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REVIEW ARTICLE

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The evolution of religious belief in humans: a brief review with a focus on cognition

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Abstract. Religion has been a widely present feature of human beings. This review explores developments in the evolutionary cognitive psychology of religion and provides critical evaluation of the different theoretical positions. Generally scholars have either believed religion is adaptive, a by-product of adaptive psychological features or maladaptive and varying amounts of empirical evidence supports each position. The adaptive position has generated the costly signalling theory of religious ritual and the group selection theory. The by-product position has identified psychological machinery that has been co-opted by religion. The maladaptive position has generated the meme theory of religion. The review concludes that the by-product camp enjoys the most support in the scientific community and suggests ways forward for an evolutionarily significant study of religion.

Keywords. religion; evolution; costly signalling; belief.

Introduction

Religion is defined as belief in god-like entities who are worshipped for possessing superhuman abilities and ultimate power over the fate of human beings. This definition, while popular, is limiting for a scholarly study from an evolutionary perspective since it implies that there is something special about religion that makes it fundamentally different from other kinds of cognition and behaviour. This, in turn, makes it difficult to explain the evolutionary underpinnings of religion since the first traces of primitive religious ritual in hominins are dated ∼225,000 years ago (Pettitt 2002), while organized religion is only estimated to be as little as 11,000 years old (Cauvin and Watkins 2000). Considering the relative 'youth' of religion (in its organized form) in evolutionary time scales, evolutionary scholars have tended to provide a much more generalized definition of religion, which includes belief in various supernatural phenomena and ritualistic behaviour in service of those beliefs. This paper will also consider religion in this generalized sense. However, this broader ambit, too, does not cover many human behaviours that are associated with the supernatural. Religion, as a term, is insufficient to cover belief systems that deal with nonomnipotent deities which

share a more interactive and less power asymmetrical relationship with humans, thus ambiguating the normative hierarchy that religion assumes between the human and the divine. This definitional limitation is an important caveat that needs to be laid out at the outset.

This review will discuss and evaluate the dominant evolutionary accounts of religion, with special emphasis on the various theoretical frameworks that have been used to explain the widespread existence of religion and its characteristics. Religious phenomena are both ubiquitous and varied across cultures (Brown 1999; Bowie 2006) despite the various cognitive and physical costs that religious practice demands. For one, belief in religion requires commitment to counterintuitive and, sometimes, illogical and unfalsifiable propositions, all of which violate core properties of the cognition that helps us survive (Ayer 1950; Atran and Norenzayan 2004). Additionally, many religious rituals also demand costly material sacrifice, along with painful physical and emotional exertions (Fischer and Xygalatas 2014). The continued flourishing of religion has, therefore, been a great puzzle to evolutionary scholars since Darwin (Darwin 1871/1981).

There have been various attempts at providing evolutionary explanations of religion and most scholars fall

into one of three major theoretical positions – those that argue that religion serves some adaptive function, those that argue that religion, by itself, does not necessarily serve an adaptive function, but is a by-product of adaptive nonreligious psychological machinery, and those that argue that religion is a culturally transmitted maladaptive phenomenon. The three factions have tend to address different aspects of religion, which has led them to incompatible conclusions on the evolutionary nature of religion. The adaptive theorists have addressed the individual and group fitness benefits that religion provides, while the by-product theorists have addressed the origins of religion as a cognitive phenomenon. The cultural theorists, on the other hand, have addressed the costly aspects of religion and how religion is spread through cultural transmission.

It has, however, been pointed out that there are significant overlaps between the lines of research generated by the three factions, and the seemingly conflicting conclusions on the evolutionary functionality of religion—adaptive, nonadaptive, or maladaptive—could arise from the differences in questions they have addressed (Smith and Arrow 2010). For example, the adaptive theorists and the cultural theorists both address the maintenance and spread of religion, albeit through different lenses—the adaptive theorists focus primarily on the biological evolution of aspects of religion at the individual level and integrate it with the evolution of religion through cultural means at the group level, while the cultural theorists solely focus on the maladaptive nature of religion as a cultural phenomenon and how it continues to be sustained in communities. As such, the two positions are compatible with each other, even though their conclusions seem to be diametrically opposed primarily because the religious phenomena they have addressed and their methods of analysis have been different.

While theorists in support of both these positions have addressed the maintenance and spread of religion once it was already in existence, the nonadaptive theorists have attempted to break down the problem of religion into its fundamental cognitive components and have explained its origin as a by-product of nonreligious but adaptive cognitive roots. Therefore, the three positions and the research they have generated integrate like pieces of a puzzle—the by-product position tells us how religion came to exist in the first place while the adaptationist and cultural-maladaptive positions tell us how it has since been maintained and its subsequent role as either an adaptation or a maladaptation (or both). It should, however, be noted that since the adaptationists and the cultural theorists tend not to provide accounts of how religion first began, their explanations are philosophically dependent on either by-product or other accounts as how religion came to be in the first place. However, the by-product account itself is independent in that if the adaptations of which it claims religion is a by-product of have remained adaptive, they can successfully explain both the origin and maintenance of religion.

Recently, although accounts that integrate findings from these differing theoretical positions have become common, it would be illuminating to explain religion in terms of these seemingly incompatible positions, and this is the primary aim of the present review.

Adaptationist explanations

The early precursory roots to the adaptationist programme can be traced back to the pioneering work of Ronald Fisher, who, in his book *The genetical theory of natural selection*, emphasized the singular importance of natural selection on trait evolution (Fisher 1930). However, the adaptationist programme as it is known today can only be traced back to the biologist George C. Williams who defined general criteria for the application of the concept of natural selection to recognizing whether a physical or psychological trait is adaptive or not (Williams 1966). While an extensive discussion of the criteria does not fall under the purview of this paper, it is important to note that Williams' (1966) criteria underscored the importance of a strict analysis of whether a certain trait improved genetic fitness in order to declare it adaptive.

Evolutionary scholars have provided such analyses for several traits, and religion, or the set of behaviours it entails, is no exception. The adaptationists have generated primarily two types of accounts addressing the adaptive nature of religion—there are those that argue that religion is an individual-level adaptation and those that argue that religion is a group-level adaptation. Scholars in support of individual-level adaptationist accounts argue that religious behaviour improved the genetic fitness of our individual ancestors and continues to do so today (Irons 2001; Sosis 2006; Norenzayan and Shariff 2008; Henrich 2009), while group-level theorists argue that religion provided and continues to provide fitness benefits to entire religious communities due to increased cohesion and cooperation and this is why religion is naturally selected for (Wilson 2002).

Individual-level adaptation

The anthropologist Richard Sosis, through his costly signalling theory of religious ritual, provided a highly influential account of how seemingly maladaptive religious practices such as ritual sacrifice could in fact enhance the fitness of individuals (Sosis 2004). Sosis' theory is a specific application of Amotz Zahavi's broader costly signalling theory (also known as the handicap principle), which was developed to explain certain peculiar signalling behaviour between prey and predator in the wild (Zahavi 1977; Grafen 1990). Sosis and colleagues studied various communities including Jewish kibbutzim (Sosis and Ruffle

2003) and concluded that those taking part in costly rituals saw an increase in reputation within the group and, therefore, had greater access to mates. Sosis argued that this was because partaking in the costly ritual signals was a commitment to the shared beliefs of the community, who in turn responded favourably because faking the commitment would be too difficult, given the extensive material, physical and emotional costs required for the ritual (Sosis and Bressler 2003).

Many religious communities rely on costly signalling to make sure that freeloaders are not taking advantage of the benefits offered by the community without being fully committed, and the expensive nature of the ritualistic behaviour is precisely what makes the behaviour adaptive (Sosis 2004, 2006). Various other theorists have emphasized the role of religion in increasing cooperation between individuals who do not directly share genetic material, i.e. they are not part of the same family (Dennett 2006). Cooperation stemming from costly signalling could be vital for the survival of members and individual-level theorists believe that the benefits provided by being religious far outweigh the costs, thereby making religious behaviour adaptive at the individual level.

Individual-level theorists also provide supporting evidence by citing the various benefits of religiousness. For example, religion has been associated with moderately better physical health outcomes, especially with regard to heart disease, hypertension and gastrointestinal disease (Levin and Vanderpool 1989; Oxman *et al.* 1995; Levin *et al.* 1996). Religion has also been associated with higher levels of psychological wellbeing and social adjustment (Bergin 1983; Larson *et al.* 1992). Critics, however, have pointed out that much of the literature in the area is correlational, and a causal link between religiosity and health benefits has not been completely established yet (Levin 2002).

Group-level adaptation

Scholars citing group-level adaptive benefits to religious belief have identified various advantages, such as increased cohesion and cooperation between members, that religious communities have over nonreligious communities. David Wilson, one of the primary proponents of this view, has invoked his multilevel selection theory of evolution to explain how religion could be an adaptation at the group level (Wilson 2002). The multilevel selection theory posits that selection pressures are exerted upon organisms at both individual and group levels, and behaviours that might seem to be costly or disadvantageous at an individual level might still be beneficial at a group level, thereby allowing the group to better compete with other groups and survive (Wilson and Sober 1994). Sober and Wilson, in using this theory to explain the existence of altruism in humans, have suggested that while altruism might hurt the genetic fitness

of the actor at the individual level, it promotes cooperation within the group, leading to an improvement in fitness of the group (Sober and Wilson 1998). This makes altruism adaptive at the group level, but not at the individual level.

Within this model, the group is a 'higher-level' entity which can act as an adaptive unit in itself. While within-group (i.e. between individuals) selection pressures continue to operate at the individual level, group level natural selection occurs through between group factors and if a specific trait is adaptive at the group level, and selection pressures are strong enough, it can help a group outcompete another group that does not possess the trait (Wilson *et al.* 2008). In applying the multilevel selection theory to religion, Wilson and others argue that religion's group advantages far outweigh the costs associated with it at the individual level and this, therefore, makes religion adaptive at the group level (Wilson 2002, 2005; Wilson and Wilson 2008). Here, it is important to note that a group-level adaptation does not necessarily entail an enhancement of genetic fitness for every single individual in the group. Often, different traits are selected for at the individual and group levels, and the one selected at the group level, as the example of altruism demonstrates, may be maladaptive at the individual level. In the case of religion, while there are costs attached to the practice of religion at the individual level, Wilson does not argue that it is necessarily maladaptive at the individual level, but instead argues for its adaptiveness at the group level. This is a more nuanced outlook towards the adaptive status of religion and is compatible with individual-level theories.

Coming to the specific benefits religion seems to provide to groups, Wilson has argued that religion plays a great role in unifying communities through the encouragement of prosocial behaviour in individuals which leads to the whole group prospering. For example, in his book *Darwin's cathedral: evolution, and the nature of society*, he claims that the moralizing force of religion leads to a certain automatic policing which ensures that individuals do not cheat one another during transactions, resulting in increased trust between members (2002). In religious communities, there is a reduced need for external rule enforcing when there exists an all-powerful entity who will punish and reward people for their actions (Bulbulia 2004). Wilson's account has garnered extensive empirical support from the results of economic games (Ruffle and Sosis 2006; Bulbulia and Mahoney 2008), which show that religious individuals, when dealing with other religious individuals, tend to be far more trusting and altruistic than nonreligious individuals tend to be in their interactions. Other research has also shown that belonging to the same religion seems to improve people's opinions of one another, which could explain why the results of economic games show high levels of trust and altruistic behaviour (Widman *et al.* 2009).

When considered along with the individual-level theories, the multilevel selection theory seems to provide a more wholesome picture of how religion can be an adaptive

force, at both individual and group levels. Individual level accounts argue that despite the costs of religion for people, it still confers fitness benefits greater than the costs while Wilson's account explains how religion could be adaptive at the group level regardless of its status at the individual level. When considered together, they explain why religion continues to flourish—both individuals and groups who are religious tend to have advantages over those who are not.

Critics, however, have pointed out two shortcomings in Wilson's group selection account that need to be addressed before it can be considered an acceptable model for explaining religion. First, rigorous theoretical work needs to go into delineating exactly what it considers a group to be, and the mechanisms by which two similar groups can be separated. Joseph Bulbulia (2004) gives the example of two Presbyterian churches that may be part of a single sect, but compete with each other for members and funds. In such a case, would these be two groups as defined by the account or just one group? What about when a church from another sect or even a mosque is added to the mix? Second, various theorists have accused the group selection account of misjudging the initial cause for the development of religion. Boyer (2001) claims that while social cohesion and cooperation might be current benefits, they cannot be the root cause for religion, while Atran (2002) argues that the origins of religious thought have to be traced to more fundamental cognitive machinery and cannot be attributed to social community benefits (which potentially rule out the role of cognitive machinery entirely).

The palaeontologist Stephen Jay Gould and the geneticist Richard Lewontin have also, in a seminal paper, criticized the adaptationist programme in general for being too quick to declare traits as adaptations and not doing enough to show the exact mechanisms of how traits were selected for (Gould and Lewontin 1979). This critique extends to religion, and critics have contended that it is not enough to just show the possible ways in which religion could improve individual or group fitness, but it is also important to show how specific religion-related behaviour would be inherited across and between generations, either through genetic or cultural transmission. Adaptationist theorists in general have not been able to respond adequately to this line of criticism, and Gould and Lewontin have called for a more conservative position on the evolutionary status of seemingly adaptive traits.

By-product explanations

Several evolutionary scholars have thus rejected the idea of religion as an adaptation and have argued instead for the more conservative claim that religion is a spandrel of other adaptive but nonreligious psychological machinery. The term spandrel was coined by Gould and Lewontin to describe traits that are by-products of adaptations but may not be adaptive themselves (1979). Essentially, sometimes, an adaptive trait of an organism is co-opted for a function it was not initially meant for, thereby giving the trait a new role. An example of this is the use of feathers in birds which were initially developed to provide warmth, but through evolution, were co-opted for use in flight, which then became a highly adaptive primary function of feathers (Regal 1975).

By-product theorists argue that religion was a similar co-option of cognitive mechanisms and, therefore, the existence of religion is a natural by-product of normal cognition. Darwin himself was the first to put forth this claim in *The descent of man* (1871/1981), in which he called religious beliefs 'indirect consequences of our highest faculties' (p. 69). Darwin compared our tendency to be religious to the occasional mistakes made by the instincts of lower animals, and hence believed that the basic cognition that led to the development of religion is not unique to human beings (p. 66–69). Darwin, however, did not make specific claims about 'which' psychological mechanisms were responsible for religion, and scholars did not begin identifying possible mechanisms until the late 20th century.

Stewart Guthrie, in his book *Faces in the clouds* provided one of the first accounts of how the co-option of an adaptive psychological trait could explain the development of religion (Guthrie 1993). Guthrie argued that one of the core aspects of religion is the belief in the existence of supernatural agents and he claimed that this is largely a by-product of our overactive agency detection systems (Guthrie 1993). Essentially, the adaptive nature of our ancestors' hyper-sensitive agency detection, termed hyperactive agency detection device (HADD) by Justin Barrett (2000), made it an inherited trait and made humans more likely to see anthropomorphic beings where there were none–hence, contributing to religious cognition. Evidence for a HADD in humans comes from a host of experimental results supporting the widespread existence of pareidolia, or the recognition of deliberate patterns where there are none. Most commonly, pareidolia is demonstrated in studies as seeing faces in random computer-generated patterns (see Voss *et al.* 2012 for a review). A recent magnetoencephalography study by Hadjikhani and colleagues showed that the recognition of faces in random patterns activates the same regions as when actual faces are seen and recognized in everyday life, and that such activation occurs before there is time for deliberate cognitive interpretation (Hadjikhani *et al.* 2009). The latter result indicates that seeing faces and possibly other deliberate patterns where there are none seems to be a relatively automatic feature of our cognition. Given that the human brain seems to be wired to overenthusiastically detect patterns, and false positives (i.e., recognizing deliberate patterns in randomness) seem to have neurological roots that are similar to accurate pattern detection, it does not seem far-fetched that humans

could have detected apparently agency-created patterns in the wild and inferred agency similar to their own from those patterns.

Both Barrett and Guthrie believed a hyperactive agency detection device was adaptive to our ancestors because detecting agency every time it was present was vital to survival while detecting/reacting to false positives had a low cost. For example, if one of our ancestors had heard rustling in the leaves behind him, although the probability that the rustle was caused by a predator would have been lower than the probability that it had been caused by the breeze, it would have been beneficial to conclude that it was a wild animal and run. This is because the cost of incorrectly concluding that it was just the breeze would be far higher—likely death—than incorrectly concluding that it was a predator—some fatigue from running. Erring on the safe side, therefore, would have been adaptive, and those individuals with a more correctly discriminating system would be less likely to pass on their genes as compared to those with a hyperactive system (for a game theoretic analysis, see Bulbulia 2004).

The hyperactive agency detection system, when considered along with some other mechanisms of the mind, such as the theory of mind module that allows us to recognize and hypothesize about the mental states of other people, can explain how religious beliefs are generated (Atran and Norenzayan 2004). Seeing agency behind natural events and then assigning a mental state to the agent leads to an extensive anthropomorphization of the environment which provides fertile ground for religion to take hold. Scholars have estimated that, given the complexity of religion, there are various (probably dozens) as of yet undiscovered psychological mechanisms which served and continue to serve a co-optive role in the development of religion (Boyer 2001; Boyer and Bergstrom 2008).

A different type of account for the origin of religion has been provided by Michael Rose and John Phelan who argue that religion is just a by-product of the tension between the development of our consciousness and notions of free will on the one hand versus our Darwinian needs on the other (Rose and Phelan 2009). According to their account, as we developed self-awareness and the ability to recognize our apparent free agency, the threat of going against evolutionary needs such as reproduction, self-preservation etc. came up. When this happened, our module preserving our evolutionary needs kicked in and gave rise to morality and religion which prevent us from straying from the 'evolutionary path'. Interestingly, Rose and Phelan have identified the frontal lobe of our brain as the centre of Darwinian calculations which subconsciously guide us away from evolutionarily dangerous behaviours and towards 'the right thing to do'. Rose and Phelan claim that some evidence for this theory came from fMRI studies which show that people who lack a moral conscience tend to have lower metabolic activity in their frontal lobes. This account, evidently, is more speculative than the other

by-product accounts, and more evidence is required for this theory to come into the mainstream of the by-product account.

Pascal Boyer, however, argues that religion cannot be explained just by the co-option of psychological machinery because such an explanation cannot account for how those religious concepts spread across communities and between generations (Boyer 2001). According to Boyer, a crucial property of religious concepts that make them more likely to spread is their minimally counterintuitive structure (Boyer 1994). Boyer explains that religious concepts seem to have a few, but not too many counterintuitive elements and this makes people remember and transmit them. He claims that concepts that are either too novel or too mundane will be difficult to remember, whereas a concept that is generally mundane, but has one or two striking features that surprise us will be discussed. An example could be a deity who mostly looks and acts like a human being except that he can summon lightning at will and wields a legendary war hammer.

While the co-option of psychological machinery and the minimally counterintuitive nature of religious concepts show how religious belief may have been generated and spread, critics have argued that the by-product account depends far too much on cognitive explanations and does not sufficiently consider the role of culture (Wilson 2002). On the whole, however, it is clear that by-product explanations address many of the flaws with adaptationist explanations. For one, it is difficult to support the position of religious behaviours as adaptations because of the strict conditions a trait must fulfil to be considered an adaptation and the lack of evidence to show that religion does indeed fulfil those conditions. The 'religion as a spandrel' position is more conservative and thus easier to support. Further, while the adaptationists point to current evolutionary benefits of religion, specifically those that enhance the social status of individuals and increase cohesiveness and cooperation in groups, they provide no explanation for the initial origins of religion. The by-product explanations show exactly how religion developed as an innocuous by-product of ordinary cognition, and thus provide a better theoretical framework for explaining the existence of religion.

Cultural explanations

Theorists supporting purely cultural explanations to religion have addressed the significant costs that religion imposes on people and how the cultural transmission of religion leads to the persistence of its maladaptive features. Members of this faction tend to play down the role of genetic factors in the spread of religion and instead rely on concepts of cultural evolution to explain the presence of religion. One of the most influential theories of religion generated by this group is the meme theory of

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religion, largely developed by Richard Dawkins. A meme is defined as a transmittable unit of behaviour or thought that spreads from person to person within a culture, mainly through imitation (Dawkins 1976; Atran 2001). Dawkins proposed that since memes do not depend on genetic transfer, as biological traits do, they can be spread both vertically from one generation to the next and horizontally from one person to another in the same generation, enabling their rapid transmission. In his seminal book, *The selfish gene*, Dawkins compares memes to genes and highlights similarities such as their ability to self-replicate and respond to selection pressures (Dawkins 1976), and various other theorists have since accepted the analogous relationship (Graham 2002).

Dawkins has defined religion as a memeplex, or a complex of memes, and has likened its spread to that of a viral disease (1993). In his view, religion is just like a virus which infects hosts and spreads, regardless of the harm it causes. Dawkins and other meme theorists decidedly hold a cynical view of religion and regard its costs to be much greater than its benefits (Dawkins 2006). Other theorists, however, have pointed out that if memes are subject to the same selection pressures as genes, then between-meme competition should lead to the survival of only those memes which offer the most significant benefits to their hosts (Dennett 2006). This provides a more benevolent picture of religion and could explain why religion offers significant fitness benefits.

While applying meme theory to religion seems to offer some conceptual benefits such as providing a framework for the cultural transmission of religious concepts, the evidence in support of a memetic explanation of religion is limited (Aunger 2002). Empirical investigation of memes in the form of neuroimaging studies has been suggested as a possible way forward (McNamara 2011); however, there has not been much work in the area yet. Various scholars have criticized the meme theory on theoretical grounds also and have questioned the basis for dividing cultural knowledge into units that can self-replicate (Atran 1998). On the whole, the meme theory of religion has raised some important questions which are not addressed either by the adaptationist or by the by-product positions. These questions include whether religion can purely be explained as a culturally perpetuated maladaptation and whether memes, or cultural ideas, can have a comparable evolutionary status to genes, however, until empirical support is found, memetic explanations will remain purely conceptual and of limited use in explaining religion.

General discussion

In this review, we have delineated accounts generated by the three major theoretical positions on the evolutionary psychology of religion. Each account has been useful in addressing specific aspects of religion: however, by and large, the by-product explanations have received the most support in the literature. Cultural explanations such as meme theory are still in the early phases of being empirically tested, and while adaptationist explanations seem to have fallen out of favour as definitive solutions to the puzzle of religion as a whole, they have generated useful conceptualizations which can be used to explain specific components of religion.

To evaluate evolutionary theories, it is important to obtain both proximate and ultimate explanations for the existence of behaviours (Scott-Phillips *et al.* 2011). Proximate explanations show *how* a specific behaviour works and evolves, while ultimate explanations deal with *why* the behaviour exists. This distinction is important to avoid confusion about the level of explanation that is being considered. By-product explanations seem to be ultimate explanations of religion because they are concerned with the early origins of religion and why it came to develop in the first place. Cultural and adaptationist explanations, on the other hand, seem to be largely concerned with proximate accounts of religion—they address how religion works by either providing critical or favourable accounts of its effects on genetic fitness. Of course, while by-product explanations describe the origin of religion by seeking its nonreligious adaptive roots, it is possible also that once religion actually came into existence, it became adaptive in itself—as the adaptationists claim and no longer depended on its nonreligious cognitive roots for transmission. This suggests that adaptationist explanations are not restricted as being proximal only and their philosophical status can be changed as having ultimate explanatory powers if in fact complete accounts can be provided of how religious behaviour can be transmitted across generations. Recently many syntheses of the research generated by the three theoretical positions seem to have recognized this difference in the level of explanations and have combined multiple facets of seemingly incompatible theories to provide more comprehensive explanations of religion (e.g., see Atran and Henrich 2010).

Future empirical work, especially of the kind that will differentiate between hypotheses generated by the three classes of theories will be extremely important. Currently, such work has been lacking and evidence seems to be mainly supportive of specific accounts rather than discriminatory between accounts. This is reflected in the structure of this review and other synthetic reviews which tend to integrate the theories and evidence. One way in which the by-product and adaptationist accounts can be differentiated is by investigating the links between religiousness and genetic fitness. While most of the evidence on the health benefits of religion is currently correlationary, finding more conclusive evidence might be a way forward.

Ultimately most of the current accounts explain religion as an exclusively human phenomenon and extensive work is required to explain how religion can be explained in a more general evolutionary context, involving behavioural

patterns and cognition found in other species as well. Work done on the costly signalling theory of religion and the co-option account of religion shows us some of the ways in which we can move towards achieving a more general evolutionary theory of religion. However, more comparative work and a more empirical approach in showing similarities and distinction between species may also be illuminating.

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