

TARGET ARTICLE

What are atheists for? Hypotheses on the functions of non-belief in the evolution of religion

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An explosion of recent research suggests that religious beliefs and behaviors are universal, arise from deep-seated cognitive mechanisms, and were favored by natural selection over human evolutionary history. However, if a propensity towards religious beliefs is a fundamental characteristic of human brains (as both by-product theorists and adaptationists agree), and/or an important ingredient of Darwinian fitness (as adaptationists argue), then how do we explain the existence and prevalence of atheists – even among ancient and traditional societies? The null hypothesis is that – like other psychological traits – due to natural variation among individuals in genetics, physiology, and cognition, there will always be a range of strengths of religious beliefs. Atheists may therefore simply represent one end of a natural distribution of belief. However, an evolutionary approach to religion raises some more interesting *adaptive* hypotheses for atheism, which I explore here. Key among them are: (1) *frequency dependence* may mean that atheism as a “strategy” is selected for (along with selection for the “strategy” of belief), as long as atheists do not become too numerous; (2) *ecological variation* may mean that atheism outperforms belief in certain settings or at certain times, maintaining a mix in the overall population; (3) the presence of atheists may *reinforce* or *temper* religious beliefs and behaviors in the face of skepticism, boosting religious commitment, credibility, or practicality in the group as a whole; and (4) the presence of atheists may *catalyze the functional advantages of religion*, analogous to the way that loners or non-participants can enhance the evolution of cooperation. Just as evolutionary theorists ask what religious beliefs are “for” in terms of functional benefits for Darwinian fitness, an evolutionary approach suggests we should also at least consider what atheists might be for.

Keywords: evolution; adaptation; religion; atheism; non-belief

Introduction

“Why have irreligious people been so grossly ignored? Given that most people in the world are religious, wouldn’t that make the study of secular men and women all the more pressing?” (Phil Zuckerman, 2008, pp. 96–97)

“Do you believe,” the disciple asked the rabbi, “that God created everything for a purpose?”

“I do,” replied the rabbi.

“Well,” asked the disciple, “why did God create atheists?”

(Jonathan Sacks, 2006, p. 80)

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“Perhaps what seems to be an adversarial relationship between believers and nonbelievers in fact represents a healthy balance between factual and practical realism that keeps social groups as a whole on an even keel.”

(David Sloan Wilson, 2002, p. 229)

Scholars have long argued that religion has functional benefits for believers (Durkheim, 1912/2001; Marx, 1844; Pals, 2006). While many remain skeptical of this notion, functionalist accounts have received a significant boost in recent years from evolutionary theory, which has grounded possible “adaptive” advantages of religion in the rigorous logic of natural selection. Evolutionary theorists have proposed that religious beliefs and behaviors, even if costly, may bring return benefits that increase net Darwinian fitness. As a consequence, individuals with a propensity for religious beliefs may have enjoyed higher reproductive success than non-believers and were thus favored by natural selection over human evolutionary history. Theories for what the adaptive advantages of religion might be (or have been) include health benefits (Koenig, 2005), the avoidance of social transgressions (Johnson & Bering, 2006), cooperation (Norenzayan & Shariff, 2008; Wilson, 2002), collective action (Bulbulia, 2004; Sosis, 2004), effectiveness in inter-group warfare (Johnson, 2008; MacNeill, 2004), and the enforcement of dominance hierarchies (Cronk, 1994).

Although this evolutionary perspective is new, as is empirical support from new methods in anthropology, experimental psychology, evolutionary biology, and neuroscience, the scientific study of religion has not changed in one important respect for over 100 years: the puzzle to be explained is religious belief, not atheism.¹ Furthermore, many of the key scholars have been atheists themselves. Durkheim, Freud, Malinowski, Marx, and Weber were all atheists or skeptics, and modern social scientists rank as the most atheistic of all academics (Beit-Hallahmi, 2007; Gross & Simmons, 2010). Although there are some important exceptions, and impressive examples of scholars who work on evolutionary theories of religion despite their own personal faith, academic research on the evolution of religion contains the implicit assumption that it is *religious beliefs and behaviors* that are in need of explanation. But if we are interested in the propensities that lead to religious beliefs, and these propensities vary like any other biological trait, then we should also be at least as interested in the propensities that lead to *non-belief* and *atheism* as well. Indeed, we may not be able to understand one without understanding the other.

Oddly, however, it turns out we know very little about atheists. Compared to the countless works on religion, few people have studied them (for some exceptions, see Bainbridge, 2005; Beit-Hallahmi, 2007; Caldwell-Harris, Wilson, LoTempio, & Beit-Hallahmi, 2011; Campbell, 1971; Galen, 2009; Geertz & Markússon, 2010; Goody, 1996; Hunsbeger & Altemeyer, 2006; Hwang, Hammer, & Cragun, in press; Kosmin & Keysar, 2007; Pasquale, 2007; Saler & Ziegler, 2006; Schnell & Keenan, 2011; Zuckerman, 2008, 2009). Lois Lee and Stephen Bullivant called this “a long-term, collective blind spot in research: atheism itself” (Lee & Bullivant, 2010, p. 26). Zuckerman’s study of godless societies noted:

Oceans of ink have been spilled, and legions of keys have been typed upon, describing and explaining what it means to be religious. But what about those humans out there who are not religious? They have been sorely neglected . . . I do not know of a single

academic journal that is devoted to the study of secularity. Books on being secular are markedly few and far between. I know of only one institute in the entire United States devoted to the study of secularity . . . only established in 2005. (Zuckerman, 2008, pp. 95–96)

Lee has established a “Non-religious and Secularity Research Network” (NSRN) in an effort to jump-start research into atheism, stressing that we know little about its psychology, anthropology, or sociology. Zuckerman and Lee are lamenting the scant study of *secularity*, which is a comparatively big issue in the social sciences. There is even less on the *evolution* of atheism. In particular, we don’t understand when, how, which, or why people are more or less resistant to the psychological mechanisms supporting religious beliefs that the “cognitive science of religion” literature suggests are universal features of human brains (Atran, 2004; Barrett, 2004; McNamara, 2006).

The purpose of this paper is to explore – it seems for the first time – *evolutionary* theories of atheism. Evolutionary theories of religion tend to focus on the emergence of religion in evolutionary history and its possible adaptive advantages during the course of human evolution. In the same way, I lay out hypotheses for the origins and benefits of atheism – broadly envisaging the same time period and socio-ecological contexts in which religious beliefs were supposedly being favored by natural selection. While evolutionary selective pressures may have favored certain types, capacities for, or degrees of religious beliefs, as many have argued, there may also be environments or dynamics that mean non-belief would also have been favored (or preserved) by natural selection over human evolutionary history. In other words, there might be functional explanations for *atheism* that challenge, coexist with, or even support functional explanations for *belief*.

Is there anything to study? Atheism in modern and traditional societies

Before going further, a critical question is the incidence of atheism in our evolutionary past. Although there are obviously many atheists around today, if everyone in human evolutionary history was a believer, then it makes no sense to posit an evolutionary account of atheism – there would have been none to explain. Atheism could simply be a recent evolutionary novelty; a product of human intellectual capacity that arose as the advent of philosophy and science challenged and replaced religious beliefs. However, this does not seem to be the case. Although there was a significant rise in the prominence of atheism after the Reformation in Europe (Hunter & Wootton, 1992), several authors argue that atheists and skeptics were present throughout human history and are common among traditional societies, suggesting that atheism stretches back some way into human evolution.

Today, the number and proportion of self-declared atheists varies enormously within and between societies (Miller, Scott, & Okamoto, 2006; Norris & Inglehart, 2004), but they are common worldwide. Zuckerman estimates from a range of international surveys that there are “somewhere between 500 million and 750 million atheists, agnostics or nonbelievers in the world today . . . ‘Nonbelievers in God’ as a group actually come in fourth place – after Christianity (2 billion), Islam (1.2 billion), and Hinduism (900 million) – in terms of global ranking of commonly held belief systems” (Zuckerman, 2008, p. 96). It is also widely recognized that skepticism (if not outright atheism) is prevalent even among those affiliated to the major world

religions. In fact, doubt is often highlighted as a key aspect of theological teaching, posing a challenge to individual convictions and faith (for example, the Book of Job). Many people continue to attend services and conduct religious rituals even though they do not have strong, or even any, belief in God (Zuckerman, 2008). Perhaps most surprisingly, there is even evidence of skepticism among devout communities. Sosis found that

religious communities, even fundamentalist communities, are not homogeneous in their beliefs. In interviews I've conducted amongst Israeli Ultra-Orthodox Jews, some have confided that they are agnostics or atheists, but they remain in their communities despite their lack of belief because they view the Ultra-Orthodox way of life positively, or at least better than the alternatives." (Sosis, 2011, p. 22; see also Winston, 2005)

The incidence of atheists in the *modern* world is not necessarily helpful for our purposes (although the example from Sosis presages some of the potential functional benefits outlined later). For our *evolutionary* perspective on belief and non-belief, we want to know how common atheism was in the pre-scientific era, when humans were being shaped by natural selection. Before scientific explanations emerged for natural phenomena, many things we now take for granted – the sun, stars, seasons, lightning, thunder, eclipses, rain, fire, droughts, tides, earthquakes, births, deaths, disease – were often considered unfathomable miracles (Bering, 2002; Frazer, 1922/1996; Guthrie, 1993). For example, George Murdock's study of 186 pre-industrial societies around the globe found that they *all* attributed the causation of illness, among other things, to supernatural sources of one form or another (Boyer, 2001; Murdock, 1980). Until fairly recently in human history, supernatural agents were routinely assumed to be responsible for many social and natural phenomena. One might be tempted to assume, therefore, that atheism was non-existent in human evolution, is not found in traditional societies, and emerged *de novo* in modern society along with philosophy and science.

However, this view is challenged by cross-cultural and ethnographic work. Several authors have explored this question and find that non-believers and skeptics were and are prevalent in both ancient and indigenous religions (Goody, 1996; Pasquale, 2007; Stark & Bainbridge, 1985; Steadman & Palmer, 2009; Thrower, 1980). Although religious beliefs may be more evenly distributed among individuals in hunter-gatherer societies compared with modern developed societies, there is considerable variation in the *degree* and types of belief, and there is evidence of individual *skepticism*. For example, in their study of the role of communication in religion, Steadman and Palmer (2009) report that, when pressed, individuals express considerable doubt as to the validity of many supernatural concepts. In other cases people may accept the veracity of a supernatural agent or concept, but do not take them very seriously. For example, Napoleon Chagnon reports that the Amazonian Yanomamo have a spirit of judgment after death, but he can be lied to about one's worldly conduct because he is stupid (Chagnon, 1997). There is even evidence of whole communities adopting more atheistic philosophies, such as the Carvaka school in India around 300–150 BC, whose tenets approximate those of contemporary atheists (Geertz & Markússon, 2010). Tantalizingly, "the reasons for the appearance of such philosophies in India are not as yet completely understood" (Geertz & Markússon, 2010, p. 159). Evolutionary theories of non-belief might lend a fresh perspective to such puzzles. More data are needed, but clearly atheism is not

rare across space or time. At the least, there is often a disconnect between people's professed beliefs and the degree to which they are willing to act on them (Lanman, in press).

We are faced, therefore, with the possibility that atheism and atheists have been present throughout human evolutionary history. This sits awkwardly with evolutionary theories that suggest religious beliefs and behaviors are universal, have powerful cognitive underpinnings, and are important to survival and reproduction. How can we square the circle?

Looking at all possible causes: Tinbergen's four questions

A helpful approach in evolutionary explanation is to work through Nobel Laureate Niko Tinbergen's famous "four questions" or "four causes", which are essential for a full understanding of any biological trait (Mayr, 1961; Tinbergen, 1963, 1968):

- (1) Phylogeny (what is its evolutionary history and ancestral state?).
- (2) Proximate mechanism (what physiological mechanisms cause it to occur?).
- (3) Development (how does it develop from birth to maturity?).
- (4) Function (what evolutionary purpose does it serve?).

Focusing only on one cause without considering the others will generate confusion, because they each yield answers at different levels of analysis. So, for example, a bird sings: (1) because birds inherited vocalization signals from ancestral species (phylogeny); (2) because changes in day length alter hormone levels that trigger neurological mechanisms for singing (proximate cause); (3) because birds learn to sing by copying others as they mature (development); and (4) because it serves to attract mates or defend territory (function). All explanations are correct, but each one misses essential parts of the story. Only considered together do they lead to a comprehensive evolutionary understanding of the behavior.

In particular, these questions can be important for understanding behavior in *modern* environments. Differences between ancestral and modern environments mean that proximate mechanisms may be activated even if the functional goal is no longer fulfilled, or the behavior actually becomes detrimental (e.g., our evolved preference for sugary and fatty foods – highly adaptive in a Pleistocene environment of scarce resources, but maladaptive in modern cities with junk food on every corner). Constraints on the available range and rate of evolutionary adaptation, combined with the rapid pace of societal and technological change, can lead to behavioral mechanisms that are not necessarily calibrated to our modern environment (a problem called "evolutionary mismatch").

In short, a consideration of atheism's phylogenetic origins, proximate mechanisms, and development will help to contextualize and think through our core question of interest: its possible evolutionary functions.

Phylogeny (what is the evolutionary history and ancestral state of atheism?)

Many evolved traits have important patterns of occurrence in the ancestral lineage of the species, and across related species. Sometimes this is crucial for explaining why a trait occurs, since it may be the result of evolutionary legacy rather than adaptation (e.g., the human appendix). The case of atheism is, however, much simpler to sort out

than most traits. Although we do not know exactly when religious beliefs arose in human history, we can deduce without doubt that, at some point in our lineage, non-belief was the default state. This is because we know for sure that our ancestors, if we go back far enough, lacked the cognitive sophistication to be able to entertain concepts such as supernatural agency. As far as we know, although one can find examples of what can be considered superstitious behavior (Foster & Kokko, 2009), other species do not have any “religious” beliefs, nor could they, given the requisite cognitive mechanisms (Barrett, 2000; Bering, 2006). The question of phylogeny is important in so far as it reminds us that evolutionary selection pressures might need to have been quite strong to *supplant* a default (“accurate”) set of beliefs with new, costly (“inaccurate”) religious beliefs about supernatural agents (McKay & Dennett, 2009).² By the same token, any fitness advantages of atheism might only need to have been weak to preserve it. The key conclusion is that non-belief unambiguously represents our phylogenetic inheritance.

Proximate mechanisms (what physiological mechanisms cause atheism to occur?)

As noted earlier, we know very little about the cognitive mechanisms that underlie atheism (Lee & Bullivant, 2010; though see Caldwell-Harris in this issue). Considerable work has developed a good understanding of the cognitive mechanisms supporting *religious* beliefs, such as theory of mind (Bering, 2010), agency detection (Atran, 2004; Barrett, 2004; Boyer, 2001), and ritual participation (Alcorta & Sosis, 2005; Bulbulia, 2008; Whitehouse, 2004, 2008), as well as underlying neurological phenomena (Blanke, Ortigue, Landis, & Seeck, 2002; McNamara, 2006, 2009; Schjoedt, 2009). We also know of psychiatric *disorders* that may lead to phenomena such as visions and extreme forms of religious belief, as famously experienced by historical figures such as Jean d’Arc (Taves, 1999). One might think that we can use this information to reverse engineer the proximate mechanisms underlying atheism. For example, Beit-Hallahmi (2007, p. 301) argues that “the psychology of religion is also the psychology of irreligion” and “atheists should be to some extent the psychological mirror image of highly religious people.” However, it is not clear that atheism is simply the “opposite” (or a weakened version) of the same cognitive mechanisms that give rise to religious beliefs (Geertz & Markússon, 2010). It might be, for example, that atheism and religion engage different parts of the brain, or are differentially influenced by experience and biochemistry, or interact differently with other cognitive processes. These are questions in need of work.

We know from twin studies that, like many other behavioral and personality traits, degree of religiosity is genetically heritable, over and above environment, education, and experience (Koenig, McGue, Krueger, & Bouchard, 2005; Saler & Ziegler, 2006). Although religiosity is likely to be influenced by a complex mixture of multiple interacting genes, these heritability studies are important because they increase the plausibility, at least, that religious and non-religious beliefs are variable in the population, can be differentially acted upon by natural selection, and thus are potentially subject to evolutionary processes. As Rowthorn (2011) points out, genetic polymorphisms (predisposing individuals to religious beliefs or atheism) may arise and remain stable for a number of reasons: (1) genetic drift; (2) selective advantages for different variants in different environments (hinting at functional advantages discussed later); (3) because heterozygotes have higher fitness than homozygotes (preserving genetic variation in the population); (4) because both polymorphisms

persist following a change in selection pressures, but one is becoming extinct; or (5) because birth rates between religious and atheist populations converge, so that genes favoring either strategy do not come to dominate the population.

The key message of this subsection is that there is both promise but also much work to be done on the genetic, physiological, cognitive, and environmental correlates of religion and atheism (cf. Lee & Bullivant, 2010). We do not know in any great detail what causes them, or when and why they vary, and our knowledge is especially poor regarding atheism since most research has focused on understanding religious beliefs instead.

Development (how does atheism develop from birth to maturity?)

One of the core strands of research in the cognitive science of religion has come from developmental psychology and the study of how children develop and learn religious concepts (Alcorta & Sosis, 2005; Bering, 2006; Bering & Bjorklund, 2004; Bering & Parker, 2006; Bloom, 2004). The main finding is that children tend to hold beliefs in supernatural agents, the afterlife, and supernatural causes of events from a very young age. As soon as the relevant cognitive machinery is in place (such as theory of mind), children appear to use it to support supernatural concepts (such as that God knows what they know). There are important changes with age, as the brain and its capacities develop, but it appears that children are highly receptive to supernatural beliefs, and only *learn* to become atheists later. Keleman (2004) dubbed children “intuitive theists”, because of their commonplace teleological reasoning that things usually exist “for” something (e.g., clouds are for raining).³ Bering and Bjorklund’s (2004) study on children’s reasoning about the psychological states of dead agents also suggests a default “afterlife” stance that may only be replaced by explicit scientific understanding about biology and death – knowledge that was of course limited in our pre-scientific evolutionary past. At first glance, this evidence suggests a problem for evolutionary theories of atheism, because it appears that no atheists are born. However, there is considerable variation in the extent of belief, even among children. Furthermore, even if all children are “intuitive theists”, this does not preclude the possibility of cultural selection mechanisms supplanting that natural stance with skepticism as they grow older.

In modern societies, the fact that supernatural beliefs are so natural and common in children but then frequently absent among adults suggests a powerful role for social and cultural factors that replace this cognitive stance with atheism – especially western secularism and science education. Atheism has to be learned. Richard Dawkins (2006) argues that religion is a form of indoctrination that causes children to entrench their religious beliefs to such an extent that they cannot easily be shaken later. A corollary of this argument is that more (secular) education should lead to higher levels of atheism, but empirical evidence on the relationship between levels of education and levels of religiosity is mixed. Bearing in mind that there is considerable variation between studies in how such constructs are measured within and across groups (Glaeser & Sacerdote, 2008), the World Values Survey shows a correlation between education and atheism in many but not all countries (Lee & Bullivant, 2010). Other surveys find that atheism varies widely across academic disciplines, with many more atheists among social scientists than physical scientists (Beit-Hallahmi, 2007). However, Beit-Hallahmi (2007, p. 308) notes that “differences among

academic fields vanished with growing eminence”, such that those at the top were more atheistic.

A different perspective comes from Bainbridge (2005, p. 4), who suggests that atheism has important causes in one’s formative social environment, such as: (1) being raised by atheists; (2) early traumatic experiences with religion; (3) having “resolutely unmystical personalities”; (4) religion becoming the target of adolescent rebellion; or (5) socialization to antireligious ideologies in one’s profession. Other factors that are empirically associated with atheism have emerged from large-sample surveys (Beit-Hallahmi, 2007; Galen, 2009). For example, atheists tend to be young, male, liberal, and well educated, a pattern that Bainbridge uses to argue that atheism is a luxury afforded to those who lack social obligations—the converse of his “secondary” compensatory theory of religion which suggests that people engage in religion as a way to help and encourage social dependents (Bainbridge, 2005).⁴

The role of developmental processes in the causes of atheism leaves many questions to explore, but the key message is that human development seems to prime us to adopt religious beliefs rather than atheistic ones.

To summarize this section, Tinbergen’s questions identified non-belief as the ancestral state, which is shared by all other species, but we do not know precisely when religious beliefs emerged to replace it (phylogeny). They also clarified that, especially in comparison to religious beliefs, we know little about the cognitive mechanisms behind atheism (proximate mechanisms), and that children appear to have supernatural beliefs as their default stance, only learning atheism later (development). Further investigation of these questions is important in its own right, but may also help to identify *which functional explanations* of atheism are more or less plausible or powerful, and it is Tinbergen’s fourth question to which we now turn: what evolutionary function might atheism serve?

Adaptive and non-adaptive hypotheses for atheism

Table 1 outlines a range of possible evolutionary hypotheses for atheism, along with the consequent fitness benefits, level of selection, and basic predictions for each.⁵ Each of the hypotheses is described in more detail below. The reader is asked to keep in mind that, throughout this article, my intention is to lay out a full range of possible hypotheses, not to evaluate their plausibility or empirical support.

Hypothesis 1. There are no atheists

One possibility is that, despite the existence of atheism as a concept and many self-identified atheists, everyone, in fact, believes in some form of supernatural agency, even if they deny it. Here and in subsequent hypotheses I give four broad predictions (as summarized in Table 1). This is a non-adaptive hypothesis, predicting (1) no fitness effects on atheists (because there are none); (2) no fitness effects on believers; (3) no genuine atheists in the past; and (4) no genuine atheists today.

The reason for including this hypothesis is that, much as believers might neither accept the doctrine of any religion, identify with a particular sect, nor believe in a specific supernatural agent, atheists may not strictly be non-believers. The cognitive science of religion literature suggests that human brains are characterized by pervasive mechanisms that tend to perceive supernatural agency in the world around them. Given that we all have the same brains, all of us should be susceptible – at least

Table 1. Summary of evolutionary hypotheses about atheism.

Hypothesis	Logic	Type	Effect on fitness of atheists*	Effect on fitness of believers*	Level of selection	Prediction in traditional societies	Prediction in modern societies
1. No variation	Everyone believes in some supernatural agency, etc., even if some deny it	Non-adaptive	N/A	0	N/A	No atheists	No atheists
2. Natural variation (Null hyp.)	There is some distribution of individual propensity to hold religious beliefs (from zero to strong belief)	Non-adaptive	0	0	N/A	Some atheists	Some atheists
3. Unnatural variation	There is some distribution of life experience or education that favors non-belief or skepticism	Non-adaptive	0	0	N/A	No atheists	Some atheists
4. Frequency dependence	Atheism is adaptive, as long as not too common	Adaptive	+	+	Individual	Some atheists	Some atheists
5. Exploitation	Atheism is adaptive for those with power	Adaptive	+	+/-	Individual	Some atheists	Some atheists
6. Ecological contingency	Atheism/belief are more or less adaptive in different settings	Adaptive	+/-	+/-	Individual	Atheists in some settings, not others	Atheists in some settings, not others
7. Catalyst	Presence of atheists facilitates adaptive advantages of belief	Adaptive	0	+	Group	Some atheists	Some atheists
8. Bolstering	Presence of atheists bolsters religious doctrine in the face of skepticism	Adaptive	0	+	Group	Some atheists	Some atheists
9. Restraint	Presence of atheists restrains religious doctrine in the face of skepticism	Adaptive	0	+	Group	Some atheists	Some atheists
10. Atheism <i>is</i> a religion	Atheists find benefits in common non-belief	Adaptive	+	0	Individual	Some atheists	Some atheists

*Note: These are fitness costs or benefits arising solely from the coexistence of atheists and believers. There may be other fitness costs and benefits arising from religious beliefs and behaviors (as argued by specific evolutionary theories of religion), but these are omitted here to enable direct comparisons (see footnote 5 for further explanation).

to some extent and at some times – to religious thinking. This is supported by some evidence. For example, 58% of adults who have no religious affiliation nevertheless admit to belief in an afterlife (Religioustolerance.org). Laboratory experiments reveal similar phenomena. Self-declared atheists display symptoms of superstitious and supernatural thinking, even though they would deny it (Bering, 2010; Hood, 2009; Shariff & Norenzayan, 2007).

A second reason for doubting whether atheists represent an evolutionarily relevant category is that even atheists share many of the same *moral* and *behavioral* norms that are explicitly advocated or proscribed by members of their wider religious community. Thus, an atheist in England tends to hold Christian values, an atheist in Saudi Arabia tends to hold Islamic values, and an atheist in India tends to hold, say, Hindu values (they may differ from mainstream doctrine, of course, but the point is that atheists on the whole are likely to be influenced to some extent by the broader religious traditions of their substrate culture). At the funeral of British politician Robin Cook, Richard Holloway, the former Bishop of Edinburgh, noted that although Cook was indeed “a devout atheist,” he was also “a Presbyterian atheist” (Linklater, 2005). As he elaborated, “the Church of Scotland, which has been the backcloth to so many Scottish lives, had helped to mould him.” From an evolutionary or game theoretical perspective, therefore, is there a substantive difference? The fitness-critical behavior of atheists could be indistinguishable from believers.

Hypothesis 2. Natural variation (null hypothesis)

My null hypothesis is that although all human brains have mechanisms that make us susceptible to supernatural concepts, there is variation in individuals’ propensities to hold religious beliefs (due to variation in, and interactions among, genes, physiology, cognition, and environment). Atheists simply occupy one end of the distribution of belief. This is a non-adaptive hypothesis, predicting: (1) no fitness effects on atheists; (2) no fitness effects on believers (and note that, here, this means *given the presence of atheists*); (3) some atheists in traditional societies; and (4) some atheists in modern societies.

This hypothesis is important because evolution relies on variation. Adaptation by natural selection cannot occur without variation, otherwise there are no fitness differences for evolution to select strong performers over weaker ones. If everyone in a population expresses an identical level of religiosity, then there can be no evolutionary change. From a Darwinian perspective, therefore, variation in supernatural beliefs (including atheists at one end of the distribution) may be *the* critical quality that allowed religion to evolve in the first place and subsequently to adapt to new challenges over time. Any evolutionary theory of religion, therefore, *requires* variation in the propensity for religious belief, at least at some point in our evolutionary past.

Hypothesis 3. Unnatural variation

Another hypothesis is that the variation described above is not enough to account for atheism. Although people may vary somewhat in their capacity for religious beliefs because of variation in genes and cognition (for example), natural variation arising from biological factors is insufficient to completely eliminate our propensity

for religious belief and account for the “extreme” state of atheism. Instead, atheism can only be explained as a result of “unnatural” variation imposed by modern culture. This hypothesis therefore suggests that modern philosophical and/or scientific education is the key cause of atheism. This is a non-adaptive hypothesis, predicting: (1) no fitness effects on atheists; (2) no fitness effects on believers; (3) no atheists in traditional societies; and (4) some atheists in modern societies.

Hypothesis 4. Frequency dependence

Evolutionary game theory shows that traits often do best when they coexist with other different traits. In many natural systems, this forms an evolutionarily stable equilibrium, with declining fitness returns preventing departures from the right mix of types in the population – so-called “frequency dependent” selection (Dugatkin & Reeve, 2000; Nowak, 2006; Weibull, 1995). There are many examples of frequency dependence in nature, and some are particularly relevant to evolutionary theories of religion. For example, models of signaling suggest that in stable systems, there are always likely to be some defectors (Johnstone, 1997 ; Searcy & Nowicki, 2005). More famously, in the evolution of cooperation literature, as cooperators become more numerous in a population, they become increasingly vulnerable to defectors (Nowak, 2006). One possibility is therefore that atheism is adaptive, as long as it coexists with belief and neither becomes too common (beyond some threshold). This is an adaptive hypothesis, predicting: (1) fitness benefits for atheists; (2) fitness benefits for believers; (3) some atheists in traditional societies; and (4) some atheists in modern societies (due to evolutionary legacy or continued benefits of atheism today).

The most obvious application to the evolution of religion is that atheists can “freeload” on the efforts of believers, reaping the spoils of collective action and public goods without incurring the costs of religious beliefs and duties. As long as the benefits of exploitation outweigh the cognitive and social costs of shirking group norms (and/or having to pretend to be a believer), and as long as there are not too many atheists and not too few believers, atheism will be selected for. It is one example of frequency dependent selection, but various other forms (including less cynical ones) are possible.

The idea also extends to other levels of analysis. Frequency dependent selection may underlie variation along several dimensions of religion, including why individuals vary in degrees of belief (as opposed to an atheist–religious dichotomy), why religious groups exhibit so much diversity, why new sects constantly break off from mainstream religions and, at the level of interacting groups, why geographically close religions tend to differentiate themselves from each other. These higher-level phenomena may of course be due to competition and niche separation rather than, or as well as, frequency dependent selection.

Hypothesis 5. Exploitation

Atheism might be adaptive for some individuals in the social structure and not others. For example, leaders might benefit by imposing religious beliefs and behaviors on others in the community in order to increase their status, wealth, or power. These leaders could be believers as well, and nevertheless insist on harsher forms of religious observance for their followers. In fact, their own belief may be critical to gaining the loyalty of their followers, and this may be easier, or only

possible, if their belief is genuine rather than a pretense (Trivers, 2011). But an evolutionary perspective suggests that an absence of religious beliefs would be most adaptive of all for leaders if religion is primarily a tool of exploitation. This would avoid the costs – for leaders – of religious beliefs in time, resources, opportunity costs, and impediments to Machiavellian calculation. This is an adaptive hypothesis, predicting: (1) fitness benefits for atheists; (2) either fitness benefits or costs for believers (depending on other factors); (3) some atheists in traditional societies; and (4) some atheists in modern societies (due to evolutionary legacy or continued benefits of atheism today).

Marx argued that religion was a tool of the elite to control the masses (Marx, 1844). Modern evolutionary theorists have suggested something similar, but newly formulated in Darwinian terms (Cronk, 1994, 2005). For example, Schloss & Murray (2011) suggest that a belief in supernatural punishment might only be adaptive for those in the social hierarchy most vulnerable to *real-world* punishment if detected transgressing social norms (i.e., those at the bottom). For others, such beliefs would damage fitness. This would suggest that atheism is more common among the higher echelons of power. However, there are counter examples – extremely pious individuals who feared God as much as their lowliest subject. Weber argued that genuine “political associations” required subordination to a god to function (Weber, 1922/1978: see “Pantheon and Functional Gods”). Indeed, many historical figures *became* leaders in the first place precisely because of strong religious convictions, which caused them to adopt ambitious goals and seek the power to enact change.

Hypothesis 6. Ecological contingency

Atheism may be adaptive in some socio-ecological settings, while belief may be adaptive in other socio-ecological settings. Across space or time, therefore, ecological variation may maintain a mix of atheism and belief in the overall population. This is an adaptive hypothesis, predicting: (1) fitness benefits for atheists (in some settings); (2) fitness benefits for believers (in other settings); (3) some atheists in traditional societies; and (4) some atheists in modern societies (due to evolutionary legacy or continued benefits of atheism in certain socio-ecological settings today).

Evolution is a process of adaptation to local ecology. Some traits are useful everywhere, but many traits evolve to deal with the challenges of a particular environment (Begon, Townsend, & Harper, 2005; Krebs & Davies, 1993). If that environment changes individuals must adapt again or move to a different environment. The same dynamic occurs with cultural phenomena such as religion. Variation in religious beliefs and behaviors can be largely accounted for as functional adaptations to local ecological challenges. This idea has precedents in anthropology (e.g., Sosis, Kress, & Boster, 2007), in sociology (e.g., Weber, 1922/1978), and in evolutionary religious studies (Wilson, 2002, 2005), but significant questions remain about how, why, and when religions change, and under what conditions different religious beliefs or *non-belief* may be adaptive.

Several evolutionary theories of religion suggest that certain types or intensities of religious beliefs and behaviors are more important in certain settings. For example, Snarey (1996) found that societies with scarce water resources, where the need for social codes to protect resources was greatest, were more likely to have “morally concerned” gods. Others have argued that certain religious beliefs and behaviors may be more important in times or places with a higher threat of

inter-group conflict (Alexander, 1987; Johnson, 2008; Lanman, in press; MacNeill, 2004; Roes & Raymond, 2003; Sosis et al., 2007). But such theories beg the question of why there are *fewer* (or less intense, or different) religious beliefs and behaviors when, following the examples here, dry climates or inter-group threats are absent. The basic argument might be that, since religious practices are costly, when an extraneous selection pressure such as dry climates or warfare is removed, selection will act against the costly trait (or perhaps the costly trait never arose in those environments in the first place). Alternatively, one could argue that in *wet* climates or times of inter-group *peace*, atheists have higher fitness returns and spread at the expense of believers. But no one has really looked at whether this is true, or why. The point is that there may be locations and situations in which more “rationalist” cost-benefit thinking (including atheism) is particularly adaptive.

Hypothesis 7. Catalysts

The presence of atheists may indirectly improve the fitness of believers by catalyzing their beneficial interactions. This is an adaptive hypothesis, predicting: (1) no clear fitness costs or benefits for atheists; (2) fitness benefits for believers; (3) some atheists in traditional societies; and (4) some atheists in modern societies (due to evolutionary legacy or continued benefits to groups of having a minority of atheists today). Because atheists generate fitness benefits for believers without deriving clear benefits for themselves, this hypothesis requires group selection.

Atheists are often seen as a danger to the integrity of the religious group. This fear was forcefully expressed by John Locke:

Those who deny the existence of the Deity are not to be tolerated at all. Promises, covenants and oaths, which are the bonds of human society, can have no hold upon or sanctity for an atheist; for the taking away of God, even only in thought, dissolves all. (Locke, 1937, pp. 212–213)

However, this and the following two hypotheses suggest that atheists might, on the contrary, *increase* the benefits of *religion* to the group.

The presence of atheists may catalyze the functional advantages of religion in a similar way that the presence of “loners” (non-participants) can enhance the evolution of cooperation. In the case of cooperation, as long as they enjoy a higher pay-off than cheats, loners have the effect of driving cheats out of the population because there are fewer cooperators for cheats to exploit, and cooperators can subsequently thrive (Hauert, De Monte, Hofbauer, & Sigmund, 2002). Although this leads to a constant cycling of strategies in the population, the introduction of punishers can stabilize the population, again thanks to loners, since they keep cheats rare, making punishment sufficiently cheap to persist (Hauert, Traulsen, Brandt, Nowak, & Sigmund, 2007). Loners may only facilitate cooperation under certain conditions (Mathew & Boyd, 2008), but the basic logic suggests that, at least in principle, atheists could have a similar effect in promoting the fitness (and/or stability) of believers in the population.

This hypothesis is already implicit in some existing evolutionary theories of religion, which postulate advantages for believers *that depend on* the co-existence of other individuals with *different* beliefs. The costly signaling theory of religion, for example (Irons, 2001; Sosis, 2006; Sosis & Alcorta, 2003), only works if believers can

signal to and identify each other in a sea of other religious groups – or atheists. If everyone shared identical beliefs, there is nothing to signal and no distinct individuals to identify. In addition, without individuals with alternative beliefs, the *perceived* costs and benefits of participation in religious rituals or behaviors do not differ between members and non-members of the group, which unravels the logic of the theory (Sosis, 2003). Thus, atheists, or members of other religious groups (Sosis, 2005), are crucial to costly signaling theory. They form the substrate in which believers need to signal to each other.⁶

Hypothesis 8. Bolstering

The presence of atheists may force the community to bolster religious doctrine in the face of skepticism. This is an adaptive hypothesis, which predicts: (1) no clear fitness costs or benefits for atheists; (2) fitness benefits for believers; (3) some atheists in traditional societies; and (4) some atheists in modern societies (due to evolutionary legacy or continued benefits to groups of having a minority of atheists today). Because atheists generate fitness benefits for believers without deriving clear benefits for themselves, this hypothesis this requires group selection.

The presence of atheists may compel the community to constantly *reinforce* religious beliefs and behaviors in the face of criticism and scrutiny, boosting religious goals, ideals and commitment in the group as a whole. David Sloan Wilson mused on the possible role of the balance between “factual and non-factual belief” in *Darwin’s Cathedral*, giving rise to the idea quoted at the beginning: “Perhaps what seems to be an adversarial relationship between believers and nonbelievers in fact represents a healthy balance between factual and practical realism that keeps social groups as a whole on an even keel” (Wilson, 2002, p. 229).

An example of this comes from the reactions of modern churches to scientific challenges to faith. Some accept scientific findings and theories such as evolution and others do not, but all have had to grapple with difficult questions in squaring scientific findings with traditional doctrine. One feature that seems to reliably *unite* a church in common cause is a major skeptic or critic. While Richard Dawkins may have won many converts to atheism, for example, the constant skepticism of such a prominent atheist has also served to cement members of religious groups together. Whatever their differences, they at least now have a common enemy. He challenges them with a set of tough questions, increases their incentives to seek out and develop theological counter-arguments, and gives religious leaders practice at rehearsing and selling doctrinal defenses. A religious community may be more united, better versed in their core beliefs, and armed with stronger justifications after battle with a skeptic.

The effect can be amplified when influential leaders within the community of believers exaggerate the threat posed by atheists as a tool to motivate their followers. This has been a strategy in western civilization since the origins of the concept: “Greeks and Romans, pagans and Christians, soon discovered the utility of the term ‘atheist’ as a means to label opponents” (Bremmer, 2007, p. 2). The approach continues today. For example, in the United States, Pat Robertson claimed that the result of society without religion will be “tyranny”; Jerry Falwell declared that 9/11 was caused by Americans angering God by pushing secularism; Ann Coulter suggested that societies without a sufficient understanding of God will slide into slavery, genocide, and bestiality; and, finally, Bill O’Reilly has argued that a society

without God leads to anarchy and crime (for more examples, see Zuckerman, 2008). Irrespective of logic, the presence of atheists can promote motives and efforts to unite believers.

Of course, interaction with skeptics may convert people *away* from religion to become atheists themselves, increasing the population of atheists at the expense of the population of believers. So, for this hypothesis to work, atheists must not be too convincing. In the context of traditional societies and human evolution, skeptics may have existed but in no case did they ever seem to spread to fixation (if they did, those societies died out). No society has ever been discovered that lacked what we would recognize as religion. The proposal, therefore, is that a few atheists might help to keep the average religious group resilient and effective, and to keep religious leaders on their toes.⁷

Hypothesis 9. Restraint

The presence of atheists may, conversely, force the community to tone down religious doctrine to keep it credible in the face of skepticism. This is an adaptive hypothesis, which predicts: (1) no clear fitness costs or benefits for atheists; (2) fitness benefits for believers; (3) some atheists in traditional societies; and (4) some atheists in modern societies (due to evolutionary legacy or continued benefits to groups of having a minority of atheists today). Because atheists generate fitness benefits for believers without deriving clear benefits for themselves, this hypothesis requires group selection.

Similar to the hypothesis above, atheists might serve to reinforce religion, but in the opposite direction. If a religion becomes too costly, incredible, destructive, or exploitative, then the protestations and arguments of atheists or skeptics may serve to tone down doctrine and prevent disaffection or disintegration. This is the argument of the rabbi quoted in the introduction to this article, who replied this way:

Sometimes we who believe, believe too much. We see the cruelty, the suffering, the injustice in the world and we say: 'This is the will of God.' We accept what we should not accept. That is when God sends us atheists to remind us that what passes for religion is not always religion. Sometimes what we accept in the name of God is what we should be fighting against in the name of God. (Cited in Sacks, 2006, p. 80)

At the level of religious communities, therefore, atheists and skeptics might conceivably save religions from planting the seeds of their own destruction, allowing them to persist via more manageable demands on their adherents. The possibility of self-destruction might seem far-fetched, but in fact there are plenty of historical examples. The Shakers more or less died out because they forbade reproduction. Numerous cults have wiped themselves out in Armageddon events. Jared Diamond's *Collapse* gives many examples of societies that created myths, traditions, and practices that led to their own destruction, such as the Easter Islanders who cut down every last tree and vanished (Diamond, 2005). Atheists or skeptics (as well as believers who simply want reform) may play a vital role in keeping religious beliefs and behaviors within reason and within the realms of sustainability – at least among those societies that survive. The ones that did not might conceivably have owed their fate to a lack of influential critics.

Hypothesis 10. Atheism is a religion

Although the definitions of atheism and religion become crucial here, it remains possible that atheists – as a group – find benefits in their shared non-belief and associated values that are very similar to the benefits (as argued by evolutionary theories of religion) derived by religious groups. This is an adaptive hypothesis, which predicts: (1) fitness benefits for atheists; (2) no clear fitness costs or benefits for believers; (3) some atheists in traditional societies; and (4) some atheists in modern societies (due to evolutionary legacy or continued benefits of atheism today).

The main reason I propose this hypothesis is because so much of the behavior of serious atheists seems to resemble the behavior of believers. A humanist friend of mine claims to “pray nightly to Richard Dawkins”! But the “religiousness” of many atheists is genuine and striking. This is particularly true of the “new atheism” characterized by Dawkins, Dennett, Harris, and Hitchens (Geertz & Markússon, 2010). David Sloan Wilson calls it a “stealth religion,” because its proponents masquerade as objectively scientific but in fact betray features that are similar to a religion: “including a polarized belief system that represents everything as good, good, good or bad, bad, bad (‘how religion poisons everything’), the unquestioned authority of its leaders, and even the portrayal of bad ideas as like demons (parasitic memes) that need to be cast out (‘breaking the spell’)” (Wilson, 2009).

Atheists (at least many of them) declare a particular world view, subscribe to a set of shared values, signal this to others, identify other religious groups as rivals, congregate, conduct rituals (e.g., humanist ceremonies), are convinced of the superiority of their beliefs, and are evangelical. For example, Richard Dawkins has sustained remarkable efforts to advertise his world view and convince others to join the following. Whatever the reasons for this behavior, it certainly shares many parallels with religious groups and leaders.

Even Zuckerman’s study of the least religious societies found that religion was actually ever-present:

One of the reasons I have titled this book *Society without God* as opposed to *Society without Religion* is because many elements of the Lutheran religion definitely continue to permeate Danish and Swedish culture. For example, the majority of Danes and Swedes are still tax-paying members of their respective national churches, most Danes and Swedes prefer to get married in church, and a large majority of Danes and Swedes still choose to baptize their children under the auspices of a pastor. (Zuckerman, 2008, p. 8)

He reports that people in these societies engage in rituals “out of a sense of cultural tradition.” Strikingly, most of his interviewees paid around 1% of their annual income to support the national church (Zuckerman, 2008, p. 8).

The key point is that (many) atheists are a collection of like-minded individuals who identify themselves by certain beliefs about the world, who differentiate themselves from people with different beliefs, and who stick together. They may, therefore, be gleaned the same adaptive benefits that religious believers do – membership of a group with shared values and beliefs. The problem with this hypothesis is that, apart from atheists lacking belief in supernatural agents (so it cannot be a religion by many definitions), it does not seem to be a convincing explanation for the persistence of non-belief in the human evolutionary past, but rather a phenomenon of modern society.

Discussion

The point of this article was not to advocate any particular evolutionary theory or explanation of atheism. Rather, it was to point out that there are several plausible hypotheses for why atheism might actually be adaptive in its own right, as well as counter-intuitively promoting the adaptive advantages of religious beliefs and religious groups. Functionalist *evolutionary theories of religion* might therefore be challenged, newly supported, or in need of revision in the light of *evolutionary theories of atheism*. Despite the explosion of evolutionary theories of religion in recent years, few have considered whether or how atheism might alter the evolutionary causes or consequences of religion.

Criticisms

One criticism of this work is the charge of panadaptationism. Just because many human traits are evolved adaptations, we should not expect all traits to serve an evolutionary function. Stephen Jay Gould offers numerous examples of “spandrels” – traits that arose by accident and have no consequences for fitness (Gould & Vrba, 1982). Atheism, in particular, should perhaps not be expected to have any adaptive function because, at least from the perspective of evolutionary theorists of religion, religious *beliefs* were subject to natural selection, not *atheism*. For these (and other) scholars, atheism is a default state that religious beliefs supplanted. Natural selection is not required for atheism to emerge in human cultures, and thus evolution is not needed for explaining atheism. This is a fair criticism and we should be sure we are not inventing interesting ideas that lack plausibility or utility. However, the goal of the present article was to think through whether there *are* any possible adaptive functions of atheism to assess.

Another criticism is that this work might be perceived as an attack on evolutionary theories of religion. However, evolutionary theories are not intrinsically *endangered* by recognizing the presence of atheists. Zuckerman (2007, p. 61) argued that the high rates of atheism around the world “delivers a heavy blow” to evolutionary theories of religion. This is a flawed argument that assumes genetic determinism (Geertz & Markússon, 2010; Sosis, 2009, p. 326). Although many evolutionary theories suggest that religious traits are adaptive and widespread, there is no reason to expect them in every individual, and the degree to which they are expressed is expected to vary as well. Hence my null hypothesis: human traits – especially behavioral traits – are complex outcomes of multiple interacting genes, physiology, cognition, and environment. Even where the causes of a trait are well known, there is wide variation in its expression. Therefore, I am not arguing that atheism *undermines* evolutionary theories of religion. On the contrary, I am arguing that atheism may be an important part of the story.

Interactions

We should also remain aware of the potential complexity of multiple phenomena occurring at once. There may be co-occurrence or interactions among multiple evolutionary functions of atheism, as well as among multiple evolutionary functions of religion. For example, atheism might be due to natural variation in how cognitive mechanisms underlying religious beliefs manifest themselves (the null hypothesis), but *given* the presence of atheists, there may be adaptive consequences for their

believing peers, or for the group. Such interactions offer a plethora of questions for further study.

Levels of selection

Some of the hypotheses in Table 1 imply that individual-level selection is all that is needed for atheism to persist because benefits accrue to atheists (so atheism would be directly selected for), whereas other hypotheses imply that group-level selection would be necessary for atheism to persist because the benefits accrue to believers but not atheists (so atheists would be selected against, without group selection). For much of the last few decades, group selection has been ruled out from serious discussion of the evolution of behavior, because individuals who act in the interests of others will be quickly outcompeted by individuals who act exclusively in their own interests (Dawkins, 1976; Williams, 1966). Recently, however, there has been a resurgence of interest in the possibility of group selection – at least in principle and under certain circumstances (Wilson, 2002, 2006; Wilson & Sober, 1994). Certainly, the role of *cultural* group selection in humans has gathered prominence, since the conditions required for group selection are more likely to occur in rapidly spreading cultural traits that differ significantly between groups (Richerson & Boyd, 2004; Sober & Wilson, 1998). The debate continues (West, El Mouden, & Gardner, 2011).

For the purposes of this paper, I am agnostic as to which may be the most important. Individual selection is typically the more potent in nature, because the fitness consequences of alternative strategies accrue directly to the actor and do not require special conditions such as between-group fitness differentials and limited migration. I am particularly drawn, therefore, to the hypotheses invoking frequency dependent selection, exploitation, and ecology – at least as first steps for further study. However, because of the likely importance of the null hypothesis – natural variation means there are always some atheists or skeptics – we should take seriously the implications of such individuals for the group as a whole.

Evolutionary mismatch

The evolutionary logic of these hypotheses might still hold true today. For example, a minority of atheists might still be able to enjoy the rewards of coexistence within a majority of believers. Whether people are interacting in a Pleistocene clan 25,000 years ago or in New York in 2012, if there are benefits to the coexistence of atheism and believers, then both may reap the spoils. Intriguingly, this may even occur *within* religious communities – as with the example of Ultra-Orthodox Jews, some of whom own up to the fact they are not true believers (Sosis, 2011; Winston, 2005). The problem is how these advantages are measured. In evolutionary history, natural selection would have acted on the differential reproductive success of believers and non-believers. Today, atheists (as well as the religious) might find advantages as a result of their beliefs, but only when measured in income, status, or happiness (for example), which may or may not translate into Darwinian fitness. However, atheism might also lead to *disadvantages* if, for example, it leads to lower income, lower status, or unhappiness. This raises the interesting possibility that, if atheism has been subject to positive selection in human evolutionary history, it may nevertheless be maladaptive in modern life (which is an interesting counterpoint to Dawkins' view that religion, whatever its origins, is maladaptive in modern life).

Extensions of the idea

In this paper, I have focused on the effects of *atheism* on religion. However, much of the logic applies to any other system of beliefs that interact with religion. Therefore, the hypotheses about frequency dependence or ecological variation, for example, might not only offer novel explanations of atheism, but could also explain other phenomena, including: (1) variation in beliefs and behaviors *within* a given religion (i.e., different denominations and sects); (2) variation and diversity among *different religions* (i.e., the evolution of one religion may have depended on the evolution of others); (3) the emergence of cults or new religious movements that directly oppose elements of the beliefs of existing groups; and (4) the emergence of nonconformist groups such as anarchists, rebels, and conspiracy theorists. Perhaps – although here we are venturing into deep speculation – one cause of these belief systems is the religious milieu from which they arise, with potential (but possibly hidden and counter-intuitive) fitness benefits for nonconformists as well as their conformist peers.

Conclusion

Personally, I am skeptical of the main adaptive hypotheses proposed. I favor the null hypothesis of natural variation, in which cognitive mechanisms underpinning religious beliefs vary in whether and how much they generate belief. At one end of this spectrum – one of the tail ends of the distribution – we will have people with very low levels of belief, even atheists, just as we always have extremes of other biological and psychological traits. However, the point of this paper is not to adjudicate among evolutionary hypotheses on atheism, but to think through what these hypotheses are. As far as I know none of these hypotheses has been theoretically examined or empirically tested in any detail. Many of their predictions could be relatively easily explored using mathematical models, empirical studies, or laboratory experiments. Certainly, an evolutionary perspective puts atheism in a new light.

The one hypothesis that seems to stand out as having copious contemporary evidence is the idea that atheists successfully bolster religious groups. Jonathan Sacks, in critiquing Richard Dawkins's argument that God has been the cause of numerous wars and genocides (which, he points out, also happen for a large number of reasons other than religion), nevertheless accepts that Dawkins is useful for highlighting instances of religion being exploited for evil ends. "If Richard Dawkins has done no more than warn us of this danger, then may he forgive me for saying that he is a fine example of why God creates atheists" (Sacks, 2006, p. 80). One *result* of the "new atheism", especially in its quite militant modern form (Dawkins, 2006; Harris, 2004; Hitchens, 2007), is promotion of the solidarity of the religious communities that they berate. An evolutionary perspective raises the possibility that this is precisely what atheists are for.

Notes

1. For the purposes of this article, I define "atheism" as the phenomenon of individuals who do not hold religious beliefs, such as a belief in a supernatural agent. They may not be intellectually "committed" to this view, as are many contemporary self-declared atheists; rather, they may be doubtful or skeptical of religious claims when pressed. I am not talking about "new atheists" or people who are anti-religion. For definitions of atheism, see Martin (2007). In general, I characterize religiosity and atheism as polymorphic

behavioral strategies (where individuals tend to be of one type *or* the other). However, many of the functional hypotheses for atheism that I propose allow the alternative possibility that the same individual may switch between atheism and religiosity, depending on environmental conditions.

2. “Inaccurate” from the perspective that God or other supernatural agents do not exist.
3. I have encountered growing skepticism of this claim, since it might simply be that children and adults in pre-scientific societies endorse a simpler view, rather than a more complex view.
4. For a contrasting view see Hunter (2010).
5. Note that I record fitness costs or benefits arising solely *from the coexistence of atheists and believers*. There may be *other* fitness costs and benefits arising from religious beliefs and behaviors (as argued by specific evolutionary theories of religion), but these are omitted here. Each hypothesis is also considered in strict isolation. For instance, while atheists may gain fitness benefits in Hypothesis X, those gains are not considered in Hypothesis Y. This approach is important because it allows us to directly *compare* the effects of the different hypotheses on the fitness of atheists and believers, while “controlling for” all other types of costs and benefits. In future studies of individual hypotheses, costs, benefits, and interactions will need to be factored in.
6. Note that this hypothesis is different from frequency-dependent selection because atheists as catalysts may reap no fitness benefits, whereas in frequency-dependent selection both atheists and believers gain fitness benefits.
7. Once again, this could be viewed as a version of frequency-dependent selection. However, within this hypothesis, atheists obtain no individual fitness benefits (unlike with frequency-dependence) but persist due to group selection.

References

- Alcorta, C.S., & Sosis, R. (2005). Ritual, emotion, and sacred symbols: The evolution of religion as an adaptive complex. *Human Nature, 16*, 323–359.
- Alexander, R.D. (1987). *The biology of moral systems*. Aldine, NY: Hawthorne.
- Atran, S. (2004). *In gods we trust: The evolutionary landscape of religion*. Oxford: Oxford University Press.
- Bainbridge, W.S. (2005). Atheism. *Interdisciplinary Journal of Research on Religion, 1*, Article 2.
- Barrett, J.L. (2000). Exploring the natural foundations of religion. *Trends in Cognitive Sciences, 4*, 29–34.
- Barrett, J.L. (2004). *Why would anyone believe in God?* New York: Altamira Press.
- Begon, M., Townsend, C.R., & Harper, J.L. (2005). *Ecology: From individuals to ecosystems*. Oxford: Blackwell Scientific.
- Beit-Hallahmi, B. (2007). Atheists: A psychological profile. In M. Martin (Ed.), *The Cambridge Companion to Atheism* (pp. 300–317). Cambridge: Cambridge University Press.
- Bering, J.M. (2002). The existential theory of mind. *Review of General Psychology, 6*, 3–24.
- Bering, J.M. (2006). The folk psychology of souls. *Behavioural and Brain Sciences, 29*, 453–462.
- Bering, J.M. (2010). *The God instinct: The psychology of souls, destiny and the meaning of life*. London: Nicolas Brealey.
- Bering, J.M., & Bjorklund, D.F. (2004). The natural emergence of reasoning about the afterlife as a developmental regularity. *Developmental Psychology, 40*, 217–233.
- Bering, J.M., & Parker, B.D. (2006). Children’s attributions of intentions to an invisible agent. *Developmental Psychology, 42*, 253–262.
- Blanke, O., Ortigue, S., Landis, T., & Seeck, M. (2002). Stimulating illusory own-body perceptions. *Nature, 419*, 269–270.
- Bloom, P. (2004). *Descartes’ baby: How the science of child development explains what makes us human*. New York: Basic Books.
- Boyer, P. (2001). *Religion explained: The evolutionary origins of religious thought*. New York: Basic Books.
- Bremmer, J.N. (2007). Atheism in antiquity. In M. Martin (Ed.), *The Cambridge companion to atheism* (pp. 11–26). Cambridge: Cambridge University Press.
- Bulbulia, J. (2004). Religious costs as adaptations that signal altruistic intention. *Evolution and Cognition, 10*, 19–38.
- Bulbulia, J. (2008). Meme infection or religious niche construction? An adaptationist alternative to the cultural maladaptationist hypothesis. *Method and Theory in the Study of Religion, 20*, 1–42.
- Caldwell-Harris, C.L., Wilson, A.L., LoTempio, E., & Beit-Hallahmi, B. (2011). Exploring the atheist personality: Well-being, awe, and magical thinking in atheists, Buddhists, and Christians. *Mental Health, Religion & Culture, 14*, 659–672.
- Campbell, C. (1971). *Toward a sociology of irreligion*. London: McMillan Press.
- Chagnon, N.A. (1997). *Yanomamo*. Face Worth: Harcourt Brace.

- Cronk, L. (1994). Evolutionary theories of morality and the manipulative use of signals. *Zygon*, 4, 117–135.
- Cronk, L. (2005). The application of animal signaling theory to human phenomena: Some thoughts and clarifications. *Social Science Information*, 44, 603–620.
- Dawkins, R. (1976). *The selfish gene*. Oxford: Oxford University Press.
- Dawkins, R. (2006). *The God delusion*. New York: Houghton Mifflin.
- Diamond, J. (2005). *Collapse: How societies choose to fail or succeed*. New York: Penguin.
- Dugatkin, L.A., & Reeve, H.K. (2000). *Game theory and animal behavior*. Oxford: Oxford University Press.
- Durkheim, É. (1912/2001). *The elementary forms of religious life*. Oxford: Oxford University Press.
- Foster, K.R., & Kokko, H. (2009). The evolution of superstitious and superstitious-like behaviour. *Proceedings of the Royal Society B: Biological Sciences*, 276, 31–37.
- Frazier, J.G. (1922/1996). *The golden bough*. New York: Touchstone.
- Galen, L. (2009). Profiles of the godless. *Free Inquiry*, 29, 41–45.
- Geertz, A.W., & Markússon, G.I. (2010). Religion is natural, atheism is not: On why everybody is both right and wrong. *Religion*, 40, 152–165.
- Glaeser, E.L., & Sacerdote, B.I. (2008). Education and religion. *Journal of Human Capital*, 2, 188–215.
- Goody, J. (1996). A kernel of doubt. *Journal of the Royal Anthropological Institute*, 2, 667–681.
- Gould, S.J., & Vrba, S. (1982). Exaptation: A missing term in the science of form. *Paleobiology*, 8, 4–15.
- Gross, N., & Simmons, S. (2010). The religiosity of American college and university Professors. *Sociology of religion*, 70, 101–129.
- Guthrie, S.E. (1993). *Faces in the clouds: A new theory of religion*. New York: Oxford University Press.
- Harris, S. (2004). *The end of faith: Religion, terror, and the future of reason*. New York: London: W.W. Norton & Co.
- Hauert, C., De Monte, S., Hofbauer, J., & Sigmund, K. (2002). Volunteering as Red Queen mechanism for cooperation in public goods games. *Science*, 296, 1129–1132.
- Hauert, C., Traulsen, A., Brandt, H., Nowak, M.A., & Sigmund, K. (2007). Via freedom to coercion: The emergence of costly punishment. *Science*, 316, 1905–1907.
- Hitchens, C. (2007). *God is not great: How religion poisons everything*. New York: Twelve Books.
- Hood, B.M. (2009). *SuperSense: Why we believe in the unbelievable*. New York: HarperOne.
- Hunsberger, B., & Altemeyer, B. (2006). *Atheists: A groundbreaking study of America's nonbelievers*. Amherst: Prometheus Books.
- Hunter, L.A. (2010). Explaining atheism: Testing the secondary compensator model and proposing an alternative. *Interdisciplinary Journal of Research on Religion*, 6, Article 6.
- Hunter, M., & Wootton, D. (Eds.) (1992). *Atheism from the Reformation to the Enlightenment*. Oxford: Clarendon Press.
- Hwang, K., Hammer, J.H., & Cragun, R. (in press). Extending the religion–health research to secular minorities: issues and concerns. *Journal of Religion and Health*.
- Irons, W. (2001). Religion as a hard-to-fake sign of commitment. In R. Nesse (Ed.), *Evolution and the capacity for commitment* (pp. 292–309). New York: Russell Sage Foundation.
- Johnson, D.D.P. (2008). Gods of war: The adaptive logic of religious conflict. In J. Bulbulia, R. Sosis, C. Genet, R. Genet, E. Harris, & K. Wyman (Eds.), *The evolution of religion: Studies, theories, and critiques* (pp. 111–117). Santa Margarita, CA: Collins Foundation Press.
- Johnson, D.D.P., & Bering, J.M. (2006). Hand of God, mind of man: Punishment and cognition in the evolution of cooperation. *Evolutionary Psychology*, 4, 219–233.
- Johnstone, R.A. (1997). The evolution of animal signals. In J.R. Krebs & N.B. Davies (Eds.) *Behavioural ecology: An evolutionary approach* (4th Edition, pp. 155–178). Oxford: Blackwell Science.
- Keleman, D. (2004). Are children “intuitive theists”? Reasoning about purpose and design in nature. *Psychological Science*, 15, 295–301.
- Koenig, H.G. (2005). *Faith, medicine and science: A Festschrift in honour of Dr David Larson*. Binghamton, NY: Howarth.
- Koenig, L.B., McGue, M., Krueger, R.F., & Bouchard, T.J. (2005). Genetic and environmental influences on religiousness: Findings for retrospective and current religiousness ratings. *Journal of Personality*, 73, 471–488.
- Kosmin, B., & Keysar, A. (Eds.) (2007). *Secularism and secularity: Contemporary international perspectives*. Hartford, CT: Institute for the Study of Secularism in Society and Culture.
- Krebs, J.R., & Davies, N.B. (1993). *An introduction to behavioural ecology*. Oxford: Blackwells Scientific Publications.
- Lanman, J. (in press). No longer ‘walking the walk’: The importance of religious displays for transmission and secularization. *Journal of Contemporary Religion*.
- Lee, L., & Bullivant, S. (2010, 6 March). Where do atheists come from? *New Scientist*, 26–27.
- Linklater, M. (2005, 13 August). Labour Party at prayer salutes Cook the atheist. *The Times*.
- Locke, J. (1937). *Treatise of civil government and a letter concerning toleration*. New York: Appleton-Century.
- MacNeill, A. (2004). The capacity for religious experience is an evolutionary adaptation to warfare. *Evolution and Cognition*, 10, 43–60.

- Martin, M. (Ed.) (2007). *The Cambridge companion to atheism*. Cambridge: Cambridge University Press.
- Marx, K. (1844). A contribution to the critique of Hegel's Philosophy of Right. *Deutsch-Französische Jahrbücher*.
- Mathew, S., & Boyd, R. (2008). When does optional participation allow the evolution of cooperation? *Proceedings of the Royal Society of London, B*, 276(1659), 1167–1174
- Mayr, E. (1961). Cause and effect in biology. *Science*, 134, 1501–1506.
- McKay, R.T., & Dennett, D.C. (2009). The evolution of misbelief. *Behavioral and Brain Sciences*, 32, 493–561.
- McNamara, P. (Ed.) (2006). *Where God and science meet: How brain and evolutionary studies alter our understanding of religion* (Vols. 1–3). Westport, CT: Praeger Perspectives.
- McNamara, P. (2009). *The neuroscience of religious Experience*. Cambridge: Cambridge University Press.
- Miller, J.D., Scott, E.C., & Okamoto, S. (2006). Public acceptance of evolution. *Science*, 313, 765–766.
- Murdock, G.P. (1980). *Theories of illness: A world survey*. Pittsburg, PA: HRAF, University of Pittsburgh Press.
- Norenzayan, A., & Shariff, A.F. (2008). The origin and evolution of religious prosociality. *Science*, 322, 58–62.
- Norris, P., & Inglehart, R. (2004). *Sacred and secular: Religion and politics worldwide*. Cambridge: Cambridge University Press.
- Nowak, M.A. (2006). *Evolutionary dynamics: Exploring the equations of life*. Cambridge, MA: Belknap Press of Harvard University Press.
- Pals, D.L. (2006). *Eight theories of religion*. New York: Oxford University Press.
- Pasquale, F.L. (2007). The “nonreligious” in the American northwest. In B.A. Kosmin & A. Keysar (Eds.), *Secularism & secularity: Contemporary international perspectives* (pp. 41–58). Hartford, CT: ISSSC.
- Richerson, P.J., & Boyd, R. (2004). *Not by genes alone: How culture transformed human evolution*. Chicago, IL: University Of Chicago Press.
- Roes, F.L., & Raymond, M. (2003). Belief in moralizing gods. *Evolution and Human Behavior*, 24, 126–135.
- Rosen, S.P. Religion, brain, biology, and politics: a preliminary essay. Manuscript in preparation.
- Rowthorn, R. (2011). Religion, fertility and genes: A dual inheritance model. *Proceedings of the Royal Society B: Biological Sciences*, 278, 2519–2527.
- Sacks, Jonathan. (2006, 21 October). Danger ahead - there are good reasons why God created atheists. *The Times*, p. 80.
- Saler, B., & Ziegler, C.A. (2006). Atheism and the apotheosis of agency. *Tenemos: Nordic Journal of Comparative Religion*, 42, 7–41.
- Schjoedt, U. (2009). The religious brain: A general introduction to the experimental neuroscience of religion. *Method and Theory in the Study of Religion*, 21, 310–339.
- Schloss, J.P., & Murray, M. (2011). Evolutionary accounts of belief in supernatural punishment: A critical review. *Religion, Brain & Behavior*, 1, 46–99.
- Schnell, T., & Keenan, W.J.F. (2011). Meaning-making in an atheist world. *Archive for the Psychology of Religion*, 33, 55–80.
- Searcy, W.A., & Nowicki, S. (2005). *The evolution of animal communication: Reliability and deception in signaling systems*. Princeton, NJ: Princeton University Press.
- Shariff, A.F., & Norenzayan, A. (2007). God is watching you: Supernatural agent concepts increase prosocial behavior in an anonymous economic game. *Psychological Science*, 18, 803–809.
- Snarey, J. (1996). The natural environment's impact upon religious ethics: A cross-cultural study. *Journal for the Scientific Study of Religion*, 80, 85–96.
- Sober, E., & Wilson, D.S. (1998). *Unto others: The evolution and psychology of unselfish behaviour*. Cambridge, MA: Harvard University Press.
- Sosis, R. (2003). Why aren't we all Hutterites? Costly signaling theory and religious behavior. *Human Nature*, 14, 91–127.
- Sosis, R. (2004). The adaptive value of religious ritual. *American Scientist*, 92, 166–172.
- Sosis, R. (2005). Does religion promote trust? The role of signaling, reputation, and punishment. *Interdisciplinary Journal of Research on Religion*, 1, 1–30 (article 7).
- Sosis, R. (2006). Religious behaviors, badges, and bans: Signaling theory and the evolution of religion. In P. McNamara (Ed.), *Where God and science meet: How brain and evolutionary studies alter our understanding of religion. Vol. 1: Evolution, genes, and the religious brain* (pp. 61–86). Westport, CT: Praeger Publishers.
- Sosis, R. (2009). The adaptationist-byproduct debate on the evolution of religion: five misunderstandings of the adaptationist program. *Journal of Cognition and Culture*, 9, 315–332.
- Sosis, R. (2011). Why sacred lands are not indivisible: The cognitive foundations of sacralizing land. *Journal of Terrorism Research*, 2, 17–44.
- Sosis, R., & Alcorta, C. (2003). Signaling, solidarity, and the sacred: The evolution of religious behavior. *Evolutionary Anthropology*, 12, 264–274.
- Sosis, R., Kress, H., & Boster, J. (2007). Scars for war: Evaluating alternative signaling explanations for cross-cultural variance in ritual costs. *Evolution and Human Behavior*, 28, 234–247.
- Stark, R. & Bainbridge. (1985). *The future of religion: Secularization, revival and cult formation*. Berkeley, CA: UC Press.

- Steadman, L.B., & Palmer, C.T. (2009). *The supernatural and natural selection: Religion and evolutionary success*. Boulder, CO: Paradigm.
- Taves, A. (1999). *Fits, Trances, and Visions: Experiencing Religion and Explaining Experience from Wesley to James*. Princeton, NJ: Princeton University Press.
- Thrower, J. (1980). *The alternative tradition: Religion and the rejection of religion in the ancient world*. The Hague: Mouton.
- Tinbergen, N. (1963). On aims and methods in ethology. *Zeitschrift für Tierpsychologie*, 20, 410–433.
- Tinbergen, N. (1968). On war and peace in animals and man: An ethologist's approach to the biology of aggression. *Science*, 160, 1411–1418.
- Trivers, R.L. (2011). *Deceit and self-deception: Fooling yourself the better to fool others*. London: Allen Lane.
- Weber, M. (1922/1978). *The sociology of religion*. Berkeley, CA: University of California Press.
- Weibull, J. (1995). *Evolutionary game theory*. Cambridge, MA: MIT Press.
- West, S.A., El Mouden, C., & Gardner, A. (2011). 16 common misconceptions about the evolution of cooperation in humans. *Evolution and Human Behavior*, 32, 231–262.
- Whitehouse, H. (2004). *Modes of religiosity: A cognitive theory of religious transmission*. Walnut Creek, CA: Altamira Press.
- Whitehouse, H. (2008). Cognitive evolution and religion; Cognition and religious evolution. In J. Bulbulia, R. Sosis, C. Genet, R. Genet, E. Harris, & K. Wyman (Eds.), *The evolution of religion: Studies, theories, and critiques* (pp. 19–29). Santa Margarita, CA: Collins Foundation Press.
- Williams, G.C. (1966). *Adaptation and natural selection*. Princeton, NJ: Princeton University Press.
- Wilson, D.S. (2002). *Darwin's cathedral: Evolution, religion, and the nature of society*. Chicago, IL: University of Chicago Press.
- Wilson, D.S. (2005). Testing major evolutionary hypotheses about religion with a random sample. *Human Nature*, 16, 419–446.
- Wilson, D.S. (2006). Human groups as adaptive units: Toward a permanent consensus. In P. Carruthers, S. Laurence, & S. Stich (Eds.), *The innate mind: Culture and cognition*. Oxford: Oxford University Press.
- Wilson, D.S. (2009). Atheism as a stealth religion. Retrieved from http://scienceblogs.com/evolution/2009/10/atheism_as_a_stealth_religion.php
- Wilson, D.S., & Sober, E. (1994). Reintroducing group selection to the human behavioural sciences. *Behavioral and Brain Sciences*, 17, 585–654.
- Winston, H. (2005). *Unchosen: The hidden lives of Hasidic rebels*. Boston, MA: Beacon Press.
- Zuckerman, P. (2007). Atheism: Contemporary numbers and patterns. In M. Martin (Ed.), *The Cambridge companion to atheism* (pp. 47–65). Cambridge: Cambridge University Press.
- Zuckerman, P. (2008). *Society without God: What the least religious nations can tell us about contentment*. New York: NYU Press.
- Zuckerman, P. (2009). Atheism, secularity, and well-being: How the findings of social science counter negative stereotypes and assumptions. *Sociology Compass*, 3, 949–971.

COMMENTARIES

Atheism: by-product of cognitive styles of independent learning and systemizing

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Johnson's taxonomy of evolutionary hypotheses for atheism is comprehensive and informative, but his illustrations of what behaviors or traits may actually have been adaptive are skeletal. Johnson recognizes this, urging other researchers to flesh out the details.

I respond to this call by proposing some cognitive features and personality characteristics that, in addition to facilitating disbelief in God, may have been

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adaptive during human evolution. It seems unlikely that atheism was a target of natural selection. Instead, skepticism toward the dominant belief system may occur for individuals with high genetic loading for an independent learning style and those with a propensity for gaining information about the world via systemizing.

Independent learning

Studies of irreligion in contemporary societies indicate that atheists are more likely to be individualistic in their social attitudes and skeptical and nonconformist with regard to authorities' teachings (Bainbridge, 2005; Beit-Hallahmi, 2006; Caldwell-Harris, Wilson, LoTempio, & Beit-Hallahmi, 2011; Hunsberger & Altemeyer, 2006; Saroglou, 2010). I suggest that a high genetic loading on what Boyd and Richerson (2005) have called an independent learning style produces these characteristics. An independent learning style is distinguishable from another style, cultural learning. These should not be seen as mutually exclusive, but as coexisting cognitive styles utilized depending on the situation. However, these learning styles are likely to be differentially successful based on environmental contingencies. Anthropologists have long noted that traditional agricultural settings most strongly emphasize childhood obedience to adults. Hunter-gatherers and modern technological societies allow children more independent exploration. This is because children in pre-modern eras were needed as farm laborers, and farming practices, distilled through generations of trial and error, are not self-evident to new learners (Barry, Josephson, Sauer, & Marshall, 1976). Rather than risk crop failure by satisfying one's curiosity via experimentation, it was imperative that learners follow what had proven useful. During the thousands of years of pre-modern planting, independent learners would have been a minority within their groups but they may also have been socially successful because their inventions and problem-solving skills led to social status and other rewards against the backdrop of successful harvests.

Cultural learning allows learners to bypass time-consuming trial-and-error learning, but leaves them open to both exploitation and needless repetition of inefficient practices. For this reason, Simon (1990) argued for the adaptiveness of "teachability," a trait that is strongest in childhood when children are under the protection and influence of parents. This allows altruistic behavior to be inculcated, since any fitness reductions from altruistic acts would be compensated for by the benefits of cultural learning. Teachability diminishes at the end of the juvenile period, according to Simon, because young adults would typically be learning from non-kin. Consistent with this, adolescence is associated with questioning parental beliefs and the formation of individual religious beliefs consistent with one's temperament (Alcorta, 2006).

A high genetic loading on independent learning would offer the benefits of creative problem solving and could allow individuals to avoid costly signals when other options were possible. Skepticism toward conventional teachings could then facilitate rejection of or reduced interest in the parents' religion or the dominant religion.

Systemizing

Systemizing and empathizing have been described as key methods humans use for reasoning and acquiring information (Baron-Cohen, 2009). Empathizing is the strategy most useful in making sense of other humans. If you imagine you are

in X's situation, you benefit from the flood of inferences based on your exposure to similar situations (Dennett, 1989). Systemizing is the ability to analyze the internal workings of a system in order to model its function, extract its rules, and make viable predictions. Systemizing is the most efficient strategy for understanding mechanical and non-agentive physical systems. Behavioral scientists and persons with Asperger's Syndrome may use systemizing for understanding human behavior, generating explanations that may seem simplistic, obvious, or overly mechanical. Most people adeptly employ both empathizing and systematizing according to the situation, but substantial differences exist. Persons with autism have stronger systematizing skills, and women seem to have stronger empathizing skills (Baron-Cohen, 2009). Scholars have also argued that these two information-processing skills are independently heritable and confer adaptive benefits in different environmental niches (e.g., Kanazawa & Vandermassen, 2005).

It is plausible that atheists have a high genetic loading on systemizing. Atheists enjoy deliberative reasoning and logical analysis, particularly in scientific and circumscribed domains (Hunsberger & Altemeyer, 2006). Because systemizing typically involves manipulation of observables, it is likely to facilitate a naturalistic world view. In a large British sample, Rosenkranz (2009) showed that religious belief was associated with empathizing, while systemizing was associated with atheistic orientation. Indeed, systemizing and empathizing so powerfully predicted religious orientation that sex differences associated with religious belief disappeared when Rosenkranz entered empathizing and systemizing into his multivariate analysis.

If atheists tend to be systemizers, they may have reaped fitness benefits due to the social status awarded to problem solvers, as mentioned above. The attributes of independent learning vs cultural learning and systemizing vs empathizing fit into Johnson's hypothesis 4 about frequency dependence and hypothesis 6 regarding ecological contingencies.

Given their similarities, could the independent-versus-cultural-learning trait and the systemizing-versus-empathizing trait be two aspects of a single cognitive attribute? Systemizing involves analyzing relatively unprocessed data; this requires independent learning. However, systemizing is most likely to produce culturally useful products when it borrows from and builds on cultural knowledge; this requires cultural learning. Similarly, empathizing involves both independent learning, in that one infers the cause of behavior through mental simulation of goals and intentions, and cultural learning, in that mental simulation presupposes an enormous amount of intricate cultural learning. Thus, the independent-versus-cultural-learning trait is distinct from the systemizing-versus-empathizing trait.

Is atheism directly selected for or an evolutionary by-product?

Independent learning and systemizing were likely to have been adaptive during human evolution, and they appear to predispose individuals towards atheism, and skepticism toward religious dogma. These learning styles may be optimal in contemporary industrialized societies where atheism is also more common than it was in previous eras. My account assumes that it was these cognitive styles that were adaptive; atheism itself was not the target of natural selection.

Is it possible to discriminate between atheism as the target of natural selection versus atheism as an evolutionary by-product? Johnson's article moves freely between statements about possible adaptive benefits of atheism and statements about atheists'

likely behaviors and personality correlates. For example, he notes that there “may be locations and situations in which more ‘rationalist,’ cost-benefit thinking is particularly adaptive.” When discussing hypotheses 8, *bolstering*, and hypotheses 9, *restraint*, he notes that criticism and scrutiny could “keep the average religious group resilient and effective.” Nonconformist, independent thinkers could spark reform within their groups, thus serving the purposes of bolstering and restraint.

My proposal, that it is personality and cognitive styles that conferred adaptive benefits, rather than atheism itself, explains why skepticism toward the dominant belief system can be found in cultures where one is hard pressed to identify actual atheism, and why the incidence of atheism varies strongly across cultures.

References

- Alcorta, C.S. (2006). Religion and the life course: Is adolescence an “experience expectant” period for religious transmission? In P. McNamara (Ed.), *Where God and science meet: How brain and evolutionary studies alter our understanding of religion, Vol. 2: The neurology of religious experience* (pp. 55–80). Westport, CT: Praeger.
- Bainbridge, W.S. (2005). Atheism. *Interdisciplinary Journal of Research on Religion, 1*, 1–25.
- Baron-Cohen, S. (2009). Autism: The empathizing-systemizing (E-S) theory. *Annals of the New York Academy of Sciences, 1156*, 68–80.
- Barry, H., Josephson, L., Sauer, E., & Marshall, C. (1976). Traits inculcated in childhood: Cross-cultural codes. *Ethology, 15*, 83–114.
- Beit-Hallahmi, B. (2006). Atheists: A psychological profile. In M. Martin (Ed.), *The Cambridge companion to atheism* (pp. 300–318). New York: Cambridge University Press.
- Boyd, R., & Richerson, P. (2005). *The origin and evolution of cultures*. New York: Oxford University Press.
- Caldwell-Harris, C.L., Wilson, A., LoTempio, E., & Beit-Hallahmi, B. (2011). Exploring the atheist personality: Well-being, awe, and magical thinking in atheists, Buddhists, and Christians. *Mental Health, Religion & Culture, 14*, 659–672.
- Dennett, D.C. (1989). *The intentional stance*. Cambridge, MA: MIT Press.
- Hunsberger, B.E., & Altemeyer, B. (2006). *Atheists: A groundbreaking study of America's nonbelievers*. Amherst, NY: Prometheus Books.
- Kanazawa, S., & Vandermassen, G. (2005). Engineers have more sons, nurses have more daughters: An evolutionary psychological extension of Baron-Cohen's extreme male brain theory of autism. *Journal of Theoretical Biology, 233*, 589–599.
- Rosenkranz, P.M. (2009). *Existential orientation: Atheism, theism and individual differences* (Unpublished doctoral dissertation). University of Newcastle upon Tyne, Newcastle upon Tyne, UK.
- Saroglou, V. (2010). Religiousness as a cultural adaptation of basic traits: A five-factor model perspective. *Personality and Social Psychology Review, 14*, 108–125.
- Simon, H.A. (1990). A mechanism for social selection and successful altruism. *Science, 250*, 1665–1668.

Why should atheists be “for” anything? On the collective idiosyncrasies and illusions of cognitive scientists of religion

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Dominic Johnson addresses an issue of critical importance to the cognitive science of religion (CSR). Just asking the question, “What are atheists for?”, however,

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exposes a central weakness in CSR thought. Johnson has not solved it, but he has systematically sketched out those scenarios of the evolution of atheism that the logic of the Naturalness of Religion Hypothesis (NRH) would allow. The central weakness, I have argued, is that most CSR scholars are idiosyncratically committed to the idea that culture has no causal relation to cognition. I will call this commitment the Evolution of Humans Without Culture Hypothesis (EHWCH), as programmatically formulated by John Tooby and Leda Cosmides (1992), who in their critique of the blank slate hypothesis systematically denied the importance of culture in human cognition and evolution. Hence, they unwittingly paved the way for a collective illusion among cognitive scientists of religion.

Fortunately, the past decades have produced new evidence in biology, archeology, physical anthropology, evolutionary psychology, the cognitive and affective neurosciences, and sociology that exposes the problems of EHWCH. In brief, it is an incontrovertible fact that *Homo sapiens* has never been without culture. It is also an incontrovertible fact that stone tools were already used by *Australopithecus*. Furthermore, there is overwhelming evidence suggesting that stone tool culture and the resultant social complexities that arose in connection with it drove the expansion of the Hominin brain. Culture has, in other words, reorganized or retooled the brain. This assumption has been argued since the 1950s at least and is most eloquently advocated today by Merlin Donald, Terrence W. Deacon, and Michael Tomasello, who promote biocultural and biosemiotic approaches to human psychology and evolution.

The illusion that if you take away culture, you will find cognitive mechanisms and constraints has led to experiments assumed to activate unconscious, intuitive constraints and mechanisms. This onion-skin model of humanity, however, just won't work. If you assume, as many of us do, that human ancestors were thoroughly enculturated even before the human species arose, how can you distinguish between cognitive and cultural constraints? You might possibly be able to identify default reactions in social intelligence shared by other mammals. But what have we accomplished except to show that, yes, we get angry at cheaters and, yes, we are keenly aware of injustice? But artificially removing culture from the equation of human cognition removes, in fact, the human in cognition.

Getting back to atheists, I argue that the question "What are they for?" is misplaced because culture has been removed from the equation. Markússon and I have argued that bringing human semiosis back into the picture avoids a lot of unnecessary problems (Geertz & Markússon, 2010). I think it is safe to assume that religious thoughts and behaviors did not appear until *Homo erectus*. By then the brain was pretty big, and the cognitive abilities that came with the prefrontal cortical expansion may have had side effects that enhanced our ability to spook ourselves with all kinds of worries, imagined and real, and perhaps also the ability to imagine beings and forces acting behind the natural world. Thus, it is not atheism that needs explanation, it is religion. Atheism (or, let us say, the absence of any interest in or inkling of supernatural or theistic ideas) is evidently the default modality. It doesn't need to be explained. It is defined by the absence of its opposite. It's like asking why we breathe instead of osmose. It keeps returning in our history whenever cultural and social pressures allow it. So, although I support Johnson's refreshing argument that we need to analyze atheism and theism together, I claim that EHWCH proponents owe us an explanation. If culture

doesn't cause anything, how can we account for ideas and behaviors that contravene our default atheistic cognition?

There is a slight tendency in Johnson's article to assume some kind of neural naturalness to religion. He states that atheism is "more or less resistant to the psychological mechanisms supporting religious beliefs" that are universal features of human brains. Please note here that very few CSR people have actually done neurocognitive studies. There are a number of other people who have, and the results are often scandalously sloppy and slanted (here I am thinking of Andrew B. Newberg's work and most meditation studies). Johnson suggests that atheists and theists might use different parts of the brain. This claim, however, assumes that there are areas of the brain dedicated to religious thought and behavior. But the above-mentioned studies provide more hype than proof. We have demonstrated in our own fMRI experiments in Aarhus that even a simple act like prayer does not make use of dedicated areas.

We don't know much about the neural correlates of human behavior and thought at the moment. But we can safely assume that atheism does *not* resist the psychological mechanisms that support religious beliefs. They either resist or attend to the social psychological pressures found in particular social environments. Remember that the only mechanisms that have been invoked in NRH are hypertrophic social intelligence, alliance and cheater-detection abilities, repertoire of moral feelings, the use of hard-to-fake signals, self-deception, and emotional rewards for gossip (Boyer, 2000). Besides these, we have theory of mind (ToM), agency detection, counter-intuitive ideas, and so on. Can anyone seriously claim that atheists resist these mechanisms?

As much as we admire the study done by Saler & Ziegler (2006), Markússon and I have argued that identifying genetic influences must depend on identifying relevant neural correlates. Johnson rightly points out that any genetic interactions would be a complex mix. However, we need to incorporate insights from probabilistic epigenesis (which biologists have been talking about for the last two decades) whereby unidirectional assumptions about the genetic predetermination of phenotypic traits have been replaced by bidirectional assumptions about the reciprocity of genes, brain, behavior, and the physical, social, and cultural environments. Until we get our facts straight, the cognitive science of religion will remain an esoteric discipline.

References

- Boyer, P. (2000). Functional origins of religious concepts: Ontological and strategic selection in evolved minds. *Journal of the Royal Anthropological Institute*, 6, 195–214.
- Geertz, A.W., & Markússon, G.I. (2010). Religion is natural, atheism is not: On why everybody is both right and wrong. *Religion*, 40, 152–165.
- Saler, B., & Ziegler, C.A. (2006). Atheism and the apotheosis of agency. *Temenos: Nordic Journal of Comparative Religion*, 42, 7–41.
- Tooby, J., & Cosmides, L. (1992). The psychological foundations of culture. In J.H. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture* (pp. 19–136). New York: Oxford University Press.

On the non-evolution of atheism and the importance of definitions and data

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In “What are Atheists For?”, Johnson provides the valuable service of outlining evolutionary hypotheses concerning atheism. With his evolutionary expertise, Johnson is well suited to the task, which makes it all the more noteworthy that Johnson does not endorse any of the evolutionary hypotheses. Instead, he places his bet on the null hypothesis of variation in individuals’ propensities to hold religious beliefs because of variation in genes, physiology, cognition, and environment. I agree with his assessment.

Here I would like to argue that we should keep at least two concerns in mind when evaluating such evolutionary scenarios: (1) the need for discipline in our definitions; and (2) the need to engage with the available sociological data.

1. Definitional discipline

Cognitive scientists of religion would prefer to avoid definitional debates. We have grown frustrated at the necessity of repeating the same arguments concerning the definition and fractionation of the term “religion” into its constituent components when conversing with those outside our field. Yet a discussion of definitions is in order here, for while Johnson does make a note of the issue of definitions in *Hypothesis 10: Atheism is a religion*, there are issues with both his definition of atheism (individuals not holding religious beliefs) and with the fact that the definition of atheism being used across the scenarios is inconsistent.

Explicit vs implicit belief

One immediate issue with the definition is the sort of belief we are talking about. The cognitive science of religion has long made a distinction between explicit and implicit beliefs (Barrett & Lanman, 2008) and some, including Bering (2010), have argued that while one may be an explicit atheist, one may also be an implicit theist, in that much of one’s intuitive cognition may be guided by a belief in the existence of supernatural agents. This is not a matter of explicitly denying something that one explicitly believes “deep down”, but two different levels of cognition at work simultaneously, with the implicit level in some cases being inaccessible to consciousness. This distinction is quite relevant to *Hypothesis 1: There are no atheists*, as whether or not there are no atheists may well depend on whether we are discussing implicit or explicit atheism.

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Supernatural agents vs religious beliefs

Johnson defines atheism as a lack of religious beliefs, “such as a belief in a supernatural agent.” Particular religions have more beliefs than just those of supernatural agents, including healing practices and non-agentive sacred powers, such as mana. By defining atheism as a lack of all of these beliefs, one is utilizing the constructed category of religion to define atheism, which overlooks the possibility that a lack of belief in supernatural agents and a lack of belief in supernatural healing depend on different cognitive mechanisms. Limiting the definition of atheism to a lack of belief in supernatural agents, however, focuses on a particular cognitive phenomenon.

Existence vs vocalization of atheism

One can lack belief in supernatural agents without vocalizing this fact; the former is a cognitive state, the latter a social act. Many of the hypotheses outlined are concerned with belief, while others depend on social acts of professing atheism. In *Hypothesis 8: Bolstering*, the presence of outspoken atheists is thought to cause theists to bolster their arguments and to reinforce beliefs. In *Hypothesis 9: Restraint*, the restraint on religious demands comes from the vocalized protests and arguments of atheists. One can have an explanation of atheism as a lack of belief in supernatural agents without being able to explain much about the vocalization of said atheism in a particular environment, and we should be clear about which phenomenon we are discussing in our evolutionary hypotheses.

Definitions vs data

In evaluating claims about the presence or absence of atheists in particular contexts, we must bear in mind possible discrepancies between our definitions and those of data gatherers. In my own research, I found a disconnect between my theoretically motivated definition of non-theism as a lack of belief in the existence of non-physical agents and the categories employed by large international surveys, which focus on belief in “God” (Norris & Inglehart, 2004). While such data sets seem to tell us that non-theists are much more common in certain countries, they leave open the possibility that individuals have beliefs in other supernatural agents, such as ghosts.

2. The sociology of religion

Even with these disconnects, however, large sociological data sets (reviewed in Norris & Inglehart, 2004, and Zuckerman, 2007) are important for theorizing about atheism and its possible evolutionary origins. It is surprising, then, to see little engagement in the article with the findings of Norris and Inglehart (2004) and Gill and Lundsgaarde (2004) concerning the environmental variables that increase rates of atheism.

It is not just that, as Johnson points out, rates of atheism vary by nation, but that particular environments (namely those categorized as existentially secure via strong social welfare states and ethnic homogeneity) work to lower theism. The question, of course, is *why*. Is it because it becomes adaptive for individuals or groups in those environments to shed their religious beliefs? Or is it the result of a variety of

mechanisms at different levels, as stipulated in Johnson's null hypothesis? I am inclined to accept the latter, and I have argued elsewhere (Lanman, 2012) that secure environments lower religious commitment, extrinsic reasons for religious participation, and superstitious behavior. All of these serve as credibility enhancing displays for supernatural ideas (Henrich, 2009), and without them subsequent generations are less likely to accept religious claims. The dynamics of existential security and credibility enhancing displays may, in fact, account for more of the variance in atheism than other facets of modernity mentioned in *Hypothesis 3: Unnatural variation*, namely scientific education and modern philosophy. The narrow gap between the US and Sweden in science education and the presence of modern philosophy cannot account for the vast gap in theistic belief between the two countries. Perhaps the larger gap in economic inequality, social welfare programs, and ethnic homogeneity can.

References

- Barrett, J., & Lanman, J. (2008). The science of religious beliefs. *Religion*, 38, 109–124.
- Bering, J. (2010). *The God instinct: The psychology of souls, destiny, and the meaning of life*. London: Nicholas Brealey.
- Gill, A., & Lundsgaarde, E. (2004). State welfare spending and religiosity. *Rationality and Society*, 16, 399–436.
- Henrich, J. (2009). The evolution of costly displays, cooperation, and religion: Credibility enhancing displays and their implications for cultural evolution. *Evolution and Human Behaviour*, 30, 244–260.
- Lanman, J. (2012). The importance of religious displays for belief acquisition and secularization. *Journal of Contemporary Religion*, 27, 49–65.
- Norris, P., & Inglehart, R. (2004). *Sacred and secular: Religion and politics worldwide*. Cambridge: Cambridge University Press.
- Zuckerman, P. (2007). Atheism: Contemporary numbers and patterns. In Michael Martin (Ed.), *The Cambridge companion to atheism* (pp. 47–65). Cambridge: Cambridge University Press.

The sleep of reason: do atheists improve the stock?

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The question of why animals sleep is an important and still largely unresolved issue in evolutionary biology. A more fruitful approach might be to turn this question on its head: why do animals have waking periods? After all, being awake consumes more energy than being asleep, and in some respects entails more risk (Cirelli & Tononi, 2008). In his stimulating Target Article, Johnson suggests a similar figure-ground inversion, inviting us to consider the biological origins of religion from a fresh point of view: ask not what religion is “for,” but what *atheists* are for.

We appreciate this switch of perspective, and agree that we should at least check that the inverse question isn't the one we should all be focusing on. We applaud

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Johnson's pioneering spirit – now we have before us a family of ideas to take seriously if we can, and to say why not if we think we shouldn't. Of course, it's only to be expected that venturing in a pioneering spirit is fraught with peril, and our aim in this brief commentary is to try to help clear the path a little.

Just as Cirelli and Tononi (2008) consider alternatives to the null hypothesis that sleep serves no essential function, Johnson considers alternatives to the null hypothesis that atheism simply represents one end of a continuum of belief (see McKay & Dennett, 2009, for related hypotheses about disordered reading and Attention-Deficit Hyperactivity Disorder). He is reluctant, however, to champion any of these alternatives, and we think this reticence is telling. He suggests that many of the predictions he outlines “could be relatively easily explored using mathematical models, empirical studies, or laboratory experiments,” but we suspect that a serious effort to sharpen many of them would expose numerous problems of interpretation and equivocation.

Although Johnson favors the null hypothesis of natural variation, the alternative hypothesis that he finds most compelling is his “Hypothesis 8,” that atheists foster solidarity among the religious and thereby increase the fitness of religious believers. Although we are amused by the irony in this suggestion (imagine how horrified Richard Dawkins and P.Z. Myers would be to discover that, all along, they had been doing God's work!), we are unconvinced by the claim that this hypothesis has “copious contemporary evidence.” The evidence that Johnson cites seems to consist of little more than a quote by Jonathan Sacks, the United Kingdom's Chief Rabbi. One could with equal (that is to say, slender) justification surmise that the new atheists are bolstering religious solidarity (and hence “doing God's work”) by predated the weak and inferior believers from congregations around the world, leaving leaner, more robust flocks! In any case, while it is uncontroversial to suggest that atheists may have the *effect* of bolstering religious communities, it is far from clear how any group selection phenomenon could secure that this is a *function* of atheist activities, requiring differential replication of religious communities.

For new atheists like Dennett, whose professed aim is not to extinguish religion but to provoke its metamorphosis into more benign forms,¹ it would be interesting and valuable to discover if the positive effects of new atheism are outweighed by the hardening of the attitudes of those who feel threatened (see Nyhan & Reifler, 2010, for a similar effect in the political sphere). Dennett and LaScola's (2010) confidential interviews with closeted non-believing preachers have turned up clergy who set out to read the works of the new atheists in order to better understand “the enemy” and ended up switching sides, largely on the strength of those forcefully written books (e.g., Dawkins, 2006; Dennett, 2006; Harris, 2004; Hitchens, 2007).

The important question which remains, to our knowledge, unaddressed, is whether such attrition of believers leaves the residual congregation more or less open to change, and more or less likely to thrive. Time will tell, but time's message will probably be equivocal: some congregations will go extinct in the wake of departures of apostates, and others will close ranks and thrive (or not); some will reform and some will resist reform. It seems unlikely that any clear selective signal will emerge from this, and certainly not over any short time span of, say, a century.

On this last point, the distinction between genetic and cultural evolution needs to be more closely observed, as it is only cultural evolution that can produce the sort of swift and visible effects described in some of the scenarios Johnson proposes. At times he seems to forget that it takes persistent selection pressure over many

generations to achieve a genetic effect. Moreover, genetic evolution entails variable numbers of surviving offspring, but the burden of demonstrating increases in reproductive fitness for atheists over the relevant time spans is onerous (and contemporary evidence suggests just the opposite; see Blume, 2009; Frejka & Westhoff, 2008; Zhang, 2008).

Perhaps the strangest hypothesis that Johnson considers is his “Hypothesis 1,” that there are no atheists (and never have been). Clearly, much will rest on issues of definition with a suggestion like this, but on even the most minimal definitions of “belief” and “supernatural agency” it seems plain that there are individuals who do not believe in supernatural agents – individuals who would bet not just their lives but their afterlives on the proposition that such agents do not exist. Nevertheless, if relevant falsifiable predictions could be identified we might at least concede the empirical possibility that atheists do not exist (however unlikely we might think it). According to Johnson, however, the hypothesis that there are no atheists predicts “no fitness effects on atheists (because there are none)” and “no fitness effects on believers.” It’s not at all clear that these are testable – or even logically coherent – empirical predictions.

In summary, although we find Johnson’s approach novel and thought-provoking, we think the path he has sketched is much stonier than he acknowledges. We know from personal experience (McKay & Dennett, 2009) how difficult it is to transform a plausible hunch into a testable hypothesis, and we think more clarity – and more caution – is needed to delineate the various theoretical possibilities and the empirical predictions that follow from them.

Note

1. Johnson quotes Wilson’s (2009) mischaracterization of Dennett’s (2006) *Breaking the spell* – the “spell” in question is actually not religion itself but the taboo against investigating religion as a natural phenomenon.

References

- Blume, M. (2009). The reproductive benefits of religious affiliation. In E. Voland & W. Schiefenhoevel (Eds.), *The biological evolution of religious mind and behavior* (pp. 117–126). Berlin: Springer.
- Cirelli, C., & Tononi, G. (2008). Is sleep essential? *PLoS Biology*, 6(8), e216, 1605–1611. 10.1080/2153599X.2012.667948doi: 10.1371/journal.pbio.0060216
- Dawkins, R. (2006). *The God delusion*. London: Bantam Press.
- Dennett, D.C. (2006). *Breaking the spell: Religion as a natural phenomenon*. New York: Viking.
- Dennett, D.C., & LaScola, L. (2010). Preachers who are not believers. *Evolutionary Psychology*, 8(1), 122–150.
- Frejka, T., & Westhoff, C.F. (2008). Religion, religiousness and fertility in the US and Europe. *European Journal of Population*, 24, 5–31.
- Harris, S. (2004). *The end of faith: Religion, terror, and the future of reason*. New York: W.W. Norton.
- Hitchens, C. (2007). *God is not great: How religion poisons everything*. New York: Twelve Books.
- McKay, R., & Dennett, D. (2009). The evolution of misbelief. *Behavioral and Brain Sciences*, 32(6), 493–551.
- Nyhan, B., & Reifler, J. (2010). When corrections fail: The persistence of political misperceptions. *Political Behavior*, 32, 303–330. 10.1080/2153599X.2012.667948doi: 10.1007/s11109-010-9112-2
- Wilson, D.S. (2009). Atheism as a stealth religion. Retrieved from http://scienceblogs.com/evolution/2009/10/atheism_as_a_stealth_religion.php
- Zhang, L. (2008). Religious affiliation, religiosity, and male and female fertility. *Demographic Research*, 18, 233–262.

Ritually faking belief

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Congratulations to the author for a thorough exposition of a challenging topic. The fact that we have 10 hypotheses (and this is probably not exhaustive) suggests that applying the correct theoretical constraints from the outset might productively narrow the field, and it is to this end that I hope I can make some contribution. Greater precision in using terms and concepts is where I shall start.

In the Introduction and Discussion sections of the target article we are told that religious beliefs were or may have been under selection pressure. This may be shorthand, but it too easily leads to confusion about both religion and belief. First let's examine belief. Beliefs are mental states and mental states are invisible to natural selection. To be under selection pressure, mental states must make themselves phenotypically visible. There are at least three ways they can do this: (a) they may be reliably connected to some fitness-relevant structure – people who believe in God have bigger muscles and are therefore faster and stronger than non-believers (unlikely); (b) mental states may be reliably connected to fitness-relevant physiological factors – people who believe in God have better immune systems (possible); (c) mental states may be reliably connected to fitness-relevant behaviors such as costly-to-fake ritual signals of within-group loyalty (best bet so far, I think). But in every case, it is the belief's fitness-relevant manifestations (muscles, immune function, ritual behaviors) that are under direct selection pressure.

Now let's consider religion. Religious beliefs are best understood not as mental states of individuals, but as shared representations of a community (similar to language). What individuals possess, in varying degrees, are the mental attributes necessary to acquire religious beliefs, which include things such as hyperactive agency detection, theory of mind, supernatural causation, teleological and abstract thinking. Collectively, these attributes form supernatural imagination. When a community gets together and decides on a shared set of supernatural concepts, myths, and rituals they create a common framework for their supernatural imaginations – in other words, they create religion. The individuals who share in this framework will have varying levels of supernatural imagination – thus it is unsurprising to find some orthodox Jews who share in the community framework (the religion) but are non-believers (low levels of supernatural imagination).

The fact that supernatural imagination varies widely suggests that it was not under strong selection pressure. Strong selection pressure tends to narrow the variability of a trait down to its (relatively) most adaptive form or range of forms. Compare TOM (Theory of Mind) to supernatural imagination. Outside of autistic spectrum disorders, TOM is pretty consistent in most people – some people are more empathic than others but everyone has a basic competence at understanding

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another's mental states. That suggests that TOM was reliably connected to a fitness-relevant behavior – in this case, the ability to direct responses based on predictions of another's social behavior – and that this fitness-relevant behavior was under strong selection pressure.

The reason why supernatural imagination was not under strong selection pressure can be easily gleaned from a number of observations in the target article. Robin Cook is credibly referred to as a “Presbyterian atheist” in Hypothesis 1: There are no atheists. Committed, practicing orthodox Jews confide to ethnographers that they are non-believers in the section entitled, *Is there anything to study? Atheism in modern and traditional societies*. Non-believers mimic believers in terms of shared values, evangelical behavior, ritual practices, etc. in Hypothesis 10: *Atheism is a Religion*. All of this suggests that one's level of supernatural imagination is less important than one's willingness to participate in a community framework of ritual, myth, and normative values. Belief can be effectively faked, provided that one (ritually) demonstrates a minimally acceptable commitment to group normative behavior. Technically speaking, ritual signals are not indicators of belief commitments; rather, they are indicators of normative behavior commitments.

In our ancestral past, skeptics (those with low levels of supernatural imagination) had little choice about participating in the group's shared framework of rituals and myths. Survival required group membership. The past's skeptics may simply have been what Gordon Allport (see Allport & Ross, 1967) have identified as the “extrinsically” religious. Traditional religion was (and is) accommodating of varying levels of belief by virtue of the fact that it was (is) not a dogmatic set of doctrines but an array of ritual practices. As anthropologist Robert Marett once observed, “savage religion is something not so much thought out as danced out” (Marett, 1909, p. xxxi).

I suggest then that our best evolutionary/theoretical bet is that there has always been a continuum of belief underlying ritually signaled commitment to group norms and values. The important research question is one of relative variance: would a wider range of belief commitments have made a group more adaptive compared to a narrower range? If a group has too few skeptics is it more prone to self-destructive fanaticism? If a group has too many skeptics does normative commitment wane, compromising cohesion? Do skeptics keep the cost of ritual signals from becoming too high; or, conversely, do too many skeptics cheapen ritual signals until they are meaningless? It may even be that belief commitment varies because it is irrelevant. All that matters is normative commitment demonstrated through ritual participation.

My questions above correspond to a combination of hypotheses 2 through 4 in the target article – natural variation (2), possibly driven by group competition to an adaptive frequency-dependent mix of varying levels of belief (4), now faced with the new pressures of the modern world (3). I suggest this as the best theoretical starting point.

Atheists have always been with us; however, it is only recently that they could afford to publicly “opt out” of community ritual participation. Modern (largely western) societies have developed social institutions supplanting local communities as the primary basis for social support. Individuals do not have the same dire need for the local community and its ritual demands as they did in the past.

References

- Allport, G.W., & Ross, J. M. (1967). Personal religious orientation and prejudice. *Journal of Personality and Social Psychology*, 5, 432–443.
- Marett, R.R. (1909). *The threshold of religion*. London: Methuen.

On affirmations of the realities of religion and atheism

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In a note to a famous essay published in 1966, Clifford Geertz rejects what he describes as “the surely untrue proposition” that all individuals in all human societies are religious in some meaningful sense of that term (1966, p. 43, n. 3). He remarks, moreover, that “if the anthropological study of religious commitment” at the time of his essay is “underdeveloped, the anthropological study of religious non-commitment is non-existent,” and that the anthropology of religion “will have come of age when some more subtle Malinowski writes a book entitled “Belief and Unbelief (or even Faith and Hypocrisy) in a Savage Society”” (1966, p. 43, n. 3).

Geertz, of course, is neither the first nor the last scholar to reject an across-the-board and seemingly monolithic attribution of religiosity. Thus, for instance, William James (1902/1920, p. 8) observes that while religion for some persons is “an acute fever,” for many others it “exists . . . as a dull habit.” James’s emphasis, nevertheless, is on “religious geniuses,” and Geertz is largely concerned with describing what he supposes to be the characteristic moods, motivations, and thoughts of people when they evince what he claims to be “a specifically religious perspective” (1966, p. 36).

The approach of many “classical” theorists of religion in the nineteenth and twentieth centuries was to emphasize the functions and hypothesized origins of what they held to be religion and to downplay or ignore its observable absences. In taking that tack, moreover, many classical students of religion in effect treated human populations as if they were genetically and culturally homogeneous. We deem both of those practices to be deleterious for advancing warranted understandings of the human condition.

Happily, however, there is now an increasing flow of studies that are both analytically and theoretically more sophisticated than those of yesteryear in that they explicitly allow for variations within human populations, variations stemming from biological as well as from cultural factors. Indeed, the very incorporation of attention to atheism in theories that seek to account for why we have religion affirms some recognition of diversity (e.g., Barrett, 2004). Johnson’s essay goes well beyond minimalist efforts in that regard. His provides us with 10 well-thought-out hypotheses that collectively map a fan of possibilities for explaining non-belief as

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well as belief within evolutionary and cognitive frameworks. In the remainder of our comments we focus on two of those hypotheses.

Hypothesis 2. Natural variation (null hypothesis)

Johnson writes:

I favor the null hypothesis of natural variation, in which cognitive mechanisms underpinning religious beliefs vary in whether and how much they generate belief. At one end of this spectrum – the tail end of the distribution – we will have people with very low levels of belief, or even atheists, just as we always have extremes of other biological and psychological traits.

We, too, favor this hypothesis. Indeed, it is consonant with our own efforts (Saler & Ziegler, 2006) to introduce biological variables into our comprehension of distributional diversity across human populations respecting what we call religion and atheism. In our article we hypothesize specific genetic mechanisms – allelic polymorphism and polygenic inheritance – that may influence distributional variations. In contrast, Johnson’s primary concern is not to advance a specific hypothesis (his personal opinions notwithstanding) but to advise us of different theoretical possibilities. As he puts it, the point of his paper “is not to adjudicate among evolutionary hypotheses of atheism, but to think through what these hypotheses are.” Doing so, we think, is logically appealing and analytically useful.

Hypothesis 1. There are no atheists

“One possibility,” Johnson writes, “is that, despite the existence of atheism as a concept and many self-identified atheists, everyone, in fact, believes some form of supernatural agency, even if they deny it.” While we do not endorse this hypothesis as it stands, we judge it to be intriguing and well worth discussion to an extent not possible here. But some relevant considerations can be briefly listed.

First, discussion, in our opinion, ought to consider definitional or conceptual issues. That is probably most obvious when dealing with the terms religion, theism, and atheism. But it could prove useful to inquire into what may be meant or implied by uses of the word “supernatural” (Saler 1977, n.d.), a term frequently invoked by contemporary scholars but rarely defined by them. In any case, we judge Johnson’s stipulated definition of atheism to be too broad to be analytically useful for sustaining Hypothesis 1.

Second, Johnson briefly indicates that there is some evidence that appears to support the hypothesis. Thus, for instance, laboratory experiments indicate that some self-declared atheists “display symptoms of superstitious and supernatural thinking.” And, we can add, self-declared atheists, like theists, may postulate virtual realities, and they can and do conjure and in some sense participate in imaginary worlds. We judge such phenomena to be compelling.

Third, as Johnson notes, “The cognitive science of religion literature suggests that human brains are characterized by pervasive mechanisms that tend to perceive supernatural agency in the world around them.” These mechanisms include what Boyer (1994, 2001) describes as “inference systems,” each of which responds to a

particular type of perceived event or effect, and which automatically suggests explanations for the type of event or effect to which it responds. According to Boyer, moreover, our brains run all such chains of inference below the level of conscious awareness so that their functioning is inaccessible to introspection and only their results are available for conscious inspection. Experimental studies, Boyer maintains, show that inference system explanations are based on specialized principles, including the principle of causation. Causation-based inference systems react to the perception of events and effects by automatically explaining them in terms of causes. Thus, for instance, inference systems that furnish intimations about agency may well be potent factors in the intuitive aspects of formulating god concepts. As Boyer (2001, p. 144) puts it, concepts of gods “are mostly organized by our intuitive notions of *agency in general*” (emphasis in original), agency here referring to any entity that appears to produce effects of its own in pursuit of its own goals.

The above remarks are obviously relevant to Johnson’s explication (but do not constitute an ipso facto endorsement) of Hypothesis 1: that because “we all have the same brains, all of us should be susceptible ... to religious thinking.” That supposition, one that pivots on the idea that important pan-human inference systems are biased toward agent detection, affirms the naturalness of religious beliefs. But rather than pursue this point as it relates to mainstream theories in the cognitive science of religion, we prefer to end by briefly considering a darker possibility: that limitations of the human brain prevent full comprehension of the entity here called a supernatural agent.

The phenomenon that we have sketched above is somewhat analogous to a classic optical illusions in which two parallel lines appear to bulge in the middle. Experimental subjects literally cannot help seeing the bulge even after they have ascertained by measurement that the lines are straight. Their failure, broadly put, is attributed to a limitation or imperfection of the human brain. We wonder if something similar may be involved in human efforts to detect, understand, and react to postulated supernatural agents. Indeed, might imperfections in the human brain somehow render it difficult for us to free ourselves from supernatural agents, even when well-intentioned (if sometimes shrill) atheists tell us that the lines really don’t bulge? Could the biologist John Haldane be right when he asserts that “The universe is not only queerer than we suppose, but queerer than we *can* suppose” (1927, p. 286, emphasis in original)?

References

- Barrett, J.L. (2004). *Why would anyone believe in God?* New York: Altamira Press.
- Boyer, P. (1994). *The naturalness of religious ideas: A cognitive theory of religion*. Berkeley, CA: University of California Press.
- Boyer, P. (2001). *Religion explained: The evolutionary origins of religious thought*. New York: Basic Books.
- Geertz, C. (1966). Religion as a cultural system. In M. Banton (Ed.), *Anthropological approaches to the study of religion* (pp. 1–16). London: Tavistock.
- Haldane, J.B.S. (1927). *Possible worlds and other essays*. London: Chatto and Windus.
- James, W.(1902/1929). *The varieties of religious experience: A study in human nature*. New York: Modern Library.
- Saler, B. (1977). Supernatural as a western category. *Ethos*, 5(1), 31–53.
- Saler, B. (n.d.). *Observations on the construction of the supernatural in Euro-American cultures*. Unpublished manuscript.
- Saler, B., & Ziegler, C.A. (2006). Atheism and the apotheosis of agency. *Temenos: Nordic Journal of Comparative Religion*, 42, 7–41.

Whence atheists: outliers or outlaws?

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At face value, the paucity of scientific accounts of atheism does not seem surprising: why should rejecting belief in invisible entities for which most cognitive scientists and biologists think no evidence exists require any kind of an explanation? Of course, the main reason the issue is of interest is that it entails an (apparent) anomaly, since most people in most human cultures appear to believe in such entities. In what follows I will avoid the temptation to engage the question of whether “atheism” constitutes a single class, much less a phenotype, and offer brief comments on Johnson’s main proposals for unbelief. If religion is an adaptation, or a by-product of adaptations, or even an infectious state to which so many are vulnerable, whence unbelief?

Natural variation (null hypothesis)

Johnson’s (and my own) favored hypothesis is that atheism represents natural variation as found in many cognitive and other polygenic or environmentally sensitive traits. Two comments: first, the hypothesis warrants further elaboration in light of the manifold and potentially fitness-relevant ways in which such “natural” variation may emerge and be sustained. The existence of phenotypic variation resulting from genetic diversity, environmental variability, and their interactions does not in itself tell us whether the trait is undergoing balancing, diversifying, directional, or no selection. Birthweight, for example, exhibits the very spectrum of variation Johnson proposes, but there are severe fitness penalties at both distributional tails. Or – via linkage or by-product interactions – atheism could co-vary with traits that have been selected for, independently of religious cognition. Therefore religion could be an adaptation and atheism a spandrel or even a maladaptation, but together they nevertheless constitute a phenotypic continuum that does not reflect any of the adaptationist hypotheses Johnson proposes. Indeed, there is reason to think that atheism does co-vary with other cognitive traits. For example, recent studies have revealed correlations between atheism and intelligence (Lynn, Harvey, & Nyborg, 2009) and high functioning autism (Caldwell-Harris, Fox, Velazquez, & McNamara, 2011).

A second point concerns the role of variation itself. While variation in a trait is necessary for selection to act upon it, variation in propensity for religious belief is not strictly necessary for “any evolutionary theory of religion.” Spandrel accounts propose that religious belief arose as a by-product of other traits, and it could be that when these traits reached a critical threshold, religious belief ensued saltationally. Memetic accounts could entail unvarying propensity, infected at some point in human evolutionary history by the emergence of religious memes.

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Phylogeny

Of course, as Johnson points out in his comments on phylogeny, at one point in the human lineage there were no religious beliefs at all. He concludes that “non-belief was the default state” and strong selection would have been needed “to supplant a default (‘accurate’) set of beliefs with new, costly, (‘inaccurate’) religious beliefs.” I would question this on two counts.

First, it is surely true that if we go back far enough, organisms lacked the requisite cognitive endowments to form beliefs about supernatural agency. But this does not make atheism the default condition. At some point, organisms also lacked ability to form beliefs about other (natural) mental agents, or to form beliefs at all. Presumably we would not call a *Trinazodon* an atheist. They did not doubt or reject religious beliefs; they had no beliefs. The important point is that we do not yet know whether beliefs about supernatural agents arose subsequent to or roughly commensurate with theory of mind and fundamental belief-forming mechanisms. Thus we do not know if earlier beliefs were “supplanted” at all.

Second, even if unbelief and not merely “no beliefs” is our ancestral state, it is not clear that the new beliefs were costly – in terms of fitness, or cognitive load, or accuracy. With respect to the last property, while many religious beliefs are demonstrably false, identifying them as “inaccurate from the scientific perspective that God does not exist” is puzzling. One could say that science has falsified the empirical claims of many religious traditions; or that science does not employ God in explanation; or even that the existence of a supernatural realm is incommensurate with some scientific epistemologies; or (more debatably) that there are no scientifically discerned features of the world that support, however ambiguously, *belief* that God exists. But how it is that science entails the non-existence of God is not clear. This is important, not because religion deserves respect, or scientific commerce requires neutrality on metaphysical issues. Quite the contrary: if we are to develop a scientific account of certain belief-forming mechanisms, the explanans must account for qualities of the explanandum. In terms of both proximal and ultimate (evolutionary) causes, demonstrably untrue beliefs require a different kind of explanation than true ones.

Frequency dependence

The most straightforward view of the frequency-dependence hypothesis is that religion is an adaptation for enhancing cooperation and that, if there is a high enough density of believers without effective mechanisms of positive assortment, non-believers can freeload without destabilizing the commons. There is, in fact, abundant and consistent evidence that religious adherents give significantly more of their time and money to charitable causes than non-religious people, and more than members of other community groups – even when their average income is lower (Benson et. al., 1980; Gallup, 1984; Hansen, Vandenberg, & Patterson, 1995; Hodgkinson, Weitzman, & Kirsch, 1990; Penner, 2002; Putnam, 2000; Ruiter & De Graaf, 2006; Wuthnow, 1994). But the relevance of this evidence to the hypothesis is not completely certain. For one thing, lower average income may itself motivate greater community involvement. For another, there may be forms of corporate commitment that the non-religious support more vigorously than the religious do. For example, since atheism correlates with liberal political views, there may be greater support for tax-based humanitarianism.

Ecological contingency

Variation in religious beliefs may represent a balanced polymorphism (informed by either genetic or cultural information); if so, this option seems to make the most sense. Indeed, there is no question that ecology influences religious belief. The question is whether the relationship is one of adaptation to differing environmental conditions, or developmental plasticity influenced by the environment, neutrally or away from an adaptive mean. I am a bit surprised that perhaps the clearest and in many respects most plausible proposal of adaptive ecological contingency is not cited by Johnson – since it his own! Johnson (2009) posits that religious belief in moralizing supernatural agents curtails defection, and makes adaptive sense at the individual level where the costs of punishment for defection are greater than the costs of missed opportunities to defect. Where these conditions are not met, such beliefs would be selectively disfavored.

Catalysts/bolstering

“Catalysis” by atheists involves stimulating prosocial behaviors to oppose the challenge of an outsider; “bolstering” presumably involves reinforcement or reformulation of religious claims in response to criticism. These seem the least plausible of the adaptationist proposals: first, because there are no benefits to atheists (and if there are disbenefits, maintenance would require strong group selection). And second, the history of religion indicates that religious believers from other sects accomplish catalysis as or more effectively than atheists, and religious prophets and reformers from within the tradition accomplish bolstering powerfully. Under adaptationist views of religion, why not accomplish catalysis or bolstering by means that do not relinquish the benefits of religion itself?

Additionally, there is a specific question about each proposal. Johnson mentions that catalysis comports with costly signaling theories of religion, which need alternative belief systems with which to contrast one’s own beliefs. While this is true of some costly signaling accounts, it is not a necessary condition. Even in a community of homogenous belief, a costly signal may be adaptive not by identifying membership or shared belief but by communicating commitment. Indeed, the distinction between life-ordering existential commitment and mere group membership via propositional belief is key in distinguishing vital from “nominal” religion (Luckmann, 1967). To illustrate bolstering Johnson cites Wilson’s (2002) comments on the role of atheism in balancing factual with practical realism. There is little question that this dialectic is reflected in the interactions between reason and religious intuition, and that in recent times the former has often, if not usually, been advanced by unbelievers in the latter. But the extent to which this was true even as recently as the rise of science, not to mention in the Pleistocene, remains complicated in the recent case (Brooke, 1991; Lindberg & Numbers, 1986) and obscure in the distant.

References

- Benson, P.L., Dehority, J., Garman, L., Hanson, E., Hochschwender, M., Lebold, C., . . . Sullivan, J. (1980). Intrapersonal correlates of nonspontaneous helping behavior. *Journal of Social Psychology*, *11*, 87–95.
- Brooke, J.H. (1991). *Science and religion: Some historical perspectives*. Cambridge, UK: Cambridge University Press.

- Caldwell-Harris, C., Fox, C., Velazquez, T., & McNamara, P. (2011). Religious belief systems of persons with high functioning autism. *Proceedings of the 33rd Annual Meeting of the Cognitive Science Society*, 3362–3366.
- Gallup, G. (1984, March). *Religion in America* (Gallup Report No. 222).
- Hansen, D., Vandenberg, B., & Patterson, M. (1995). The effects of religious orientation on spontaneous and nonspontaneous helping behaviors. *Personality and Individual Differences*, 19, 101–104.
- Hodgkinson, V., Weitzman, M., & Kirsch, A. (1990). From commitment to action: How religious involvement affects giving and volunteering. In R. Wuthnow, V. Hodgkinson, & Associates (Eds.), *Faith and philanthropy in America: Exploring the role of religion in America's voluntary sector*. San Francisco, CA: Jossey-Bass.
- Johnson, D.D.P. (2009). The error of God: Error management theory, religion, and the evolution of cooperation. In S.A. Levin (Ed.), *Games, groups, and the global good* (pp. 169–180). London: Springer.
- Johnson, D.D.P., & Bering, J. (2009). Hand of God, mind of man: Punishment and cognition in the evolution of cooperation. In J. Schloss & M. Murray (Eds.), *The believing primate: Scientific, philosophical, and theological reflections on the origin of religion* (pp. 26–43). Oxford: Oxford University Press.
- Lindberg, D., & Numbers, R. (1986). *God and nature: Historical essays on the encounter between Christianity and science*. Berkeley, CA: University of California Press.
- Luckmann, T. (1967). *The invisible religion: The problem of religion in modern society*. New York: Macmillan.
- Lynn, R., Harvey, J., & Nyborg, H. (2009). Average intelligence predicts atheism rates across 137 countries. *Intelligence*, 37, 11–15.
- Penner, L. (2002). Dispositional and organizational influences on sustained volunteerism: An interactionist perspective. *Journal of Social Issues*, 58, 447–467.
- Putnam, R. (2000). *Bowling alone*. New York: Simon & Shuster.
- Ruiter, S., & De Graaf, N. (2006). National context, religiosity, and volunteering: Results from 53 countries. *American Sociological Review*, 71, 191–210.
- Wilson, D.S. (2002). *Darwin's cathedral: Evolution, religion, and the nature of society*. Chicago, IL: University of Chicago Press.
- Wuthnow, R. (1994). *God and Mammon in America*. New York: Free Press.

Religious belief and atheism are not mutually exclusive

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Scientific thinking has almost certainly been with us from the beginning . . . A proclivity for science is embedded deeply within us, in all times, places and cultures. It has been the means for our survival. (Carl Sagan, 1996, pp. 315, 317)

In his target article, Johnson provides a framework for answering the question, “What are atheists for?” Johnson uses Tinbergen’s “four questions” to guide his analysis of atheism, from which he formulates several hypotheses. We commend Johnson for applying an evolutionary perspective toward better understanding atheism, and we expect that Johnson’s efforts may facilitate further research.

In this commentary, we begin by briefly addressing several concerns we have with Johnson’s arguments. We then focus for the remainder of the commentary on a particular set of arguments. We have some concern about the way in which Johnson applies evolutionary principles to understanding religious beliefs and atheism. First, Johnson suggests, or at least implies, that natural selection operates at the level of the

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group to select for atheism. Nearly half a century ago, Williams (1966) carefully and meticulously unraveled any sensible arguments in favor of group selection operating as an important selective force. Because natural selection operates at the individual-gene level, the question, “What are atheists for?” is nonsensical if Johnson’s goal is to understand the evolved psychological mechanisms that motivate or result in atheism. A proper evolutionary psychological analysis might begin with the question: “What selection pressures might our ancestors have faced recurrently that caused the evolution of psychological mechanisms that produce religious beliefs?” Or perhaps: “What selection pressures might our ancestors have faced recurrently that caused the evolution of psychological mechanisms that motivate critical thinking and, therefore, atheism?”

Second, aside from the unjustified group selectionism implicit in the question “What are atheists for?” this question confuses manifest beliefs (or non-belief) with the evolved mechanisms that produce those beliefs. Religious belief is a manifestation of human evolved psychology, as is atheism. A proper evolutionary psychological analysis of religious beliefs and of atheism should focus on the evolved mechanisms that produce religious beliefs or atheism, not on the manifest beliefs themselves (Confer et al., 2010; Tooby & Cosmides, 1992). Johnson seems to be arguing that there is a continuum from religious belief to non-belief or atheism, and that this continuum is a consequence of both religious beliefs and non-belief being produced by the same set of evolved mechanisms.

In the remainder of our commentary, we offer a different argument: critical thinking based on an assessment of evidence-based reality (and, therefore, in this context, atheism) has been an important feature of human evolutionary history and is not generated by the evolved psychology that produces religious beliefs.

Human psychology may include mechanisms specifically “designed” to motivate gullibility and, therefore, religious beliefs – an argument that Dennett (2006) presents. In addition, or alternatively, religious beliefs may be generated as a by-product of evolved mechanisms designed to solve a different set of problems, perhaps related to social navigation (see Bering, 2010). The argument that religious belief (whether produced as a designed outcome or as a by-product) is sensibly organized along a continuum from strong belief to atheism implies that religious belief and atheism are produced by the same evolved mechanisms. But there is an alternative argument, made clearer with a proper focus on evolved psychological mechanisms rather than on the beliefs produced by these mechanisms. We propose that, in addition to the evolved mechanisms that make us susceptible to religious beliefs (whether by design or as a by-product), there is a different set of evolved mechanisms designed to motivate critical thinking, including forming conclusions based on facts and evidence. One manifestation of such an evolved psychology is atheism.

Thus, rather than a single set of psychological mechanisms producing a continuum of religious belief (from strong belief to atheism), we propose that there are *two* sets of evolved mechanisms, both of which are universal features of human psychology: (1) mechanisms that produce gullibility, including a susceptibility to religious beliefs; and (2) mechanisms that motivate critical thinking. We might call the first set of mechanisms “gullibility mechanisms” and the second set of mechanisms “critical thinking” mechanisms. Religious beliefs are key products of the gullibility mechanisms, and they may indeed fall along a continuum from committed belief to weak belief. A key product of the critical thinking mechanisms is atheism, which is a consequence of the evidence-based assessment of events in the real world. Although we propose two distinct sets of evolved mechanisms that

generate religious belief and atheism, respectively, we acknowledge that both sets of mechanisms may operate independently and even simultaneously. The woman who is pregnant with triplets (at risk of preterm delivery and other complications), for example, praises God for each day that her triplets remain in utero, and yet remains under 24-hour medical observation in her state-of-the-art hospital room. Does she believe that God is helping her? Or does she believe that those trained in medical science are helping her? In this example, both sets of mechanisms are operating, but produce objectively contradictory beliefs and behaviors (see Kurzban, 2010).

In conclusion, we appreciate Johnson's arguments and agree that more research should be conducted on atheism. We also agree that an evolutionary perspective will shed light on religious belief and atheism like no other perspective can. We offer our comments and suggestions in the service of these broader agreements.

References

- Bering, J. (2010). *The God instinct*. London: Nicolas Brealy.
- Confer, J.C., Easton, J.A., Fleischman, D.S., Goetz, C.D., Lewis, D.M., Perilloux, C., & Buss, D.M. (2010). Evolutionary psychology: Controversies, questions, prospects, and limitations. *American Psychologist*, 65, 110–126.
- Dennett, D.C. (2006). *Breaking the spell*. New York: Viking Penguin.
- Kurzban, R. (2010). *Why everyone (else) is a hypocrite*. Princeton, NJ: Princeton University Press.
- Sagan, C. (1996). *The demon haunted world*. New York: Random House.
- Tooby, J., & Cosmides, L. (1992). The psychological foundations of culture. In J. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind* (pp. 19–136). New York: Oxford University Press.
- Williams, G.C. (1966). *Adaptation and natural selection*. Princeton, NJ: Princeton University Press.

RESPONSE

Atheists: accidents of nature?

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I am grateful to the editors and commentary authors for helping to lift the veil of ignorance about atheism, and especially its role in the evolution of religion.¹ Given the mounting evidence that religion is a product (or at least a by-product) of evolution, atheism sometimes seems to be a greater puzzle than belief. At the least, this exercise has served to hone key questions that we need to ask (and answer) in order to tackle the puzzle. The main conclusion I draw from this debate is that, as most of us appear to agree, atheism is a result of natural variation in individuals' propensities to hold religious beliefs. This implies that religion has been favored by natural selection while atheism has not – it is the tail end of a distribution of belief. In one sense, therefore, atheists are merely accidents of nature.

We owe a debt of gratitude to Caldwell-Harris for her painstaking work in unearthing the characteristics of atheists. She argues that atheism is a by-product of

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skepticism (which itself arises from the traits of “independent learning” and “systemizing”). She suggests that skepticism “toward the dominant belief system” is itself adaptive, and has thus been subject to natural selection, while atheism is merely one non-functional consequence of skepticism.

This is a compelling argument, but it does raise an empirical question: does being skeptical about X necessarily make one skeptical about other issues Y and Z? This is important because while skepticism of conformity in some contexts may be adaptive, skepticism of, say, taboos or supernatural agents may not. In other words, even if we are selected to be skeptical of some (or many) things, it does not automatically follow that we should be skeptical of prevailing religious beliefs as well. For example, in some Islamic countries skepticism of western values may be praised, but skepticism of Islam is punishable by death.

One thing I remain skeptical about myself is what personality profiles really tell us about atheism. If personality predicts atheism, then all we know is that the two are associated. But we do not know why, and we do not know which causes the other. This is especially important, given a likely interaction with the specific variables Caldwell-Harris invokes: religious upbringing or environments may teach conformity and empathy (religious traits), while atheist upbringing or environments may teach independent thinking and systemizing (atheist traits). Thus, atheists and believers may be a product of their environments as much as their personalities.²

Caldwell-Harris notes that differing cognitive styles may partly support Hypotheses 4 (Frequency Dependence) and Hypothesis 6 (Ecological Contingency), given that the traits of independent learning and systemizing may be selected for in the presence of conformists or in particular environments. Nevertheless, her conclusion is that atheism is not a “target” of natural selection. But note this can only be true if religion is also not a target of natural selection, because if religion improves Darwinian fitness then atheism is likely to constrain or reduce it, and thus also be subject to natural selection in the opposite direction. An implication of Caldwell-Harris’s argument, therefore, is that both atheism and religion are non-functional. This is possible under many evolutionary accounts (e.g., memes), but clashes with accounts that envisage net fitness benefits of religion.

Geertz is concerned that we are forgetting the role of culture. While most evolutionary scholars of religion focus on underlying cognitive mechanisms as the cause of religious beliefs, Geertz argues that our ancestors were already “encultured” long before “religious thoughts and behaviors” ever emerged on the scene. This suggests that religion evolved as a response to culture, rather than that religion is an automatic product of cognitive mechanisms. But what does this mean for understanding atheism?

One interpretation of Geertz’s argument is that cultural factors actually constrained human evolution so that cognition was shaped by religion (and other cultural phenomena) rather than the other way around. If so, religion could be argued to be as much a product of culture as it is a product of cognition. In this scenario, however, we are still stuck (perhaps even more entrenched) in the original dilemma – how do we explain the persistence of atheists?

Another interpretation is that human cognition does not in itself predispose us towards religion. Rather, it prepares a fertile field that may be seeded by a range of cultural innovations, including religion. If so, then religion and atheism may be equally likely to emerge, depending on prevailing cultural factors. While this approach may seem very different from the hypotheses in my original article, I

would argue that it is a version of Hypothesis 6 (Ecological Contingency). In different socio-ecological environments (which include cultural variation) we may expect different frequencies of atheism and religiosity. This is not to deny the influence of culture – the mechanism of selection in this hypothesis (and the others) need not be genetic evolution, but may be gene-culture or cultural evolution as well.

Geertz's hard line on the importance of culture perhaps leads him to overplay the puzzle of religion as opposed to the puzzle of atheism. He argues that "it is not atheism that needs explanation, it is religion" since "[A]theism . . . is evidently the default modality." My original article tried to make the point that, although we certainly do need to "explain" religion, that particular problem is already being addressed. What we also need to do is understand the causes and consequences of atheism. Even if it is the default state, atheism may have important consequences for the evolution of religion. Having said that, Schloss specifically questions whether atheism really is a meaningful "default state" after all.

Lanman points out that definitions of atheism not only affect the plausibility of the hypotheses (e.g., Hypothesis 1 is either possible or impossible depending on the definition used), but also our interpretation of empirical studies. Surveys and laboratory experiments use a great range of measurements that correspond to very different definitions of belief and non-belief. This becomes a problem when different measures are invoked to support or contest a given hypothesis.³

Lanman suggests a very interesting extension of Hypothesis 3 (Unnatural Variation). I suggested that education in science and philosophy are key factors undermining religious belief and favoring atheism, but Lanman stresses that there must be other factors at work as well. For example, the US and Sweden have similar levels of education but vastly different rates of atheism. What explains the disparity? Lanman proposes that a core factor is security, such that people in areas with high economic inequality, poor social welfare, and ethnic diversity are more likely to be religious. This seems plausible and lends itself to empirical testing with data. It also generates interesting predictions for the future. If atheism is (at least partly) a product of security, then we may expect it to spread in wealthy democratic states. In other regions, such as Africa, South Asia, and the Middle East, a lack of security may present obstacles to atheism and catalyze religion.

McKay and Dennett adopted the spirit in which I wrote the original article: here are some unconventional ideas, let's push them as far as they go and see where they take us. While they did not declare which hypothesis they find most compelling, McKay and Dennett obviously found Hypothesis 8 (Bolstering) the most appealing. They rightly point out that it needs more evidence, because although I offered some anecdotes suggesting that bolstering is an *effect* of atheists, we have no idea if it is (or was) a systematic *function* shaped by natural selection. In places where atheism is on the rise in western democracies, we have an opportunity to test these ideas. Are religious groups stronger or weaker without atheists? McKay and Dennett appear pessimistic about such tests, lamenting that we may not be able to observe clear trends over "any short time span of, say, a century." That may be true, but we can look back in time instead, and identify (and even collect data on) atheism and its impact on religious groups over time. Historians may even have already done the requisite "natural history" (gathering the evidence) leaving us to revisit it through an evolutionary lens (cf. Wilson, 2002).

McKay and Dennett also sportingly entertain the possibility of the "strangest" hypothesis, Hypothesis 1 (There Are No Atheists). As "Brights",⁴ they are of course

skeptical of this notion, but their psychologist leanings allow them to at least see the logic of the hypothesis. As they point out, it relies heavily on one's definition of atheism. If atheism is defined as not believing in a Christian God then obviously there are many atheists. If it is defined as not believing in any supernatural agency of any kind then there are fewer. But the extreme proposal of Hypothesis 1 is that there are no humans that do not exhibit some form of supernatural thinking in the proper circumstances (Barrett, 2004; Bering, 2010).

If McKay and Dennett agreed to be taken into the lab for a few hours, we could almost certainly find evidence of subconscious agency detection in random events, or of mind–body dualism. We could also subject them to a field study. If we exiled them in isolation on a desert island for 20 years, or placed them as soldiers in the Battle of Stalingrad, we might find that – after a while – they would begin to display evidence of teleological thinking or spiritual purpose. To some, this would prove nothing. To Bering and others, this would suggest they are not really atheists. Like all other humans, they are predisposed to perceive supernatural agency at work in the world whether they like it or not. As E.O. Wilson noted: “The human mind evolved to believe in the gods. It did not evolve to believe in biology” (Wilson, 1999, p. 292). Having learned biology, however, we may not know whether we are really atheists because we have not had the opportunity or the misfortune to put it to the test.

Rossano is concerned with breaking down what we mean by “religious beliefs.” He stresses that beliefs in themselves cannot be selected for; only “fitness-relevant manifestations” of those beliefs can. He is also concerned with separating the “supernatural imagination” that individuals have as a result of underlying cognitive mechanisms from “religion,” which is a set of “supernatural concepts, myths and rituals” that many individuals share as a community. I agree with both of these clarifications (they were intended, if not clear, in my original article).

More interesting is his suggestion that “[t]he fact that supernatural imagination varies widely suggests that it was not under strong selection pressure.” He sees support for this claim in the examples I gave of atheists who were nevertheless rooted in their surrounding religious milieu, and concludes that “supernatural imagination is less important than one's willingness to participate in a community framework of ritual, myth, and normative values. Belief can be effectively faked, provided that one (ritually) demonstrates a minimally acceptable commitment to group normative behavior.”

This is crucial to the debate because, if Rossano is right, then: (1) atheism is less of a puzzle and may have been quite common in human evolutionary history (given weak selection pressure on religious belief); and (2) atheists may have had fitness advantages over believers because they could reap the benefits of the religious group without being believers themselves.

This is an interesting possibility but I challenge it for two reasons. First, although religious beliefs appear to vary widely, to what should we compare this level of variation? Rossano compares it to theory of mind, which is “pretty consistent” among humans. However, although religions and religious beliefs are fantastically diverse, their broad features appear to follow common patterns. Elements of religion are more or less universal across cultures (Brown, 1991), and Whitehouse (2008) identified a “cross-culturally recurrent religious repertoire” of 12 traits that are “probably found, in some shape or form, in all human societies – or at least are very widespread and historically recurrent” (pp. 31–32). To me, it remains unclear whether selection on religion has been strong or weak. This uncertainly is

compounded when one considers that cultural selection may have *increased* variation in religion as a mechanism to differentiate groups. Similarly, ecological diversity may have increased variation in religion as adaptations to different challenges.

Second, I would challenge Rossano's suggestion that belief can easily be faked. Costly signaling theory suggests that signals are not reliable if they can be faked. Hence, in both humans and other animals we see the evolution of "honest," hard-to-fake, or costly signals (Irons, 2001; Sosis & Alcorta, 2003; Zahavi, 1975). Costly signaling theory as applied to religion is especially interesting because genuine belief can itself act as a barrier to fakers. For a believer, the perceived costs of religious participation may be lower than the benefits (given, say, an expectation of supernatural consequences for failing to perform a ritual); for a faker, the costs of participation will often seem to outweigh the benefits (Sosis, 2003). This is not to say that fakers do not exist. Signaling can be evolutionarily stable even in the presence of cheats (Johnstone, 1997; Searcy & Nowicki, 2005), and some non-believers in religious groups appears to be common empirically (Dennett & LaScola, 2010; Sosis, 2011; Steadman & Palmer, 2009). Fakers may slip under the radar and benefit from doing so as long as they are not so common as to undermine the public goods they exploit. In other words, this is a version of Hypothesis 4 (Frequency Dependence).

Rossano ends by favoring Hypothesis 2 (Natural Variation), and sets out a series of interesting questions that fall under Hypotheses 3 (Unnatural Variation) and 4 (Frequency Dependence). Note that his questions invoke Hypotheses 8 (Bolstering) and 9 (Restraint) as well. His closing scenario highlights the possibility that several hypotheses may have been at work simultaneously or in sequence. This may complicate the picture and make empirical tests harder, but it may also make for a more realistic account of the origins, persistence, and development of atheism.

Saler and Benson offer an interesting anthropological history of the dearth of attention paid to individual variation in general and to atheism in particular. They favor Hypothesis 2 (Natural Variation), and have in fact been able to go further in proposing specific genetic mechanisms (allelic polymorphism and polygenic inheritance) to account for the persistence of atheism, even – perhaps – if atheists have lower Darwinian fitness than believers.

They also find Hypothesis 1 (There Are No Atheists) intriguing, although like others they note that this will hinge on definitions. Saler and Benson extend the reach of this hypothesis by suggesting that, not only might we be unable to avoid subconscious supernatural thinking, we might also be unable to fully comprehend our vulnerability to it, given our cognitive limitations. Firm atheists such as Dawkins or Dennett may remain entangled in supernatural dispositions even while they deny them. Summarizing his life's work on cognitive biases, Daniel Kahneman (2011) warns that even a deep knowledge of the workings of human cognition does not prevent us from succumbing to cognitive errors: "I don't think reading this book will help you," he has said, since, "writing it certainly hasn't helped me!" (Jarrett 2012, p. 15).

Weekes-Shackelford and Shackelford are worried about the invocation of group selection. This puzzled me at first, not only because I like to think of myself as a skeptic of group selection (Burnham & Johnson, 2005; Johnson, Price, & Takezawa, 2008; Johnson, Stopka, & Knights, 2003), but also because Table 1 in the original article explicitly considered whether each of the proposed hypotheses invoked individual selection or group selection (and only 3 of the 10 invoked group selection). I was not particularly endorsing any of those hypotheses but merely identifying which selection mechanism each one would require.

Their concern may have arisen from a literal interpretation of the article title, “What Are Atheists for?”, if they took it to mean “Are Atheists Useful to Others Who Are Not Atheists?” This would tend to imply Hypotheses 7 (Catalyst), 8 (Bolstering) and 9 (Restraint) – those invoking group selection. A title that better encompasses the full range of hypotheses might have been “What Is Atheism for?” I agree that their proposed alternative title is more accurate (if boring): “What selection pressures might our ancestors have faced recurrently that caused the evolution of psychological mechanisms that motivate critical thinking and, therefore, atheism?” Hopefully the cost of my deliberately provocative title will be outweighed by the slightly larger number of people who may be intrigued to read it.

The most interesting suggestion made by Weekes-Shackelford and Shackelford is that the cognitive mechanisms underlying belief are not the same as the cognitive mechanisms underlying atheism. This is a major issue, with a split among authors. Weekes-Shackelford and Shackelford warn that “The argument that religious belief . . . is sensibly organized along a continuum from strong belief to atheism implies that religious belief and atheism are produced by the same evolved mechanisms.” They argue exactly the opposite: “that there are two sets of evolved mechanisms . . . ‘gullibility mechanisms’ and ‘critical thinking mechanisms’ . . . both sets of mechanisms may operate independently and even simultaneously.”

First, it seems to me that there can still be (and obviously is) an empirical continuum of strong belief to atheism even if the underlying mechanisms for each end of the distribution is different (i.e., if you survey religiosity and plot the data, you get a normal distribution). As Caldwell-Harris and others point out, there are likely several traits that contribute to both belief and atheism. But as long as people vary in any or all of these traits, this will produce a mix of levels of belief in the overall population – ranging from strong belief to atheism.

Second, other authors specifically argue that the underlying mechanisms are the same for both belief and atheism. In prior work, Beit-Hallahmi (2007) argued that “the psychology of religion is also the psychology of irreligion . . . atheists should be to some extent the psychological mirror image of highly religious people” (p. 301). Some commentators endorse it here, too. For example, Geertz states that atheism “is defined by the absence of its opposite.” In my original article I expressed skepticism about this argument.⁵ I favor the argument that there are non-overlapping mechanisms underlying religion and atheism (but an empirical continuum).

Schloss favors Hypothesis 2 (Natural Variation). However, he points out that this null hypothesis raises as many questions as it answers. Many biological traits display natural variation, but this often means that selection is acting on trait values at the extreme ends of the distribution (e.g., both very small and very big individuals may be selected against). This is important because it highlights the point that, even if atheism is just one end of a continuum, it may nevertheless be subject to selection. Selection may favor or disfavor high or low values of a trait, or any combination thereof, leading to directional, balancing, diversifying, or no selection. These have various possible consequences, such as narrowing the distribution over time (if extremes are selected out), or shifting the mean level of belief up or down (Kingsolver & Pfennig, 2007). Although this introduces complexity, these are all predictions that can be tested with data.

Schloss also suggests that atheism may not be the “default state” for the human lineage (contra Geertz and my original claim). This might be the case if, for example, supernatural thinking was an immediate product of the ancestral cognitive

mechanisms that first made it possible. Furthermore, recent work suggests that superstitious behavior can evolve even in non-human animals if it avoids costly outcomes by, for example, assuming random noises are caused by agents such as predators (Foster & Kokko, 2009). This suggests that there may even have been a continuous line from animals to humans with supernatural-like perceptions all along. We need more data on this point.

Schloss graciously points out that my own previous work may support Hypothesis 6 (Ecological Contingency). I had been thinking primarily of adaptation to different physical environments (e.g., where belief or atheism is better for dealing with a given environmental challenge). However, variation may also result from adaptation to different socio-ecological environments. The earlier work (e.g., Johnson, 2009) suggested that belief may bring adaptive benefits, but only under certain regimes of costs and benefits related to the detection and punishment of social transgressions (otherwise non-believers will prevail). Since these factors may differ between habitats or social organizations, belief and atheism may vary too.

Schloss suggests that bolstering is not a strong explanation for atheism. If a religious group needs bolstering then the impetus can come from among the religious group itself – it doesn't need to come from non-believers. That may be true, although it seems to me that atheists may represent the most powerful critics because: (1) they are not invested in any of the religion's beliefs (and can thus challenge anything and everything); and (2) they will have fewer qualms about doing so (since they need not worry about offending fellow believers or the gods).

Finally, Schloss argues that costly signaling can still work even without outsiders (such as atheists) if, for example, individuals are signaling commitment rather than group membership. While I agree that costly signals may arise within a homogenous population, such a process *creates* new groups within the original – those who have displayed higher commitment, and those who have not. That is the consequence of the signal. If there is no variation among individuals, then there are no fitness differences and signaling would not evolve. In support of this, although initiation rites among indigenous cultures may be a signal of commitment to other group members (not outsiders), the signal serves to mark out those who have been brave enough to participate from those who have not (Sosis, Kress, & Boster, 2007). Presumably, skeptics are less likely to partake in such rituals, or less likely to do so willingly or convincingly (and humans are very good at spotting such reluctance).

Conclusions

The target article and the commentaries suggest that we face a number of significant obstacles to understanding the origins and evolution of atheism. Most notably, we do not know very much about atheism. Nor do we have the data to evaluate or compare alternative hypotheses for the evolutionary functions of atheism. We also do not know the relative roles of genetics and culture in the origins of atheism. Finally, we are not even agreed on what atheism is! Although these obstacles paint a pessimistic picture, they open up a treasure trove of possibilities for future research. For me, the debate has highlighted six key questions that we need to address:

- Are atheism and belief opposites of the same underlying cognitive mechanisms, or do they have different sources altogether?

- Do personality profiles dispose people towards atheism or does atheism dispose people to develop certain personality types?
- How common are atheists among small-scale cultures (those most similar to the ones in which we evolved), and what are their fitness pay-offs relative to believers?
- What other evolutionary hypotheses for atheism have we missed?
- What environmental factors cause an increase in atheism, and where and when will these factors rise or decline in the future?
- Are religious groups stronger or weaker without atheists?

Despite these uncertainties (or perhaps because of them), the one apparent consensus among the commentators is that atheists are best accounted for by Hypothesis 2 (Natural Variation): atheists are simply one end of a continuum of belief. On the face of it, this is unsurprising, even an anti-climax. Like numerous other traits in nature, beliefs vary – so what? However, if this is true, then there are in fact several striking implications. First, it implies that the mean of the distribution is some positive level of religious belief (that is, there is a consensus that natural selection has favored cognitive mechanisms underlying belief, and/or religion itself). Second, it implies that atheism is (or was) a suboptimal strategy for human beings.⁶ Third, it implies that atheists – given their status at the tail end of the distribution – are (or were) selected against. I began with the question, “What are atheists for?” I conclude that atheists are not “for” anything. But this in itself is intriguing because, whether religion is a product or a by-product of evolution, it means atheists are essentially accidents of nature.

Notes

1. Often I will write “religion” for ease of reading but I nearly always mean “religious beliefs and behaviors” and the cognitive mechanisms that underlie them.
2. This is not simply a nature–nurture argument, because the development of these traits may involve epigenetic processes.
3. One recent source of definitions of atheism can be found in Martin (2007).
4. Those who take a naturalistic world view.
5. I wrote: “It might be, for example, that atheism and religion engage different parts of the brain, or are differentially influenced by experience and biochemistry, or interact differently with other cognitive processes. These are questions in need of work.”
6. If atheism was not suboptimal, and brought equal or greater fitness benefits compared to religious beliefs, then we enter the realm of other hypotheses such as Hypothesis 4 (Frequency Dependence), rather than Hypothesis 2 (Natural Variation).

References

- Barrett, J.L. (2004). *Why would anyone believe in God?*. Walnut Creek, CA: Altamira Press.
- Beit-Hallahmi, B. (2007). Atheists: A psychological profile. In M. Martin (Ed.), *The Cambridge companion to atheism* (pp. 300–317). Cambridge, UK: Cambridge University Press.
- Bering, J.M. (2010). *The belief instinct: The psychology of souls, destiny and the meaning of life*. New York: W.W. Norton.
- Brown, D.E. (1991). *Human universals*. New York: McGraw-Hill.
- Burnham, T., & Johnson, D.D.P. (2005). The biological and evolutionary logic of human cooperation. *Analyse & Kritik*, 27, 113–135.
- Dennett, D.C., & LaScola, L. (2010). Preachers who are not believers. *Evolutionary Psychology*, 8, 122–150.
- Foster, K.R., & Kokko, H. (2009). The evolution of superstitious and superstitious-like behaviour. *Proceedings of the Royal Society B: Biological Sciences*, 276, 31–37.

- Irons, W. (2001). Religion as a hard-to-fake sign of commitment. In R. Nesse (Ed.), *Evolution and the capacity for commitment* (pp. 292–309). New York: Russell Sage Foundation.
- Johnson, D.D.P. (2009). The error of God: Error management theory, religion, and the evolution of cooperation. In S.A. Levin (Ed.), *Games, groups, and the global good* (pp. 169–180). Berlin: Springer.
- Johnson, D.D.P., Price, M.E., & Takezawa, M. (2008). Renaissance of the individual: Reciprocity, positive assortment, and the puzzle of human cooperation. In C. Crawford & D. Krebs (Eds.), *Foundations of evolutionary psychology: Ideas, issues and applications* (pp. 331–352). New York: Erlbaum.
- Johnson, D.D.P., Stopka, P., & Knights, S. (2003). The puzzle of human cooperation. *Nature*, 421, 911–912.
- Johnstone, R.A. (1997). The evolution of animal signals. In J.R. Krebs & N. B. Davies (Eds.) *Behavioural ecology: An evolutionary approach* (pp. 155–178). Oxford: Blackwell Science.
- Kahneman, D. (2011). *Thinking, fast and slow*. London: Allen Lane.
- Kingsolver, J.G., & Pfennig, D.W. (2007). Patterns and power of phenotypic selection in Nature. *BioScience*, 57, 561–572.
- Martin, M. (Ed.) (2007). *The Cambridge companion to atheism*. Cambridge, UK: Cambridge University Press.
- Searcy, W.A., & Nowicki, S. (2005). *The evolution of animal communication: Reliability and deception in signaling systems*. Princeton, NJ: Princeton University Press.
- Sosis, R. (2003). Why aren't we all Hutterites? Costly signaling theory and religious behavior. *Human Nature*, 14, 91–127.
- Sosis, R. (2011). Why sacred lands are not indivisible: The cognitive foundations of sacralizing land. *Journal of Terrorism Research*, 2, 17–44.
- Sosis, R., & Alcorta, C. (2003). Signaling, solidarity, and the sacred: The evolution of religious behavior. *Evolutionary Anthropology*, 12, 264–274.
- Sosis, R., Kress, H., & Boster, J. (2007). Scars for war: Evaluating alternative signaling explanations for cross-cultural variance in ritual costs. *Evolution and Human Behavior*, 28, 234–247.
- Steadman, L.B., & Palmer, C.T. (2009). *The supernatural and natural selection: Religion and evolutionary success*. Boulder, CO: Paradigm.
- Whitehouse, H. (2008). Cognitive evolution and religion: Cognition and religious evolution. In J. Bulbulia, R. Sosis, C. Genet, R. Genet, E. Harris, & K. Wyman (Eds.), *The evolution of religion: Studies, theories, and critiques* (pp. 19–29). Santa Margarita, CA: Collins Foundation Press.
- Wilson, D.S. (2002). *Darwin's cathedral: Evolution, religion, and the nature of society*. Chicago IL: University of Chicago Press.
- Wilson, E.O. (1999). *Consilience: The unity of knowledge*. London: Abacus.
- Zahavi, A. (1975). Mate selection – a selection for a handicap. *Journal of Theoretical Biology*, 53, 205–214.