Evolutionary Psychology: History and Current Status

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Origins of Evolutionary Psychology

The evolutionary study of the mind in the twentieth century has been marked by three self-conscious movements: classical ethology, sociobiology and Evolutionary Psychology (capitalized to indicate that it functions here as a proper name). Classical ethology was established in the years immediately before the Second World War, primarily by Konrad Lorenz and Niko Tinbergen (Burckhardt, 1983). Interrupted by the war, the movement blossomed in the early 1950s, when ethologists established major research institutes in most developed countries and developed a successful sideline in popular science writing. From the outset, ethology sought to apply its methods for the comparative study of animal behavior to human beings, something that was especially prominent in more popular works. Lorenz's *On Aggression* (1966a) is perhaps the best known of these works, but several other leading ethologists wrote advocating the application of the new evolutionary science of the mind to problems of international conflict and social unrest.

The ethologist who focused most on human beings in his actual scientific work was Irenaus Eibl-Eibesfeldt who throughout the 1960s and 1970s sought to document innate, universal behavior patterns in *Homo sapiens* through photography and film (Eibl-Eibesfeldt, 1989).

Classical ethology was largely displaced in the 1970s by sociobiology (Wilson, 1975), a movement that sought to apply to humans a set of new mathematical techniques for the study of animal behavior. During the 1960s behavioral ecologists had come to view animal behaviors primarily as strategies in competitions between and within species. Models of these competitive interactions could be constructed using evolutionary game theory and the predictions of these models tested against actual behavior. Animal behaviors were expected to correspond to ‘evolutionarily stable strategies’, that is, to equilibria in the relevant game-theoretic models. The game-theoretic approach had the advantage that it did not require knowledge of the neural mechanisms underlying behavior (or the genetic mechanisms underlying its transmission). The early ethologists’ 'hydraulic model' of neural mechanisms had collapsed during the 1950s as it became clear that the pre-war neuroscience that inspired it had not been borne out by further investigation. The hydraulic model also failed to accommodate many of the new behavioral phenomena uncovered as ethology matured (Hinde, 1956). No new model of similar generality was available to replace the hydraulic model and its relatives, making a method that dealt directly with behavior highly desirable.

Sociobiologists also argued that their approach was intrinsically more scientific than classical ethology because it made predictions about behavior and tested them rather than merely describing behavior and explaining it. This led to the hope that evolutionary models could guide psychological research and point it towards important phenomena that would otherwise be misunderstood or overlooked, an idea that remains central to today's Evolutionary Psychology. In fact, the advocates of sociobiology included leading figures in today's Evolutionary Psychology, such as Jerome Barkow, who expressed this viewpoint succinctly in his title 'Classical Ethology: Empirical Wealth, Theoretical Dearth' (Barkow, 1979). But despite such oppositional rhetoric, there was considerable continuity of practice and personnel between ethology and sociobiology. Richard Dawkins and Desmond Morris, for example, key figures in the popularization of sociobiology, were students of Niko Tinbergen and regarded sociobiology as a continuation of the tradition he had established (see the introduction to Dawkins, Halliday, & Dawkins, 1991).

At the end of the 1980s sociobiology in its turn came under attack from a new movement calling itself Evolutionary Psychology (Barkow, Cosmides, & Tooby, 1992; Crawford, Smith, & Krebs, 1987). Evolutionary Psychology argued that the whole project of explaining contemporary human behaviors as a direct result of adaptive evolution was misguided (Symons, 1992). The contemporary environment is so different from that in which human beings evolved that their behavior probably bears no resemblance to the behavior that was important in evolution. This problem had been identified by many of the best-known critics of sociobiology (e.g. Kitcher, 1985), but evolutionary psychology

followed it up with a positive proposal. Evolutionary theory should be used to predict which behaviors *would have been* selected in postulated ancestral environments. Human behavior today can be explained as the output of mechanisms that evolved to produce those ancestral behaviors when these mechanisms operate in their very different, modern environment. Furthermore, the diverse behavior seen in different cultures may be the manifestations of a single, evolved psychological mechanism operating under a range of local conditions, an idea that originated in an offshoot of sociobiology known as Darwinian anthropology (Alexander, 1979). Refocusing research on the 'Darwinian algorithms' that underlie observed behavior, rather than the behavior itself lets the evolutionary psychologist 'see through' the interfering effects of environmental change and cultural difference to an underlying human nature.

Adherents of today's Evolutionary Psychology normally present their approach as something very novel, typically describing it as 'the new science of the mind'(Cosmides and Tooby 2001). They allege that the social and behavioral sciences have until recently been dominated by 'the standard social science model' (SSSM). The SSSM denies the existence of any evolved features of the mind and grew out of the liberal political agendas in the 1960 which aimed to change traditional social behavior: 'Not so long ago jealousy was considered a pointless, archaic institution in need of reform. But like other denials of human nature from the 1960s, this bromide has not aged well', as Stephen Pinker puts it on the dustjacket of a recent book (Buss, 2000). But the presentation of Evolutionary Psychology as a rebellion against an anti-biological consensus in the social and behavioral sciences is at best a considerable exaggeration. Instead, Evolutionary

Psychology represents the latest stage of a tradition of evolutionary psychology dating back at least to Lorenz. Nor is the public prominence of Evolutionary Psychology entirely new. Lorenz was as successful a popular author in the 1950s and 60s as Richard Dawkins in the 1970s and 80s. Furthermore, in some important respects, Evolutionary Psychology actually represents a return to the positions of classical ethology. Classical ethologists thought that modern human behavior was the - often maladaptive - result of ancient, evolved mechanisms operating in radically new environments. They also shared the 'modular' conception of the mind, described below. Most importantly, classical ethology and Evolutionary Psychology offer very similar critiques of conventional psychology. Lorenz's complaints were directed against those he liked to call 'American behaviorists'. The laboratory-based search for general laws of learning seemed to him as misguided as dropping automobiles from buildings under controlled conditions and writing down the results. Without an evolutionary perspective, he argued, psychology does not know what it is looking for and when it finds something it does not know what it is looking at (e.g. Lorenz, 1966b, p. 274). In the same way, advocates of Narrow Evolutionary Psychology argue that empirical psychology without an evolutionary perspective has no way to determine whether it is studying meaningful units of behavior or mental functioning: "Cognitive scientists will make far more rapid progress in mapping this evolved architecture if they begin to seriously incorporate knowledge from evolutionary biology and its related disciplines … into their repertoire of theoretical tools, and use theories of adaptive function to guide their empirical investigations". (Tooby & Cosmides, 1998: 195)

Evolutionary Psychology and Cognitive Science

The ethologists based their ideas about mental mechanisms on the neuroscience of the inter-war years. Evolutionary Psychology has turned to ‘classical’ cognitive science with its guiding idea that the mind is computer software implemented in neural hardware (Fodor, 1983; Marr, 1982). Evolutionary Psychology argues that the representational, information-processing language of classical cognitive science is ideal for describing the evolved features of the mind. Behavioral descriptions of what the mind does are useless because of the problem of changing environments described above. Neurophysiological descriptions are inappropriate, because behavioral ecology does not predict anything about the specific neural structures that underlie behavior. Models in behavioral ecology predict which behaviors would have been selected in the ancestral environment, but they cannot distinguish between different mechanisms that produce the same output. Hence, if we accept the conventional view in cognitive science that indefinitely many different neural mechanisms could potentially support the same behavior, behavioral ecology predicts nothing about the brain except the information-processing functions it must be able to perform:

> When applied to behavior, natural selection theory is more closely allied with the cognitive level of explanation than with any other level of proximate causation. This is because the cognitive level seeks to specify a psychological mechanism's function, and natural selection theory is a theory of function. (Cosmides & Tooby, 1987: 284)

It is thus slightly confusing that Evolutionary Psychologists talk of discovering psychological ‘mechanisms’, a term which suggests theories at the neurological level. What ‘mechanism’ actually refers to in this context is a performance profile – an account of what output the mind will produce given a certain range of inputs.

This fact that evolutionary reasoning yields expectations about the performance profile of the mind fits neatly with the explanatory framework of classical cognitive science. According to the influential account given by David Marr (Marr, 1982), explanation in cognitive science works at three, mutually illuminating levels. The highest level concerns the tasks that the cognitive system accomplishes – recovering the shape and position of objects from stimulation of the retina, for example. The lowest level concerns the neurophysiological mechanisms that accomplish that task – the neurobiology of the visual system. The intermediate level concerns the functional profile of those mechanisms, or as it is more usually described, the computational process that is implemented in the neurophysiology. Hypotheses about the neural realization of the computational level constrain hypotheses about computational processes: psychologists should only propose computational models that can be realized by neural systems. Conversely, hypotheses about computational processes guide the interpretation of neural structure: neuroscience should look for structures that can implement the required computations. Similar relations of mutual constraint hold between the level of task description and the level of computational processes. But there remains something of a puzzle as to how the highest level - the task description - is to be specified other than by stipulation. It seems obvious that the task of vision is to represent things around us, but

what makes this true? According to Evolutionary Psychology, claims about task descriptions are really claims about evolution. The overall task of the mind is survival and reproduction in the ancestral environment and the sub-tasks performed by parts of the mind correspond to separate adaptive challenges posed by the ancestral environment. It would obviously have been useful for our ancestors to be able to see, so we should expect people to have a visual system. This kind of thinking becomes useful when the function of a psychological mechanism is not as blindingly obvious as in the case of vision. What, for example, is the task description for the emotions system, or for individual emotions such as jealousy or grief? Evolutionary Psychology argues that in such cases it should be evolutionary thinking that sets the agenda for cognitive science, telling it what to look for and how to interpret what it finds.

The Massive Modularity Thesis

One of the best-known features of Evolutionary Psychology is the ‘massive modularity thesis’ or ‘swiss army knife model’, according to which the mind contains few if any general-purpose cognitive mechanisms. The mind is a collection of separate ‘modules’ each designed to solve a specific adaptive problem, such as mate-recognition or the enforcement of female sexual fidelity. The flagship example of a mental module is the ‘Language Acquisition Device’ - the mechanism that allows human infants to acquire a language in a way that it is very widely believed would not be possible using any general-purpose learning rules (Pinker, 1994). Other well-known examples include the perceptual input devices for which the modularity concept was originally introduced (Fodor 1983). The massive modularity thesis is an example of the kind of evolutionary guidance for

cognitive science described in the last section. Evolutionary Psychology argues that evolution would favor multiple modules over domain general cognitive mechanisms because each module can be fine-tuned for a specific adaptive problem. So cognitive scientists should look for domain specific effects in cognition and should conceptualize their work as the search for and characterization of mental modules.

The Monomorphic Mind Thesis

The leading Evolutionary Psychologists John Tooby and Leda Cosmides have argued strongly for the ‘monomorphic mind thesis’ or 'psychic unity of humankind' (Tooby and Cosmides 1992: 79). This thesis states that any differences that exist in the cognitive adaptations of individuals or groups are not due to genetic differences. Psychological differences between people are always, or almost always, due to environmental factors that trigger different aspects of the same developmental program. If true, this would make cognitive adaptations highly atypical, since most human traits display considerable individual variation related to differences in genotype. All human beings have eyes, but these eyes exhibit differences in color, size, shape, acuity and susceptibility to various forms of degeneration over time, all due to differences in genotype. It has been known for half a century that wild populations of most species contain substantial genetic variation, and humans are no exception.

Tooby and Cosmides offer one main argument for the conclusion that the genes involved in producing cognitive adaptations will be the same in all human individuals:

> ‘Complex adaptations necessarily require many genes to regulate their development, and sexual recombination makes it combinatorially improbable that all the necessary genes for a complex adaptation would be together at once in the same individual, if genes coding for complex adaptations varied substantially between individuals. Selection, interacting with sexual recombination, enforces a powerful tendency towards unity in the genetic architecture underlying complex functional design at the population level and usually the species level as well.’ (Tooby and Cosmides 1990a: 393)

The authors only apply this argument to psychological adaptations, but its logic extends to all traits with many genes involved in their etiology. The argument fails because it assumes that development is a mechanical consequence of the exact sequence of genes on each chromosome. What Cosmides and Tooby seem to have overlooked is the phenomena described by C.H Waddington in the 1940s as 'developmental canalisation': development is buffered against genetic variation, as well as against environmental variation. This is why surprisingly many gene knock-out experiments produce negative results. Disabling a gene known to be involved in a developmental pathway frequently produces no effect (‘null phenotype’), because development contains positive and negative feedback mechanisms that increase transcription of the required gene product from the other allele, initiate transcription from another gene copy or initiate transcription of a different gene product that can produce the same outcome (Freeman, 2000). On a larger scale, it has become a commonplace amongst evolutionary developmental biologists that complex phenotypic features of organisms can be conserved over

evolutionary time despite changes in the specific genes used to construct them and even in the general form of the developmental pathway by which they are constructed (Raff, 1996; Wagner, 1994).

One reason for the popularity of the doctrine of the monomorphic mind is probably as a bulwark against racism. If all human being have substantially the same genes, then racial differences are superficial and modifiable. But no such bulwark is necessary. If we assume that variation in evolved human phenotypes roughly mirrors the known variation in human genotypes, then it follows that the vast majority of traits are pancultural and that the differences between human groups are dwarfed by the differences between individuals within those groups (Cavalli-Sforza, Menozzi, & Piazza, 1994).

Alternatives to Evolutionary Psychology

Many authors disagree with one or more elements of the Evolutionary Psychology program. Some of the strongest rejections of the whole program can be found in Rose and Rose, 2000. Jerry Fodor, one of the originators of Evolutionary Psychology's preferred framework for cognitive science, rejects the massive modularity thesis and has expressed considerable scepticism about the value of evolutionary thinking as a heuristic for cognitive science (Fodor, 2000). Objections from several authors to the massive modularity thesis and to claims about the heuristic value of evolutionary thinking are surveyed in Chapter 13 of Sterelny and Griffiths, 1999. Critics of a different stripe agree with Evolutionary Psychology that evolutionary thinking has considerable implications for cognitive science but disagree about what it implies. Two recent collections of papers

that include many pro-evolutionary criticisms of this sort are Holcomb, In Press and Scher & Rauscher, In Press. Finally, a ‘developmentalist’ tradition in behavior research, also with its roots in classical ethology, has criticized both sociobiology and Evolutionary Psychology for failing to integrate the Darwinian study of behavior with the study of how behavior develops. An accessible introduction to this tradition is provided by Bateson and Martin, 1999.

References

Alexander, R. *Darwinism and Human Affairs*. Seattle: Washington University Press, 1979.

Barkow, J. H. "Human Ethology: Empirical wealth, theoretical dearth". *Behavioral and Brain Sciences, 2*(1) (1979): 27.

Barkow, J. H., Cosmides, L., & Tooby, J. (Eds.). *The Adapted Mind: Evolutionary Psychology and the Generation of Culture.* Oxford: Oxford University Press, 1992.

Bateson, P. P. G., & Martin, P. *Design for a Life: How behavior and personality develop*. London: Jonathan Cape, 1999.

Burckhardt, R. W. "The development of an evolutionary ethology". In *Evolution: From Molecules to Men,* edited by D. S. Bendall, 429-444. Cambridge: Cambridge University Press, 1983.

Buss, D. M. *The Dangerous Passion: Why Jealousy is as Essential as Love and Sex*. New York: Simon and Schuster, 2000.

Cavalli-Sforza, L. L., Menozzi, P., & Piazza, A. *The History and Geography of Human Genes*.: Princeton University Press, 1994.

Cosmides, L., & Tooby, J. "From evolution to behaviour: evolutionary psychology as the missing link". In *The Latest on the Best: Essays on optimality and evolution,* edited by J. Dupré, 277-307. Cambridge: MIT Press, 1987.

Cosmides, L., Tooby, J., & Barkow, J. H. "Introduction: Evolutionary Psychology and Conceptual Integration". In *The Adapted Mind: Evolutionary Psychology and the Generation of Culture,* edited by J. H. Barkow & L. Cosmides & J. Tooby, 3-15. Oxford, New York: Oxford University Press, 1992.

Cosmides, L., & Tooby, J., *What Is Evolutionary Psychology : Explaining the New Science of the Mind*. New Haven: Yale University Press, 2001.

Crawford, C., Smith, M., & Krebs, D. (Eds.). *Sociobiology and Psychology: Ideas, Issues and Applications*. New York: Lawrence Erlbaum Associates, 1987.

Dawkins, M. S., Halliday, T. R., & Dawkins, R. (Eds.). *The Tinbergen Legacy*. London: Chapman and Hall, 1991.

Eibl-Eibesfeldt, I., *Human Ethology*. New York: Aldine de Gruyter, 1989.

Fodor, J. A. *The Modularity of Mind: An Essay in Faculty Psychology*. Cambridge, Mass: Bradford Books/MIT Press, 1983.

Fodor, J. A.. *The Mind Doesn't Work That Way: The Scope and Limits of Computational Psychology*. Cambridge, Mass: MIT Press, 2000.

Freeman, M. "Feedback control of intercellular signaling in development". *Nature,* 408 (2000): 313-319.

Hinde, R. A. "Ethological Models and the Concept of 'Drive' ". *British Journal for the Philosophy of Science,* 6 (1956): 321-331.

Holcolmb, H. H. III. (Ed.). *The Evolution of Minds: Psychological and Philosophical Perspectives*. Dordrecht: Kluwer, In Press.

Kitcher, P. *Vaulting Ambition*. Cambridge: M.I.T. Press, 1985.

Lorenz, K. *On Aggression* Translated from the German by M.K. Wilson). New York: Harcourt, Brace and World, 1966a.

Lorenz, K. "Evolution of ritualisation in the biological and cultural spheres". *Philosophical Transactions of the Royal Society of London,* 251 (1966b): 273-284.

Marr, D. *Vision*. New York: W.H. Freeman, 1982.

Pinker, S. *The Language Instinct: The New Science of Language and Mind*. New York: William Morrow, 1994.

Raff, R. *The Shape of Life: Genes, Development and the Evolution of Animal Form*. Chicago: University of Chicago Press, 1996.

Rose, H., & Rose, S. *Alas Poor Darwin: Arguments Against Evolutionary Psychology*. New York: Random House, 2000.

Scher, S., & Rauscher, M. (Eds.). *Evolutionary Psychology: Alternative Approaches*. Dordrecht: Kluwer, In Press.

Sterelny, K., & Griffiths, P. E. *Sex and Death: An Introduction to the Philosophy of Biology*. Chicago: University of Chicago Press, 1999.

Symons, D. "On the use and misuse of Darwinism in the study of human behavior". In *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*, edited by J. H. Barkow, L. Cosmides & J. Tooby, 137-159. Oxford: Oxford University Press, 1992.

Tooby, J., & Cosmides, L. "The past explains the present: emotional adaptations and the structure of ancestral environments". *Ethology and Sociobiology, 11* (1990): 375-424.

Tooby, J., & Cosmides, L. "Evolutionizing the cognitive sciences: A reply to Shapiro and Epstein". *Mind and Language, 13*(2) (1998): 195-204.

Wagner, G. P. Homology and the Mechanisms of Development. In *Homology: The Hierarchical Basis of Comparative Biology*, edited by B. K Hall, 273-299. New York: Academic Press, 1994.

Wilson, E. O. *Sociobiology: The New Synthesis*. Harvard: Harvard University Press, 1975.