How Useful Are the Concepts “Innate” and “Adaptation” for Explaining Human Development?

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Adaptationist thinking has played an important role in the life sciences, especially since the neo-Darwinian modern synthesis of Darwinian natural selection and Mendelian genetics that occurred in the 1930s. Adaptationist approaches focus on what a phenotype “is for” by reasoning about what particular adaptive problem it might have solved in an ancestral environment. This in turn leads to hypotheses regarding the manner in which the phenotype in question may have enhanced reproductive success. In the past 20 years or so, largely through the work of evolutionary psychologists, adaptationist explanation has become more common in psychology. During this same period of time, core knowledge explanations of human development have also increased in popularity. Such researchers conceive of the core capacities for which they marshal empirical evidence as the products of natural selection and, therefore, adaptations. In this article, I briefly describe these two approaches to human development and place their adaptationist programs in a historical context. I then describe recent developments that complicate adaptationist and innatist claims and briefly discuss the possibility of an alternative evolutionary meta-theory.

In a general sense, evolutionary psychology can be understood as the study of the effect of evolutionary change on psychological development. It is sometimes capitalized as Evolutionary Psychology to single out the so-called Santa Barbara school of evolutionary psychology associated primarily with the theorizing of Tooby and Cosmides, but also Pinker, Buss and a few others [e.g., Buss, 1995; Pinker, 2003; Tooby & Cosmides, 1992]. Although my goal in this necessarily brief article is to discuss adaptationism more generally, I focus on evolutionary psychology because it lays out the basic assumptions that are in play when psychologists claim that a given phenotype is the result of an adaptation and is, accordingly, in some sense innate. In broad strokes, evolutionary psychology explains currently adaptive behavior – and sometimes maladaptive behavior through relying on mismatch arguments between our ancestral and modern environment – in terms of specific cognitive adaptations that are the product of the differential reproductive successes of our hominid ancestors. It is explicitly adaptationist because it explains human development by attempting to

construct the putative domain-specific design features of the mind and to then reverse engineer the evolutionary pressures that would have selected for them. This form of explanation has been explicitly applied to the development of social cognition and language [e.g., Baron-Cohen, 1995; Pinker, 2003]. Although evolutionary psychology approaches do not typically hypothesize specific links between particular sets of genes and adaptations for a given phenotype, they do in some sense conceive of phenotype as innately specified as a result of heritable positive selection acting on the genetic carriers of the phenotype. Otherwise, how else is the trait in question to be inherited? Adaptationism though is far broader than evolutionary psychology and is even used by psychologists who are explicitly critical of evolutionary psychology. For example, although strongly objecting to Pinker's evolutionary psychology view of language, Tomasello [1995, 2008] uses adaptationist reasoning to argue for the evolutionary origins of the capacity to share intentions with other humans and has described this capacity as innate. Although human social interest and sociality may well be "innate" in some rough sense, in what particular sense is a harder question to answer and one that is central for explanatory purposes [Mameli & Bateson, 2011].

Core knowledge approaches to human development are also unified in their emphasis on innate domain-specific structure. The innate concept has been used to explain the core foundations of mathematical, physical, social, biological and moral cognition [e.g., Baillargeon, 2004; Baillargeon, Scott, & He, 2010; Carey, 2009; Gelman & Raman, 2002; Hamlin, Wynn, & Bloom, 2007; Spelke & Lee, 2012; Wynn, 1992]. Unlike evolutionary psychology approaches to human development which often rely on comparative notions of the presence or absence of capacities in related species, or in some cases behavioral or survey data to support claims of universality, core knowledge approaches rely on a variety of experimental techniques that are typically used to probe the prelinguistic minds of infants. Sometimes versions of these studies are also performed on other species to support the universalism of the claim. Although evolutionary psychologists are explicit about their evolutionary commitments, core knowledge theorists have written little about the evolutionary foundations of their approach. However, some form of adaptationism is clearly shared by both camps.

One way to frame what is at issue for evolutionary psychology and core knowledge approaches to human development with respect to their views of evolution is to briefly review a seminal article by Gould and Lewontin [1979]. This paper, and a related one by Gould and Vrba [1982], constitute what is essentially a cautionary tale about the dangers of adaptationist thinking, which can lead, in their view, to the telling of "just so stories" in Kipling's sense. In summary, although a presently adaptive behavior might well be argued to be the product of an adaptation that was selected because it "conferred" upon its bearer reproduction enhancing behavior in an ancestral environment, it is risky to reverse engineer such an adaptation just because a phenotype is presently adaptive. Gould and Lewontin [1979] suggest through the use of the concept of a spandrel that one can have phenotypes that appear well designed but that are in fact the byproduct of other organismic constraints rather than direct or indirect selection pressures. Gould and Vrba [1982] added the concept of an exaptation, a term Gould [1991] later recommended for adoption by evolutionary psychologists, and refined the discussion such that there are three possibilities when one witnesses current adaptation: (a) it is underwritten by an adaptation in the classical sense (i.e., directly selected), (b) it is a co-opted adaptation – one form of exapta-

tion – resulting from the recruitment of a previously directly selected phenotype for a new function (for example, feathers seem first used for thermoregulation but then later afforded flight), and (c) there is no direct selection at all as in the case of the spandrel – another form of exaptation, and one that Gould and Lewontin claim is far more common and interesting than appreciated. The chief point made by Gould and his colleagues though was to draw attention to the conceptual and methodological difficulties one faces in reverse engineering an adaptation from a presently adaptive phenotype.

One way of responding to Gould and Lewontin's critique might be to claim that they misunderstand the nature of evolutionary explanation; the issue at hand is not whether phenotypes are optimally designed but whether it makes sense to treat and test them as if they are. This is to take the so-called adaptationist stance as a methodological principle and to proceed through reverse engineering and if – then optimality models to test various adaptationist hypotheses of the phenotype in question [Durrant & Haig, 2001]. If one rejects them all, it is claimed, then one could proceed to test nonadaptationist explanations such as genetic drift where neutral characteristics can become common and amplified by what is effectively sampling error. This methodological gambit encourages evolutionary theorists to focus on presumed design features while ignoring developmental and genetic explanation, which seems to follow from Mayr's [1961] distinction between ultimate and proximate causation. And, as such, one could claim that treating phenotypes as well designed seems quite reasonable in the first instance and therefore Gould and Lewontin's critique (and also the present argument) is off the mark.

However, there is another aspect of Gould and Lewontin [1979] that also happens to be quite in step with recent discoveries and theoretical work in biology. Here the most relevant consideration would be that Gould and Lewontin, as Lewontin does in more detail in later work [Lewontin, 2004; see also e.g., Gottlieb, 2002], are arguing for a more inclusive conception of evolution than is afforded by neo-Darwinism. In particular, they claim it is mistaken to conceive of an organism as a collection of parts, domain-specific or otherwise, each deserving of its own individual explanation. If so, methodological convenience might turn out to be a bad gamble except in cases where the underlying biology and development of the phenotype in question is well understood. Part of what is at issue then is the extent to which it makes sense to think of genes as sufficient – I presume all parties would agree that they are necessary – for species-typical phenotypic development. Although I presume all parties would also agree that experience is necessary, the devil, as they say, is in the details. But if we truly want to understand the evolutionary and developmental history of a phenotype, these details may well matter. Here, there are clear differences of opinion, or else core knowledge theorists and evolutionary psychologists would not choose to use terms like “innate” and “adaptation” or speak of “designed minds.” And it is not clear that these approaches are immune to the sort of “just so” criticism that Gould and Lewontin raised in 1979. If one wishes to ignore Gould and Lewontin and turn this into a methodological injunction to assume phenotypes are the product of an adaptation unless proven otherwise, what of the second thrust of their article and other more recent claims that typical development is the outcome of a variety of complex interacting factors, some of which are undoubtedly genetic but many of which are not? Treating phenotypes as adaptations and/or innate seems to skate over this very possibility.

Another possible objection, again mindful of Mayr's [1961] distinction between ultimate and proximate causation and perhaps also Tinbergen's [1963] distinction between ontogeny and phylogeny, would seem to be the claim that evolution is a population-level concept, and we must not confuse factors that might influence development with population processes. This point is well taken, but it underscores a more fundamental potential issue in neo-Darwinian thought which is that a simplifying assumption in the population genetic model upon which Mendelian genetics and Darwinian selection is based was to assume reliable development and, therefore, to remove evolution from development [see e.g., Wereha & Racine, 2012]. This is a reasonable assumption for the purpose of characterizing changes in allele frequencies in populations over time. However, it seems an unreasonable assumption to employ when attempting to explain human development. To repeat: The neo-Darwinian framework is at root, by definition, a nondevelopmental framework. It is therefore obscure how it can do very much to illuminate the development of particular cognitive capacities. Perhaps it is not very surprising then that core knowledge and evolutionary psychology explanations of human development have proven to be somewhat controversial; part of the reason might be that they are simply based on the wrong evolutionary meta-theory.

To put this in a historical context, the modern synthesis of the 1930s has proven so successful in the life sciences that it is easy to forget that Mendel's and Darwin's ideas were seen as incompatible in the early 20th century. There are strong indications that a similarly revolutionary climate might exist today [Pigliucci & Müller, 2010]. The tree of life, probably the most fundamental idea in neo-Darwinian thinking, has been complicated by the discovery that horizontal rather than vertical gene transfer may be the norm in simpler parts of the natural world. Epigenetics, and especially epigenetic inheritance, has made the line between gene and environment blurry and has ushered in concepts like the epigenome. The role of culture in evolution is becoming more appreciated, as is the activity of the organism in the evolutionary process. Discoveries in molecular and evolutionary developmental biology that document the subtle and highly conserved nature of genetic processes are of a pace with developmental systems views of evolution that conceive of gene regulation as a cellular, bidirectional, multiply influenced and highly dynamic process. The neo-Darwinian population level understanding of evolution as changes in gene frequencies over time has in turn been critiqued for having little use in explaining the development of individuals and also for its potential determinism and reductionism [Dupré, 2001].

Although these findings and theoretical innovations and a variety of related ones are for the most part uncontroversial in biology, they have been slow to seep into the study of human development. Ironically, Nielson [2009, p. 2887] claims that as a result of Gould and Lewontin's [1979] classic article, "Evolutionary biologists are today, arguably, much more reluctant to invent adaptive stories without direct evidence for natural selection acting on the traits in question." At present, it does not seem that the same can be said about adaptationist explanations of human psychological development. As Nielson [2009, p. 2488] goes on to remark, "The fallacy that functional effects combined with evidence for selection provides evidence that selection is acting on the specific traits has led to a number of dubious claims in human genomics," several of which he proceeds to document in some detail. Perhaps another reason that evolutionary psychology and core knowledge explanations remain fairly common in

psychology is that psychologists may be working at a level of abstraction that we would not be able to countenance if we had to cash such claims out in actual networks of genes. There is even less discussion in human developmental circles of the debates occurring in the philosophy of biology concerning the coherence of basic concepts like innate, learned, and heritable, or even more fundamentally what is meant by a gene or adaptation. Although alternatives to evolutionary psychology have arisen in psychology that emphasize, for example, the role of cultural evolution and show that local adaptation does not require *an* adaptation in the neo-Darwinian and evolutionary psychology sense, so-called gene-culture co-evolution views seem to have a neo-Darwinian backbone when it comes to explaining the more general purpose mechanisms that they favor [e.g., Boyd, Richerson, & Henrich, 2011].

To conclude, the issue from my point of view is not that evolutionary psychology and core knowledge approaches may be somehow wrong. The problem is that it is hard to know if they are right. However, this is *not* to claim that in fact these features of human development are not the product of evolution but rather some other favored process (e.g., statistical learning, general cognitive development, and so forth); it is simply to come to terms with the difficulty and complexity of evolutionary explanation. As much as we might wish these to be simple empirical or methodological issues, they are not. It may also suggest that evolutionary psychology and core knowledge approaches are relying, explicitly or otherwise, on the wrong evolutionary meta-theory. Whatever the case, those interested in understanding human development would do well to appreciate how little we may have said when we claim something is innate or the product of an adaptation.

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