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## Evolutionary Psychology: A Review

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Evolutionary Psychology is a highly controversial approach synthesizing the twin disciplines of cognitive psychology and evolutionary biology. Leslie Allan takes the reader through an overview of the key theoretical underpinnings, research methods and experimental successes of this new perspective on human evolution. He concludes his review with a look at the major criticisms levelled against its proponents and the dominant challenges evolutionary psychologists face if they are to advance the discipline and attract more adherents.

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## 1. Introduction

In this essay, I take the reader on a quick guided tour of a discipline that seeks to marry evolutionary biology with human psychology. Evolutionary Psychology has generated a lot of debate in the last few years, and for good reason. The claims of its proponents are highly controversial, gaining critics from the fields of biology, psychology and philosophy. I start by clarifying the two different senses of the term and how its central tenets differ from that of other researchers in the fields of human evolution and cognition. In the following section, I go on to outline the theoretical principles underpinning Evolutionary Psychology developed by its founders, Tooby and Cosmides. Here, I introduce the massive modularity hypothesis about the human brain and the arguments advanced in its favour. I also review the research methods used by Evolutionary Psychologists, especially that of functional analysis.

Next, I provide an overview of three key experimental successes of this approach. Evolutionary Psychologists point to the validation of the cheater detection hypothesis, the differentiation between men and women on spatial ability tests and differences in sexual selection as support for their overall theory. Critics of Evolutionary Psychology downplay these successes by advancing serious objections to the Evolutionary Psychologists' principles and methods. It is to these criticisms that I turn to next. I discuss what I think are the five most substantive problems faced by this approach. These include the possibility that evolutionary selective pressures occur in a short time span and that these pressures can act directly on behaviour. Also, recent research seems to support the existence of non-specific cognitive mechanisms. Two further criticisms I discuss are that Evolutionary Psychologists ignore other credible explanations and that their assumptions about the early environment are highly conjectural.

In the final section of this essay, I review the challenges that the theory of Evolutionary Psychology faces going into the future. I argue that more research needs to be done in support of its central massive modularity thesis. It is also facing steep competition from rival research programmes, such as phenotypic plasticity and gene–culture coevolution.

## 2. What Is Evolutionary Psychology?

Evolutionary psychology, in the broad sense in which this term is used, is a scientific approach to human behaviour that seeks to explain its psychological causes in terms of our evolutionary history. In this sense, it includes the fields of human behavioural ecology, memetics and dual-inheritance theory. In its narrower sense, Evolutionary Psychology (EP) is one approach within this broader stream of study of the evolutionary origins of the human psyche. The narrower sense is signified by the capitalization of the phrase.<sup>1</sup> This approach had its beginnings in the 1980s when the psychologist Leda Cosmides and the anthropologist John Tooby, both from Harvard University, teamed up with the anthropologist Donald Symons at The University of California.

The central tenets of their approach are that human behaviour is the result of a series of adaptations in our evolutionary past set in the Pleistocene era (the period spanning approximately 1.8 million years ago to 10,000 years ago) when humans lived in small nomadic hunter-gatherer societies. During this long evolutionary period, our cognitive mechanisms adapted to solve specific problems in the environment (what Evolutionary Psychologists call the *environment of evolutionary adaptedness* or EEA for short). What sets Evolutionary Psychologists apart from other researchers in this field are two highly controversial claims.

Firstly, they contend that further substantive evolution of these cognitive mechanisms have not occurred since modern times (agriculture, industrial, urban, technology) as the time period is too short. Secondly, they claim that each of these cognitive mechanisms is purpose-built through selective pressures to solve just one problem. They claim that there is no domain-general computing architecture in the human brain and, furthermore, there are in fact hundreds, perhaps thousands, of domain-specific computers working in our brains.

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<sup>1</sup>Introduced by Buller [2000, 2005a]

### 3. Evolutionary Psychology Principles and Methods

The founders of Evolutionary Psychology claim that their biologically adaptive approach can elucidate a range of human behaviours by bringing together all that we know about biology, artificial intelligence and evolutionary dynamics. The theoretical assumptions that underpin their research are listed by the founders, Tooby and Cosmides [2005], as follows.<sup>2</sup>

1. The brain is a computer designed by natural selection to extract information from the environment.
2. Individual human behaviour is generated by this evolved computer in response to information it extracts from the environment. Understanding behaviour requires articulating the cognitive programs that generate the behaviour.
3. The cognitive programs of the human brain are adaptations. They exist because they produced behaviour in our ancestors that enabled them to survive and reproduce.
4. Natural selection ensures that the brain is composed of many different special purpose programs and not a domain general architecture.
5. Describing the evolved computational architecture of our brains 'allows a systematic understanding of cultural and social phenomena' [Tooby and Cosmides 2005: 18].

Assumption 4 rests on the veracity of the massive modularity hypothesis. This theory has gained a lot of attention and an equal amount of criticism. The hypothesis counters the theory that the mind consists of a general purpose computing device that solves problems through the application of general algorithms. In contrast, the massive modularity hypothesis specifies a large number of content-specific computing algorithms that developed independently of each other in response to selective pressures in the Pleistocene era. Evolutionary Psychologists support the hypothesis with three key arguments. These can be summarized as follows.<sup>3</sup>

1. The computational modules in the human mind are analogous to organs in the body, such as the heart and liver. These developed independently as separate biological systems in response to specific environmental pressures.
2. As there are no general problems presented by the environment, there can be no general problem solving module. Each problem is solved by a distinct computational unit.
3. There is not enough time and information for the mind to learn from nothing all that it needs to solve the myriad of environmental problems presented to it.<sup>4</sup>

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<sup>2</sup>Also quoted in Downes [2010]

<sup>3</sup>See Tooby and Cosmides [2000: 1171]. For a discussion, see [Walter 2014: §2d; Downes 2010: §3].

<sup>4</sup>Note that this is a generalisation of Chomsky's poverty of the stimulus argument for universal grammar.

I will return to a consideration of the massive modularity hypothesis in §5 below.

Turning now to the methods that Evolutionary Psychologists use in their research, fundamental to their approach is the analysis of the mind's functions as a pointer to its structure. For the Evolutionary Psychologist, to show that a modern human behaviour trait is an adaption from our stone-age past, they must demonstrate that:

1. it has many design features that are improbably well suited to solving an ancestral adaptive problem,
2. these phenotypic properties are unlikely to have arisen by chance alone, and
3. they are not better explained as the by-product of mechanisms designed to solve some alternative adaptive problem or some more inclusive class of adaptive problem.

[Tooby and Cosmides 2005: 28]

To achieve this, Evolutionary Psychologists use functional analysis. This is a six step procedure, outlined by Tooby and Cosmides [1989: 40–1].<sup>5</sup>

- Step 1* uses evolutionary considerations to formulate a model of the past adaptive problems the human mind had to solve.
- Step 2* generates hypotheses about exactly how these problems would have manifested themselves under the selection pressures present in the evolutionary environment of our ancestors.
- Step 3* formulates a 'computational theory' that specifies 'a catalog of the specific information processing problems' [Cosmides and Tooby 1987: 289] that had to be solved to overcome the adaptive problems identified in step 2.
- Step 4* uses the computational theory 'as a heuristic for generating testable hypotheses about the structure of the cognitive programs that solve the adaptive problems in question' [Cosmides and Tooby 1987: 302].
- Step 5* rules out alternative accounts of the cognitive mechanisms in question that do not treat them as the result of evolution by natural selection.
- Step 6* tests the adaptationist hypotheses by checking whether modern Homo sapiens indeed possess the cognitive mechanisms postulated in step 4.

Once all of the steps have been completed successfully for a specific study, then the researcher concludes that the cognitive mechanisms and the attendant behaviours tested are the result of evolutionary adaptations for the posited problem.

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<sup>5</sup>Also reproduced in Walter [2014: §2b].

## 4. Experimental Successes of Evolutionary Psychology

Using the functional analysis approach, Evolutionary Psychologists have conducted a number of studies which, they contend, lends empirical support to their hypothesis. The most well known and readily accepted are these.

The seminal series of studies was that of Cosmides and Tooby's testing of the cheater detection hypothesis. In this study, they used Wason selection tasks [Wason 1966; Wason and Johnson-Laird 1972] to test the hypothesis that logical reasoning in humans is specialized to specific content domains. In particular, their study found that when subjects were asked to test for breaches of a social contract using logical rules, they found that they performed much more accurately (65–80%) compared with more general tests (25%) [Cosmides 1985, 1989; Cosmides and Tooby 1989, 1992].<sup>6</sup>

Silverman and Eals [1992] hypothesized that the superior spatial abilities of men compared with woman found on psychological tests dwarfs women's ability to recall the locations of objects. This locating skill, they said, was a function required by stone-age woman to locate and gather thousands of plants. Their tests confirmed that women consistently remembered more items and their locations more accurately than their male counterparts.

In a series of studies, Buss tested the hypothesis that the differences in the way males and females selected sexual partners and expressed jealousy are due to selection pressures in the stone-age environment. For example, he thought that male ancestors regarded the sexual infidelity of their partners more seriously than the loss of their emotional attachment because of the investment they made in their genetic offspring. On testing his hypothesis, he found that on average his male test subjects were more upset by the prospect of sexual infidelity (51%) compared with his female subjects (22%) [Buss 1992, 1994, 2000; Buss and Schmitt 1993].<sup>7</sup>

In spite of these successes, Evolutionary Psychologists have come in for a fair amount of criticism on a number of fronts. In the next section, I will outline what I think are the most significant challenges faced by the Evolutionary Psychology research programme.

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<sup>6</sup>For a discussion, see [Tooby and Cosmides 1997; Walter 2014: §3; Buller 2005a: §5].

<sup>7</sup>For more information, see Walter [2014: §3].

## 5. Current Challenges for Evolutionary Psychology

The first difficulty for Evolutionary Psychologists centres on their claims about the environment of evolutionary adaptedness (EEA) from which the current adaptations in our cognitive structures are argued to have evolved. Evolutionary Psychologists claim that the last 10,000 years comprising the modern era is insufficient time for new structures to develop [Cosmides and Tooby 1987: 280; Tooby and Cosmides 1989: 34]. However, this amounts to some 400 generations and it is an empirical question whether significant changes to structures can occur within this time. The Evolutionary Psychologists' insistence that the modern period comprises less than 1% of our total evolutionary development is irrelevant if there had been significant selective pressures during this time.<sup>8</sup>

A second line of argument comes from behavioural ecologists, who argue that the Evolutionary Psychologists' conception of adaptation is overly restrictive. For behavioural ecologists, such as Buller [2005b], selective pressures can act directly on behavioural traits, short-circuiting the Evolutionary Psychologists' need for specific information processing modules. Buller's notion of *phenotypic plasticity* is a serious candidate for explaining the wide range of human behaviours without recourse to the evolution of specific cognitive structures for each of those behaviours.<sup>9</sup>

In §3 above, I summarized the Evolutionary Psychologists' arguments for the massive modularity hypothesis; the theory that there are a large number of content-specific cognitive mechanisms that evolved to solve very specific problems in the EEA. This hypothesis gets some support from findings in cognitive psychology. For example, the brain contains separate specialized circuits for analysing the shape of objects, detecting the presence of motion, detecting the direction of motion, judging distance, analysing colour, identifying an object as human, recognizing your mother's face, and so on.<sup>10</sup>

Critics such as Samuels [1998: 587] make the point that a small number of domain-general cognitive mechanisms could have evolved that performed their operations on innate domain-specific information. This criticism is lent weight by recent advances in our knowledge of how the brain develops. Researchers don't see a positive correlation between brain complexity in mammals and genome size (the number of genes). And most of these genes are not dedicated to building specific structures in the brain. It appears that the shape and function of specific structures is the result of pruning, mostly of brain cells that are not interacting with the environment, and outside the ambit of direct gene control.<sup>11</sup> Just how many domain-specific mechanisms there are and how wide the scope is of domain-general mechanisms are open empirical questions that will only be answered by further research.

The fourth kind of argument levelled at Evolutionary Psychologists is that they have not demonstrated that their explanations for current human behaviour are the only ones or the most probable. Gould has labelled the Evolutionary Psychologists' explanations as

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<sup>8</sup>See Walter [2014: §2] for a discussion.

<sup>9</sup>For a discussion on this point, see Downes [2010]. For a brief summary of Buller's position, see his [2005a].

<sup>10</sup>This set of examples is taken from Tooby and Cosmides [1997].

<sup>11</sup>Buller [2005a] summarizes the research data.

'just-so-stories' [Gould and Lewontin 1979; Gould 2000: 119]. I think this criticism is not entirely fair.<sup>12</sup> With the three experimental studies mentioned in the previous section, the Evolutionary Psychologists conducted a functional analysis of a perceived problem faced by our ancestors in the EEA and predicted a computational algorithm that would have solved the problem. The prediction was then tested in the laboratory. As Sell *et al* [2003: 48] put it, using the predictions derived from their functional analysis the Evolutionary Psychologists 'devise experiments that make possible the detection and mapping of mechanisms that no one would otherwise have thought to test for in the absence of such theories'. These studies are exemplars of good scientific practice for empirically supporting a theory. Of course, that still leaves a lot of analyses offered by Evolutionary Psychologists that do not fit this mould.

A related criticism of the Evolutionary Psychologists' approach concerns the uncertainty of our knowledge about what conditions were like during the EEA. The critics' argument is this. Without the particulars about social structures, task differentiation between males and females, kinship relations, and so on, any kind of functional analysis on which conclusions about cognitive structures are based is highly conjectural [Gould 1997: §31; Gould 2000: 120]. I don't think this objection stands. In testing scientific theories, theories are not tested in isolation. In the case of the Evolutionary Psychology programme, the hypotheses specifying conditions during the EEA are auxiliary hypotheses that are tested at the same time as the core theory. In fact, posited conditions at the EEA form part of the positive heuristic of the Evolutionary Psychologists' research programme. When novel predictions from the theory are confirmed, the auxiliary hypotheses about EEA conditions are confirmed concurrently.<sup>13</sup>

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<sup>12</sup>For a critique of Gould's criticisms, see Buller [2005a: §3].

<sup>13</sup>Sell *et al* [2003] makes a similar point.



## 6. The Future for Evolutionary Psychology

Despite its successes, Evolutionary Psychology continues to face a number of theoretical and experimental challenges. Much more work needs to be done to put this approach to the science of psychology on a firm footing. For example, functional analyses that have led to firm novel predictions are comparatively rare. Evolutionary Psychology's central tenet that the human brain consists of many domain specific computational circuits is also far from decided. The viability of the massive modularity thesis may have to wait many more years for the answer to be resolved by research in cognitive science.

The Evolutionary Psychology programme is up against some stiff rivals. Human behavioural ecologists investigate a diametrically opposed hypothesis; that of *phenotypic plasticity*. Natural selection, they propose, has given us a wide repertoire of possible behaviours to fit a diverse range of ecological and cultural environments.

Richard Dawkins proposed a different mechanism to explain our behavioural diversity. His memetics programme looks for and attempts to categorize the cultural corollary to the replicator for genetic biological (genes), which he labelled memes.

Proponents of gene–culture coevolution (also known as dual inheritance theory) argue that singular biological and cultural approaches to human evolution are both inadequate. They are unsatisfactory, they say, because they ignore the fact that human cultures affect their adaptive environments on the one hand and that humans' genetic makeup constrains the types of cultures they can create.

Evolutionary Psychology, I believe, has and will continue to make significant contributions to the way we think about the mind and human evolution. In the next few years, I hope we will see the integration of Evolutionary Psychology into the broader stream of evolutionary studies and continue to witness fruitful cross-fertilisations between the various research streams in biology and the cognitive sciences. Whether Evolutionary Psychologists will succeed in taking the bulk of scientists working within complementary disciplines on their journey, as they wish, or whether Evolutionary Psychology will end up in the dustbin of discarded scientific theories remains to be seen.

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