



# The Adaptationist-Byproduct Debate on the Evolution of Religion: Five Misunderstandings of the Adaptationist Program

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## Abstract

The primary debate among scholars who study the evolution of religion concerns whether religion is an adaptation or a byproduct. The dominant position in the field is that religious beliefs and behaviors are byproducts of cognitive processes and behaviors that evolved for other purposes. A smaller group of scholars maintain that religion is an adaptation for extending human cooperation and coordination. Here I survey five critiques of the adaptationist position and offer responses to these critiques. Much of the debate can be resolved by clearly defining important but ambiguous terms in the debate, such as religion, adaptation, adaptive, and trait, as well as clarifying several misunderstandings of evolutionary processes. I argue that adaptationist analyses must focus on the functional effects of the religious system, the coalescence of independent parts that constitute the fabric of religion.

## Keywords

Adaptation, byproduct, evolution of religion, cognitive science of religion

*The first question to be addressed by any evolutionary approach to religion is whether religion is an adaptation or a byproduct of adaptations designed for other purposes.*

Lee Kirkpatrick, 2008

In January 2007, scholars from around the world gathered in Hawaii to attend the first *International Conference on the Evolution of Religion*. The conference brought together scholars with diverse academic backgrounds and widely disparate views on the application of evolutionary theory to explain religion (Bulbulia et al., 2008). The conference served as a venue to present the latest research on the evolution of religion, but more importantly, it provided an opportunity for intense discussions about the primary challenges facing this emerging area of study. One of the most heated topics of discussion concerned whether or not religion should be considered an adaptation or a byproduct.

While many of us left the conference believing that a consensus had been reached on this difficult but important issue, subsequent articles, presentations, media interviews, and discussions reveal that the community of scholars who study religion remains divided.

Debates over scholarly questions are of course healthy and essential for all fields, but some debates strike at the heart of the field and are vital to resolve before progress can be made. This is one of those debates. Most scholars studying religion are in the humanities – historians, philosophers, religious studies scholars, theologians – and it is among these researchers that the evolutionary study of religion has the greatest potential to provide novel insights and encourage new and productive avenues of research (Wilson and Green, 2007). The adaptationist-byproduct debate, however, is likely to hamper efforts at genuine interdisciplinary work between evolutionary scientists and religious scholars because it reveals disagreements about the core ideas upon which the evolutionary study of religion is founded. I believe much of the debate hinges on ambiguous definitions and a lack of clarity about evolutionary processes, and thus can be resolved with adequate clarification.

The dominant position of the field is that religion is a byproduct. The most influential scholars of the field (e.g., S. Atran, J. Barrett, P. Boyer, R. McCauley, E.T. Lawson and H. Whitehouse) hold this view, and it is espoused by the widest number of practitioners, many of whom are former students of these pioneers. This consensus is primarily an artifact of the historical development of the field. Cognitive scientists, who largely support the byproduct view of religion, have been actively studying the cognitive and evolutionary foundations of religion since the 1990s. It is only in the last decade that evolutionary scholars outside of the cognitive sciences have joined the discussion and begun to question the byproduct view of religion (e.g., Irons, 2001; Wilson, 2002, 2005; Bulbulia, 2004a, 2008; Sosis and Alcorta, 2004; Alcorta and Sosis, 2005, 2006; Johnson and Bering, 2006; Dow, 2008; Richerson and Newson, 2008; Sanderson, 2008). Byproduct theorists have responded, and largely rejected, these arguments. Here I respond to five critiques of the adaptationist position raised by these scholars.

Before summarizing the primary positions of the adaptationist-byproduct debate, I wish to clarify what this article is not. I will not be offering a full or even partial adaptationist account of religion, but rather a response to objections of the adaptationist approach to religion that have recently appeared in the literature. Previously, I have proposed with Candace Alcorta (Sosis and Alcorta, 2003, 2004; Alcorta and Sosis, 2005, 2006) that religion may best be understood as an adaptive complex of traits incorporating cognitive, affective, behavioral, and developmental elements. We argued that these traits derive

from pre-human ritual systems and were selected for in early hominin populations because they contributed to the ability of individuals to overcome ever-present ecological challenges. By fostering cooperation and extending the communication and coordination of social relations across time and space, these traits served to maximize the potential resource base for early human populations, thereby increasing individual fitness. The religious system, I contend, is an exquisite, complex adaptation that serves to support extensive human cooperation and coordination, and social life as we know it.

### **The Adaptationist-Byproduct Debate**

Cognitive scientists have amassed an impressive body of theoretical and empirical work that has genuinely revolutionized our understanding of the underlying cognitive structures that produce religious behavior and belief. For example, one productive research program initiated by Justin Barrett and colleagues highlights the difference between our ‘theologically incorrect’ beliefs that recognize God’s omniscience and nonmaterial nature, and the ‘theologically incorrect’ beliefs that we typically employ in real-time, in which we impose anthropomorphic limits on God (Barrett and Keil, 1996) and other deities (Barrett, 1998). Guthrie (1993) argues that our tendency to anthropomorphize deities arises out of what has become known as our hyperactive agency detection device (HADD). We are inclined to see faces in the clouds and creatures in the closet because natural selection favored a response system that actively perceives agents and agency in events. Guthrie and others maintain that selection favored hyperactive vigilance because the costs of assuming, for instance, that the wind is the cause of a rustling bush, rather than a tiger, are too high; hence we are designed to assume the tiger’s presence and err on the side of caution. In the most celebrated body of cognitivist research on religion, Boyer (2001) and Atran (2002a) explore the cognitive foundations of supernatural belief. They describe how supernatural agent concepts are formed by violating the basic expectations of universal ontological categories (person, animal, plant, and artifact). For example, ghosts are humans who violate the assumption of materiality from the person category.

Cognitive scientists have not limited themselves to supernatural agent concepts, most notably exploring ritual behavior. Some of this work has brilliantly combined psychological and sociopolitical models to delineate two broad ‘modes of religiosity’, one characterized by highly arousing rituals, the other characterized by more mundane, routinized rituals (Whitehouse, 2004). In other research, McCauley and Lawson (2002) show that ritual performers and

observers employ the same cognitive expectations and assumptions to perform ritual behavior as we employ to understand all goal-directed action. Their pioneering work highlights one of the commonalities that unite much of the cognitivist research on religion: the psychological mechanisms involved in the production of religious beliefs and behaviors were not designed to produce these beliefs and behaviors. This position has become axiomatic among cognitive scientists of religion, and serves as the starting point for their contention that religion is a byproduct. They argue that there are no “religion modules” or “religion genes”; religion is a byproduct of psychological mechanisms that evolved for other purposes.

Adaptationists, regrettably, joined this discussion late and most were puzzled by the state of affairs they encountered. Biologists argue for high standards before a trait can be accepted as an adaptation, but they caution that nonadaptive explanations should be offered as a last resort because they stifle further scientific enquiry (Krebs and Davies, 1993: 31). Yet among cognitivists, religion was embraced as a byproduct even though adaptationist hypotheses had never been evaluated. Not until 2002, with the publication of D. S. Wilson’s *Darwin’s Cathedral*, was there a significant challenge to the byproduct position, and Wilson did not tackle the byproduct position of the cognitivists, but rather the byproduct views of prominent sociologists Rodney Stark, William Bainbridge, and Roger Finke. Wilson offered an adaptationist account of religion based on cultural group selection models that focused on the secular utility of religion at the group level. Although Wilson demonstrated that religion can confer great benefits upon its constituents, he did not address the underlying psychology of religious beliefs of interest to cognitive scientists, and thus did little to sway them from their anti-adaptationist stance (e.g., Boyer, 2004). Subsequent evolutionary researchers have offered adaptationist models that acknowledge and incorporate the findings of cognitive scientists (Bulbulia, 2004a; Alcorta and Sosis, 2005; Bering and Johnson, 2005), but this research has received comparatively little attention among cognitivists.

### **Five Critiques and Responses of the Adaptationist Approach to Religion**

In addition to the general interpretations of most cognitive research that religion is a byproduct, there are also a number of publications that explicitly argue against the adaptationist approach to religion (Gould, 1991; Boyer, 2001; Atran, 2002a; Atran and Norenzayan, 2004; Kirkpatrick, 2006, 2008; Martin, 2008). I draw on these arguments and consider five common critiques of the adaptationist approach to religion.

1. *There is no such thing as “religion.” Since it does not exist, how can it be an adaptation?*

“Religion” endures almost as many definitions as the number of people who study it. Even the Latin origins of the English word remain obscure and do not provide guidance. According to the OED, “religion” is either derived from *relegere* (to read over again) or *religare* (to bind), but even if the latter is correct as some scholars contend, it is unclear whether the binding is to the gods, community, or both. If scholars cannot agree on a definition, how do they know what they are studying? A more radical proposition, although one that has wide acceptance among religious studies scholars, is that there is no such thing as “religion,” it is merely a Western construct created and used for analytical purposes. These scholars note that many traditional cultures possess no word in their lexicon for religion and make no conceptual distinction between religious and secular life as we do in the West (Klass, 1995). Even if such arguments are correct, there is clearly some set of remarkable beliefs and behaviors that appear to be universal in structure and demand explanation (Bulbulia, 2005), regardless what the phenomenon is called. Indeed, most scholars who maintain there is no such thing as religion spend their careers studying something that does not exist!

More importantly, some have argued that since religion does not exist it cannot possibly be a functional product of natural selection. For instance, Martin maintains, “‘religion’ is a Western academic (and political) category and not a ‘natural kind’ with any independent existence that might be presumed to have evolved” (2008: 349). Or, as Atran contends, “religions... as selectable objects simply don’t exist” (2002b: 505). What then is the appropriate unit of study for an adaptationist analysis? Adaptationists study traits; is religion a trait? This of course begs the question, what is religion?

As already mentioned, countless scholarly definitions of religion have been offered. None are universally accepted, although ‘belief in supernatural agents’ might win a popular vote. If religion is anything at all, it is an inherently fuzzy category with unclear boundaries. Therefore, rather than define religion, many scholars have concluded that it can be best studied by considering its constituent parts (Atran and Norenzayan, 2004; Alcorta and Sosis, 2005; Bering, 2005; Bulbulia, 2005; Whitehouse, 2008). Religion consists of recurrent core features that receive varied emphasis across cultures; some cultures, for instance, place great emphasis on the afterlife (Christianity), others less so (Judaism). The task of religious scholars is to demarcate these recurrent features rather than provide a summary definition of religion per se. Such features include ritual, myth, taboo, emotionally charged symbols, music, altered states of consciousness, commitment to supernatural agents, and afterlife

beliefs among others. Developing a list of religion's core features is of course fraught with its own difficulties, particularly that scholars will fiercely debate what should be included and excluded from the list. Notice that even if a list of features were universally accepted, religion would remain a fuzzy category as there are always human activities on the fringes that will defy strict definitional boundaries. Nonetheless, breaking the social category of religion down into its more easily definable core elements has several advantages.

First, this approach avoids endless disputes concerning whether Marxism, science, patriotism, sports and so on are religions. It is clear that religion shares some core elements with all these other cultural institutions. Indeed, this approach clarifies that most of religion's core elements are not unique to religion. Ritual, myth, music, and taboo, to consider a few examples, are also manifest in other cultural institutions including politics and sports. Second, defining religion according to its core elements highlights an important goal of comparative research; namely, explaining why some groups emphasize particular core features whereas other groups emphasize other features. Third, and most importantly, by breaking religion down into its core elements it becomes obvious that these elements did not evolve together. Ritual, for example, has antecedents in many other species (D'Aquili et al., 1979; Alcorta and Sosis, 2005, 2007) and presumably has a much deeper evolutionary history in our lineage than many other core elements, such as myth. Therefore, asking "When did religion evolve?" is a poor question because it assumes that at some point in our evolutionary history religion "appeared." Religion, however, did not appear; it consisted of uniting cognitive processes and behaviors that for the most part already existed. Although these elements evolved separately, they coalesce in similar ways across all cultures and at some point in our history they began to regularly coalesce. The appropriate question with regard to timing, therefore, is "When did the features of religion coalesce?" At the moment we do not have a clear answer to this question, and we know surprisingly little about the dynamic interrelationship between religion's core features. Of course, understanding why these features coalesce should provide us with insights about *when* they began to coalesce.

Adaptationists have been accused, I think inaccurately, of not specifying "what it is that evolved or is evolving" (Wiebe, 2008:344). I've emphasized the 'bottom-up' approach to defining religion because it clarifies what selection has operated on – a coalescence of cognitive, emotional, and behavioral elements – and directs us to the appropriate questions for an adaptationist analysis. Even if religion is simply a Western construct, it *is* a collection of cognitive processes and behaviors that form an appropriate unit of evolutionary analysis. Specifically, it is an adaptive system, similar to – but no less complex

than – the respiratory, circulatory, or immune systems, all of which are also Western constructs and probably lacking in the lexicon of traditional populations, yet no less interpretable through an evolutionary lens. Rather than debate whether “religion” is a natural category and wallow in its murky definitional waters, we should recognize the religious system, consisting of a recurrent set of core elements, as the appropriate unit of evolutionary analysis. To clarify, I am not claiming that we should abandon the study of individual core elements of the religious system, such as supernatural agent beliefs, ritual, music, or emotionally charged symbols. Quite the contrary; studying these core elements are essential. The point here is that it is the religious system – the coalescence of these elements – that must be the focus of an adaptationist analysis.

Religion is not the only ambiguous term in the above critique; adaptation is a notoriously slippery concept (Reeve and Sherman, 1993). Mayr (1983: 324) perceptively observes, “The difficulty of the concept adaptation is best documented by the incessant efforts of authors to analyze it, describe it, and define it.” Here I seek to simply provide relevant definitions and clarify several misunderstandings of the adaptationist approach to religion. Adaptation, often confusingly, refers to both a process of phenotypic modification by natural selection, as well as the products of that process. In this article I employ only the latter usage. Adaptations solve particular ecological problems organisms face in acquiring energy for growth and reproduction. More specifically, adaptations are traits that exist because of a process of phenotypic modification by natural selection for a particular gene-propagating effect (Gould and Vrba, 1982; Andrews et al., 2002). Adding to the confusion is the term adaptive, which is often mistakenly assumed to be synonymous with adaptation, though they are distinct concepts. A trait is adaptive if it confers reproductive benefits upon its bearer in a particular environment. Demonstrating that a trait is adaptive does not establish that the trait is an adaptation (Laland and Brown, 2002).

Like the concept of adaptation, traits (or characters) also lack a universally accepted definition. Broadly, traits are quantifiable features of organisms, yet what should qualify as a trait is often uncertain. There is no one-to-one relationship between genes and traits (genes, for example, often have pleiotropic effects), thus underlying genotypes do not provide a guide. Adding to the challenge, traits are integrated with one another and therefore organisms are not simply a collection of traits. Traits of concern to adaptationists are those that have *effects*, that is, they respond to environmental interaction. And most importantly, behaviors and cognitive processes can be analyzed as traits (Andrews et al., 2002).

Similar to adaptationist analyses of other traits, an adaptationist analysis of the religious system must identify its function (if any) and determine the

specific selective pressures that are responsible for its evolution. How this is accomplished is no easy task and will be discussed in more detail below. The important point for the moment is that while ‘religion’ might be a Western construct, the religious system – the collection and interaction of defined cognitive, emotional, and behavioral elements – remains an appropriate object of study for the adaptationist paradigm.

*2. The psychological mechanisms that produce religious thoughts and behaviors were not designed to produce religion; therefore, religion is a byproduct*

As described above, cognitive scientists have produced a wealth of research detailing the cognitive structures underlying religious behavior and belief (Boyer and Bergstrom, 2008). These researchers, with a few exceptions (e.g., Bering, 2006), interpret their findings as support for the byproduct interpretation of religion, a position that derives from Gould and Lewontin’s (1979) influential critique of the adaptationist program. Gould and Lewontin argue that some features of organisms are byproducts of the constraints and design of other adaptations. These features are often referred to as spandrels, following Gould and Lewontin’s classic architectural example. Spandrels, the space between arches, are not designed for any functional purpose, but rather exist as an inevitable consequence of the functional design of arches. Any search for the functional design properties of spandrels, Gould and Lewontin contend, would be misleading and in vain.

Despite the claims of cognitivists, I argue below that it has yet to be fully demonstrated that religious beliefs and behaviors are inevitable spandrels or byproducts of the psychological mechanisms that produce them. But even if the cognitivist assessment is accurate and, for example, supernatural belief is a byproduct of HADD, this would tell us nothing about whether or not the religious system is an adaptation. All adaptive systems consist of constituent parts. We can study the constituent parts, such as ‘minimally counterintuitive ideas’ (Boyer, 2001) or the ‘ritual form’ (McCauley and Lawson, 2002), and the inevitable tradeoffs they face as building blocks of complex traits, but it is the encompassing system that must be evaluated for functional effects. For instance, to evaluate whether the human respiratory system is an adaptation to mediate the movement of oxygen and carbon dioxide in and out of the body, a detailed analysis of the larynx would be important, but insufficient to reveal the selective pressures that ultimately shaped the respiratory system. Moreover, to understand the selective pressures that shaped the larynx we would have to know how it fits within the respiratory system and other functions unrelated to respiration it may sustain (such as its role in human vocalization).

Similarly, we cannot evaluate whether or not the religious system is an adaptation by examining its independent parts in isolation. We must consider the religious system more comprehensively, focusing on how the constituent parts contribute to the system, how the parts interact with each other to achieve functional goals, and other functions that the parts might play.

To clarify, studying the independent parts that constitute religion – ritual, myth, supernatural agent belief and so on – is crucial. And the argument here is in no way a critique of reductionism. I am simply pointing out that to claim that the religious system is not an adaptation because the cognitive systems that produce supernatural agent belief might not have evolved to produce such beliefs is misleading and inaccurate. 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.

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. Exaptations can emerge in two ways. First, they can emerge as an unintended consequence or byproduct of selection for another trait. These are non-adaptations that are coopted for a functional effect. For example, “flying fishes fall back into the water by virtue of gravity, and this descent is essential to their continued existence. [W]eight... is an exaptation for falling back, clearly not an adaptation” (Gould, 1991: 47). Second, traits can evolve for a particular effect, but are coopted for another effect. Birds' feathers are the classic example, having apparently evolved for insulation and only later were they coopted for flight. If feather design remains unchanged by this move into a novel ecological niche, feathers are an exaptation. If the move into a new niche spurs structural design changes, feathers would be considered secondary adaptations (Gould and Vrba, 1982). While some byproduct theorists maintain that religion does not solve functional goals for its bearers (e.g., Dennett, 2006), most byproduct theorists assume religion is an exaptation and evolved via the second pathway. For example, Atran and Norenzayan (2004: 714) claim that religion constitutes a “converging by-product of several cognitive and emotional mechanisms that evolved for mundane adaptive tasks”.

While many adaptationists agree that the cognitive and emotional mechanisms that produce religious beliefs and behaviors did not evolve for this purpose, they argue that co-opting of preexistent structures for novel solutions to ecological challenges is a hallmark of evolutionary adaptation (Sosis and Alcorta, 2004; Alcorta and Sosis, 2005; Richerson and Boyd, 2005). The critical issue of the adaptationist-byproduct debate is therefore whether or not the cognitive and emotional mechanisms exapted by the religious system have been adaptively modified by the new socioecological niche created by religion. If yes, the religious system is an adaptation (or secondary adaptation in Gould's terminology); if no, the religious system is an exaptation. While I would put my money on the former, this remains an open question in need of further research.

### 3. *Adaptationist accounts of religion are "just-so stories"*

Gould and Lewontin (1979: 588) chastised adaptationists that "[t]he criteria for acceptance of a story are so loose that many pass without proper confirmation. Often, evolutionists use consistency with natural selection as the sole criterion and consider their work done when they concoct a plausible story". Gould and Lewontin likened these stories to Rudyard Kipling's fanciful tales; "just-so story" remains one of the most common critiques of evolutionary psychology research, and has been leveled against adaptationist accounts of religion as well (e.g., Wiebe, 2008). Claiming that adaptationist accounts are "just-so stories", however, is not an argument against religion (or any trait) as an adaptation. It is an argument for better scientific standards, and one which I fully endorse. As Wilson (2007:62) quips, "Properly understood, 'just-so story' is just another phrase for 'untested hypothesis' and should be treated as a rallying cry for another turn of the crank", specifically, more hypothesis testing.

The burden of evidence required to demonstrate an adaptation is considerable and unfortunately there is no agreed-upon protocol for accepting and rejecting what counts as an adaptation. Andrews et al. (2002) review six evidentiary standards that have been employed by biologists to identify adaptations, including phylogenetic comparisons, fitness maximization, and beneficial effects in ancestral environments, but their thorough review also highlights the limitations of each of the approaches they discuss. Williams (1966), the recognized father of the adaptationist program, cautioned that alternative explanations for the emergence of trait characteristics must be eliminated, but he also recognized that there is no universal list of evidentiary standards that can be applied to all traits. He argued that adaptations should exhibit evidence of "special design"; i.e., they should efficiently solve the adaptive problem they are purported to solve, and demonstrate reliability, economy

and precision. Byproduct theorists have argued that religion exhibits none of these. Kirkpatrick (2006: 173) declares: “Given all its complexities and observed variability, it is difficult for me to see how religion, however defined, could possibly be regarded as a reliable, economical, precise solution to any adaptive problem. If religion-specific psychological mechanisms are designed to solve some particular adaptive problem, they do not seem to be very good at it”. However, “complexity” and “variability” do not constitute evidence against adaptive design; most adaptive traits are both complex and variable! Moreover, it is impossible to examine the claim that religion is not “very good” at something when that “something” remains unspecified. In fact, if we consider the religious system as a complex adaptation for cooperation (Alcorta and Sosis, 2005), built on highly flexible cognitive processes (Purzycki and Sosis, 2009), there is indeed considerable historical, ethnographic, and experimental evidence that religion does this quite well (Sosis, 2000, 2005; Sosis and Bressler, 2003; Sosis and Ruffle, 2003, 2004; Johnson, 2005; Wilson, 2005; Ruffle and Sosis, 2007; Shariff and Norenzayan, 2007; Sosis et al., 2007; Bulbulia and Mahoney, 2008; Norenzayan and Shariff, 2008).

Despite the inability of adaptationists to conclusively eliminate all alternative explanations of a trait’s emergence in a particular round of hypothesis testing, the cumulative output of sustained rigorous hypothesis testing can reasonably support the existence of an adaptation. What is often unappreciated is that the standards of evidence necessary to support the position that a trait is a byproduct are no less burdensome than establishing that a trait is an adaptation. Indeed, adaptationist hypotheses must be tested as alternative explanations (Andrews et al., 2002). Needless to say, such standards of evidence are rarely met, especially by those claiming that religion is a byproduct. As Buss et al. (1998:542) describe:

The hypothesis that something is an exaptation or even a functionless effect should be subjected to reasonable standards of hypothesis formulation and empirical verification, just as hypotheses about adaptation must meet these standards. The hypothesis that religion, to use one of Gould’s (1991) examples, is an exaptation would seem to require a specification of (i) the original adaptations or by-products that were co-opted to produce religion; (ii) the causal mechanism responsible for the co-opting (e.g., natural selection or an existing motivational mechanism); and (iii) the exapted biological function of religion, if any; that is, the manner in which it contributes to the solution to an adaptive problem of survival or reproduction. These predictions can then be subjected to evidentiary standards of empirical testing and potential falsification.

Hypotheses about functionless by-products must meet rigorous scientific standards that include a functional analysis of the original adaptations responsible for producing the functionless by-products and the existing human cognitive and

motivational mechanisms responsible for the co-opting. Without this specification, the mere assertion that this or that characteristic is an exaptation encounters the same problem that Gould (1991) leveled against adaptationists – the telling of “just-so stories.”

4. *If religion were an adaptation, everyone would be religious. Since everyone is clearly not religious, religion must not be an adaptation*

Such a critique is tempting to ignore because of its blatant ignorance of evolutionary processes, but since it has emerged among respected scholars, it is important to address this misunderstanding. For example, Zuckerman (2006: 61) claims that recent data on the high rates of atheism in many parts of the world “delivers a heavy blow” to evolutionary theories of religion. Zuckerman mistakenly equates evolutionary theory with genetic determinism and falsely assumes that recent evolutionary research, which reveals psychological biases toward supernatural belief (e.g., Bering, 2006), must be inaccurate since plenty of people appear to not exhibit these biases. Patterns of religious belief and behavior, however, are likely to be under frequency dependent selection pressures and therefore evolutionary scholars actually anticipate intracultural variability. Moreover, neither adaptationists nor byproduct theorists endorse genetic determinism. On the contrary, evolutionary theory assumes that environmental input during ontogeny is critical for the expression and adaptive functioning of many traits, including religious belief (Wilson, 2002; Alcorta and Sosis, 2005). In the absence of such input, genetic predispositions remain latent. Such environmentally-cued gene expression permits broad adaptive lability while ensuring optimal allocation of limited resources. The development of religious beliefs and behaviors is likely to reflect such interactive ontogenetic processes.

Similar to Zuckerman, Thagard (2005) “points out that religion in post-civilization cultures is not universal and that this, therefore, constitutes a significant anomaly to [evolutionary] theorizing” (Wiebe, 2008: 344). Thagard (2005: 70) claims that being “deficient in religiosity does not seem, at least in the current world environment, to impede the ability of people to survive and reproduce”. There are a number of problems with this position. First, natural selection is about relative advantages. The comparative reproductive success of theists, deists, atheists, those committed to an institutionalized religion, and so on is an open empirical question requiring sophisticated research methods (e.g., Hout et al., 2001), but most demographers would not be surprised to find religious communities on average to be out-reproducing nonreligious ones. Second, Thagard is confusing whether a trait is currently adaptive in modern environments with whether the trait is an adaptation, evolved for

particular functional effects. As noted earlier, measuring the fitness costs and benefits of traits in modern environments does not inform us about whether or not a trait is an adaptation (Laland and Brown, 2002). Although they have been equated by some in the literature, “Is religion adaptive?” and “Is religion an adaptation?” are very different questions that address distinct theoretical issues and require different methodological tools to answer.

##### *5. Religion is so costly, how could it be adaptive?*

The costs involved in religious practice can be extreme, including time, resource and opportunity costs, as well as physical and emotional pain. Some religious adherents remain celibate and others intentionally sacrifice themselves for their ideological beliefs. Such actions seem to contradict evolutionary expectations. Kirkpatrick (2006:169) charges that adaptationists have ignored these costs: “In their zeal to outline the potential adaptive benefits of religion, religion-as-adaptation theorists often fail to adequately consider the potential costs associated with the proposed mechanism”. This is simply inaccurate.

The “cost puzzle” of religion, in fact, is what attracted many evolutionary scholars to study religion. The solution to the puzzle lies in understanding religion as an evolved system of communication, which offers mechanisms that can promote in-group trust and overcome commitment problems (Rapaport, 1999; Irons, 2001; Atran, 2002a; Sosis, 2003; Atran and Norenzayan, 2004; Bulbulia, 2004a,b; Alcorta and Sosis, 2005). Irons (2001), for example, posits that the primary adaptive benefit of religion is its ability to foster cooperation and overcome problems of collective action that humans have faced throughout their evolutionary history. The costliness of religious activities, or specifically what I’ve referred to as the four “B’s” – religious belief, behavior (rituals), badges (such as religious attire) and bans (taboos) – enables them to serve as reliable and honest signals of group commitment (Sosis, 2006). Only those who are committed to the group will be willing to incur the time, energetic, and opportunity costs of religious belief and performance. In other words, adherents pay the costs of religious adherence, but by doing so they demonstrate their commitment and loyalty to the group, and can thus achieve a net benefit from successful collective action and other status benefits available to trusted signalers. Contrary to Kirkpatrick’s assessment, the application of costly signaling theory to religious phenomenon is one of the most active areas of adaptationist scholarship on religion (e.g., Sosis, 2000, 2003, 2009; Irons, 2001; Sosis and Alcorta, 2003; Bulbulia, 2004a; Dow, 2008; Schloss, 2008; Soler, 2008).

## Conclusion

Azim Shariff (2008:119) cautions, “In studying the evolution of religion, one misstep to avoid is treating “religion” as a seamless whole”. It would appear that not only have I taken this misstep, I have unashamedly embraced it. Shariff’s concerns are not unfounded. In whatever way ‘religion’ is defined, it is indeed not a ‘seamless whole.’ While it is important to recognize that religion is a fuzzy category, the indeterminate boundaries of the religious system do not preclude an adaptationist analysis. All traits have somewhat indefinite boundaries as they interact and overlap with other traits to produce an organism’s phenotype. The religious system is the appropriate trait to subject to an adaptationist analysis. Only once we consider the religious system’s functional goals can we begin to understand the recurring coalescence of the cognitive, emotional, and behavioral elements that make up the system.

An adaptationist analysis of the religious system will of course be exceedingly complex, but this does not justify ignoring the task. A satisfactory byproduct analysis would be equally challenging. One of the most pressing issues for evolutionary researchers concerns how the purported exapted traits that constitute the religious system interact with one another. Some evolutionary scholars have made progress in this direction (Atran, 2002a; Alcorta and Sosis, 2005), but much more needs to be done. The most insightful scholarship to examine the dynamic interrelationship between the parts of the religious system is the work of Roy Rappaport, the prominent cultural ecologist and anthropologist. In his posthumously published magnum opus, *Ritual and Religion in the Making of Humanity* (1999), Rappaport investigates the religious system from the vantage point of one of its constituent parts, ritual, and shows how ritual interrelates with music, dance, religious experience, supernatural beliefs, morality, meaning, symbolism, and cultural constructions of truth, the sacred, and time. While Rappaport’s understanding of evolutionary processes was not consistent with the neo-Darwinian synthesis, I mention his work because his insights on the religious system were profound and they provide a rare glimpse of this complex adaptation.

I conclude by paraphrasing Pinker and Bloom’s (1990) eloquent comments on the functional design of the eye. It is impossible to make sense of the coalescence of elements that constitute the religious system without noting that it appears as if it was designed for the purpose of uniting individuals under common purpose. Systems that can do what the religious system does are extremely low-probability arrangements. By an unimaginably large margin, most biologically possible arrangements cannot unite unrelated organisms under common purpose, achieve extraordinary self-sacrifice, and motivate

large-scale cooperation and coordination. All of this suggests that the religious system is an adaptation. Now we must begin to properly evaluate this possibility.

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