an essential tool for professionals who actually accomplish behavioral change at scales both small (e.g., individual therapy; Hayes 2004) and large (e.g., nationwide reduction of problem behaviors such as smoking; Biglan 1995 , Embry 2004).

In retrospect, the massive modularity position of Tooby and Cosmides suffers from the same kind of extremism as Skinner's version of behaviorism. When it comes to the human capacity for open-ended change over short time scales, Skinner claimed too much and Tooby and Cosmides claimed too little. The truth lies somewhere in between. Progress for EP as a discipline requires a careful exploration of the middle ground.

Learning from the Immune System

As we search for metaphors and analogies to explore the middle ground, the mammalian immune system has much to offer. It is an elaborate set of mechanisms that evolved by genetic evolution to protect the organism from parasites and diseases. The mechanisms are mind-bogglingly complex and many of them are highly specialized—like the psychological modules described by Tooby and Cosmides. Yet, the centerpiece of the mammalian immune system is an open-ended process of antibody evolution that can rapidly adapt to current disease environments—like the open-ended learning described by Skinner. If these two positions can be combined for the immune system, then perhaps they can be combined in a similar way for our behavioral adaptations.

Sompayrac (2008) provides an elegant overview of the immune system for the non-specialist. Here I will summarize a few insights relevant to establishing a new paradigm for evolutionary psychology.

• Immunologists distinguish between the "innate" and "adaptive" components of the immune system, which roughly correspond to the Tooby/Cosmides and Skinner positions for EP.

• The adaptive component of the immune system was *added* to the innate component over evolutionary time, does not substitute for it, and relies extensively upon it to operate, as described in more detail below. By analogy, Skinner's claim that operant conditioning largely replaces instinctive behaviors is highly implausible.

• There is no way to understand either the innate or adaptive components of the immune system without a detailed understanding of the proximate mechanisms. Skinner's reliance on input-output functions and refusal to look inside the "black box" of the brain is absurd from an immunological perspective.

• Tooby and Cosmides (1992) attempted to make a strong theoretical argument that domain general learning is impossible in principle. This position is also absurd from an immunological perspective. The adaptive component of the immune system demonstrates the existence of what Calvin (1987, 2002) and Plotkin (1994) term a "Darwin Machine": A fast-paced process of evolution, built by the slow-paced process of genetic evolution. Darwin machines, by definition, are capable of adapting organisms to their environments over much shorter time scales than genetic evolution. By analogy, this means then when an evolutionary psychologist attempts to explain a given human behavior, it is not necessarily appropriate to look for a specialized mechanism that evolved by genetic evolution in the distant past. The behavior might be a product of psychological and cultural processes that count as evolutionary and operate over faster time scales. The concept of the EEA is still relevant, but the time scale of the EEA for Darwin machines is much shorter than the time scale of the EEA for genetic evolution.

• The adaptive component of the immune system includes historical and non-adaptive aspects inherent in all evolutionary processes. When different people are exposed to the same disease, they usually evolve different antibodies because antibody diversity is so great that many antibodies can bind to a given antigen and the ones that are amplified in any particular individual are largely a matter of chance. To pick an analogous example for human behavior, Ostrom (1992; Poteete and Ostrom 2007) has studied how human groups solve the "tragedy of the commons" problem for irrigation systems in traditional cultures around the world. Even within a single culture, there can be dozens of groups faced with the same basic problem of coordinating water use in an equitable fashion. It turns out that they have arrived at multiple solutions that do the same job in different was, similar to different antibodies that fight the same disease. More generally, the study of genetic evolution goes beyond the narrow study of adaptations, and the same applies to the study of Darwin machines.

• The adaptive component of the immune system does not entirely solve the environmental mismatch problem. Sompayrac (2008) compares the adaptive

immune system to the quarterback of a football team, who is totally reliant on the rest of the team to function. The "rest of the team" is the innate component of the immune system, which is not open-ended and can tragically misfire in novel environments. For example, intestinal worms were evidently such a constant part of the genetic EEA that the mammalian immune system "relies" upon their presence to form appropriate antibodies. When they are removed, as in modern hygienic human environments, the immune system reacts to inappropriate antigens, resulting in ailments such as asthma, hay fever, and irritable bowel syndrome (Jackson et al. 2008). The adaptive immune system is incapable of solving this particular problem because it was not designed to be flexible *in this particular way*. For this particular case, it *is* appropriate to explain the current day behavior (e.g., asthma) in terms of the genetic EEA (e.g., a mismatch between current and ancient environments).

Why it Matters

The nascent discipline of Evolutionary Psychology became associated with the massive modularity thesis of Tooby and Cosmides in the early 1990's, largely on the basis of their long theoretical essay in *The Adapted Mind* (Barkow, Cosmides and Tooby 1992) and other chapters in this influential volume that reflected the same theme. I happened to organize the Human Behavior and Evolution Society (HBES) meeting in 1993 and made a point of showcasing the issues. My own talk was a critique of their view (published as Wilson 1994; see also Wilson 2005) and was followed by a response from John Tooby. During the public discussion and private conversations, I got the impression that EP was being set apart from the SSSM in part to attract attention to a bold new discipline, including important aspects of human psychology that were not already being considered as part of the SSSM.

If so, then it was a classic case of a strategy with short-term benefits and long-term costs. The goal of EP is to provide a complete explanation of psychology from an evolutionary perspective, not to provide a counterweight to other positions that are also legitimate. Moreover, if the SSSM stands for anything, it is the human capacity for open-ended change over time scales shorter than genetic evolution. By creating a strong polarity between EP and the SSSM, the position articulated by Tooby and Cosmides appeared to deny the human capacity for open-ended change. Moreover, this is not just a *misunderstanding*, but a *legitimate criticism* insofar as the massive modularity thesis ignores the behavioral equivalent of the adaptive component of the immune system.

It is important to stress that *other* approaches to human psychology from an evolutionary perspective did not make this mistake. I have already mentioned figures such as B.F. Skinner, Donald Campbell, William Calvin, and Henry Plotkin, who conceptualize the human capacity for open-ended change as both a product of genetic evolution and an evolutionary process in its own right. The formal study of human cultural evolution antedates the massive modularity thesis and is increasingly occupying center stage in the current literature (e.g., Boyd and Richerson 1985, Richerson and Boyd 2005, Henrich et al. 2008). Thus, a major part

of the problem has been the restriction of the term "Evolutionary Psychology" to a *particular position*, rather than *to the field as a whole*.

At the same time, it is not my purpose to criticize the position associated with Tooby and Cosmides in every respect. The human mind is not just a jukebox, but neither is it just a blank slate. The immune system provides a comprehensive guide to how these two positions can be combined for human behavioral adaptations, no less than adaptations to parasites and diseases.

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