

The Goldberg Exaptation Model:
Integrating Adaptation and By-product Theories of Religion

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Abstract

The literature on the evolution of religion has been divided by a fundamental debate between adaptation theories, which explain religious traits as products of selection for religion, and byproduct theories, which explain religious traits as products of selection for other, non-religious functions. Recently, however, a new position has emerged in this debate, as an influential new theory based on cultural selection claims to integrate adaptation theories with byproduct theories, yielding a single, unified account. I argue that the proponents of this view do not say enough about how integration is actually supposed to work, from a logical point of view. Basic questions arise from the assumptions required for unifying these apparently conflicting approaches, which the authors of the account do not address. In response to these questions, I provide a model of the religious phenotype, the Goldberg Exaptation Model, which shows that adaptation and byproduct theories are consistent, and explains how they are positively related, over and above mere consistency. On this view, the religious phenotype is best understood on analogy with a Rube Goldberg device: it is assembled by selection for religion, but using parts designed by selection for other, non-religious functions.

1. Introduction

A central debate in the scientific study of religion has been that between adaptation theories, which explain religious belief and behavior as an evolutionary adaptation (Haidt 2012; Powell and Clarke 2012; Bering 2011, 2006; Bulbulia 2009; Sosis 2009; Sosis and Alcorta 2003; Wilson 2002; Irons 2001), and byproduct theories, which deny that religion is an adaptation (Baumard et al. 2014; Baumard and Boyer 2013; Kirkpatrick 2008; Bloom 2007; Pinker 2006; Barrett 2004; McCauley 2004; Atran 2002; Boyer 2001; Lawson and McCauley 1990). According to the byproduct account, religion per se has no evolutionary function, and religious belief and behavior is best explained as a byproduct of the activities of psychological traits adapted for other, non-religious functions. More recently, however, a third position has emerged in this debate, which I call *integrationism*. The integrationist thesis is that adaptation and byproduct accounts can be unified, and it is my aim here to explain how, from a logical or conceptual point of view, this unification can be achieved.

Integration requires that the theories being integrated are logically consistent, and this claim has been defended elsewhere. For example, Thurow (2013, p. 80) and Bourrat (2015) both argue that while byproduct theories may explain the origins of various religious traits, adaptation theories explain, instead, the subsequent spread and persistence of these traits. Likewise, Powell and Clark (2012, p. 478) advocate a “pluralist” model, based on Godfrey-Smith’s (2009) distinction between “origin explanations” and “distribution explanations.” On this view, “religion or various aspects of religion originated as byproducts of evolved cognitive structures but were subsequently co-opted for adaptive purposes” (p. 456). Moreover, as we shall see, there are several other ways in which these two types of theories may be said to address different explanatory questions, and thus to be mutually consistent. Yet while consistency is necessary for integration, it is not sufficient. Integration requires, in addition, that the theories being integrated *cohere*, forming a single, unified account. Consistency is cheap. The ideal gas theory and the heliocentric model of the solar system are consistent with one another, but this does not show that they can be integrated in any interesting sense. Further, these theories are also consistent with byproduct and adaptation theories alike, but this consistency does not show that the ideal gas theory plays any role in explaining religion. Thus, if adaptation and byproduct theories are indeed consistent, then a new question arises, which is equally important: how are these accounts positively related, over and above mere consistency, as theories of religion? But while previous

treatments of the adaptation/byproduct debate have done the important work of showing that this question needs to be addressed, they have only begun to actually address it. Here I provide a model of the religious phenotype—the Goldberg Exaptation Model—designed to address this question directly, and in detail.

For the purposes of integration, the most promising empirical account available is what I refer to here as the “Big Gods” account, following the title of Norenzayan’s (2013) book-length treatment.¹ What is distinctive about this account is that it is based on the dual-inheritance framework, a modeling approach founded on the assumption that social learning counts as a distinctly cultural form of inheritance, on a par with genetic inheritance.² It follows from this basic assumption that there exists, in human evolution, a distinctly cultural form of Darwinian natural selection, which runs in parallel with genetic selection, such that the two processes interact causally in dynamic, coevolutionary relationships. And because the dual-inheritance framework independently provides what is, to my knowledge, the most comprehensive and sophisticated theory of human cooperation in general (Sterelny 2016; Chudek, Zhou, and Henrich 2013; Henrich et al. 2006; Boyd and Richerson 2005, Richerson and Boyd 2005; Henrich 2004; Fehr and Fischbacher 2003), it is particularly well positioned to explain the fundamentally social nature of religion, in addition to explaining the proximate cognitive adaptations involved in forming supernatural beliefs. Accordingly, Norenzayan claims that, “The argument in this book is an attempt at integrating these two perspectives—the social and the cognitive—that are currently seen as competing accounts” (2013, p. 11). Yet while the authors of the Big Gods theory tout its integrationist potential, they actually say very little about how, logically speaking, it brings adaptation theories and byproduct together. Integration is indeed one of the most important contributions that the Big Gods theory stands to make to the study of religion, but existing presentations of it do not articulate how the concepts and insights they provide function to knit previous theories together, forming a single, unified account, rather than a mere collection of distinct and independent accounts, which simply explain different things. Moreover, the integrationist claims made in current versions of the Big Gods account generate new conceptual problems, which they do not address.

¹ For article-length versions, see: Norenzayan et al. 2014; Atran and Henrich 2010; Henrich et al. 2010.

² For dual-inheritance theory in general, see: Richerson et al. 2015; Chudek, Zhou, and Henrich 2013; Henrich, Boyd, and Richerson 2008; Richerson and Boyd 2005.

I begin by describing the theory of Big Gods itself, and explicating the assumptions that underlie its integrationist claims. I then identify three important conceptual problems that arise from these assumptions. After presenting the Goldberg Exaptation Model (GEM) itself, and articulating the basic sense in which it brings adaptation and byproduct theories together, I go on to show how this model solves the conceptual problems facing the Big Gods view. In the process, the GEM identifies and clarifies the basic principles of a unified theory of the evolution of religion, and it shows how these principles function within what I take to be the most comprehensive and fully developed empirical theory currently available.

2. Integration By Big Gods, and Problems that Arise

2.2 Integration By Big Gods

It is crucial to note from the outset that adaptation theories and byproduct theories alike share a commitment to *adaptationism*, in the general sense of the term. Like adaptation theories, byproduct theories explain their target traits as adaptations, or traits produced by natural selection.³ One important consequence of this is that all theories in this domain are functionalist theories based on some form of etiological notion of function (e.g., Griffiths 1993). That is, everyone agrees that the psychological traits in question are functional capacities—capacities defined teleologically, in terms of what they are for—and that what they are for is determined by what they have been selected for, in the evolutionary past. Another important consequence of the shared commitment to adaptationism, however, is that it reveals the fundamental issue at stake to be, not whether the traits in question are products of selection in general, but whether they are products of selection specifically for religion itself. By definition, byproduct accounts explain their target traits by appealing to selection for anything but religion, while adaptation theories explain their target traits by appealing to selection specifically for religion. Thus, byproduct theories identify non-religious functions, while adaptation theories identify religious functions. Accordingly, as I explain in more detail below, one additional sense in which these theories are

³ No trait is produced solely by natural selection, of course, since other sources of evolutionary change—mutation, migration, sexual recombination, drift, etc.—are needed to generate the variation on which selection acts.

consistent is due to the fact that the same trait, or functional capacity, may possess more than one etiological function.

Moreover, by appealing to the dual-inheritance framework, the Big Gods theory offers a principled way of showing how some religious traits could be byproducts, while other religious traits are adaptations: even if there has been no genetic selection for religion per se, there may nevertheless have been cultural selection for religion per se. Thus, the religious phenotype is assumed to be a complex of functional traits, which includes both cultural adaptations possessing religious functions and genetic adaptations possessing non-religious functions. Here is how the authors themselves make the point (Norenzayan et al. 2016, p. 5):

We begin with the idea that religious elements arose as a non-adaptive evolutionary byproduct of ordinary cognitive functions (Atran & Norenzayan 2004; Bloom 2004; Boyer 1994; Barrett 2004). However, we go beyond cognitive byproduct approaches... We argue that while religious representations are rooted in innate aspects of cognition, only some of the possible cultural variants then spread at the expense of other variants because of their effects on success in intergroup competition... Our contribution builds on evolved psychological mechanisms, but also explores in great detail the cultural learning dynamics and the historical processes that shape religions and rituals in both adaptive, and maladaptive ways. Thus, we argue that our framework reconciles key aspects and insights from the adaptationist and byproduct approaches.

Being committed to the dual-inheritance framework entails that the Big Gods theory is an instance of what I call *broad adaptationism*, or adaptationist theorizing that appeals to multiple forms or processes of selection occurring at once.⁴ By contrast, traditional adaptationist theories assume narrow adaptationism, appealing to just one form of selection: genetic selection occurring at the individual level. Dual-inheritance theories appeal to cultural selection in addition to genetic selection, and to group selection in addition to individual-level selection. And since selection acting on either of these two forms of inheritance may, in principle, occur at either of these two levels, this means the dual-inheritance framework ultimately recognizes four distinct forms of selection that may, in principle, explain any given trait. In practice, however, for reasons that are empirical, rather than conceptual, dual-inheritance theorists also reject one of these four selection processes, namely, genetic group selection. For a process of selection to count as selection at the group level, the phenotypic differences on which selection acts must be concentrated at the group level (Richerson et al. 2015; Henrich 2004). This means that members

⁴ For an alternative instance of broad adaptationism, and an adaptationist framework that is even broader than the dual-inheritance approach, see Jablonka and Lamb (2006).

of the same group share with each other the same variant of the trait in question, while members of other groups share with each other some other variant of that trait. Of course, individuals in the same group will typically differ from one another to some degree as well, but to the extent that they do, and to the extent to which selection acts on those differences, this would be individual-level selection, not group selection. In addition, *cultural* group selection requires that the relevant group-level differences occur specifically among traits that individuals acquire through social learning, or cultural inheritance. In genetic group selection, by contrast, group-level variation must be produced instead by a corresponding, underlying pattern of group-level variation in genes (Bell, Richerson, McElreath 2012). Yet dual-inheritance theorists Richerson and Boyd argue that, in humans at least, too little genetic variation remains concentrated at the group level for long enough periods of time to render selection acting on such variation a significant evolutionary factor. They present modeling work showing that ordinary rates of migration in humans would erode group-level variation in genes much too quickly for the slow process of genetic selection to take effect (2005, p. 203). They also present empirical work showing that group-level genetic variation is, in fact, extremely small, especially in comparison to the amount of group-level variation found among cultural traits (Bell, Richerson and McElreath 2012). Further, Richerson et al. (2015) identify a number of mechanisms through which group-level variation in cultural traits can be maintained over many millennia—ample time, in cultural evolution, for selection to have dramatic effects. As a result, the adaptationist framework on which the Big Gods theory is founded actually appeals to three distinct processes of selection: genetic selection among individuals, cultural selection among individuals, and cultural selection among groups. For any given trait, it is thus an empirical question which of these processes explains its evolution, a question that depends on (1) how the trait is inherited by individuals, and (2) whether, or to what extent, some variation in the trait is concentrated at the group level.

Since byproduct theories in general are based on traditional, narrow adaptationism, it is clear enough how the Big Gods theory is capable of incorporating byproduct accounts. Narrow theories only appeal to individual-level genetic selection, and the Big Gods account assumes that many important traits of the religious phenotype—the byproducts—are products of individual-level genetic selection. Yet cultural selection at the individual level is also essential, on this view, because it explains how the traits of any particular religious system spread within groups, rather

than between them. And when the traits in question are those that distinguish members of particular religions from one another, rather than those that distinguish religious individuals from non-religious individuals, the relevant form of variation is cultural, not genetic. Genetically inherited traits may explain much about how an individual acquires *some* set of religious beliefs or other, but to explain this is not to explain why that individual possesses the particular religious beliefs she actually possesses—the traits in virtue of which she counts as a Protestant, a Taoist, or a Hindu, for example. For even when the children of Protestant parents inherit their religious beliefs and practices directly from their genetic parents, they do not inherit these traits *genetically*—any more than English-speaking children acquire through their genes the capacities to use “please” and “thank you” correctly. Accordingly, when psychological traits of this kind are maintained at high frequencies within groups, the form of selection at work is cultural selection, not genetic selection.

So while the Big Gods account is deeply committed to individual-level selection acting on both genes and culture, its authors also argue that a full explanation of religion will ultimately require appealing to cultural group selection (but not genetic group selection), in addition. In particular, they argue, what still is not explained by any other account is the prosocial nature of religion, or the role religion plays in promoting cooperation and suppressing selfishness among group members. The theory begins from the observation that, of all the things that culturally inherited beliefs might be about, beliefs involving *supernatural monitoring* are disproportionately common. These are beliefs in which moralistic supernatural agents monitor the social behavior of humans, rewarding individuals who follow norms and make sacrifices for others, while punishing individuals who cheat and behave selfishly. Moreover, the authors note that belief systems involving supernatural monitoring tend to occur at higher frequencies in large-scale societies than in small-scale societies, such as tribes of hunter-gatherers (Henrich et al. 2010). This distinctive pattern of distribution among religious traits is something that cultural group selection is uniquely poised to explain, they claim, because it coheres beautifully with an independent account of the evolution of large-scale cooperation in general, which is itself based on cultural group selection (Henrich 2004; Boyd and Richerson 2005; Chudek and Henrich 2011; Richerson et al. 2015). The account focuses on prosocial behavior, or cooperation that is costly to the agent, but beneficial to at least one other individual, where the relevant costs and

benefits are measured in the currency of genetic fitness. More specifically, it focuses on prosocial behavior in the form of large-scale collective action.

In small-scale societies, as in other species, cooperative partners consist of genetic relatives and well-known partners in reciprocal exchange. But in modern nation-states, hundreds of millions of unrelated, anonymous individuals pay substantial costs to generate non-excludable public goods, which benefit all group members equally (Boyd and Richerson 2005). Soldiers sometimes give their lives—a genetic fitness cost that can never be repaid—for the benefit of millions of other individuals who are not genetically related, and whom they will never even meet. Likewise, churches and governments redistribute wealth in social welfare programs in which “haves” pay costs to benefit anonymous “have nots” who will never repay them. And Americans on vacation tip at restaurants to which they know they will never return. Genetic selection among individuals cannot explain such behavior, because of the well-known problem of free riding.

All else being equal, individuals who incur mortal risks for the equal benefit of all of their fellow group members have lower genetic fitness than the other individuals in their group, who receive all the same fitness benefits, but without paying the costs. In such contexts, selection at the individual level favors free riding over prosociality. At the group level, however, things are different; selection favors prosociality over free riding, in spite of its inherent costs. Armies composed largely of free riders do not win battles, because the individuals who make them up tend to scatter at the first signs of personal risk. And there is nothing special about collective defense, except that it is a salient form of non-excludable public good, from which benefits accrue to all group members equally. Collective action, or prosocial behavior that benefits the public indiscriminately, also occurs in a wide range of other domains, including foraging (hunting big game, collective agriculture), resource management (pollution of rivers, depletion of grazing lands, or fish and game populations) and the establishment and maintenance of public infrastructure (roads, water systems, courthouses). In general, groups in which collective action is common enjoy many types of benefits over other groups, enabling them to compete better for limited resources, to expand in size, and to spread their cultural traits more widely.

Importantly, while collective action does have important genetic fitness benefits, these benefits are not the ones responsible for explaining how prosocial behavior has spread, on this account. For while prosocial behavior is *defined* in terms of genetic fitness consequences, it is

explained in terms of cultural fitness (at both levels), not genetic fitness. Because cultural traits do not spread through reproduction, they do not spread in virtue of their contribution to reproductive potential. As Richerson and Boyd point out (2005, Ch. 5), our capacities for social learning would never have evolved in the first place if social learning in general reduced genetic fitness, rather than enhancing it, but it does not follow that each particular cultural trait must have positive fitness effects. After all, people learn from other people how to process and consume heroine and crack, and these culturally inherited skills spread all too successfully despite obviously negative fitness effects. Thus, the claim is that when cultural beliefs and practices contribute to collective action, they also tend to increase in frequency—not because public goods contribute positively to individual genetic fitness, but because public goods increase the probability of cultural traits’ being *learned* by more individuals. There are many ways this may occur.⁵ Individuals from groups with less prosocial beliefs and customs might immigrate into more prosocial societies, and then acculturate. Alternatively, individuals from less prosocial cultures might stay put, but adopt more prosocial beliefs and practices from neighboring groups. Unfortunately, one of the most common ways in which such traits have spread is for more prosocial societies to generate larger, more cohesive armies, use them to conquer smaller, less prosocial societies, and then force assimilation upon members of the vanquished group. Any of these mechanisms would count as cultural group selection, as long as the traits in question are inherited through social learning, and vary at the group level.

According to the Big Gods account, then, the beliefs, norms and practices of the world’s most successful and widespread religions are among the class of prosocial cultural traits that have been selected for at the group level. As noted above, the concept of supernatural monitoring functions, within this account, to connect the cultural-group-selection account of prosocial behavior in general with the specifically religious forms of prosocial behavior observed in successful religions, such as Judaism, Christianity, Islam, Hinduism, Buddhism, and others. “Big Gods” are defined as supernatural agents who are both powerful and moralistic, and what they are said to be monitoring is, ultimately, free riding: the antisocial pursuit of self interest at the expense of the group as a whole. People who believe they are being monitored by such agents are thus predicted to be more motivated than other individuals to follow norms that regulate free riding, to make sacrifices for others, and generally to engage in collective action with anonymous

⁵ For a more technical analysis of these factors, see Richerson et al. 2015, Section 2.1

partners.⁶ So to the extent that prosocial behavior is brought about specifically by socially learned beliefs, the same group-level selection pressures that favor prosocial behavior in general will also favor the beliefs that contribute to this behavior. Thus, “interrelated religious elements that sustain faith in Big Gods have spread globally along with the expansion of complex, large-scale human societies” (Norenzayan et al. 2016, p. 2).

2.2. Problems for Integration

Because the Big Gods account appeals to cultural fitness—the contribution a trait makes to its own potential for being more widely learned—rather than to genetic fitness—the contribution a trait makes to the reproductive potential of individuals who possess it—the sense in which religion may be said to count as an adaptation means something very different from what it means in most other theories, including other adaptation theories of religion. Traits produced through cultural group selection are, by definition, cultural adaptations, rather than genetic adaptations. At the same time, however, the byproducts of the religious phenotype are indeed genetic adaptations of individuals. Thus, in order to integrate adaptation theories with byproduct theories, the Big Gods theory must employ a concept of adaptation that is capable of abstracting away from facts about genes and fitness, but also capable of including ordinary genetic adaptations. This represents a substantial difference between this account and previous adaptation theories, such as Irons’ costly signaling account (2001), or Bering’s account of supernatural monitoring (2011; 2006), which make no mention of cultural selection. It thus represents a substantial difference between the theory doing the integrating and the theories it purports to integrate.

A different question concerns what it means for any kind of adaptation to be adapted specifically for religion. As noted above, the basic logical difference between adaptation theories and byproduct theories concerns whether or not the relevant traits are products of selection directly for religion itself. Accordingly, if the religious phenotype consists of a combination of adaptations and byproducts, then in order to determine which traits are adaptations and which are byproducts, the Big Gods theory must be able to determine, for any given functional trait, whether it is a product of selection for religion or selection for something else. Yet current

⁶ Norenzayan (2013) documents in great detail the range of psychological mechanisms involved in connecting supernatural beliefs with prosocial behavior.

presentations of the Big Gods theory never discuss what it means for a process of selection to favor religion itself. Moreover, in a related discussion about the empirical meaning of the term “religion,” they misdescribe the commitments of their account in a way that obscures this issue even further.

A third question arises from the answer to this second one, but it concerns the byproducts, rather than the adaptations. To explain the evolution of religion is not just to explain how certain traits have evolved, but also to explain the specifically religious roles those traits play—the religious things they do. By definition, however, byproduct theories don’t identify religious functional roles. As a result, it isn’t clear how these theories explain anything about religion. They may explain the existence of traits that also perform religious functions, but since they don’t explain the religious functions themselves, they don’t explain what it is about these traits that makes them religious. If so, then why bother integrating byproduct theories with adaptation theories? The adaptation approach alone seems to explain religion.

Thus, the integrationist claims of the Big Gods theory give rise to three basic, important questions: First, what does it mean for traits to count as adaptations in general? Second, what does it mean for traits to count as adaptations for religion, specifically? Third, why should byproducts be included as traits of the religious phenotype in the first place? After presenting the Goldberg Exaptation Model itself, I turn to show how it answers these questions.

3. The Goldberg Exaptation Model

The GEM provides a conception of the religious phenotype that brings together suggestions made independently, and in very different terms, by theorists from both sides of the adaptation/by-product debate. In defense of the byproduct approach, McCauley (2004) employs the metaphor of a Rube Goldberg device, emphasizing the claim that many important traits *of* religion did not originally evolve *for* religion, but were already in place in the human mind before religion itself came into existence. Several years later, however, Sosis (2009) provides a more literal description of the religious phenotype, in defense of the adaptation approach instead. His description distinguishes explanations of the religious phenotype as a whole from explanations of its constituent parts, and he describes the whole as the product of *exaptation*—a form of adaptation in which a trait evolves first in virtue of one selected function, but later comes

to be selected for in virtue of some other functional role, in addition. While McCauley and Sosis take these claims to support opposing positions in the adaptation/byproduct debate, what they actually show is that adaptation theories and byproduct theories share certain basic assumptions that are capable of unifying them.

3.1 Sosis's Mereological Analysis

In defense of the adaptation approach, Sosis accuses byproduct accounts of committing a mereological error—explaining the parts when they should be explaining the whole. I disagree that his analysis shows the byproduct theory to be in error, because I disagree that byproduct theories ought to focus on explaining the whole. But I agree with the more important claim that only adaptation theories are capable of explaining the religious phenotype as a whole.

Sosis notes that the religious phenotype is a complex phenomenon, an “adaptive complex” analyzable into constituent functional parts. He also observes, correctly, that what byproduct theories explain are the parts themselves, not the larger system formed from them. He argues that, “It is the religious system, not the constituent parts, that produces functional effects and is the appropriate unit of an adaptationist analysis. A proper byproduct account of religion, which has yet to be offered, must explain why the religious system’s constituent parts recurrently coalesce across cultures” (2009, p. 323).

In evaluating this criticism, we must distinguish between two claims being made. One is the descriptive claim that byproduct theories do not, in fact, explain the whole. A second claim, however—implied by the terms “proper” and “appropriate”—is the normative claim that byproduct theories *ought* to explain the whole. I agree with the descriptive claim, but I disagree with the normative one. Certainly some theory needs to explain the whole, but why must it be the byproduct theory, in particular? All theories have limits; they explain what they explain, but they don’t explain everything. So it is no fault or flaw of a theory that it does not explain facts that fall outside its scope. No form of Darwinian theory explains why thunder follows lightning, for example, but this does not show that Darwinian theory is in error. The same can be said of the byproduct theory in this context. Certainly some theory needs to explain the system-level facts that Sosis identifies, but it is no flaw of the byproduct theory that it does not.

What is important about Sosis’s mereological analysis, then, is not that it supports the adaptation approach over the byproduct approach, but that it identifies an important set of facts

that only adaptation theories can explain. It is one thing to explain the prior existences of otherwise independent traits, but to do this is not to explain why a larger system was formed from them, or to identify the new functional roles these traits take on in the process. What brought *these* traits together, rather than other sets of traits that already existed? What is the overarching function of the system as a whole? How is it best analyzed into functional parts? What is the difference between the original, non-religious functions these traits perform and the new, religious functions they perform? Sosis's mereological analysis helps to illustrate the distinct conceptual roles played by adaptation theories and byproduct theories, within an integrated account.

3.2 McCauley's Metaphor and the Role of Exaptation

McCauley (2004) describes the religious phenotype in very different terms, which he uses to support and motivate the byproduct approach over the adaptation approach:

The mind does not contain a specific department of religion. Instead, religion exploits a diverse collection of emotional and cognitive inclinations in human beings that enjoy neither logical nor psychological unity. The upshot of this analysis is that *cognitively speaking* religion is a Rube Goldberg device, which is to say that it is an exceedingly complicated contraption calling on all sorts of psychological propensities that are, otherwise, usually unlinked. (p. 48, emphasis in the original)

By denying the existence of “a specific department of religion,” and denying that religious traits enjoy “psychological unity,” McCauley sides here with the byproduct theory. As we’ve just seen, adaptation theories show that religious traits *do* enjoy psychological unity: they are parts of the same functional system, which explains religious behavior by identifying the relevant internal cognitive and motivational states. Accordingly, the workings of this system might reasonably be described as “a specific department of religion” in the mind. But while McCauley emphasizes the “otherwise unlinked” nature of the parts of the Goldberg device of religion, this does not change the fact that they are now, in fact, linked. In a Goldberg device, otherwise unlinked parts become linked as parts of a coherent system, which *does* possess functional unity. The device itself possesses a dedicated, overarching function of its own, which links the parts together as sub-functions. As a result, the same metaphor could just as easily be used by Sosis instead, to emphasize the special role of the adaptation approach. Armed with this image, Sosis could argue that while byproduct theories explain the original, non-religious functions of the device’s parts,

they nevertheless cannot identify the function of the device itself. Consequently, they also cannot identify the new functional roles these parts play *within* the device.

[Insert Figure 1]

[*Figure 1 Caption:* While byproduct theories identify the original, non-religious functions of various parts within the Goldberg device of religion, only adaptation theories are able to identify the religious functions those parts perform, in virtue of the roles they play within a larger system possessing a distinct function of its own.]

Sosis emphasizes what byproduct theories do not explain, but he also recognizes, at least implicitly, the significance of what they do explain (p. 323):

The most likely evolutionary scenario is that cognitive, emotional, and behavioral elements were exapted for use in a complex system of communication, cooperation, and coordination, namely the religious system. An exaptation is a preexisting trait that acquires a new role for which it was not originally designed by natural selection (Gould and Vrba 1982). Importantly, exaptations have functional effects but exapted traits are not modified when taking on their new role; if they are, adaptive modifications are known as secondary adaptations.

By identifying constituent traits as exaptations, and by distinguishing these from secondary adaptations, Sosis recognizes here an important explanatory role for the original, non-religious functions that byproduct theories identify. Unlike secondary adaptations, which can be changed, or “customized” to the needs of new functional roles, exaptations cannot be given over entirely to their new functional roles, because they are still needed to perform their original functions. These old, original functions, thus, constrain the structure and the efficiency of the system’s design. And the same constraints also lie at the heart of what is so entertaining about Rube Goldberg’s cartoons: *inefficiency*. The humor arises specifically from the ironic bad fit between the new functions that the parts are asked to perform and the old functions those parts already possess, outside the context of the device. By adding many such parts together, Goldberg created devices that piled bad design onto bad design, yielding comical levels of inefficiency. This is not to suggest that the religious phenotype is comically inefficient, of course. But if it is a functional system assembled largely from functionally-independent traits, which cannot be customized to suit their new purposes, this fact will have wide-ranging effects upon the device’s structure and

efficiency. McCauley's choice of metaphor thus emphasizes the fact that byproduct theories explain much of the bad design found in the religious phenotype. And whether or not Sosis recognizes that byproduct theories explain such facts, he recognizes here that some theory needs to do so.

Note that while Sosis borrows the term "exaptation" from Gould and Vrba (1982), he also alters its meaning from their usage. They introduce the term as part of an *anti*-adaptationist campaign (see also Gould and Lewontin 1979), assuming that exaptations are somehow *different from* adaptations. But Sosis employs the term within an adaptationist theory, and he specifically uses the concept of exaptation to show that the religious phenotype counts as an adaptation. Thus, on Sosis's definition, which I adopt here as well, an exaptation is simply a specific kind of adaptation. Exaptations *are* adaptations, so exaptation for religion counts as adaptation for religion. Indeed, Dennett (1995) has challenged the notion of exaptation itself on grounds that *all* adaptations count as exaptations in some manner, and thus that there is no interesting difference at all between the two concepts. In response, however, Buss et al. (1998) point out that, even if all traits that are adaptations are also exaptations, the logical difference between the meanings of the concepts remains significant, because it is important to distinguish the different ways in which different selection pressures have influenced the functional properties of the same trait: "understanding the degree to which a new function is superimposed on a predecessor structure that already existed as an adaptation or as a by-product may indeed shed light on its nature." In particular, it may shed light on the design constraints emphasized by the Goldberg metaphor.

Thus, while Sosis's mereological analysis highlights an essential role for adaptation theories within an integrated theory of religion, the concept of exaptation, and the Goldberg metaphor, also highlight an essential role for byproduct theories. Byproduct accounts cannot, by definition, identify religious functions; these facts simply fall outside their scope. Accordingly, it falls to adaptation theories to identify religious functions, both for the whole and for the parts of the religious system. Yet the fact that byproduct theories cannot identify religious functions does not entail that they have nothing to contribute to the study of religion. For while it is necessary to identify what the functions of religious traits *are*, or how they are identified, it is also important to understand how these functions are *realized*, given the design constraints imposed by earlier stages in evolutionary history. The distinction between identifying what functions are and

identifying how they are realized, then, represents yet another sense in which adaptation theories and byproduct theories may be said to be consistent, addressing different questions.

These considerations demonstrate that a full account of the evolution of religion must address at least three different explanatory aims: (1) identifying the general function of the religious phenotype as a whole, (2) analyzing this general function into sub-functions performed by constituent parts, and (3) identifying how these functions are actually realized in the human mind, given the constraints imposed by the original prior functions these parts already possess. Only the adaptation theory is capable of addressing the first two aims, which require identifying religious functions, and thus selection for religion itself. But any functional system constructed largely from independent parts that were originally designed for other functions, and that are still needed to perform those other functions, will be greatly constrained in its design. Because the entertaining inefficiencies of Goldberg devices emphasize the role of exaptation in identifying such constraints, the GEM brings all of these distinct explanatory aims to the surface, clearly illustrating the distinctions between them, while also explaining how they are related within a coherent account. In the next sub-section, I illustrate by example how the GEM functions to keep these different explanatory aims organized.

3.3 The Example of Folk Dualism

“Folk dualism” refers to the universal human capacity to represent minds and mental states in ways that are independent from facts about physical bodies. Such representations often appear in non-religious contexts, explaining, for example, how people understand stories about ghosts who pass through walls, or movies like “Freaky Friday,” in which a mother and her daughter switch bodies. But dualistic concepts also appear within a wide range of religious systems, given the central roles played in these systems by gods, demons, ancestors, spirits, saints and souls that survive the death of the body. Bering (2006) explains this capacity as an adaptation for religion, but Bloom (2007) explains it, instead, as a byproduct. Thus, the case of folk dualism appears, on the surface, to serve as a counterexample to the claim that adaptation theories and byproduct theories are consistent. Since they explain the same trait in two different ways, they appear to offer competing explanations for the same target phenomenon. But the terms of the GEM show why this is not actually the case. In the sense in which both theories explain the same trait, they

still do not explain the same phenomenon, because they do not explain the same facts about that trait. More specifically, they explain different functional roles, which evolved at different times.

According to Bering, the capacity to form dualistic representations is a genetic adaptation for promoting prosocial behavior. Like the theory of Big Gods, he appeals to supernatural monitoring, noting that religious systems from all over the world involve beliefs about agents who lack physical bodies, but nevertheless use supernatural powers to punish norm violations and antisocial selfishness, and to reward norm-following, prosocial behavior. Consequently, Bering notes, dualistic beliefs of this kind have the effect of promoting prosocial cooperation, via the same mechanism that the Big Gods theory employs. But instead of arguing that this behavior spreads by cultural group selection, Bering argues that it spreads by individual-level genetic selection, enhancing fitness through reputation management. Social relationships are crucial for human fitness in general, he argues, and good reputations are crucial for maintaining good social relationships. Thus, dualistic cognition is a trait that has been (genetically) selected for in virtue of the contribution it makes to prosocial behavior.

Bloom also relies on a narrow adaptationist framework, appealing only to individual-level genetic selection. Nevertheless, the specific selection pressures he identifies are different: “Our dualism is a natural by-product of the fact that we have two distinct cognitive systems, one for dealing with material objects, the other for social entities. These systems have incommensurable outputs” (2007, p. 149). On this view, selection favored individuals who represented agents and minds using distinct and specialized cognitive systems, instead of using the same systems and processes used to represent ordinary, non-agentive, material bodies. On this view, animals move in ways that are so different from the other objects in the environment that selection has favored the formation of entirely distinct cognitive systems for explaining and predicting their movements. Hence humans possess a distinct and independent agent-representation system, which, in its more elaborate applications, includes the attribution of mental states. But this means it is possible for this system to be activated in the absence of any activation in the other, non-agentive representation system. Thus it is possible to form representations of agents’ and their mental states without forming any representations of their bodies. On Bloom’s view, the role selection plays has nothing to do with prosocial behavior, and nothing to do with functional interactions between folk dualism and any other traits of the religious phenotype. The trait is

explained by appeal to selection, but not selection for religion, and no role is identified in the context of a larger religious system.

I take both accounts to provide explanations that are plausible enough, but clearly partial. Bloom's account is partial in the same way that all byproduct theories are partial: they explain where various traits of religion originally came from, but they don't explain how those traits came to be parts of the religious phenotype, or what the religious functions of those traits are. At the same time, even if Bering's account is accurate, appeals to cultural group selection would also be needed, in addition, to explain those features of the social environment that constitute the relevant selection pressures. It is adaptive to maintain a reputation for prosociality primarily because of the punishments and rewards imposed by prosocial norms, whether such norms are informal attitudes or formalized laws. But these norms are transmitted culturally, not genetically, so they are not explained by Bering's narrow adaptationist account. Nevertheless, the important point here is that the two accounts identify different selection pressures, from different times in evolutionary history. The fitness benefits that come from representing animals differently from non-animals are not a recent occurrence in the ecology of our lineage. Our distant fish and reptilian ancestors would have had every bit as much reason as our recent primate ancestors did to represent predators, prey and mates differently from rocks, trees and ice floes. Clearly, of course, a trait that evolved in fish or reptiles would not have a religious function. Yet there is plenty of room in evolutionary history for things to change after such traits originally evolved. Bering's account assumes an ecological context in which language, norms and cooperative punishment figure heavily, but these are features of the human social environment that evolved only very recently in our lineage. Thus, the selection pressures used to identify etiological functions in these accounts could easily be separated by many millions of years. A capacity for forming dualistic beliefs in general could have been a stable feature of the human mind long before certain specific forms of dualistic belief, involving supernatural monitoring, began to be exapted for prosociality.

It follows that even if adaptation theories and byproduct theories are said to explain the same trait, they still do not explain the same facts, or target phenomena, and thus they do not conflict. Indeed, in one very important sense Bloom and Bering do not actually explain the same trait in the first place. It is important to distinguish two common meanings of "trait." In the functional sense, "trait" picks out some property or feature of an organism specifically on the

basis of some function it performs. But this functional sense of “trait” must be contrasted with the morphological sense, according to which traits are identified as features of physical form, or structure, in a manner that leaves open further questions about what functional roles these features perform. For instance, having a tail is morphological trait of howler monkeys. But since one function their tails perform is that of grasping, having a *prehensile* tail is a functional trait, not a morphological trait. Thus, in the sense in which Bering and Bloom identify two different functions for the same trait, this trait must be a morphological trait with multiple functions. Just as a tail is the same morphological feature whether it performs the function of grasping or the function of providing balance, as a counterweight, a capacity for folk dualism may be thought of as a general morphological feature that supports multiple functions. Sometimes this trait functions in a religious manner, when it is performing its role within the religious system. But at other times, the same morphological structure may perform other, non-religious functions, such as enabling people to understand ghost stories and movies about body switching. Accordingly, in the functional sense of “trait,” Bloom and Bering do not explain the same trait at all. Meanwhile, in the morphological sense of “trait,” they explain different facts about the same trait. Either way, as the GEM illustrates, they explain different target phenomena, and thus do not conflict.

4) Solving the Problems for Integration

Here I return to the conceptual problems mentioned above, which arise from the integrationist claims of the Big Gods theory. We are now in a position to see how the GEM addresses them.

4.1: What is an Adaptation?

Because of their reliance on the dual-inheritance framework, the integrationist claims of the Big Gods theory assume a special, unusual definition of “adaptation,” quite different from that employed in other adaptation and byproduct theories. In these theories, as in most other contexts, “adaptation” is used according to the assumptions of narrow adaptationism, such that adaptations are genetically inherited traits that spread by enhancing survival and reproduction. By contrast, in the sense in which the Big Gods theory treats certain traits as adaptations for religion, these traits would have to be cultural adaptations, which are acquired through learning, not genes, and which spread for reasons quite independent from their effects on reproductive fitness. At the

same time, of course, the byproducts of religion would still be ordinary genetic adaptations. So the Goldberg device of religion is a complex contraption indeed. Not only is it a combination of adaptations for religion and adaptations for other functions, but the adaptations in question also come in two fundamentally different forms, which are inherited in different ways, and which are products of different selection processes exhibiting very different evolutionary dynamics. As a result, the concept of adaptation actually doing the work of integration is much more abstract than the concept of adaptation employed in the theories being integrated.

The basic assumption of broad adaptationism is that genetic selection among individuals is *one* way of identifying etiological functions, but not the only one. As a result, for a broad theory to classify a trait as an adaptation is still to leave open some crucial questions: What kind of adaptation is it? How is it inherited? At what level does variation occur? For the narrow adaptationist, these questions do not arise. If a trait is an adaptation, it already follows that it is inherited genetically, and that it spreads by contributing to the reproductive potential of the individuals who possess it. Accordingly, what the Big Gods account shares with other adaptation theories is not the claim that adaptations for religion are products of *genetic* selection, but rather that they are products of *selection in general*—some form of selection or other. Since the selection process said to be responsible for creating the system as a whole is cultural group selection, the Big Gods view counts as an adaptation theory of religion only if the concept of adaptation is substantially redefined, in accordance with the broad adaptationist assumptions of dual-inheritance theory. If there are problems with broad adaptationism, then they are problems for an integrationist theory of religion as well.

An important consequence of this is that some resistance to the integrationist approach may come, not from the claims it makes about religion, but rather from resistance to the general idea of broad adaptationism. Indeed, alternative adaptationist theories of religion and prosociality, which are based on narrow adaptationism instead, make no appeal to cultural selection or group selection (Baumard et al. 2014; Baumard and Boyer 2013; Baumard, Andre, and Sperber 2013; Krasnow et al. 2012; Bering 2011, 2006). And while these accounts do not argue explicitly against the very idea of cultural selection, they do present their own gene-based theories as competing accounts, apparently because of the alternative evolutionary processes they posit. As a result, they take the evidence they present in favor of their own theories to count as evidence against broad theories.

This is obviously not the place to provide a general defense of broad adaptationism or dual-inheritance, so I must rest content with having identified the important difference in meaning between the broad concept of adaptation, which is required for integration, and the narrow concept at work in most other adaptationist theories. That said, however, it is important to note that the authors of these narrow adaptationist theories of religion and prosociality are wrong to present their accounts as being in conflict with broad accounts, as though evidence in favor of their own views counts as evidence against broad accounts. If there is something wrong with the broad framework, this cannot be demonstrated simply by showing that narrow theories are true. The two approaches do not make conflicting empirical claims, and the assumption that they do illustrates an important sense in which broad adaptationism has been misunderstood by narrow adaptationists.

The frameworks themselves necessarily conflict, of course. The same theory cannot both appeal to multiple forms of selection and appeal to only one form of selection. But this does not mean that specific empirical theories derived from these different frameworks conflict as well. Dual-inheritance theories appeal to cultural selection *in addition to* genetic selection, and the traits they explain by appeal to cultural selection are always clearly distinguished, in a principled way, from the traits they explain by genetic selection. Thus, when broad theories posit additional forms and levels of selection, they never use these posits to explain the same target traits and facts that are also explained by narrow theories. Narrow theories only explain traits that individuals acquire through their genes, while broad theories only use cultural selection to explain *other* traits, which individuals acquire in a different way. So whenever broad theories posit additional selection processes, they do so exclusively to explain phenomena that already fall outside the scope of narrow theories, for principled reasons. Clearly, narrow theories cannot provide competing explanations for *these* facts, because they do not explain such facts at all.

Being broader in scope, the broad framework offers more comprehensive theories, which explain everything the narrow framework explains, and much more besides. And if broadening the concept of adaptation allows us to explain important phenomena that otherwise go unexplained altogether—since narrow theories offer no alternative—then I see no motivation for adopting the constraints on adaptationist theorizing that the narrow framework imposes. Accordingly, I see no problem with appealing to alternative forms of selection, or with defining “adaptation” broadly, to include traits acquired through learning, or traits that reduce genetic

fitness. But since this issue cannot be decided here, it must at least be made explicit that the integrationist view put forward by the Big Gods theory is committed to it, for better or for worse.

4.2 What is Selection for Religion?

If the religious phenotype is a combination of adaptations and byproducts, and if the logical difference between adaptation theories and byproduct theories concerns whether or not selection has directly favored religion itself, then the distinction between adaptations and byproducts rests on a prior distinction between selection for religion and selection for other things. Yet current versions of the Big Gods account do not discuss the question of what counts as selection specifically for religion. They do discuss the related issue of how the concept *religion* itself is defined, or of how religious traits in general are to be identified. However, in this discussion, the authors claim their theory relies on folk intuitions to identify religious traits, rather than scientific theory. Thus, they appear to assume that “selection for religion” refers to the role selection plays in explaining traits that have already been picked out, pretheoretically, by the folk concept of religion. But as the GEM will illustrate, this claim is at odds with their claims about integration. Indeed, it is at odds with their adaptationist commitments in general.

According to Big Gods theory, which traits count as traits of religion is a matter determined by selection, or by adaptationist principles, not folk intuition. The religious phenotype is said to be a functional system, with parts identified in functional terms, as sub-functions within that system. All of these attributions of function then rest on etiology, such that what the whole and the parts alike are *for* is determined by what they have been *selected for* in the past. Accordingly, what determines whether a given trait counts as religious, or as a part of the religious phenotype, is whether or not empirical facts about selection history show that it plays a role within the larger system of the religious phenotype as whole. In principle, then, the folk concept of religion and the Big Gods theory could come into conflict about whether a given trait counts as a religious trait. But to allow folk intuition determine which traits count as religious, rather than empirical facts about selection history, would be to abandon the principles of adaptationist theory in general.

When the authors claim that it is the folk concept that picks out religious traits in their theory, they do so in the context of arguing that the theory undermines the meaning, or coherence, of the folk concept (Norenzayan et al. 2014, p. 52-53):

Our framework also circumvents unproductive definitional debates about “religion.” ... In our framework, the concept of religion merely provides a pithy rhetorical prop to cue readers to the kinds of interrelated phenomena that require explanation. The religious package is a statistical pattern governed by specific hypotheses, rather than a predefined concept with necessary or sufficient features. There is therefore no expectation of a single over-arching definition of religion or clear semantic boundaries, because the package of traits that gets labeled “religion,” while containing recurrent elements, culturally mutates in a predictable fashion, taking different shapes in different groups and at different historical times (Norenzayan 2013; for a similar but distinct account, see Taves 2009).

The point seems to be that their theory is not committed to any claims about which traits fall within the extension of the term “religion,” because it predicts wide variation among the traits that make up “the religious package.” The folk concept is useful for identifying target explananda, but it also assumes that the religious phenotype is a coherent package. And once the evolution of the constituent traits has been explained, the authors claim, the explanation provided conflicts with this assumption of coherence; cultural evolutionary dynamics predict a great deal of variation across times and cultures with regard to which traits count as constituents of the package, so the package itself is incoherent. As a result, the Big Gods theory is not committed to any claims about which traits count as religious, so it can “circumvent unproductive definitional debates about ‘religion.’”

If this argument were sound, however, then “selection for religion” would refer only to the role selection plays in byproduct theories. For what selection explains, according to this argument, is why the same traits *do not* “recurrently coalesce,” as Sosis puts it, across cultures and times. But as Sosis argues, what adaptation theories are good for is precisely the task of explaining the *coherence* of the religious package. Thus, while it may be true that the religious package is less coherent than folk intuitions suppose, it is crucial to recognize that coherence comes in degrees. The religious phenotype is neither simply coherent nor simply incoherent, so what needs to be explained is why it has just the degree of coherence that it actually has, rather than more or less. Byproduct theories explain why the package is not more coherent than it actually is, but adaptation theories explain, instead, why it is not less coherent than it actually is. Both accounts are needed.

It follows that the Big Gods account cannot, as its authors claim, “circumvent definitional debates about ‘religion.’” Scientific theories may circumvent definitional debates about the folk concept *witch*, for example, by showing that witches don’t exist; no human female possesses the

essential constituent trait of supernatural power. But the Big Gods theory does not show, in the same way, that religion does not exist, and this is so even if it is true that the package of traits picked out by the folk concept of religion is much less coherent than folk intuitions assume. The coherence of the religious package exists, and it stands in need of explanation just much as the incoherence of the package does. Fortunately, the Big Gods theory itself fully recognizes this, even if its authors do not. For on this account, coherence is explained by the role selection has played in assembling a number of otherwise disparate functional traits into a single coherent system. Those traits are, according to the theory itself, the constituents of the religious package. Thus, to identify the system and its parts is to be committed to specific claims about which traits are and are not picked out by the term “religion.”

Because it is an adaptationist theory, which identifies functions in terms of facts about selection history, rather than on the basis of folk intuition, the Big Gods theory actually treats the religious phenotype as something much more than a package: it is a *system*, with a function of its own, distinct from any of the functions of its parts. And because the system may be analyzed into parts, it is a straightforward matter to identify which traits count as traits of religion. In the functional sense of “trait,” religious traits are simply traits that play some role within the system. In the morphological sense, religious traits are those that possess at least one function within the system, along with any other functions they may also perform outside the system. Accordingly, folk dualism does not count as a religious trait when it is enabling a person to understand a movie in which characters switch bodies, but it does count as a religious trait when it functions to produce beliefs involving Big Gods, or souls who leave the body and go to heaven. Only in virtue of their operations within the system can traits be counted as traits of the religious phenotype.

It follows that “selection for religion” refers, not to the role selection plays in explaining traits that have already been picked out by the folk concept, but rather to the role selection plays in creating a specific functional system—a Goldberg device that uses supernatural monitoring to increase prosociality. Selection for prosocial behavior in general is not sufficient to count as selection for religion, of course, because other Goldberg devices might also possess the same function. It is at least plausible to suppose that the moral phenotype, whatever else it may be, is also a complex system with the general function of promoting prosociality. If so, however, then while the Goldberg device of religion and the Goldberg device of morality would possess the

same function, they would still be two different systems, which realize this function using different sets of parts (even if some parts overlap, or are shared between the two devices). Accordingly, “selection for religion” refers to the role selection plays in creating one type of functional system, while “selection for morality” refers to the role of selection in creating a different system. Perhaps folk intuitions could be brought in to determine which system counts as the religious one and which counts as the moral one, but to do this would not be to use folk intuition to identify the parts of either system. It would still fall to adaptationist principles, not intuition, to do the functional analysis in virtue of which constituent parts are picked out. As a result, the GEM provides the Big Gods account with a principled way of identifying selection for religion itself, and thus for distinguishing adaptations from byproducts.

4.3 Why Do Byproducts Count as Religious Traits?

Thus far I have assumed that byproducts count as traits of religion, even if they are not adaptations for religion. But I have also just argued that an integrationist account would have to identify religious traits specifically in virtue of the religious functions they perform, and byproducts do not perform religious functions, by definition. To explain religion, it is necessary to explain the religious things that certain morphological traits do. Having a capacity for dualism may explain how religious individuals understand non-religious ghost stories, but to do this is not to explain anything about religious psychology. If so, however, then why should byproducts even be considered traits of religion, since they don't do anything religious?

The apparent threat here may be dissolved by working backward, so to speak, from the terms of GEM. Instead of identifying religious functions, as noted above, what byproduct theories contribute to the study of religion are explanations of realization, showing how (in)efficiently certain functions are performed, once they have been identified. Byproduct theories are not up to the task of identifying the religious functions of various morphological traits, but it does not follow that these traits do not possess religious functions. What follows is only that, if they do, some theory other than the byproduct theory must identify what the religious functions are. Fortunately for the integrationist, the adaptation theory is on hand. And once religious functions have been identified independently by adaptation theories, byproduct theories can then explain *other* properties and activities of those same morphological traits. To do this is not to explain why those traits count as religious, but it is to explain why those traits

realize their religious functions in the (inefficient) ways they do. It is thus clear how byproduct theories contribute to the science of religion, even if they must rely on adaptation theories to explain why byproducts count as traits of the religious phenotype.

5. Conclusion

The authors of the Big Gods theory are right to claim that their theory is capable of integrating previous adaptation and byproduct theories, but it is not obvious how it does so, and they do not explain. Some basic conceptual questions arise from the assumptions required for integration to go through, including questions about what it means for any trait to be an adaptation in general, what it means for the adaptations of religion to be adapted specifically for religion, and what it means for byproduct theories to count as theories of religion at all. The GEM provides the conceptual resources needed to answer these questions. In the process, it also illustrates how adaptation theories and byproduct theories actually cohere, in spite of their apparent conflict.

As we've seen, there are a number of different ways in which the two theories may be said to address different empirical questions, and thus to offer mutually consistent causal explanations. As other theorists have noted, one approach provides origin explanations, while the other provides distribution explanations. Moreover, one explains cultural traits, appealing to cultural fitness, while the other explains genetic traits, appealing to genetic fitness. In addition, one identifies the proximate cognitive mechanisms involved in forming supernatural beliefs, while the other identifies the behavioral and social consequences those beliefs have, once they have been formed. Further, one identifies religious functions, while the other identifies non-religious functions. And, finally, one identifies what religious functions are, while the other identifies how those functions are actually realized in human minds. What is important is not the fact that the two types of theory are consistent, but the questions that arise as a result of this consistency: how are the theories actually *related* within a single, coherent, scientific image? By identifying the basic principles of the integrationist position, the Goldberg Exaptation Model provides a way of answering these questions.

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