Area review

The cognitive and evolutionary psychology of religion

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Abstract. The following reviews recent developments in the cognitive and evolutionary psychology of religion, and argues for an adaptationist stance.

Introduction

Religious cognition presents significant explanatory questions to those interested in the evolutionary biology of our species.[1] Suppose the function of cognition, in the widest sense, is to help an organism deal, in the widest sense, with environmental complexity (Godfrey-Smith 2002). It is easy to appreciate how the ability to construct mental maps or for colour vision emerged in complex organisms given the enhancements to reproduction these bring. However, a functional explanation for religious cognition is less obvious. Assume that gods do not figure as genuine aspects of environmental complexity. Given the costs of religious cognition – misperceiving reality as phantom infested, frequent prostrations before icons, the sacrifice of livestock, repetitive terrifying or painful rituals, investment in costly objects and architecture, celibacy, religious violence and non-reciprocal altruism, to name a few – it seems selection should have weeded out any religious tendency. But religious conviction and practice is extremely commonplace. It is universal among hunter gathers and emerges in all modern societies (Rappaport 1999). Archaeologists trace religion back to our earliest Sapiens progenitors (Trinkhaus and Shipman 1993; Mithen 1999). Atheism seems to be a relatively recent and rare phenomenon, and though secular pundits have long predicted the demise of religion, it continues to flourish. It seems the human mind is especially prone to religion, in spite of the associated costs. Why?

To a crude approximation, there are two dominant research strands in the naturalistic study of religion.[2] In one camp are those that see religious cognition as a by-product of the evolved mind. For these spandrelists, religion has no adaptive value per se. The psychological architecture that produces god-related thought and activity has evolved for other purposes, and religion falls out of it as relatively harmless noise. On the other side are the adaptationists, who view religion as exquisitely functional, an elegant mechanism best explained as the target of natural selection, and best discovered by reverse-engineering its design. Below I highlight recent developments in both camps and suggest (i) why I think the evidence is stronger on the adaptationist side, and (ii) how I think adaptationism matters to the study of religion.

Strand 1: Spandrel explanations

Given the universality of religion, its strong motivational aspects, and behavioural consequences, venturing a functionalist explanation may seem irresistible. Viewing our species as one among many, an alien scientist might compare our strong and elaborate religious tendencies to the migratory instincts, territorial defence rituals, and intricate sexual displays of other animals [compare (Laughlin and McManus 1979; Smith 1979)]. Noticing a discrepancy between the outlay of nature on the one side, and how religious persons understand and interact with their world on the other, the scientist might conclude that selection outfitted our species with internal god-projectors – systems that distort experience to generate supernatural conviction, emotion, and behaviour. Here the poverty of stimulus could not be more extreme, nor could religious responses be more robust. Consider adolescent Khoisa males in Southern Africa who endure excruciating ritual circumcision only to live in exile in a desert environment without any food or water until they heal. The initiates risk infection, dehydration, exposure, and willingly submit to certain agony. The Khoisa claim the gods demand this ordeal of them. But how can chopping bits of genitals before the heavens improve survival?

Traditional theories of religion provide a suite of candidate functions – enhanced solidarity and co-ordination among the faithful, an answer book to life's riddles, an existential purpose generator, a means for providing hope and solace to the suffering, an adaptation for inter-group warfare, or for morality, and various combinations thereof (Preus 1987). In an effort to understand the god-projector, what it does beyond warping the outlay of reality, the alien naturalist might look to how these distortions enable the religious to relate to and manipulate their world, and other people, in ways that bolster reproduc-

tion. Though supernatural beings cannot improve survival – they don't exist – perhaps through religion we somehow do.

But need religion enhance reproduction to evolve? Interestingly, Darwin didn't think so. In the *The Descent of Man*, Darwin devoted only several paragraphs to the subject of human religious tendencies, amazingly little given the place of religion in human life (Darwin 1871/1981). Darwin concluded that our religious inclinations are best explained as spandrels of consciousness. He noticed that:

(i) religious cognition isn't a natural or psychological kind, but rather a composite of many distinct and overlapping elements: "the feeling of religious devotion is a highly complex one, consisting of love, complete submission to an exalted and mysterious superior, a strong sense of dependence, fear, reverence, gratitude, hope for the future, and perhaps other elements" (p. 68).

(ii) these elements yield to apparent cultural variation and many cultures lack any concept of "God" known to the Abrahamic faiths: "there is ample evidence, derived ... from men who have long resided with savages, that numerous races have existed and still exist, who have no idea of one or more gods, and who have no words in their languages to express such an idea" (p. 64). Darwin suggested that varieties of religious thought and behaviour materialize through the influence of social and institutional structures, by way of nurture's effects on common human nature. The broad spectrum of religiosity – savage through noble (to use Darwin's categories) – suggests that the best explanation of religion comes through an understanding of how culture assembles religious elements.

(iii) religious elements are not localised to our species:

> The tendency in savages to imagine that natural objects and agencies are animated by spiritual or living essences, is perhaps illustrated by a little fact which I once noticed: my dog, a full-grown and very sensible animal, was lying on the lawn during a hot and still day; but at a little distance a slight breeze occasionally moved an open parasol, which would have been wholly disregarded by the dog, had any one stood near it. As it was, every time that the parasol slightly moved, the dog growled fiercely and barked. He must, I think, have reasoned to himself in a rapid and unconscious manner that movement without any apparent cause indicated the presence of some strange living agent, and no stranger had a right to be on his territory (p. 67).

Contemplating blood rituals, trials by poison and fire, witchcraft and other "superstitions" Darwin summed up his spandrelist view: "These miserable and indirect consequences of our highest faculties may be compared with the incidental and occasional mistakes of the instincts of the lower animals" (p. 69). For Darwin, the elemental strands of religiosity can be seen in other

animals very clearly as the by-products of ordinary cognition. Given that environmental complexity really is complex, religious "mistakes" should not be surprising. Different cultures generate distinctive religious doctrines, practices, and institutions because the inhabitants of those cultures are prone to supernatural errors.

In Darwin's classic statement religion serves no adaptive function. But if Darwin wasn't tempted to Darwinize religion, why should we?

Starting in the 1990s cognitive psychologists began to seriously explore specific features of religious cognition. Following in Darwin's footsteps, they argued that the aspects of religious cognition are most fruitfully understood not as parts to a globally adaptive system but as spandrels of other systems. Once we understand how these other integrated, modular, information processors work, we'll understand how they wind up accidentally generating supernatural thought as noise.

One of the first theorists to apply cognitive psychology to religion was Stewart Guthrie who in his 1993 monograph *Faces in the Clouds* argued that religion is mainly a by-product of agency detection systems (Guthrie 1993). Guthrie understood that the cornerstone of any religious life is religious experience. You can't throw a brick at a church or temple without hitting someone who has had a powerful religion-affirming encounter with the supernatural. Otherwise, without evidence, why commit to the gods? What makes religion plausible, for Guthrie, is our experience of the world as filled with animate beings.[3]

Contrary to the methodological assumptions of late 20th century anthropology, Guthrie didn't think that anthropomorphic tendencies could be explained solely as products of local culture and context. You don't "learn" to read gods into the fabric of reality. Rather god-mongering is a panhuman tendency; even secularists do it, for example when we perceive faces in clouds or a man on the moon. Guthrie explained anthropomorphism as resulting from perceptual hypersensitivity to persons. We animate the world with human life because we need to find other people whenever they are there, and faced with vague reality, perception gambles cautiously. In doing so, we lose little if they are not there and gain much if they are. Religious experience emerges from a hyperactive agent detection device, what the Justin Barrett calls "HADD" (Barrett 2000).

Assume that selection could have enhanced accuracy in the perception of persons. For Guthrie the payoff for enhanced accuracy did not warrant the costs of more a discriminating detection system. Because selection conserves HADD, religious beings spring from our minds like jack-in-the-boxes. They are projected everywhere because our brains overcompensate when facing vague reality. Like Darwin's dog, our cognitive organisation leads us to

Chart 1. Guthrie's wager

Seeing person when it is unlikely that a person is there (odds = 0.1), but where payoffs for perception are high (+10,000 utiles). Assume a cost of false perception is –10 utiles. Selection will favour HADD, if evolving perfect perception is difficult or more costly than to an organism than running HADD.

Perception	Reality: person there	Reality: person not there
Benefit of HADD = 901	+10,000 (0.1) or +1000	–10 (0.9) or –9
Opportunity cost of no HADD = –1000	–10,000 (0.1) or –1000 (opportunity cost)	0 (0.9) or 0

attribute natural effects to intentional causes, and so to project human-like beings into the world. We do this in our rapid unconscious inferences to the best explanation for what we perceive. Because these inferences are to human-like beings, we get worked up in ways that activate the social mind.

Notice that on this approach, evolution didn't design us to be religious any more than it designed us to love cinema or fast food. Once HADD is in place, religiosity falls out as an innocuous after-effect.

But why should we perceive only human-like beings and not also dangerous predators, food, potential mates and other reproductively important distractions (crouching with fear before clouds, exhibiting Pavlovian responses to the moon, or erotic responses to shadows?) And "human-like" needs to be disambiguated. In important ways, the gods are not at all human-like. They possess *supernatural* traits and powers. Given the "human" in "HADD," why are the gods conceived – always – as *not human*? And how does HADD explain religious rituals and institutions? While it is understandable how Darwin's dog could have responded to a moving gate by barking, it is not obvious why we would respond to vague reality with a Sistine Chapel, or a Mecca, or with painful rituals? – "I detect an agent, therefore, off with my foreskin."

Around the time Guthrie was publishing *Faces in the Clouds*, Pascal Boyer, a young French anthropologist then at Cambridge, began what was arguably a more rigorous application of cognitive psychology to religion. Like Guthrie, Boyer was impressed with the pervasiveness of religious thought and behaviour and unimpressed with standard anthropological explanations that we learn religion from culture. For Boyer, anthropological locutions about "learning" fail to elucidate the processes by which we acquire religious representations, obscuring this extremely perplexing

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dimension of human nature. Boyer wanted to better understand, at the level of cognitive architecture, just how the mechanisms for the acquisition and dispersion of religious understandings and practices work. His early research and subsequent career has been grounded in the view that religious ideas are attractive and spread because they activate multiple features of the intuitive inferences systems that govern our natural understandings of the world. Very generally these systems are panhuman, aspects of biological rather than cultural inheritance. They also function largely implicitly. Apparently, no one teaches us folk physics and psychology. They develop along predictable schedules that resemble the growth of organs. When psychological architecture encounters specific conceptual information supplied by the environment, it triggers rich understandings whose intricacy far outstrips external factors. On Boyer's view, religious concepts function like pin-balls falling into spring loaded psychological pockets, which, when they strike them just right, trigger an ornate array of largely implicit mental representations and psychological responses. Regularities in the system that generates these responses allow for psychological generalizations across cultures. Critically, there is no single system like HADD that is responsible for religious cognition. Like Darwin, Boyer doesn't think religious thought emerges from only one cognitive domain. And because religion is complex, its explanation is likely complex: there are no explanatory "magic bullets" in the naturalistic study of religion (Boyer 2001).

A critical property of any religious concept, on Boyer's view, is its minimally counterintuitive structure (Boyer 1994; Boyer and Ramble 2001). Boyer hypothesised that religious concepts violate *a few but not many* of our intuitive expectations for the relevant natural kinds. This is what makes them interesting and memorable.

To understand Boyer's reasoning imagine how religious concepts located at each extreme of the conceptual spectrum will function. Consider the case where religious concepts are ordinary and so do not violate intuitive expectations. Plainly, ordinary concepts will not be felt as arresting or considered worth talking about. Few would care if "god" referred to a car dealer who lives in Toledo Ohio, or to a phase in the development of turnips. On the other hand a being with an absolute power to create and destroy is memorable. Were you to meet the THE CREATOR OF THE UNIVERSE at a cocktail party you'd likely remember his name, tell others about it, and try to get on the Deity's good side. Given that counterintuitive concepts startle us, we are more likely to discuss them, which is why they spread in populations.[4]

Now imagine a concept that violates innumerably many of our intuitive expectations for the relevant kind. Will such a concept not startle us even more? Not if we can neither represent nor remember its properties. Consider

the God of St. Thomas's five volume Summa Theologica. Thomas's ultra complicated Deus gives even the brightest seminary students mental cramps. Thomas's theology – though clearly written – is ambiguous enough to have fuelled over seven centuries of theological debate. His "God" concept remains too detailed and counterintuitive for common or garden believers to employ. Boyer suggests that as violations of intuitive psychology pile up beyond the attention-grabbing threshold, we become less able to understand and retain theological meanings. The gods must be strange, but once they become too exotic we lose our mental grip on them.

By the 1990s important experimental evidence began to emerge supporting Boyer's theory. The cognitive psychologists Justin Barrett and Frank Keil prompted religious devotees in American and India represented their gods in ways that made them far more anthropomorphic than the theologically explicit representations that these believers of each tradition consciously assent to in explicit doctrines and creeds (Barrett and Keil 1996). God or Shiva knows all, but you still need to pray if you want to communicate your intentions. This discrepancy between explicit theology and implicit religion has been duplicated in numerous experiments, revealing the gods of living religion to depart from the officially sanctioned versions theologians describe (Barrett and Keil 1998; Boyer 1998; Barrett 2000; Boyer and Ramble 2001).

Interestingly, Boyer and Barrett's line on minimally counterintuitive agents patches an oversight in Guthrie's HADD based explanation. Clearly, the supernatural is *never* conceived as an ordinary agent (Boyer 2003). There is always some conceptual twist. Satan is a talking serpent, not a serpent. Shiva has eight arms, not two. Ganesh doesn't just have a big nose; he's endowed with an elephant's trunk. If religion could be explained by HADD then we'd come to believe in ordinary persons animating the world. There are few absolutely universal rules in human culture. That religious thought *always* centres on non-natural or supernatural entities is one of them. The violation of natural expectation is what generates the distinctively sacred quality of supernatural conviction. It is what causes one's neck hairs to stand on end.

Of course we are not just attracted to the gods, but also to god-centred celebrations. No account of religion could be complete without an account of religious ritual. As Khoisa initiates demonstrate, religion doesn't just concern exotic belief; religious commitment may involve disfiguration, fire walks, starvation, awkward bodily postures and manipulations, the recitations of scriptures, psychedelic drugs, dance, and countless other special behaviours and practices. Around the same time that Boyer was developing his minimal counterintuitive violation theory of supernatural concept disper-

sion, the philosophers Tom Lawson and Robert McCauley began applying cognitive principles they learned from linguistics to religious ritual (Lawson and McCauley 1990). The result was a massively ambitious and complex theory – along the lines of generative grammar – aimed at elucidating and predicting structured religious behaviour. The latest refinement of the theory explains rituals in virtue of the (largely implicit) cognitive processes unleashed through either dramatic or repetitive practices (McCauley and Lawson 2002). Dramatic religious rituals produce what Harvey Whitehouse calls "flashbulb effects" – such rituals burn religious representations into our memories, rendering them salient and vivid (Whitehouse 2000). You would forget your mother's name before forgetting the day a knife was taken to your genitalia. On the other hand ritual repetition – doing something over and over and over again – screws religious representations firmly into cognitive place. Repeat: "The Lord is my Shepard" often enough, and do not be surprised that the phrase becomes believable and normative. [See (Whitehouse 2000) for a similar view].

In an impressive book, Scott Atran attempts to draw these various spandrelist threads together to provide an overview of cognitive research (Atran 2002). Like Boyer, Atran believes that we should not expect a simple explanation religious thought and action. Atran furthermore addresses two key problems that Boyer's earlier work exposes but did not (at that time) clearly answer.

First, there is a difference between remembering a minimally counter-intuitive representation and becoming ontological committed to it. Many classicists maintain extremely detailed understandings of Greek religion, but few end up worshipers of Zeus. Atran noticed that Boyer and other cognitive psychologists face the "Mickey Mouse Problem." We can represent and easily recall fictional characters like Mickey Mouse (or Zeus) yet few adults come to believe Mickey Mouse actual exists outside the fiction. Compare "Mickey Mouse" with any religious conviction, say "Lord Jesus", and notice that the religious concept possesses something approximating mathematical certainty. It may also carry moralistic overtones. You will make no friends of religious persons suggesting their gods are as fictional as Donald Duck. Atran thinks we need to attend more carefully to how religious information grinds through diverse psychological systems to produce ontological and moral commitments. For example, the systems that generate existential meaning and purpose are susceptible to supernatural concepts capable of answering existential questions and providing hope and solace [compare (Bering 2003)]. Mickey Mouse is cold comfort on the cancer ward. Yet a Loving Sky Father who will carry me through the pain and separation of death helps me to make better sense of my life, and so I am attracted to the idea. Atran observes that

the systems generating strong solidarity and that produce signals of commit-ment are susceptible to supernatural concepts that police social contracts. That is why there are religions of gods but not of sports teams or musical groups, which may also serve as rallying points. Michael Jordon is only meta-phorically a god worthy of worship. He cannot bring rewards commensurate with moral goodness to all. But Yahweh or Allah can. And so individuals uphold and support these concepts to secure co-operation and morality with co-religionists.

Thus for Atran, in any instance where a religious concept flourishes, the precise brand of supernatural causation it supplies is attractive because it activates specific (and diverse) psychological systems. There is sense in which the particular form a religious *concept* takes owes to *its* adaptive features, and so the expression of a religious concept is the result of a selection process. This is true of many cultural products, from automobiles to videogames. However, the underlying psychological systems that accom-modate religious concepts were not designed to process them for reproductive advantage. Like Boyer, Atran thinks religious information merely excites systems evolved for other purposes: "Religion has no evolutionary function per se. It is rather that moral sentiments and existential anxieties constitute – by virtue of evolution – ineluctable elements of the human condition, and that the cognitive invention, cultural selection and historical survival of religious beliefs owes, in part, to success in accommodating these elements" (p. 279).

It seems to me that Boyer and Atran provide something like the following methodological agenda to bring cognitive insights to Darwin's spandrelist intuitions about religious cognition:

Step 1: Take a feature of religious thought (like perception of a supernatural agents, categorization of supernatural entities, ritual understanding, etc.)

Step 2: Notice how this feature is a spandrel of some adaptive psychological mechanism or collection of psychological mechan-isms (like agent detection, categorization of natural entities, sensory vividness and memory, etc.)

Step 3: Notice how these adaptive psychological mechanisms, even subtracting costly religious spandrels, enhance reproduction.

Step 4: Use the cognitive and developmental analysis of these adaptive psychological mechanisms to shed light on the religious spandrel in question.

Repeat 1–4 for other features of religious cognition.

Here we have a powerful methodological agenda for developing a biologically grounded theory of religion that is not adaptive. Whenever a new feature of religious cognition is noticed or discovered it can be linked to an adaptive psychological system as a non-selected after-effect.

I think the rationale behind spandrel accountancy is plausible. The strategy simplifies explanation by minimising the complexity ascribed to cognitive design. There is no need to view religious cognition as engineered; no need to find specific dedicated psychological architecture to explain why we believe in gods. Spandrelists understand that a highly specialized brain will be prone to cognitive hiccups. As long as religion doesn't kill or maim too much, selection may preserve religious tendencies because it preserves the more broadly functional design that produces them. [For general overviews see (Barrett 2000; Andresen 2001; Boyer 2001; Pyysiainen 2001; Boyer 2003)].

But there is a way of looking at religious waste as itself an aspect of exquisite design.

Explanatory strand 2: Adaptationism

Consider how religious coalitions are more effective than secular coalitions. Let's suppose Barney and Fred want to undertake reciprocal exchange. They live in the Pleistocene and so can't rely on the police or the courts to enforce any of their agreements. Both stand to benefit from mutual aid, but as is so often true with reciprocity, both stand to benefit even more from defecting, receiving but not giving, the stuff of prisoner's dilemmas. We know that the potential for defection poses no insurmountable barriers to reciprocity. Organisms have evolved a suite of elaborate devices to secure and enhance co-operation. Dunbar presents plausible evidence that the evolutionary driver of our big brain was the presence of other people, for detecting and dealing with friend and foe in large social groups (Dunbar 1998). If we view religion as an aspect of the social mind, we can begin to understand how the excessive costs associated with it may actually be exquisite adaptations that selection targeted to enhance.

Amotz Zahavi's costly signalling theory holds the key (Zahavi 1977; Grafen 1990; Zahavi and Zahavi 1997). Take the prisoner's dilemma that obtains between predatory lions and gazelle in the African savannah. Both predator and prey wants the other to die willingly: the gazelle want the cats to starve without ever chasing them, and the lions want the gazelle to jump into their hungry mouths. But there is an opportunity for co-operation, even here where reproductive interests appear to completely diverge. Neither the lions nor the gazelle want a chase at each encounter. Mainly, gazelle are faster than lions; so constant chasing will leave both exhausted to no end.

But were fit gazelle able to accurately signal their speed, a pointless waste of resources could be avoided on both sides. Such a signal/detection system has in fact evolved to mediate the relation between predator and prey. Gazelle communicate their fitness by stotting – vigorously leaping up and down in place. This is exactly the opposite of what you would expect an animal to do to avoid the jaws of a fast and hungry predator. Stotting makes a gazelle more visible, and flushes its muscles with lactic acid. Why not run or hide? It is precisely because only fit gazelle can afford the costs associated with stotting – can do all that, and still run away and not get caught – that lions have learned to assess the information to avoid senseless pursuits. Through costly signalling a prisoner's dilemma has been averted. Zahavi describes many such examples. Cost may authenticate a resource or intention because waste is the luxury only the resource rich or predictably committed can afford.

In understanding how costly religious displays convey information that solves prisoner's dilemmas, we can better understand why the objects of religious beliefs are agents with very specific supernatural properties. Boyer notes that the objects of religious devotion and piety are typically, "full access strategic agents." The gods or ancestor spirits, or impersonal forces like "Karma" and "Grace," are beings and forces with the power to scrutinizing the morality of earth dwellers. God's eye sees everything, and in particular every virtue and transgression.[5] Boyer explains this feature as a spandrel of the social mind. The moral record of others provides critical strategic infor-mation. Barney is more likely to trust Fred if Fred has a proven track record of honour, less if Fred's dealings remain unknown. So for Boyer, when we're confronted with full-access strategic agents concepts, our passion for surprise and wonder is activated, and we take a special interest in them (Boyer 2000).

Yet here again, taking an interest is one thing, belief quite another. Santa Clause knows who's been naughty and nice, but I do not worship him or seek a religion of Clausanity. Precisely what makes Clause interesting makes him, to me and everyone else over the age of 9, absurd. The concept is propagated, and the festival of Clause is celebrated each December, but only as a child's game. Bona fide religious conviction, however, is a deadly serious affair. (I will return to Santa below.)

Consider another common feature of the gods. Not only do they observe moral behaviour, they are empowered to reward and punish it. In no living religion are the gods inert. Much of religious practice is an attempt to commu-nicate and exchange with the gods, to receive benefits, appease, or bring merit to oneself and the community of the faithful. The gods can dish out hurt – eternal damnation in hellfire, reincarnation as a garden shrub, bus terminal-like purgatories, and so on. But they frequently bring fortune to the good and righteous – lusty heavens, reincarnation as an emperor, release from

Chart 2. Predator/Prey prisoner's dilemma for fit prey encounter

Some arbitrary (but not wild) assumptions:

- Stotting is a costly signal that only fit Gazelle can perform.
- The energy of a chase is 1000Kj for Lion and Gazelle.
- The energy of stotting is 50Kj for Gazelle.
- Prize for Gazelle kill is 5000Kj.
- Chance of a lion catching a fit gazelle = 0.
- Chance of a lion catching an unfit gazelle = 0.9.
- Gazelle is lion's only food source.

Chase game where fit gazelle cannot signal speed: *Chase dominates Stay*

Action	Fit gazelle chases	Fit gazelle stays	Unfit gazelle chases	Unfit gazelle stays
Lion chases	−1000 −1000	Death 5000	(0.9) Death −1000 4000 (0.9)	Death 5000
Lion stays	Death	0 Death	−1000 Death	0 Death

Chase Game where fit gazelle reliably signal speed through stotting and Lion can detect this as signal of fitness: Stot/Stay Dominates Chase for fit gazelle/lion interactions, and Chase dominates unfit gazelle/lion interactions.

Action	Fit gazelle stots and chases	Fit gazelle stots and stays if lion doesn't chase otherwise chase	Unfit gazelle chases	Unfit gazelle stays
Lion chases	−1050 −1000	−1050 −1000	(0.9) Death −1000 4000 (0.9)	Death 5000
Lion stays	−1050 Death	−50 Death	−1000 Death	0 Death
Lion chases only if gazelle doesn't stot	−1050 0	−50 0	(0.9) Death −1000 4000 (0.9)	Death 5000

Chart 3. Ordinary prisoner's dilemma: defection dominates co-operation

Action	Barney co-operates	Barney defects
Fred co-operates	Prison = 1 year Prison = 1 year	Prison = 0 years Prison = 25 years
Fred defects	Prison = 25 years Prison = 0 years	Prison = 15 years Prison = 15 years

Chart 4. Prisoner's dilemma when both players act on the belief in a perfect supernatural reward and punishment regime. Heaven = maximally desirable. Hellfire = maximally undesirable. Assumption. Chart 3 gives actual outcomes. Chart 4 gives perceived outcomes. Co-operation dominates defection

Action	Barney co-operates	Barney defects
Fred co-operates	Prison = 1 year + heaven Prison = 1 year + heaven	Prison = 0 years + hellfire Prison = 25 years + Heaven
Fred defects	Prison = 25 years + heaven Prison = 0 years + hellfire	Prison = 15 years + Heaven Prison = 15 years + heaven

the cycle of birth and re-birth, profound insight and protection from harms way. Even the unrewarding gods of ancient Greece, Asia, and some African religious traditions tend to punish those who act badly, and in the case of Greek religions, their descendents [see (Hunter 1994)]. A god that harms everyone, but the righteous less, can still police social exchange. The key to the theory of religion as an adaptation for social exchange is that all-seeing gods impinge on our lives to hold us morally accountable. The supernatural causation represented through religious conviction is one capable of solving prisoner's dilemmas between those who share similar religious outlooks. In an ordinary prisoner's dilemma, economic rationality favours defection. But religious persons views the world as bound by supernatural causation, one that alters the relevant payouts for exchange. Even gods that bring few rewards and mainly punish are capable of policing exchange.[6]

Moreover extremely pro-social behaviour – suicide for one's group and its socially acceptable equivalent, celibacy, may be viewed as desirable, given supernatural causation.

Chart 5. Punishing Gods game: Zeus who punishes all, but the righteous less. Hates = Hell

	Barney defects	Barney co-operates
Fred defects	Hates Hates	−1000 Hates
Fred co-operates	Hates −1000	−1000 −1000

Chart 6. Celibacy game with supernatural rewards

Action	Perceived outcome
Celibate priest	Sexual frustration + Heaven
Carnal priest	Sexual Gratification + Hellfire

Clearly policing costs are substantially reduced in communities of prudent individuals who believe their transactions are perfectly policed by supernatural beings. All things equal then, members of religious coalitions are at an advantage over non-religious coalitions. They pay less to secure reciprocity. Solitary organisms would have no use for religious illusions, but in social species the illusions, when shared, benefit all who exchange under their spell [For discussion see (Atran 2002; Bulbulia 2004; Johnson and Kruger (in press).]

Notice however that while religious individuals living among religious cohorts extract the full benefits available to co-operating groups, irreligious invaders will be even more handsomely rewarded, deriving all the benefits of exchange but paying no cost for reciprocity. Clearly religious communities are open to invasion.[7] An individual who sees only natural causation will flourish among moral supernaturalists, and over time, naturalistic inclinations in her offspring will come to dominate mixed communities of religious altruists and irreligious defectors.[8] It seems that secularist ballast over the long haul sinks religious reciprocity.

Religious signalling, however, may keep the gods afloat. By producing and detecting hard-to-fake signals of religious commitment, the god-fearing can certify authentic exchange partners, sifting impious outlaws from the devout. The model predicts that religious deeds function as discriminatory screens

through which religious groups preserve their integrity, an intuition echoed in the Christian Gospel: "They profess to know God but by their deeds they deny Him" (Tit 1: 16).

But what constitutes a religious deed? Answer: a costly signal capable of authenticating religious commitment.

The anthropologist William Irons is the first theorist I know of to describe religious behaviour as a commitment device (Irons 1996). On Iron's view, costly religious expressions are hard-to-fake signals that authenticate commitment to moralistic supernatural agency. For example, among Yomut Turkmen of northern Iran, a version of highly conspicuous Islamic practice infuses life. This is especially true among travelling Yomut whose ostentatious display signals to strangers commitment to a common morality, thus enhancing solidarity and trust (Irons 2001).

Importantly then, religious individuals do pay for invisible police forces. The cost of policing is the price of hard-to-fake religious display. But where these costs are lower than secular policing, the distortions that produce religious cognition, it seems, will be favoured by selection.

Evidence of supernatural security applies to many types of prisoner's dilemma. Irons and his colleagues Lee Cronk and Shannon Steadman found that among the people of Utila (a Bay Island of Honduras), men prefer to marry women who frequently attend church. This preference, however, is not reversed: women are not as interested in expressions of religious piety. Irons and his associates note that men in Honduras spend months away from home in maritime work. Because a woman knows the mother of her children, and a father cannot be certain, husbands should be especially interested in the sexual virtue of their wives. Given Utilan work regimes, the threat posed by infidelity is especially high. Irons concludes that hard-to-fake religious signally is favoured among Utilan women, who are far more religious than Utilan men, because the religious causation secures virtue (Irons 2001).

University of Connecticut anthropologist Richard Sosis has done more than any other researcher to test and develop the costly signalling theory of ritual. In a comparative study of two hundred religious and secular communes in the 19th century, Sosis determined that the religious communities were far more likely to outlast their non-religious counterparts – four times as likely in any given year (Sosis 2000). In a subsequent study, Sosis and Bressler determined that compared to secular communes, religious communes imposed over twice as many costly requirements on their members, and that the number of costly requirements was positively correlated with group lifespan. Interestingly a similar effect did not hold for secular communes, where costly requirements did not correlate with secular commune lifespan (Sosis and Bressler 2003). Adding further support to the costly signalling theory

of ritual, Sosis and Ruffle have shown that religious ritual influences co-operation in contemporary religious kibbutzim. Using common-pool resource games, the authors found that religious males were significantly more altruistic in their play than were religious and secular females, and secular males. The authors discovered no sex differences in co-operation among the secular kibbutz members, eliminating the possibility that there were differences in the ways males and females play the game. Noting that only orthodox men are expected to participate in communal prayer three times a day, the authors conclude that costly ritual participation (rather than any inherent differences between the sexes) accounts for the discrepancy (Sosis and Ruffle 2003).

It may be, of course, that altruists are more inclined to partake of ritual, rather than vice versa. But consider nature's economy. While it is possible to explain costly religious behaviour as accidents, costly signalling theory enables us to view these costs as adaptations. Given the enhancements to individual life that comes through co-operation, it should be unsurprising that selection has outfitted us with dedicated cognitive equipment to secure it. Moreover the success of religious communes over their secular counterparts is evidence for religious altruism as a special form of social glue.

Generalising, it is possible to view aspects of ritual activity described by cognitive psychologists in a different light. One reason rituals exhibiting "flashbulb" effects may be dramatic is that rituals frequently inflict punishment and ordeal to assess commitment. The drama comes from either enduring an ordeal or scrutinizing it. But the theory can explain repetitive religious rituals as well. Only a committed Christian will endure a boring sermon week after week; a ritual to which many atheists would prefer the stimulation of dental surgery. Fasting on Yom Kippur or during Ramadan is an entrance requirement for many Jewish or Islamic communities, here again deprivation proving commitment. Buddhists must sit still for hours and do nothing – pure torture for those not interested in Buddhist liberation. These rituals screen by imposing sensory deficits and extreme opportunity costs on those who partake of them.

It is important to be precise about how subjecting ritual goers to specific traumas and ordeals actually tests the presence and strength of altruistic commitments. Such costs assess devotion by rendering expected utilities explicit in ways directly related to supernatural belief. Ritual trials need to be arranged so that only those actually committed to the relevant gods would be willing to subject themselves to the trials.

Consider Bruce the believer deciding whether to partake in the strenuous or tedious rituals of his religion. The costs of participating in a ritual times their frequency must be discounted by the conditional probability that the gods will bring about some better outcome outweighing the costs. If Bruce

genuinely accords a high probability to future supernatural reward then Bruce perceives that:

The cost of ritual participation × frequency < conditional probability of value from pleasing gods.

Now consider Sally the defecting atheist. Sally would like to receive the spoils of defection from social exchange, but must discount those benefits from the costs of ritual participation multiplied by their frequency. Sally expects zero future returns to make up for these costs. Rather she anticipates only more ritual pain or drudgery. Beyond this expense, there is the real possibility that Sally will be caught out as defector – given this is her plan – and hence the requirement to factor in additional risk. It is easy to see that how the expected utility from costly ritual action may well exceed the likelihood of any advantage from cheating the devout.

Sally finds religious ritual hard because she perceives:

Conditional probability of value from cheating the devout < costs of ritual participation × frequency

Notice that ritual costs are not arbitrary. For ritual to be an effective test, it must accurately measure religious commitment. It must reliably reflect a commitment to a system of supernatural causation capable of altering outcomes favourable to those who believe in it (and so act altruistically towards others similarly committed.) The logic is simple: if Sally doesn't believe the gods will repay her ritual sacrifice, then it is unlikely she will believe they will repay her altruistic sacrifice. Whatever Sally may *say* about her conviction, rituals assess whether she is willing to put her money where her mouth is [for discussion see (Sosis 2003; Sosis and Alcorta 2003; Bulbulia 2004).]

Of course, defectors can still invade, where the payoffs from defection are extremely high. In such cases, the expectation if for ritual costs and frequency to move upward [see discussion of (Chen 2004) below]. Importantly, beyond the actual expense and opportunity cost of participating in religious ritual, religious rituals are structured to prompt public displays of god centred *emotions*. Emotions are notoriously hard to fake (Ekman 1975; Frank 1988; Ramachandran and Blakeslee 1998). Most of us cannot convincingly produce on demand an expression of love and devotion to say Zeus, or some other god we don't believe exists. Rituals that elicit god-centred emotions in public can serve to hold such religious commitment open to public scrutiny, insulating religious groups from defectors.

Sosis theorizes that ritual performance actually impacts belief (Sosis 2003). On his view, repeated ritual performance lowers the perceived costs of ritual action (or increase the perceived benefits) by generating conviction in

the supernatural outlook that imbues ritual with meaning. Thus ritual not only serves as a forum for signalling godly commitments, it inculcates religion by generating affirming religious experiences. Sosis and Alcorta hypothesize that religious ritual alters affective centres in the brain, educating the mind to feel religious wonder and passion toward the relevant religious symbols and mythology of a group (Sosis and Alcorta in preparation), a view echoing sociologist Emile Durkheim's work theory of "collective effervescence" a century ago (Durkheim 1964 [1915]).

The model makes some surprising predictions. In cases of extreme hardship, where common-pool resource problems abound and the threats of defection are high, the expectation is for the cost outlays to intensify and to become more frequent. When the chips are down the religious will produce *more* effort and expend *more* resources proving their faith. Interestingly Daniel Chen, a graduate student in economics at MIT has shown that during the Indonesian financial crisis of 1996–1997, Muslim participation in religious rituals became both more frequent and more intense (Chen 2004) see also (Johnson 2003). Given lower resource availability, both the benefits of social exchange and the threats posed to it by defection would have increased, thereby increasing the threshold standards for discriminatory religious signalling. This is only one case, and it will be interesting to see whether this prediction of costly signalling theory generalises.

Religion and group selection

It may be that the exchange-based understanding of religion is founded on too narrow a conception of reciprocity. Selection produces design through the differential success of replicating entities. Implicit in the adaptationist approaches I have been considering is the idea that selection operates on gene lineages through the differential reproductive success of religious individuals (that is, their ephemeral phenotypes) who propagate them. But selection may act at any replicating entity, given certain constraints (Sterelny 2000). David Sloan Wilson has recently argued that the religious groups may function as adaptive units (Wilson 2002). The benefits uniquely available to social species do not just flow directly from the mutual aid-giving of co-operating individuals, but through highly indirect channels opened through group-level structures, which those engagements create and maintain. Where resources can only be acquired through the integrated action of several individuals, the functional organization of groups relative to competing groups may generate adaptive features at the group level [See also (Hardin 1995)]. For Wilson, the best explanation for religious thought and behaviour is that it facilitates strongly integrated and functionally adaptive groups [for evidence

see (Wuthnow 1994)]. Functionally adaptive groups purdure through time by adapting themselves to variable local circumstances. This may go some way to explaining why the Christianity of Canada is relatively benign when compared to the more violent strains of Christianity in Northern Ireland or the Balkans. In the latter cases, limited resources lead to severe group competition. To access these resources, individuals must sink their individuality in the identity of a group whose fate they share, one for all. David Wilson suggests that religious cognition in particular has been selected because, "Supernatural agents and events that never happened can provide blue-prints for action that far surpass factual accounts of the natural world in clarity and motivating power." (p. 42)

From the analysis of supernatural causation above we can see how this works. The gods punish and reward in ways that defy imperfect natural justice, and so bolster morality more thoroughly than secular alternatives. In extreme conditions of inter-group competition, it may be that psychological mechanisms are favoured that (i) track distinctively group affirming religious information and (ii) integrate this information with social behaviour.

Sosis argues that if religion emerged to promote group well-being then there would be little need for doctrines stressing human frailty (Sosis 2003). We'd all be good religious citizens, naturally. Over time, group selected moralities would tend to weed out psychological tendencies to religious thought and practice. We wouldn't need supernatural police forces if our natural inclinations were to help each other. Strong group instincts similar to parental love could facilitate reciprocity without the resource wastes of religious practice. But Wilson is careful to point out that groups are subject to internal competition among members. Group level adaptations may include internal checks and balances to these contests. In fact, from the vantage point of group selection theory, ritual signalling could be a group level adaptation that enables functionally co-ordinated units to emerge in situations where individual optimizers face prisoner's dilemmas. Groups that better facilitate these dilemmas compete better against groups at war with themselves. Moreover that costly signalling makes the join-defect-leave strategy less appealing accords well with the idea that religion is group level adaptation: groups that pray together stay together, and so flourish against other groups.

One avenue to testing Wilson's theory would be to study the forms of altruism that develop in religious groups. Forms of apparent non-reciprocal altruism – practices of Christian agape (universal love), Hindu and Buddhist non-violence and vegetarianism, Muslim and Jewish charities, and other forms of sacrifice may prove to be group supporting activities rather than mere Zahavian signals of religious commitment. The trick is to isolate signalling variables from group-sacrifice variables and see whether extreme

pro-social sacrifice can be generated where there is no chance it will be detected. Missionary practices in which entire families risk life and limb to spread a faith may prove a fertile source for empirical testing. It would be interesting to see whether missionaries sacrifice when the probable inclusive benefits are extremely low. If religious altruism doesn't fit a model of inclusive fitness maximization, then costly signalling and reciprocity may be inadequate to explain all the varieties of religious sacrifice.

The group selection theory of religion faces some difficult conceptual problems. For example, the theory requires an empirically adequate definition of a religious group. Consider two Presbyterian churches that view themselves as members of a single overarching religious sect. Imagine they compete with each other for members and funds. Is this one group or two (or both)? At any rate, it is probably unhelpful to think of religious groups as mere collections of individuals. To think so obscures the ways in which the physical, legal, and theological products of collective activity endure over time. Clearly these environmental legacies influence the fitness of those (individuals and/or groups of individuals) who inherit them. Of course, ambiguity over the unit of selection is a problem that faces any group selectionist theory, not merely those crafted to explain religion.

Beyond coming to definitional grips with "religious group," it seems to me that the exact psychological pathways that lead individuals to generate group level adaptations need to be articulated with some clarity. Whether the idea that selection can produce group level adaptations is capable of generating robust understandings of intricate psychological architecture needs to be demonstrated, not assumed. In his book, Wilson admirably describes numerous features of certain religious groups that promote their survival, but how individual psychological design reliably generates these group level patterns remains somewhat obscure. I think Wilson would acknowledge this, and argue for the urgency of more empirical work, for example along the lines of Sosis's excellent kibbutzim studies.

The correct approach: Darwin's or Darwinian?

Consider how Wilson's group-selectionist argument can be taken in spandrelist directions. Earlier I played up religion's generality. But it seems not everyone is committed to supernatural causation. I take as evidence myself. In some places, like Western Europe, Scandinavia, New Zealand and Australia, explicit religious commitments are rapidly declining. And clearly not all group competition falls along religious lines. Often ethnicity, sex, or political affiliation provides the relevant ties that bind groups. Further many people require no God to back morality. They feel justice is its own reward. Impor-

tantly, this is so with many religious persons. Baston et al. have shown that "quest oriented" religious persons view faith as a method for personal or social transformation, and are generally more tolerant and pro-social than the "extrinsically" religious, who act with the expectation of supernatural profits (Batson and Schoenrade et al. 1993).[9] If Wilson is correct, and we assume variable resource distributions over our evolutionary history, then it would be unsurprising if group-markers proved to be flexible: religious when religion binds – ethnic, sexist, nationalistic, democratic or otherwise secular when these ties secure more powerful and effective alliances. The strategy "one-for-all" clearly does not always reduce to "all-for-god(s)." Given the prominence of secular communal organisation, it seems difficult to rule out the hypothesis that religion is a spandrel of a more basic group-oriented sociability, as Atran argues. [Though we would need some account for the success of religious communes over secular alternatives observed in (Sosis 2000).]

Critical to the spandrel/adaptationist debate is how individuals, especially children come to acquire their religions. If religion were part of genetic endowment, we would expect certain features to spring from internal architecture, perhaps according to developmental schedules, in ways that generalize across cultures. Recently there has been increasing experimental attention devoted to the religiosity of children, though gaps in our understanding of childhood religion remain large.

Barrett et al. have argued that children before the age of five reason easily about god-like beings, before they have developed robust folk psychological powers (Barrett and Richert 2003). The authors presented children between the ages of 3–8 with nonhuman agent puppets: a kitty cat, a monkey, and a little girl named "Maggie." Children were told that of these puppets, the kitty cat has a special power for seeing things in the dark. Children were then shown a darkened box and asked to report what they saw inside. All children reported they could see nothing. After, illumination of the box revealed it to contain a red block. The children were then asked what each of the puppets would see if they were to look inside the darkened box. Preschoolers reported that Maggie would be able to see the contents of the box. At age 5, children reasoned correctly that Maggie as well as the monkey would not be able to see the block. Older children however reasoned that only the kitty cat could see the block. This is consistent with developmental studies suggesting that recursive mental state attributions (X doesn't know that Y knows that P) do not appear until after pre-school. However, children *at all ages* reported that God would see the block. This supports the idea that children do not reason about God as just another person but rather as a different type of agent with nonhuman properties. On the author's view "children may be better prepared to conceptualize the properties of God than for understanding

humans" (p. 60). Importantly, the authors do not ascribe adaptive significance to this developmental feature: gods are easier to conceptualize because god-concepts require less computational power than ordinary agent concepts do (like ascriptions of false belief.) Nevertheless, it is startling that the first agent concepts children apparently acquire are of gods, which they then apply to persons, whom they endow with familiar god-like powers such as omniscience and omnipotence. Knight et al. have come to similar conclusions in a cross-cultural study (Knight and Sousa et al. forthcoming).

These experiments suggest that very early in cognitive development, children easy grasp with rich inferential understandings the meaning of supernatural agent concepts. But there may be far more to the developmental story. Deb Kelemen has recently argued that beyond mere facility with supernatural agent concepts, children are "intuitive theists" who explain much of their world through supernatural concepts (Kelemen in press). Kelemen points to converging bodies of research suggesting children are biased to reason about the natural world in terms of intentions and purpose, as well as to view natural phenomena as intentionally created by non-human agents. With respect to promiscuous teleological intuitions, when prompted to respond to the question "what is this for?" American 4–5 year olds find the question appropriate not only to body parts and artefacts, but also to living things like lions ("to go in the zoo") and non-biological natural kinds like clouds ("for raining"). Moreover when asked whether raining is what a cloud "does" or what it is "made for," pre-schoolers favour explanations that natural entities are "made for something" and that is their reason for being here (Kelemen 1999). Kelemen has shown that rampant teleology endures well into elementary school, especially with respect to object properties, with the teleological biases only beginning to moderate at age 9–10. When asked to perform a "science" task and decide whether ancient rocks were pointy because "bits of stuff piled up for a long period of time" (i.e. a physical process) children preferred "self-survival" functions like "so that animals wouldn't sit on them and smash them" and "artefact" functions like "so that animals could scratch on them when they got itchy" (Kelemen 1999). This bias to favour teleological explanation for non-living as well as living natural object properties persists even when children are told that adults employ physical explanations, a pattern also observed in British children (Kelemen 2003). Given that parents actually prefer non-teleological explanations, the child's promiscuous teleology remains difficult to explicate in terms of social acquisition.

It appears moreover that children view non-artefact items and events of the world as caused by supernatural agents. With respect to childhood explanatory biases for nature's origins, Evans found that regardless of the religiosity in their homes, children exhibit a bias for intentional accounts (Evans 2000;

Evans 2001). For example when asked: "how do you think the very first sun-bear got here on earth?" 8–10 year olds from both fundamentalist and non-fundamentalist American homes favour creationist accounts, namely that "god made it" over other teleological accounts "a person made it" or non-teleological accounts, "it just happened." 5–7 year olds exhibit the same explanatory bias for both animate and inanimate objects. It is only among 11–13 year old non-fundamentalist children that patterns of divergence emerge. Gelman and Kremer have found that children prefer to explain the existence of remote natural items (like oceans) as made by God (Gelman and Kremer 1991). A similar result has been observed among British children (Petrovich 1997). It appears that while children identify people as the designing agents of artefacts, they distinguish god as the designing agent of nature (Kelemen and DiYanni 2002). Additionally, Bering has shown that over the age of 5, though critically not before, children explain random events in nature as caused by invisible agents (Bering in press). This result is especially interesting because it shows that recursive theory of mind abilities actually enhance the domain of supernatural explanation.

Though in its infancy (so to speak), the developmental literature suggests that children's pervasive teleological ideas about things and events of the world are closely linked to their endorsements of intentional design by a supernatural agency – leading them to distinguish supernatural beings as the designing agents of nature. Moreover current evidence suggests the systems that generate these beliefs emerge without any specific or robust cultural input (Kelemen in press). It may well be that a child's default theory of the world includes an "intuitive theism." Speculating further, it may be as with language, that children are endowed with all possible religions, acquiring their religious idiolect largely by forgetting [for discussion see (Bulbulia in preparation).] If so then perhaps the Clausanity of children at Christmas is best explained as just such a proto-religion.

Reverse engineering religion beyond intuitive theism, we'd expect the developmental pattern to generate specifically moralizing gods by the age that hunter-gatherer children begin to exchange with non-relatives, roughly mid-adolescence. In a startling experiment, Bering has shown that children before the age of three use supernatural concepts to orient moral behaviour – this pattern emerging long before they acquire robust folk psychological capacities, let alone transact with strangers (Bering in press). In a series of experiments, Bering primed very young children with a supernatural agent concept, "Princess Alice," who is described as invisible, present, and who "really likes good boys and girls – I bet she really like you!" The children are then led to a game in which they are asked to guess the contents of a box, for which correct answers are rewarded. Before starting the game the

experimenter says she must leave the room, and instructs the child to stay in the room until she returns, "but don't worry, you won't be alone, because Princess Alice will be in the room with you." A second experimenter, watching the child from another room, flashes a light on and off if the child attempts to "cheat" by removing the box lid. The child is then observed to see whether she will continue "cheating." Bering writes, "preliminary evidence suggests that even 2.5 year-olds display the inhibitive response after encountering the unexpected event in the midst of their cheating. Even these youngest children act as if they have been 'caught red-handed'. ... Some of these children display behavioural signs of dejection and fear. Moreover many children respond on the unexpected event as soon as the experimenter returns to the room. To quote one very excited [girl] *'Princess Alice is real!'* " (Bering in press). Bering takes these experiments as initial evidence that a child's intuitive theism has a moral component.

So does intuitive theism, particularly if it is susceptible to moralizing varieties, seal the adaptationist case? Not yet. It may be that the child's predilection for intentional explanation emerges from cognitive features dedicated to explaining human agency, which in their undeveloped form prefer simpler supernatural agent concepts, as Barrett suggests (though this would leave unexplained the retention of intuitive theism to late childhood). Moralistic notions may come on-line early because moral restraint is important to survival, and acute morality + simple agent concepts = young children's moralizing religion. It cannot be ruled out that the moralized religion of adolescents and adults is disassociated from these early developmental processes, resulting for example from the sort of informational cuing Atran postulates. That is, it may be that information relevant to solidarity and exchange is sometimes religious information. If so then there is no need for dedicated religious features to explain its uptake and use.

I have been assuming that religion polices morality, but is this case? There is some preliminary evidence suggesting that the moral causation critical to adaptationist theories of religion may have appeared only recently. Roes and Raymond have shown that moralizing gods are favoured in larger differentiated groups where religious elites draw disproportionately large slices of the resource pie (Roes and Raymond 2003). In larger groups as total resource pies grow proportionally larger through enhanced efficiencies, lower castes can still benefit even as fat casts on top grow fatter. In less stratified hunter-gather communities the case is different. While a class of religious elites, shamans, are commonplace, these religious experts do not seem to draw greater resources. In fact some of the most egalitarian societies we know of are hunter-gatherer. Interestingly, the gods don't seem to matter as much in them. It may be that moralistic religions only surface as societies became

more differentiated. An echelon of religious elites use the moral absolutisms of religion to promote both pie and personal-slice growing agendas [though see (Cronk 1994)]. If this story proves roughly correct, then the developments that brought moralizing religion into the world would have occurred too late in our evolutionary history for human psychological architecture to be substantially effected. Instead the best explanation for such tendencies may simply be that individuals target information that builds functionally adaptive groups. We get moralizing religion where strong socially differentiated groups are more likely to prevail over rival groups. If so, then no special purpose mechanisms for religion needs to be postulated. Moralizing religion, like the wheel or farming, may be a cultural invention, independently discovered in multiple places because the moralizing religious concepts help us (individuals or groups of individuals, depending on your evolutionary story) to flourish.

However, in my view, the evidence against moralising religion relies heavily on how anthropologists describe specific cases. Consider the !Kung! people of the Kalahari Desert. Their creator god is envisioned as a stupid and lazy sky being with long hair and a horse, who takes little interest in human affairs (Katz 1984). In !Kung! culture, the dominant supernatural power is a healing energy called "num." Ritual life centres on healing dances that occur several times a month. In these dances, the community gathers in all-night festivals, in which !Kung! healers lay their hands on sick persons healing them with num and releasing these salubrious energies to all present (Katz 1997). It is not obvious that these rituals support a conception of reality in which the righteous are rewarded and defectors are punished. Nevertheless, the rituals provide ample scope for enhanced solidarity. The close physical proximity of participants, the touching and stroking, the intense focus on those who are unwell, the holding of each other through dance, strike me as clear hard-to-fake demonstrations of social commitment. Here we find social grooming writ large. Moreover to challenge the num-centred conception of reality would be to undermine the sacred underpinning of !Kung! social life. Rather than conceiving of !Kung! religion as non-moralizing, it may be more accurate to expand the conception of supernatural enforcement at the centre of solidarity theories to embrace the multifarious ways in which num-centred illusions (and other apparently non-moral religious understandings more generally) bind individuals together. There may be multiple forms of supernatural glue, apart from clearly moralistic gods who wield heavens and hells. At any rate, it seems to me that spandrelists need to take care in their selection of counter-examples to moralizing religion.

Let me lay my cards on the table. I am an adaptationist. In my view, the strongest evidence for adaptive account of religion comes from the precise

way in which religious distortions mediate a believer's relationship to the world and to other people. We should not forget that the self-deception involved in religious cognition operates on a massive scale: for innumerably many people, powerful and dramatic religious understandings and dramas are thickly draped over an impoverished secular reality. For religion to happen at all, there must be an active distorting and biasing of experience strong enough to erect cathedrals and to bring people to their knees. Notice that these tremendous deceptions, though motivating and normative in various ways, are nevertheless encapsulated to prevent people from seriously harming themselves: generally, the Cartesian certainty of religious conviction does not leave the exigencies of life up to gods. The faithful believe the gods will provide, but still till fields, provide for children, arm themselves against attack, and seek medicine when ill. Actually committing to supernatural causation without constraint is a recipe for disaster. But in fact religious cognition mainly enhances health [for example see (Ellison 1991; Hummer and Rogers et al. 1999; McClenon 2002; Sosis and Alcorta 2003), though see (Livingston 2002)]. Looking at religion from the vantage point of our alien naturalist, it strikes me that this functionality combined with the overarching concinnity of the system that produces religious thought, its modularity and adaptation of parts to whole, is best explained as the target of natural selection. Again, Irons and Sosis have shown us that even the harms that religion brings are not inefficiencies when viewed as signals authenticating religious commitment. And David Wilson has taught us that even beyond religious signalling, religious illusions may support pure sacrifice and organisational commitments to group welfare, where individual fates are anchored to collective futures.

In my view, a broader understanding of supernatural causation able to capture Atran's insights into the place of religion outside of social exchange (as a provider of hope and solace, and an impetus to heath) will need to be developed to make sense of full spectrum of religious conviction and practice on the ground. Very basically, if believing in supernatural causation helps us to recover from illness or meet the terrors of life, then tendencies to fall into such deceptions will be conserved and more intricately articulated (McClenon 1997; Bulbulia 2003; Sosis and Alcorta 2003). If so, the relationship between "moralizing supernatural belief" and "existential supernatural belief" may prove interesting. An optimal psychological design would shift between conceptions of just gods and conceptions of loving gods (and other conceptions) to suit circumstances. In some instances obliging Barney may think a *vengeful god* will punish him for cheating Fred. This distortion secures co-operation, where accuracy would favour defection. In other instances, defecting Barney may seek a *loving god's* assistance to free him from a

punishing Fred's torture chamber. This distortion sustains courage and hope, where accuracy would warrant despondency. On average the optimism that supernatural illusions warrant may prove helpful to individuals like Barney whose actual prospects are dim.

Speculating about optimal design raises a critical issue. In my view, the main (and maybe the only) reason the spandrel/adaptationist debate should be interesting to naturalists is methodological. If religion is a product of natural selection, then reverse engineering techniques may help unravel features of its internal architecture. Time and again biases and distortions have yielded their secrets to functionalist reasoning (Trivers 2001). If adaptationists are correct, then we can use ideal designs to formulate testable hypotheses about information flow and behavioural outputs. We can then work to discern and unravel intricacies in the systems that regulate supernatural thought. It may even turn out, surprisingly, that the apparent demise of religion in some places is illusory. Perhaps secular conceptions of reality are nevertheless informed by quasi-supernatural understandings, artefacts of our ancestral way of coming to grips with the world and each other. Bering observes that even atheists are prone to supernatural commitments, "even the atheist's God seems to bite through its muzzle from time to time" (Bering in press) see also (McCauley 2000). Or it may be that distinctively supernatural understandings can be genuinely suppressed in secular communities – as seems to happen with racists, sexists, and homophobic biases. Clearly there remain a lot of maybes surrounding the naturalistic study of religion.

To sum up, the past ten years have witnessed a renaissance in the psychology of religion. We have learned a great deal about how supernatural thought develops and spreads, and how it mediates social relationships. But much remains obscure, and the hard work lies ahead of us.

Acknowledgements

Notes

[1] A variety of definitions of "religion" and "religious cognition" circulate in the naturalistic study of religion. Loose conceptions, for example counting just about anything that involves ritual and non-mechanical causal beliefs create a pseudo-universal of "religion" similar to "human practice" and "imagination" inquiry into which demands the kind of theory-of-everything that science cannot supply [for a related stance see Boyer, P. (2001). *Religion*

Explained: the evolutionary origins of religious thought. New York, Basic Books. I am interested in motivating beliefs and practice relative to supernatural agents and powers. Departing somewhat from ordinary language, I call these supernatural agents and powers "gods."

[2] For the most part I will not discuss developments in the social psychology of religion, a more descriptive than explanatory field (though clearly these descriptions provide evidence for those interested in explanation). There is a large literature inspired by the writings of Freud, Jung, and more recent European philosophers, which I will ignore, because they do not hold themselves accountable to standards of naturalistic inquiry. I do not consider meme theoretic accounts according to which religion is explained in virtue of the adaptive properties of religious ideas in accommodating themselves to human minds, which support them. Here religion is an adaptation, but not our adaptation. I ignore this approach because it has yet to inspire any experimentally fruitful psychological research programme.

[3] Guthrie started out as an anthropologist of Japanese culture. Japan's indigenous religious tradition, Shinto, holds that the world is brimming with "kami." These are god-like nature deities who infuse nature. Many contemporary Japanese, while claiming not to be religious, still believe in and pay tribute to the kami. And new religious movements largely based on kami-like animisms proliferate at an extremely high rate. In Japan, the bullet train, camera cell phone, and pocket-sized supercomputer co-exist with a thoroughly deified conception of nature: see Reader, I. and G. J. J. Tanabe (1998). *Practically Religious: Worldly Benefits and the Common Religion of Japan*. Honolulu, University of Hawaii Press.

[4] Here Boyer's work echoes David Hume's theory of religion. In the essay "On Miracles," Hume credits our "passion for surprise and wonder" (p. 71) and "inclination to the marvellous" (p. 73) for the popularity of supernatural stories – what Hume calls "pious frauds" (p. 83). Hume thought we believe in miracles precisely *because* they are outlandish. Boyer seeks to bring to Hume's observation the precision of 21st century cognitive psychology, to elaborate the cognitive apparatus that leave us susceptible to religious wonder.

[5] Boyer observes the gods are not imagined as knowing the contents of your refrigerator or the correct way to change motor oil, though these inference follow from their imagined powers Boyer, P. (2001). *Religion Explained: the evolutionary origins of religious thought*. New York, Basic Books.

[6] Clearly this and otherworldly desires are in part influenced by culture and a more detailed account of religion would need to take account of how particular reward/punishments schemes become desirable. For example many of us would prefer a life of karma to the annihilation of nirvana.

[7] For simplicity, I ignore redundant cheater detector and punishment systems.

[8] For simplicity, I ignore what Skyrms calls "viscous communities" of related exchange partners Skyrms, B. (1996). *Evolution of the social contract*. New York, Cambridge University Press. In such communities co-operation evolves more easily than in communities of largely unrelated exchange partners.

[9] Though it may be that "extrinsically religious" define their groups more narrowly – morality is always the morality of a group "our people" – with indifference or moralistic aggression to those outside, depending on resource distributions and scarcities. See Hartung, J. (1996). "Love They Neighbor: The Evolution of In-Group Morality." *Skeptic* **3**(4): 86–99.

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