RELIGION’S EVOLUTIONARY LANDSCAPE:
COUNTERINTUITION, COMMITMENT, COMPASSION, COMMUNION

Scott Atran,
CNRS – Institut Jean Nicod and
ISR – University of Michigan

and

Ara Norenzayan
University of British Columbia
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Short Abstract

Religion is not an evolutionary adaptation, but a recurring by-product of the complex evolutionary landscape that sets cognitive, emotional and material conditions for ordinary human interactions. The conceptual foundations of religion are intuitively given by task-specific panhuman cognitive domains, including folkmechanics, folkbiology, folkpsychology. Core religious beliefs minimally violate ordinary intuitions about the world and its inescapable problems. This enables people to imagine minimally impossible supernatural worlds that solve existential problems, including death and deception. Because religious beliefs cannot be deductively or inductively validated, validation occurs only by ritually addressing the very emotions motivating religion. Cross-cultural experimental evidence encourages these claims.

Abstract

Religion is not an evolutionary adaptation per se, but a recurring by-product of the complex evolutionary landscape that sets cognitive, emotional and material conditions for ordinary human interactions. Religion involves extraordinary use of ordinary cognitive processes to passionately display costly devotion to counterintuitive worlds governed by supernatural agents. The conceptual foundations of religion are intuitively given by task-specific panhuman cognitive domains, including folkmechanics, folkbiology, folkpsychology. Core religious beliefs minimally violate ordinary notions about how the world is, with all of its inescapable problems, thus enabling people to imagine minimally impossible supernatural worlds that solve existential problems, including death and deception. Here the focus is on folkpsychology and agency. A key feature of the supernatural agent concepts common to all religions is the triggering of an "Innate Releasing Mechanism," or "agency detector," whose proper (naturally-selected) domain encompasses animate objects relevant to hominid survival - such as predators, protectors and prey - but which actually extends to moving dots on computer screens, voices in wind, faces on clouds. Folkpsychology also crucially involves metarepresentation, which makes deception possible and threatens any social order; however, these same metacognitive capacities provide the hope and promise of open-ended solutions through representations of counterfactual supernatural worlds that cannot be logically or empirically verified or falsified. Because religious beliefs cannot be deductively or inductively validated, validation occurs only by ritually addressing the very emotions motivating religion. Cross-cultural experimental evidence encourages these claims.
1. Introduction

In every society,\footnote{1} there is:

1. widespread counterfactual and counterintuitive belief in supernatural agents (gods, ghosts, goblins, etc.);

2. hard-to-fake public expressions of costly material commitments to supernatural agents, that is, offering and sacrifice (offerings of goods, property, time, life);

3. mastering by supernatural agents of people’s existential anxieties (death, deception, disease, catastrophe, pain, loneliness, injustice, want, loss); and

4. ritualized, rhythmic sensory coordination of (1), (2) and (3), that is, communion (congregation, intimate fellowship, etc.).

In all societies there is an evolutionary canalization and convergence of (1), (2), (3) and (4) that tends towards what we shall refer to as “religion”; that is, passionate communal displays of costly commitments to counterintuitive worlds governed by supernatural agents.

This theoretical framework drives our program of research.\footnote{2} The aim is to foster scientific dialogue between cultural anthropology, cognitive, developmental, and social psychology, and evolutionary biology regarding a set of phenomena vital to most human life and all societies. The present article mainly concerns the first (1) and third (3) criteria of religion. This introductory section first presents in general terms the overall intellectual framework that interrelates all four criteria, discusses some obvious objections to these generalizations, and offers some caveats.

The criterion (2) of costly commitment rules out cognitive theories of religion as sufficient, however insightful they are. Cognitive theories attempt to explain religious belief and practice as cultural manipulations of ordinary psychological processes of categorization, reasoning and remembering (Lawson & McCauley 1990, Atran & Sperber 1991, Boyer 1994, Barrett 2000). They do not account for the emotional involvement that lead people to sacrifice to others what is dear to themselves, including labor, limb and life. Such theories lack motive. In principle, they are unable to distinguish Mickey Mouse from Moses, cartoon fantasy from religious belief (Atran 1998:602; cf. Boyer 2000, Pyysiäinen 2001; Norenzayan & Atran, in press). They fail to tell us why, in general, the greater the sacrifice – as in Abraham offering up his beloved son - the more others trust in one’s religious commitment (Kierkegaard 1955[1843]).

The criterion (1) of belief in the supernatural rules out commitment theories of religion as sufficient, however insightful they are. Such theories underplay or disregard cognitive structure and its causal role. Commitment theories attempt to explain the apparent altruism and emotional sacrifice of immediate self interest accompanying religion in terms of long-term benefits to the individual (Alexander 1987, Irons 1996, Nesse 1999) or group (Boehm 1999, Wilson 2002) - benefits that supposedly contribute to genetic fitness or cultural survival. They do not account for the cognitive peculiarity of culturally universal belief in beings who are imperceptible in principle, and who change the world via causes that are materially and logically inscrutable in principle. They cannot distinguish Marxism from Monotheism, secular ideologies from religious belief (Atran 2002a).
Religions invoke supernatural agents (Tylor 1958[1871], Horton 1967) to deal with (3) emotionally eruptive existential anxieties (Malinowski 1961[1922]), such as death and deception (Becker 1973, Feuerbach 1972[1843], Freud 1990[1913]). Nearly all religions, it appears, have “awe-inspiring, extraordinary manifestations of reality” (Lowie1924:xvi). They generally have malevolent and predatory deities as well as more benevolent and protective ones. Supernatural agent concepts trigger our naturally-selected agency-detection system, which is trip-wired to respond to fragmentary information, inciting perception of figures lurking in shadows, and emotions of dread or awe (Guthrie 1993; cf. Hume 1956[1757]). Granted, nondeistic “theologies”, such as Buddhism and Taoism, doctrinally eschew the supernatural, or at least animistic spirits. Yet, common folk who espouse these faiths routinely entertain belief in an array of gods and spirits. Even Buddhist monks ritually ward off malevolent deities by invoking benevolent ones, and conceive altered states of nature as awesome.

Conceptions of the supernatural invariably involve the interruption or violation of universal cognitive principles that govern everyday human perception and understanding of the everyday world. Consequently, religious beliefs and experiences cannot be reliably validated (or disconfirmed as false) through consistent logical deduction or consistent empirical induction. Validation occurs only by (4) collectively satisfying the emotions that motivate religion in the first place. Through a “collective effervescence” (Durkheim 1995[1912]), communal rituals rhythmically coordinate emotional validation of, and commitment to, moral truths in worlds governed by supernatural agents. Rituals involve sequential, socially interactive movement and gesture and formulaic utterances that synchronize affective states among group members in displays of cooperative commitment. Through the sensory pageantry of movement, sound, smell, touch and sight, religious rituals affectively coordinate actors’ minds and bodies into convergent expressions of public sentiment (Turner 1969) – a sort of N-person bonding that communicates moral consensus as sacred, transcending all reason and doubt (Rappaport 1999).

These four conditions do not constitute the necessary and sufficient features of “religion.” Rather, they comprise a stipulative (working) framework that delimits a causally interconnected set of pancultural phenomena that comprises the object of our study. One may choose to call phenomena that fall under this set of conditions “religion” or not; however, for our purposes their joint satisfaction is what we mean by the term. Nevertheless, we offer this working framework as an adequate conceptualization that roughly corresponds to what most scholars consider religion. Furthermore, this framework is concerned with the pancultural foundations of religion; accordingly, our conceptualization is broad in scope. We recognize that religions are inevitably manifested in culturally diverse ways. Our proposal offers candidates for the psychological building blocks of religion, which then are culturally exploited in distinct but converging paths.

More critical are the many ethnographic reports interpreting that some people or some societies make no hard and fast distinction (1) between the natural and supernatural, or (2) between costly sacrifice and indirect reciprocity in the social redistribution of material or social rewards; or that (3) religions are as anxiety-activating as anxiety-assuaging, or (4) sometimes devoid of emotional ritual. We address each of these objections next.

1.1. The Natural versus the Supernatural

We base our argument regarding the cognitive basis of religion on an ever growing number of converging cross-cultural experiments on “domain-specific cognition” emanating from
developmental psychology and cognitive psychology and anthropology. Such experiments indicate that virtually all (non brain-damaged) human minds are endowed with core cognitive faculties for understanding the everyday world of readily perceptible substances and events (for overviews, see Hirschfeld & Gelman 1994, Sperber et al. 1995, Pinker 1997). The core faculties are activated by stimuli that fall into a few intuitive knowledge domains, including: folkmechanics (object boundaries and movements), folkbiology (biological species configurations and relationships), and folkpsychology (interactive agents and goal-directed behavior). Sometimes operation of the structural principles that govern the ordinary and “automatic” cognitive construction of these core domains are pointedly interrupted or violated, as in poetry and religion. In these instances, counterintuitions result that form the basis for construction of special sorts of counterfactual worlds, including the supernatural. For example, a world that includes self-propelled, perceiving or thinking mineral substances (e.g., Maya sastun, Arab tilsam [talisman]) or beings that can pass through solid objects (angels, ghosts) (cf. Atran & Sperber 1991, Boyer 1994).

These core faculties generate many of the universal cognitions that allow cross-cultural communication and make anthropology possible at all. For example, even neonates assume a naturally occurring rigid body cannot occupy the same space as another (unlike shadows), or follow discontinuous trajectories when moving through space (unlike fires), or change direction under its own self-propelling initiative (unlike animals), or causally effect the behavior of another object without physical contact (unlike people) (Spelke et al. 1995). When experimental conditions simulate violation of these universal assumptions, as in a magic trick, neonates show marked surprise (longer gaze, intense thumb sucking, etc.). Children initially expect shadows to behave like ordinary objects, and even adults remain uncertain as to how shadows move. This uncertainty often evokes the supernatural.

All known societies appear to partition local biodiversity into mutually exclusive species-like groupings (Darwin 1859, Diamond 1966, Atran 1990, Berlin 1992), and to initially identify nonhuman organisms according to these groupings rather than as individuals (unlike the immediate local identification of individual human faces and behaviors, Atran 1998; cf. Hirschfeld 1996). Individualized pets and taxonomic dualizers, such as monsters, become socially relevant and evocative because they are purposely divorced from the default state of “automatic” human cognition about the limited varieties of the readily perceptible world, that is, “intuitive ontology” (Atran 1989, Boyer 1997; cf. Sperber 1975). This commonsense ontology is arguably generated by task-specific “habits of mind” that evolved selectively to deal with ancestrally recurrent “habits of the world” that were especially relevant to hominid (and in some cases, pre-hominid) survival: inanimate substances, organic species, persons.

What testable evidence there is indicates that, sometime after age three and except for severe autistics, most any person understands that most any other person can entertain perceptions, beliefs and desires different from one’s own, and that these different mental states differentially cause people’s behaviors (Wimmer & Perner 1983, Avis & Harris 1991, Baron-Cohen 1995, Knight et al. 2001). There, are to be sure, numerous anecdotal interpretations of this or that cultural behavior as indicating an inability to distinguish between true and false beliefs, or reality from desire (cf. Lévy-Bruhl 1966[1923], Lilliard 1998). But anecdotes aside, experimental evidence suggests that children growing up in very different cultures, soon develop similar understanding of human behavior as a function of beliefs and desires (Avis & Harris, 1991; Flavell, et al 1983). Furthermore, there is no generally accepted body of evidence indicating that our simian cousins can simultaneously keep in mind the thoughts of others, or, equivalently,
entertain multiple possible and different worlds from which to select an appropriate course of action (Premack & Woodruff 1978, Hauser 2000; cf. Hare et al. 2001 for intriguing experiments suggesting rudimentary perspective taking in chimps). Without the ability to entertain multiple possible worlds, belief in the supernatural is inconceivable.

Within the emerging work on domain specificity there are controversies and doubts, as in any young and dynamic science. But the findings sketched above are widely replicated. Admittedly, there are alternative approaches to understanding cognition, such as connectionism, artificial intelligence, or phenomenology. Using any of these other approaches to model religion would no doubt present a different picture than the one we offer. We leave it to others to work the alternatives.

1.2. Costly Sacrifice versus Indirect Reciprocity

Although economic calculations often influence the choice and practice of sacrifice (e.g., Stark 2000) the conclusion that sacrifice is a purely economic strategy is unfounded. In religious offerings, there is usually a nonrecoverable cost involved both in the selection of the item offered and in the ceremony itself. Thus, for the Nuer of Sudan, substitution for a highly-valued item (cow) by one less-valued (fowl or vegetable) is allowable only to a point, after which “a religious accounting might reveal that the spirits and ghosts were expecting a long overdue proper sacrifice, because accounts were out of balance so to speak” (Evans-Pritchard 1940:26). Religious sacrifice usually costs something for the persons on whose behalf the offering is made. That is why “sacrifice of wild animals which can be regarded as the free gift of nature is rarely allowable or efficient” (Robertson Smith 1894:466). In many cases, the first or best products of one’s livelihood goes to the gods, as with the first fruits of the Hebrews or the most perfect maize kernels of the Maya. Most, if not all, societies specify obligatory circumstances under which religious sacrifice must be performed, regardless of economic considerations. Reviewing the anthropological literature, Raymond Firth (1963:16) surmises: “In all such cases the regular religious need to establish communication with god or with the spirit world… would seem to be pressing and primary. ‘Afford it or not’.”

1.3. Relieving versus Provoking Anxieties

Often the naturally eruptive anxieties that bring on the supernatural are artificially (purposely) excited then assuaged (Durkheim 1995[1912]). It might seem, then, that the problem of theodicy is akin to the wag about the salesman who throws dirt on the rug in order to demonstrate the vacuum cleaner’s ability to remove it. Consider initiation rituals that involve “rites of terror” (Whitehouse 1996), as among Native American Cheyenne and Arapaho (Lowie 1924), Walbiri (Meggitt 1965) and other aboriginals of the Central Australian Desert (Spencer & Gillen 1904), Mountain Ok Baktaman (Barth 1975) and Ilahita Arapesh of Highland Papua New Guinea (Tuzin 1982), or Candombolé Nagô sects of African-Brazilian Bahia (Caneiro 1940, Omari 1994). These arouse existential anxieties by culturally mimicking and manipulating seemingly capricious and uncontrollable situations that naturally provoke them: terror and risk of death from unidentified sources, the menace of infirmity and starvation through physical ordeal and deprivation, the injustice of whimsical oppression, sudden isolation and loneliness. Often initiates temporarily manifest behaviors and cognitions associated with persons clinically diagnosed as suffering abuse, stress or trauma, including: re-experiencing the events (nightmares, intrusive memories, flashbacks), avoidance (amnesia of the event, refusal to talk about or think
about it) and hyperarousal (startle response, fitful sleep, poor concentration) (cf. Newport & Nemeroff 2000).

Still, there are important differences between such initiations and stress syndromes (e.g. posttraumatic stress disorder). Stress sufferers who permanently lose memory and undergo reduced immune response often suffer from chronic stress and lack of effective social support (Khansari et al. 1990, Dhabhar & McEwen 1999). By contrast, even the most severe and emotionally aversive religious initiations end in positive exhibitions of social acceptance:

Boys and girls are made to recognize members of The People [Navajo] and are introduced to full participation in ceremonial life.... The first boy is led out beside the fire. The figure in the white mask makes a mark on each shoulder with sacred cornmeal.... Then, using a different falsetto cry, the black-masked figure lightly strikes... other places on the body, and the one who uses the reeds varies the time interval between touching the boy and uttering his cry, so its unexpectedness causes the boy to start convulsively.... Then the one who wore the black mask places it over the face of each child in turn.... All the children are told to look up and always remember the Holy People. The reversal of the masks is a very intelligent psychological act, for it allows the child to see that the dread figure is actually someone he knows, or at least a human being, and thus the ritual is robbed of some of its terror.... The ceremony closes with the admonition to each child not to betray to uninitiates what he has seen. (Kluckholn & Leighton 1974[1946]:207-208; cf. Turnbull 1962:225)

Through the stress that these exaggerated sensual displays induce, rites of passage furnish emotionally costly and memorable - but ultimately satisfying - commitments to the group and its supernatural agents.

In brief, these life rehearsals incite the very emotions and existential anxieties that motivate religious beliefs and quests for deliverance. Then, by assuaging and resolving the ensuing distress, successful completion of the ritual performance authenticates the religious thoughts and actions that stage-manage both the rehearsal and the real thing. This confirms the efficacy of religious belief and ritual performance in fusing cosmos to culture by overcoming the dreads and uncertainties of both spontaneously occurring natural events and the manipulated happenings of the social milieu.

1.4. Emotional Ritual

Although there is wide variation in the degree of sensory pageantry associated with religious rituals (Whitehouse 2000, McCauley & Lawson 2002), religious rituals habitually – perhaps invariably - include displays of social hierarchy and submission typical of primates and other social mammals (outstretched limbs baring throat and chest or genitals, genuflection, bowing, prostration, etc.). Even priests and kings must convincingly show sincere obeisance to higher supernatural authority lest their own authority be doubted (Aristotle 1958, Burkert 1996; cf. Watanabee & Smuts 1999). Moreover, collective religious ritual always seems to involve ancestrally primitive communicative forms that Tinbergen calls “ritualized social releasers” (1951:191-192). Social releasers exhibit sense-evident properties, “either of shape, or colour, or special movements, or sound, or scents,” which readily elicit a well-timed and well-oriented cooperative response in a conspecific: for mating, parenting, fighting, defense, food gathering, and the like. But humans appear to be the only animals that spontaneously engage in creative,
rhythmic bodily coordination to enhance cooperation. Unlike, say, avian mating calls or flight formations, human music or body dance, which are omnipresent in worship, can be arbitrarily and creatively recomposed.

A key feature of the creativity of human worship is use of music in social ritual. Even the Taliban, who prohibited nearly all public displays of sensory stimulation, promoted a cappella religious chants. Nearer to home, in a survey of persons who reported a religious experience (Greeley 1975), music emerges as the single most important elicitor of the experience. Listeners as young as three years old reliably associate basic or primary emotions to musical structures, such as happiness, sadness, fear and anger (Trainor & Trehub 1992; cf. Panksepp 1995, Schmidt & Trainor 2001).

Much of the intimate connection between music and religion remains a puzzle. One possible account sees music as an invitation to interpersonal relationships, creating emotional bonds between people, through the “attunement” of somatic states – much as the rocking and cooing behavior of mother and infant attunes the parental bond (Stern 1985). This is especially apparent in “call-response” format, as in Yoruba dances and Hebrew services. Moreover, in religious contexts, music is frequently experienced as authorless, like the sacred texts that often accompany it.[v] The pre-tonal religious music of small-scale societies usually has its mythic beginnings in the origins of the world, which invites audiences to share in a sense of timeless intimacy. For the Catholic Church, Gregorian chants were taught to men by birds sent from heaven. Even Bach, Mozart and Beethoven were but vehicles of The Divine’s call to communion.

Finally, our account opposes other evolutionary approaches to religion and culture, including much sociobiology (E. Wilson 1978, Harris 1974), some versions of group selection theory (Boehm 1999, Sober & Wilson 1998), and certain aspects of memetics (Dawkins 1993, Dennett 1997). These “mindblind” alternatives disregard cognitive constraints on religious beliefs and practices in favor of essentialized views of religion and culture as bundles of functionally-integrated, fitness-bearing traits: for example, packages of environment-induced rituals (the material infrastructure underlying ideational superstructure), partnerships of invasive and authorless ideas (memplexes), or machinelike patternings of collective norms (worldviews). Proponents of these alternatives do not deny that minds have causally “proximate” roles in generating religious behaviors - as they may in generating economic behaviors – or that cognition may form part of some “ultimate” explanation of religion. Nevertheless, a common claim is that a meaningful causal account of such behaviors requires initial focus on measurable relationships between putative fitness-motivating factors in religious behaviors and ostensible fitness consequences (Dennett 1995:358-359, Sober & Wilson 1998:182,193; cf. Lumsden & Wilson 1981): for example, between individuals needing protein in animal-poor environments and ritual human sacrifice (E. Wilson 1978, Harris 1974), between ideas endeavoring to propagate themselves and proselytizing for altruism (Lynch 1976, Blackmore 1999), or between groups competing for survival and Judaism’s alleged cultural and genetic separatism (MacDonald 1998, D. Wilson 2002). These arguments are presented through selective use of anecdotal evidence, rather than being reliably tested and demonstrated (for reviews and analyses of specific arguments, see Atran 2001, in press).

We argue that none of these alternatives provides insight into cognitive selection factors responsible for the ease of acquisition of religious concepts by children, or for the facility with which religious practices and beliefs are transmitted across individuals. They tell us nothing
about which beliefs and practices – all things being equal – are most apt to survive within a culture, most likely to recur in different cultures, and most disposed to cultural variation and elaboration. None predicts the cognitive peculiarities of religion, such as:

- Why do agent concepts predominate in religion?
- Why do supernatural-agent concepts are culturally universal?
- Why are some supernatural agent concepts inherently better candidates for cultural selection than others?
- Why is it necessary, and how is it possible, to validate belief in supernatural agent concepts that are logically and factually inscrutable?
- How is it possible to prevent people from deciding that the existing moral order is simply wrong or arbitrary and from defecting from the social consensus through denial, dismissal or deception?

This article tries to address these and related questions.

2. The Supernatural: Agency’s Cultural Domain

AGENCY, we speculate, is a sort of "Innate Releasing Mechanism" (Tinbergen 1951) whose proper evolutionary domain encompasses animate objects but which actually extends (as an inadvertently but spontaneously activated evolutionary by-product) to moving dots on computer screens, voices in the wind, faces in the clouds, and virtually any complex design or uncertain circumstance of unknown origin. For each natural domain, there is a proper domain and (possibly empty) actual domain (Sperber 1994). A proper domain is information that is the module’s naturally-selected function to process. The module’s function is a set of outcomes that causally contribute to making the module a stable species feature. Thus, stimuli that track behaviors of animals, including people, fall under the proper domain of an AGENCY module. Identifying animate beings as agents, with goals and internal motivations, would have allowed our ancestors to anticipate goal-directed actions of predators, prey, friends and foe, and to profit from this in ways that enhanced hominid survival and reproductive success.

The actual domain of a module is any information in the organism’s environment that satisfies the module’s input conditions whether or not the information is functionally relevant to ancestral task demands – that is, whether or not it also belongs to its proper domain. For example, cloud formations and unexpected noises from inanimate sources (e.g., a sudden, howling gush of wind) readily trigger inferences to agency among people everywhere (Hume 1957[1756], Guthrie 1993). Although clouds and wind occurred in ancestral environments, they had no functional role in recurrent task problems with animate beings. Similarly, a number of experiments show that children and adults spontaneously interpret the contingent movements of dots and geometrical forms on a screen as interacting agents who have distinct goals and internal motivations for reaching those goals (Heider & Simmel 1944, Premack & Premack 1995, Bloom & Veres 1999). Moving dots on a screen do not belong to AGENCY’s proper domain because they could not have been involved with ancestral task demands. Like clouds and wind, moving dots on computer screens belong to its actual domain.

A parallel example is food-catching behavior in frogs. When a flying insect moves across the frog’s field of vision, bug-detector cells are activated in the frog’s brain. Once activated, these cells in turn massively fire others in a chain reaction that usually results in the frog shouting out its tongue to catch the insect. The bug-detector is primed to respond to any small dark object that suddenly enters the visual field (Lettvin et al. 1961). If flying insects belong to the proper
domain of frog’s Food-Catching module, then small wads of black paper dangling on a string belong to the actual domain.

Our brains, it seems, are wired to spot lurkers (and to seek protectors) where conditions of uncertainty prevail (when startled, at night, in unfamiliar environments, during sudden catastrophe, in the face of solitude, illness, or prospects of death, etc.). People interactively manipulate this hypersensible cognitive aptitude so as to create agents who creatively order and unite culture and cosmos. This gives the same order of meaning to all manner of existence, including one’s own.

Such a prepared, or modularized, processing program would provide a rapid and economical reaction to a wide – but not unlimited – range of stimuli that would have been statistically associated with the presence of agents in ancestral environments. Mistakes, or “false positives,” would usually carry little cost, whereas a true response could provide the margin of survival (Seligman 1971). Thus, for the Carajá Indians of Central Brazil, intimidating or unsure regions of the local ecology are religiously avoided: “The earth and underworld are inhabited by supernaturals…. There are two kinds. Many are amiable and beautiful beings who have friendly relations with humans…. The others are ugly and dangerous monsters who cannot be placated. Their woods are avoided and nobody fishes in their pools (Lipkind 1940:249).” Nearly identical descriptions of supernaturals can be found in ethnographic reports throughout the Americas, Africa, Eurasia and Oceania (Atran 2002a).

Plausibly, the most dangerous and deceptive predator for the genus Homo since the Late Pleistocene has been Homo itself, which may have engaged in a spiraling behavioral and cognitive arms race of individual and group conflicts. According to evolutionary biologist Richard Alexander (1989), this “runaway social competition” led to larger groups of a nonkin sort that is absent from the rest of the animal world. Larger groups would greatly allay the threat from nonhominid predators, such as prides of wild felines and canids, and enhance success in capturing nonhominid prey, such as large game. But as genetic ties weakened, large groups would also generate more and greater threats from defecting nonkin within and prod competitors to form even larger groups that would threaten from without. Given the constant menace of enemies within and without, concealment, deception and the ability to generate and recognize false beliefs in others would favor survival.

In potentially dangerous or uncertain circumstances, it would be best to anticipate and fear the worst of all likely possibilities: presence of a deviously intelligent predator. How else could humans have managed to constitute and survive such deadly competitive groups as the Iatmul head-hunters of New Guinea (Bateson 1958) or the Naga of Assam (northern India)?

All the Naga tribes are, on occasion, head-hunters, and shrink from no treachery in securing these ghastly trophies. Any head counts, be it that of a man, woman, or child, and entitles the man who takes it to wear certain ornaments according to the custom of the tribe or village. Most heads are taken... not in a fair fight, but by methods most treacherous. As common a method as any was for a man to lurk about the water Ghat of a hostile village, and kill the first woman or child who came to draw water…. Every tribe, almost every village is at war with its neighbour, and no Naga of these parts dare leave the territory of his tribe without the probability that his life will be the penalty. (Crooke 1907:41-43)
Recognizing the minor differences in dialect and tattoo marks between Naga groups would alone hardly guarantee safety, especially against night infiltrators in disguise.

Throughout the world, societies cast their enemies as physically or mentally warped supernatural beings, or at least in league with the supernatural. Originally, naga “applied to dreaded mountain tribes, and [was] subsequently used to designate monsters generally” (Werner 1961:284). The dragons of ancient India (naga) and their Chinese derivatives (lung) are often depicted as creatures half human and half animal who emerge from the clouds to wreak havoc on humankind.

From an evolutionary perspective, it’s better to be safe than sorry (Guthrie 1993; cf. Hume 1956[1757]). For example, serpent-like devils and demons seem to be culturally ubiquitous (Munkur 1983), perhaps evoking and addressing a primal fear shared by our primate line (Mineka et al. 1984). This cognitive proclivity would favor emergence of malevolent deities in all cultures, just as the countervailing Darwinian propensity to attach to protective caregivers would favor the apparition of benevolent deities. Mammals, such as social carnivores and primates, evince behaviors consistent with an integrated appreciation of evolved predator-protector-prey schema. In “chase play” the young typically “dare” a protector (parent, sibling) to chase them as a predator would, only to “surrender” to the chaser’s comforting behaviors (pettings, lickings, etc.).

Thus, humans conceptually create actual-domain entities and information to mimic and manipulate the natural input conditions of evolutionarily proper-domain entities and information (Sperber 1996). That is, they create cultural domains that ride piggyback on mental modules. Masks, make-up, Mickey Mouse, geometry, governments, gods and so on are made by and for human beings. Because the phenomena created readily activate modular processes, they are more likely to survive transmission from mind to mind under a wide range of different environments and learning conditions than entities and information that are harder to process (Atran 1998, 2001). As a result, they are more likely to become enduring aspects of human cultures, such as belief in the supernatural.

Another example from ethology offers a parallel. Many bird species have nests parasitized by members of other species. Thus, the cuckoo deposits its eggs in passerine nests, tricking the foster parents into incubating and feeding the cuckoo’s young. Nestling European cuckoos often dwarf their host parents (Hamilton & Orians 1965): “The young cuckoo, with its huge gape and loud begging call, has evidently evolved in exaggerated form the stimuli which elicit the feeding response of parent passerine birds…. This, like lipstick in the courtship of mankind, demonstrates successful exploitation by means of a ‘super-stimulus’” (Lack 1968). Late nestling cuckoos have evolved perceptible signals to manipulate the passerine nervous system by initiating and then arresting or interrupting normal processing. In this way, cuckoos are able to subvert and co-opt the passerine’s modularized survival mechanisms.

Humans, too, can have their innate releasing programs “fooled,” as when people become sexually aroused by lines drawn on paper or dots arranged on a computer screen, that is, pornographic pictures. Indeed, much of human culture – for better or worse - can be arguably attributed to focused stimulations and manipulations of our species’ innate proclivities. The soft drink and fast food industries manipulate our evolved but evolutionarily unconstrained likings for sweets and fats (fruits and animals) that are not easy to find in nature.
Supernatural agents are readily conjured up because natural selection has trip-wired cognitive schema for agency detection in the face of uncertainty. Uncertainty is omnipresent; so, too, the sort of hair-triggering of an agency-detection mechanism that readily promotes supernatural interpretation.

3. Counterintuitive Worlds

All the world’s cultures have religious myths that are attention-arresting because they are fundamentally counterfactual and counterintuitive. Still, people in all cultures also recognize that such beliefs are fundamentally counterfactual and counterintuitive, whether or not they are religious believers (Atran 1996). In our society, for example, Catholics and non-Catholics alike are unquestionably aware of the difference between Christ’s body and ordinary wafers, or between Christ’s blood and ordinary wine. Likewise, Native American Cowlitz are well aware of the difference between the deity Coyote and everyday coyotes, or between Old Man Wild Cherry Bark and ordinary wild cherry bark:

Coyote fell down, his limbs entirely wrapped and tied with the cherry bark.... He got his knife, and cut at the cherry bark.... Coyote got to his feet, no more tied up by the cherry bark, he had cut.... Old Man Wild Cherry Bark fell down and died. Coyote went on directly. He burst into laughter as he went. “Ha! Ha! Ha! Wild cherry bark could never kill me, its only mere cherry bark. (Jacobs 1934:126-133)

Religious beliefs are counterintuitive, hence also necessarily counterfactual, because they violate innate expectations about how the world is structured, including such basic ontological categories as those of LIVING KIND [ANIMATE (PERSON, ANIMAL), PLANT] and STUFF [ARTIFACT, SUBSTANCE] (Sperber 1985, Atran 1990, Boyer 1994). As Atran and Sperber (1991:52) note, though, religious beliefs nonetheless remain integrally bound to factual, commonsense beliefs and inferences:

They are generally inconsistent with common-sense knowledge, but not at random: rather they dramatically contradict basic commonsense assumptions. For instance, they include beliefs about invisible creatures who can transform themselves at will or who can perceive events that are distant in time or space. This flatly contradicts factual commonsense assumptions about physical, biological and psychological phenomena.... As a result, these beliefs are more likely to be retained and transmitted in a human group than random departures from common sense, and thus to become part of the group’s culture.... To the extent such violations of category distinctions shake basic notions of ontology they are attention-arresting, hence memorable. But only to the degree that the resultant impossible worlds remain bridged to the everyday world can information be stored and evoked in plausible grades.

As a result, religious concepts need little in the way of overt cultural representation or instruction to be learned and transmitted. A few fragmentary narrative descriptions or episodes suffice to mobilize an enormously rich network of implicit background beliefs. For instance, if God is explicitly described as being jealous and able to move mountains, He is therefore implicitly known to have other emotions, such as anger and joy, and other powers, such as the ability to see and touch mountains or to lift and sight most anything smaller than a mountain, such as a person, pot, pig or pea.
At initial stages of processing, supernatural agents do not represent ontological violations of the universal ontological categories of PERSON or ANIMATE BEING. As experiments with infants consistently show, the minimal conditions for activating cognition of agency require only schematic indications of directed movement, such as dots interacting with other dots on a computer screen (Csibra et al. 1999). Sudden movement of an object stirred by the wind may trigger the agent-detection system that operates over the domain of folkpsychology, and a ghost invoked to interpret this possibly purposeful event. In normal circumstances, a sudden movement of wind might activate cognitive processing for agents, but would soon deactivate upon further analysis ("it's only the wind"). But in the case of (bodiless) supernatural agents, the object-boundary detectors that operate over the domain of folkmechanics, and which are required to identify the agent, cannot be activated. As a result, assignment to the PERSON or ANIMAL category cannot be completed. Ontological violations kick in at later stages of processing supernatural agent concepts. By violating innate ontological commitments – for example, endowing spirits with movement and feelings but no body - processing is never brought to factual closure, allowing indeterminately many interpretations of indefinitely many arising situations.

Invocation of supernatural agents implicates two cognitive aspects of religious belief:

1. activation of naturally-selected conceptual modules, and
2. failed assignment to universal ontological categories.

The processes responsible for activating conceptual modules and those responsible for fixing ontological categories are intimately related but not identical. Conceptual modules are activated by stimuli that fall into a few intuitive knowledge domains, including: folkmechanics (object boundaries and movements), folkbiology (species configurations and relationships), and folkpsychology (interactive and goal-directed behavior). Ontological categories are generated by further and more specific activation of conceptual modules. Among the conceptually primary ontological categories are: PERSON, ANIMAL, PLANT, ARTIFACT, SUBSTANCE (Atran 1989). All ontological categories involve more specific processing over the folkmechanics domain (nonliving objects and events).

- Only SUBSTANCE involves further processing that is exclusive to folkmechanics.
- PERSON involves more specific processing over the folkpsychological domain (human behavior is scrutinized as indicating friend or foe, and possibly predator or prey) and the folkbiological domain (essentialized group assignments, like race and ethnicity).
- ANIMAL involves supplemental processing over the domains of folkbiology (every animal is assigned uniquely to a folk species) as well as folkpsychology (animal behavior is scrutinized as indicating predator or prey, and possibly friend or foe).
- PLANT involves additional processing over the folkbiological domain (every animal is assigned to one and only one folk species).
- ARTIFACT involves further processing over the folkmechanics and folkpsychology domains (intentionally produced nonliving object).
The combination of (3) conceptual modules and (5) ontological categories results in a 3 X 5 matrix with 15 cells. Changing the intuitive relationship expressed in any cell generates a minimal counterintuition (cf. Boyer 2000, Barrett 2000). For example, switching the cell (-folkpsychology, SUBSTANCE) to (+ folkpsychology, SUBSTANCE) yields a thinking talisman, whereas switching (+ folkpsychology, PERSON) to (- folkpsychology, PERSON) yields an unthinking zombie.

All things being equal, supernatural concepts that join ontologically distant categories (e.g., PERSON-SUBSTANCE, ANIMAL-SUBSTANCE) should be less prevalent than supernatural concepts that join ontologically nearer categories (e.g., PERSON - ANIMAL). For example, the metamorphosis of humans into animals and animals into plants appears to be more common than that of humans or animals in artifacts or substances (Kelly & Keil 1985, Boyer & Ramble 2001). Intervening perceptual, contextual or psycho-themed factors, however, can change the odds. Thus, certain natural substances - mountains, seas, clouds, sun, moon, planets – are associated with perceptions of great size or distance, and with conceptions of grandeur and continuous or recurring duration. They are, as Freud surmised, psychologically privileged objects for focusing the thoughts and emotions evoked by existential anxieties like death and eternity. Imaginary or actual violation of fundamental social norms also readily lends itself to religious interpretation (e.g., ritual incest, fratricide, status reversal).

Finally, supernatural agent concepts tend to be emotionally powerful because they trigger evolutionary survival templates. This also makes them attention-arresting and memorable. For example, an all-knowing bloodthirsty deity is a better candidate for cultural survival than a do-nothing deity, however omniscient. In the next part, we address some of the cognitive processes that contribute to the cultural survival of supernatural beliefs.

4. Cultural Survival: A Memory Experiment

Many factors are important in determining the extent to which ideas achieve a cultural level of distribution. Some are ecological, including the rate of prior exposure to an idea in a population, physical as well as social facilitators and barriers to communication and imitation, and institutional structures that reinforce or suppress an idea. Others are psychological, including the ease with which an idea can be represented and remembered, the intrinsic interest that it evokes in people so that it is processed and rehearsed, and motivation and facility to communicate the idea to others.

Of all psychological factors, mnemonic power is one of the most important (Sperber 1996). In oral traditions that characterize most of human cultures throughout history, an idea that is not memorable cannot be transmitted and cannot achieve cultural success. Moreover, even if two ideas pass a minimal test of memorability, a more memorable idea has a transmission advantage over a less memorable one (all else being equal). This advantage, even if small at the start, accumulates from generation to generation of transmission leading to massive differences in cultural success at the end.

One of the earliest accounts of the effects of memorability on transmission of natural and nonnatural concepts was Bartlett’s (1932) study of how university students remembered, and then transmitted a culturally unfamiliar story (a Native American folk tale). Over successive
retellings of the story, some culturally unfamiliar items or events were dropped. Other unfamiliar items were distorted, being replaced by more familiar items (e.g., a canoe replaced by a rowboat). Bartlett reasoned that items inconsistent with students’ cultural expectations were harder to represent and recall, hence less likely to be transmitted than items consistent with expectations.

Recent studies, however, suggest that under some conditions counterintuitive beliefs are better recalled relative to intuitive beliefs (Boyer & Ramble 2001). Barrett & Nyhof (2001) asked people to remember and retell Native American folk tales containing natural as well as nonnatural events or objects. Content analysis showed that participants remembered 92% of minimally counterintuitive items, but only 71% of intuitive items.

Although suggestive, these studies leave several issues unresolved. For one: why don’t minimally counterintuitive concepts occupy most of the narrative structure of religions, folktales and myths? Even casual perusal of culturally successful materials, like the Bible, Veda or Popul Vuh, suggests that counterintuitive concepts and occurrences are a minority. The Bible is a succession of mundane events - walking, eating, sleeping, dreaming, copulating, dying, marrying, fighting, suffering storms and drought - interspersed with a few counterintuitive occurrences, such as miracles and appearances of supernatural agents like God, angels, and ghosts.

An answer to this puzzle may lie in examining memorability for an entire set of beliefs taken as a single unit of transmission, rather than individual beliefs. Accordingly, we conducted a study to examine the memorability of intuitive (INT) and minimally counterintuitive (MCI) beliefs and belief sets over a period of a week (for examples, see Table 1). Participants were 107 undergraduate students at an American university. MCI beliefs were generated by transferring a property from its intuitive domain to a novel domain (e.g., thirsty door, closing cat). For each MCI belief, there was a corresponding INT belief (thirsty cat, closing door). Recall was measured after a 3-minute delay, and a surprise free recall after a one-week delay. This latter measure better reflected the role of recall in oral traditions. The list-learning format provided a neutral context to measure recall, rather than participants’ notions of what is interesting to report. It was designed to simulate the degraded informational context of nascent cultural materials.

INT beliefs showed better recall rates than MCI beliefs, both immediately (Figure 1) and after a one-week delay (Figure 2). Because the two kinds of beliefs were matched (each term was equally likely to occur in an intuitive and counterintuitive belief), we are confident that the intuitiveness factor, not other unknown factors left to vary, contributed to the recall advantage of the intuitives (Norenzayan & Atran in press).

We replicated this finding with a different set of ideas, where a sharper distinction was made between counterintuitive ideas and ideas that are intuitive but bizarre, and between degrees of counterintuitiveness. Participants received ideas that were (1) intuitive and ordinary (2) intuitive but bizarre (3) minimally counterintuitive (4) maximally counterintuitive. Two-word or three-word statements that represented INT, BIZ, MCI, MXCI-Control, and MXCI beliefs were generated (Table 1). Each statement consisted of a concept and one or two properties that modified it. INT statements were created by using a property that was appropriate to the ontological category (e.g., closing door). BIZ statements were created by modifying the concept with an intuitive, but bizarre property (e.g., blinking newspaper). MCI statements were created by modifying with a property transferred from another ontological category (e.g., thirsty door).
Finally, MXCI statements were created by modifying a concept with two properties taken from another ontological category (e.g., squinting wilting brick). For each MXCI statement, a matching MCI statement was generated, only one of the properties being counterintuitive (e.g., chattering climbing pig). Participants received one of two different versions.

Intuitive ideas enjoyed highest recall; maximally counterintuitive ideas the lowest (Figure 3). Most distortions occurred within the same ontological category (39 items, or 55%), the majority being within the minimally counterintuitive (MCI) category (23 items = 59% of all same-category distortions). For example, “Cursing horse” was remembered as “Laughing horse” (both MCI). For distortions that crossed ontological boundaries, the most common was from counterintuitive to intuitive (14 distortions = 20%). The least common distortion was from intuitive to counterintuitive: only 1 such distortion was found (1.4%). Results for distorted items, with a preference for rendering counterintuitive beliefs intuitive, follows the main lines of Bartlett’s (1932) study.

One finding that converges with previous studies was that minimally counterintuitive beliefs degraded at a lower rate after immediate recall. Minimally counterintuitive beliefs may have a potent survival advantage over intuitive beliefs: once processed and recalled, they degrade less than intuitive ones. Disadvantage in recall may be offset by resilience, so that over generations of transmission, an idea that is less remembered, but also less degradable, may prevail over an idea that is initially remembered well but eventually dies out because of a higher rate of degradation.

The belief set that was mostly intuitive, combined with a few minimally counterintuitive ones had the highest rate of delayed recall and the lowest rate of memory degradation over time (Figure 4). This is the recipe for a successful transmission of cultural beliefs, and it is the cognitive template that characterizes most popular folktales and religious narratives. The “equal proportions” belief set had moderate memorability. Critically, the belief set with a majority of minimally counterintuitive beliefs had the lowest rate of delayed recall and highest level of memory degradation. In fact, this is a cognitive template rarely encountered in existing culturally successful materials. Thus, the way natural and nonnatural beliefs are combined is crucial to survival of a cultural ensemble of beliefs, such as those that form the core of any religious tradition.

With Yukatek Maya speakers we found the same recall pattern as in the USA follow-up. Also, minimally counterintuitive beliefs were again more resilient than intuitive ones, confirming the USA pattern. Finally, we found no reliable differences between the Yukatek recall pattern after one week and after three months (Figure 5). These results indicate cultural stabilization of that pattern.

In sum, minimally counterintuitive beliefs, as long as they come in small proportions, help people remember and presumably transmit the intuitive statements. A small proportion of minimally counterintuitive beliefs give the story a mnemonic advantage over stories with no counterintuitive beliefs or with far too many counterintuitive beliefs, just like moderately spiced-up dishes, have a cultural advantage over bland or far too spicy dishes. This dual aspect of supernatural beliefs and belief sets - commonsensical and counterintuitive - renders them intuitively compelling yet fantastic, eminently recognizable but surprising. Such beliefs grab attention, activate intuition, and mobilize inference in ways that greatly facilitate their mnemonic retention, social transmission, cultural selection and historical survival.
5. Metarepresenting Counterintuitive Worlds: A Theory of Mind Experiment

Thus far we have claimed that the presence of minimally counterintuitive beliefs in religious belief sets favors the production, transmission and cultural survival of those belief sets over time. We have also provided initial experimental support for the claim, although clearly much more needs to be done. This claim leaves open the issue of how counterintuitive beliefs can be formed at all. If counterintuitive beliefs arise by violating innately-given expectations about how the world is built, how can we possibly bypass our own hardwiring to form counterintuitive religious beliefs? The answer is that we don’t entirely bypass commonsense understanding but conceptually parasitize it to transcend it. This occurs through the species-specific cognitive process of metarepresentation.

Humans have a metarepresentational ability to form representations of representations. This ability allows people to understand a drawing or picture of someone or something as a drawing or picture and not the real thing. It lets us enjoy novels and movies as fiction that can emotionally arouse us without actually threatening us. It lets us think about being in different situations and deciding which are best for the purposes at hand, without our having to actually live through (or die in) the situations we imagine. It affords us the capacity to model the world in different ways, and to conscientiously change the world by entertaining new models that we invent, evaluate and implement. It enables us to become aware of our experienced past and imagined future as past or future events that are distinct from the present that we represent to ourselves, and so permits us to reflect on our own existence. It allows people to comprehend and interact with one another’s minds.

Equally important for our purposes, metarepresentation allows humans to retain half-understood ideas (Sperber 1985, Atran & Sperber 1991). By embedding half-baked (quasi-propositional) ideas in other factual and commonsense beliefs, these ideas can simmer through personal and cultural belief systems and change them. Children come to terms with the world in similar ways when they hear a new word. A half-understood word is initially retained metarepresentationally, as standing in for other ideas the child already has in mind. Initially, the new word is assigned an ontological category: for example, if “andro chases balls,” then it must be an ANIMAL or PERSON, like Fido or Fred.

After Dennett (1978), most researchers in folkpsychology, or “theory of mind,” maintain that attribution of mental states, such as belief and desire, to other persons requires metarepresentational reasoning about false beliefs. Not before the child can understand that other people’s beliefs are only representations – and not just recordings of the way things are – can the child entertain and assess other people’s representations as veridical or fictional, truly informative or deceptive, exact or exaggerated, worth changing one’s own mind for or ignoring. Only then can the child appreciate that God thinks differently from most people, in that only God’s beliefs are always true.

In one of the few studies to replicate findings on “theory of mind” in a small-scale society (cf. Avis & Harris 1991), Knight, Barrett, Atran and Ucan Ek’ (2001) showed 48 Yukatek-speaking children (26 boys, 22 girls) a tortilla container and told them, “Usually tortillas are inside this box, but I ate them and put these shorts inside.” They asked each child in random order what a person, God, the sun (k’in), principal forest spirits (cumil k’ax’ob’, “Masters of the Forest”), and
other minor spirits (chiichi’) would think was in the box. As with American children (Barrett et al. 2001), the youngest Yukatek (4 years) overwhelmingly attribute true beliefs to both God and people in equal measure. After age 5, the children attribute mostly false beliefs to people but continue to attribute mostly true beliefs to God (Figure 6). Children over 5 attribute true beliefs according to a hierarchy with God at the top and people at the bottom (Figure 7). Yukatekan groups consider the Masters of the Forest powerful and knowledgeable spirits that punish people who overexploit forest species. For adults, such beliefs have measurable behavioral consequences for biodiversity, forest sustainability, and so forth (Atran et al. 2002). In brief, from an early age people may reliably attribute to supernaturals cognitive properties that are different from parents and other people.

6. From False Belief to Costly Commitment

One plausible evolutionary story is that understanding agency, together with metarepresenting false belief and deceit, emerged as a later development of intentional communicative displays that signaled possibilities for hominids to cooperate (or deceive) in a wide variety of situations (Leslie & Frith 1987). Autistic children seem to miss intentional communicative display. Although they can often imitate a gesture, and so represent it, they can’t go beyond this primary representation to infer that the gesture stands for something else. Thus, unlike nonautistic one-year-olds (Masur 1983, Baron-Cohen 1995), older autistic children can’t signal communicative intent by pointing (as only humans can, Premack & Woodruff 1978, Povinelli 2000). They can’t metarepresent the relation INTENTIONALLY COMMUNICATE, between a person as an agent (mother), a stimulus situation (upturned palm oriented towards a vase of flowers) and an inferred situation (child giving flowers to mother). Neither, apparently, can they entertain counterfactual beliefs. This can be particularly striking in children suffering from Asperger’s Syndrome, a high-functioning form of autism.

Religious acts of faith incorporate universal, metarepresentational features of pragmatic communication, including: PRETEND (that p) and PROMISE (to do p). These are social acts common to all normally interacting human agents. A principal difference between religious and nonreligious employments of these behaviors is that the situation that is represented (p) in a religious act is not a state of affairs by which the truth, adequacy or accurateness of the representation is evaluated. Rather, a religious representation (statement or other display) is always right and the situation to which it is properly applied is made to conform to what is conventionally stipulated to be the case.

In pretense, person A believes that [person B believes that [“p is true”] is false] because not-p is demonstrably or verifiably the case. In faith, person A believes that [person B believes that [“p is true”] is meaningful] because “p is true” is The Word of God and because God always speaks the truth. Faith, like pretense, necessarily involves metarepresentation (the embedded brackets). In pretense, though, p’s content is transparent and the state of affairs it represents is assessable by observation and inference for truth or falsity. In faith, the notion to be assessed is not p, but the conceptually fused and opaque quasi-proposition “p is true” (Sperber 1975; cf. Ayer 1950 on religious “pseudo-propositions”). Believers are not concerned with whether “p” is true or not, but with what “p is true” could possibly mean (connote) for them.

As with pretense, religious acts of faith involve exaggerated gestures that are intended to connote a situation, that goes beyond, the one perceptually manifest. For example, the act of receiving the
host during Mass is an extraordinary eating display, where people are typically fed on their knees with no chewing of the wafer allowed. It is obvious to everyone that the intended goal of the display is not eating, but communion (Rappaport 1999). The meaning of an act of faith like Communion is not an inference to specific propositions, but to an emotionally charged network of partial and changeable descriptions of counterfactual and counterintuitive worlds.

Expression of religious prescriptions performatively signals and establishes cognitive and emotional commitment to seek convergence, but doesn’t specify (the propositional content of) what people should converge to. Supernatural agents are guarantors and placeholders for appropriate actions in future circumstances. The truth about them is accepted on faith and communicated through ritual display, not discovered or described as a set of factual or logical propositions.

In sum, human metarepresentational abilities, which are intimately bound to fully developed cognitions of agency and intention, also allow people to entertain, recognize and evaluate the differences between true and false beliefs. Given the ever-present menace of enemies within and without, concealment, deception and the ability to both generate and recognize false beliefs in others would favor survival. But because human representations of agency and intention include representations of false belief and deception, human society is forever under threat of moral defection. If some better ideology is likely to be available somewhere down the line, then reasoning by backward induction, there is no more justified reason to accept the current ideology than convenience. As it happens, the very same metacognitive aptitude that initiates this problem also provides a resolution through metarepresentation of minimally counterintuitive worlds. Invoking supernatural agents who may have true beliefs that people ordinarily lack creates the arational conditions for people to steadfastly commit to one another in a moral order that goes beyond apparent reason and self-conscious interest. In the limiting case, an omniscient and omnipotent agent (e.g., the supreme deity of the Abrahamic religions) can ultimately punish cheaters, defectors and free riders no matter how devious (cf. Frank 1988, Dennett 1997).

In the competition for moral allegiance, secular ideologies are at a disadvantage. For, if people learn that all apparent commitment is self-interested convenience or worse, manipulation for the self-interest of others, then their commitment is debased and withers. Especially in times of vulnerability and stress, social deception and defection in the pursuit of self-preservation is therefore more likely to occur (Ibn Khaldun 1958[1318]:II:liii:41). Religion passionately rouses hearts and minds to break out of this viciously rational cycle of self-interest, and to adopt group interests that may benefit individuals in the long run. Commitment to the supernatural underpins the “organic solidarity” (Durkheim 1995[1912]) that makes social life more than simply a contract among calculating individuals. Commitment to the supernatural has the added benefit of relieving pervasive existential anxieties, to which we now turn.

7. Existential Anxiety: A Motivation Experiment

In the first section, we claimed that emotionally eruptive existential anxieties motivate religious beliefs, and that this motivation has been sorely lacking in cognitive theories of religion. This section summarizes an experiment that we undertook with Ian Hansen linking adrenaline-activating death scenes to increased belief in God’s existence and the efficacy of supernatural intervention in human affairs. The experiment is also aimed at commitment theories of religion that neglect special attention to the supernatural.
Our experiment builds on a study by Cahill and colleagues (1994) dealing with the effects of adrenaline (adrenergic activation) on memory. They showed college students a series of slides and a storyline about a boy riding a bike. Some subjects were exposed to an uneventful story: the boy rides his bike home, and he and his mother drive to the hospital to pick up his father (who is a doctor). For the other participants, the story begins and ends in much the same way, but the middle is very different: the boy is hit by a car and rushed to the hospital’s emergency room, where a brain scan shows severe bleeding from the boy’s brain and specialized surgeons struggle to reattach the boy’s severed feet. After exposure to the stories, and before being tested for recall, half the subjects were given either a placebo pill or a drug (propranolol) that blocks the effects of adrenaline. The placebo and drug groups recalled the uneventful story equally well. Only the placebo group, however, remembered the emotional story more accurately than the uneventful one.

Our hypothesis was that existential anxieties (particularly death) not only deeply affect how people remember events but also their propensity to interpret events in terms of supernatural agency. We first controlled for religious background and measured for religious identification. Then we primed each of three groups of college students with one of three different stories (Table 2): Cahill et al.’s uneventful story (neutral prime), Cahill et al.’s stressful story (death prime), and another uneventful story whose event-structure matched the other two stories but which included a prayer scene (religious prime). Afterwards, each group of subjects read a New York Times article (2 October 2001) whose lead ran: “Researchers at Columbia University, expressing surprise at their own findings, are reporting that women at an in vitro fertilization clinic in Korea had a higher pregnancy rate when, unknown to the patients, total strangers were asked to pray for their success.” The article was given to students under the guise of a story about “media portrayals of scientific studies.” Finally, students rated strength of their belief in God and the power of supernatural intervention (prayer) on a nine-point scale.

Results show that strength of belief in God’s existence (Figure 8) and in the efficacy of supernatural intervention (Figure 9) are reliably stronger after exposure to the death prime than either to the neutral or religious prime (there were no significant differences between either uneventful story). This was the case regardless of students’ religious background, and even after statistically controlling for prior degree of religious identification.

In a follow-up study, USA subjects were told that the prayer groups were Buddhists in Taiwan, Korea, and Japan. In the death prime, subjects who identified themselves as strong believers in Christianity were more likely to believe in the power of Buddhist prayer than subjects who identified themselves as weak believers in Christianity. In the neutral (control) condition, the correlation was zero. When given a choice between belief in the supernatural versus rejecting an alien worldview (Buddhism), Christians clearly chose belief in the supernatural. These results indicate that thoughts of death do not simply prod people to reinforce their cultural worldview (and derogate alien cultural worldviews, as “terror management theory” might suggest, cf. Greenberg et al. 1990; Pyszczynski, Greenberg, & Solomon 1999). There seems to be a privileged psychological pipeline from mortality awareness to supernatural belief.

In sum, awareness of death-related thoughts seems a stronger natural motivator for religiosity than mere exposure to emotionally unstressful religious scenes, such as praying. This provides some confirmation of the claim that emotionally eruptive existential anxieties motivate belief in the supernatural. We also plan to test the further claim that invocation of the supernatural not
only cognitively validates these eruptive emotions, but is affectively validated by assuaging the very emotions that motivate belief in the supernatural. With this in mind, it is worth noting that uncontrollable arousal mediated by adrenergic activation (as for subjects exposed to death scenes) may lead to Posttraumatic Stress Syndrome if there is no lessening of terror and arousal within hours; however, adrenergic blockers (propranolol, clonidine, guanfacine, and possibly antidepressants) can “interrupt the neuronal imprinting that leads to long-term symptoms” (McReady 2002:9). A possibility arises, then, that heightened expressions of religiosity following exposure to death scenes that provoke existential anxieties could also serve this blocking function (Atran 2002b).

All of this isn’t to say that the function of religion is to promise resolution of all outstanding existential anxieties anymore than the function of religion is to neutralize moral relativity and establish social order, to give meaning to an otherwise arbitrary existence, to explain the unobservable origins of things, and so forth. Religion has no evolutionary function per se. It is rather that existential anxieties and moral sentiments 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. There are other factors in this success, involving naturally-selected elements of human cognition, such as the inherent susceptibility of religious beliefs to modularized (innate and universal) conceptual and mnemonic processing.

8. Conclusion: Evolution’s Canalizing Landscape

Think metaphorically of humankind’s evolutionary history as a landscape formed by different mountain ridges. This landscape functions everywhere to canalize, but not determine, individual and cultural development. It greatly reduces the possible sources of religious expression into structures that constantly reappear across history and societies.

This landscape is shaped by natural selection. It is ancestrally defined by specific sets of affective, social and cognitive features - different mountain ridges. Each ridge has a distinct contour, with various peaks whose heights reflect evolutionary time. One such evolutionary ridge encompasses panhuman emotional faculties, or “affect programs.” Some of these affect programs, such as surprise and fear, date at least to the emergence of reptiles. Others, such as grief and guilt, may be unique to humans. Another ridge includes social-interaction schema. Some schema may go back in evolutionary time, such as those involved in detecting predators and seeking protectors, or which govern direct “tit-for-tat” reciprocity (“you scratch my back, I’ll scratch yours”). Other social-interaction schema seem unique to humans, such as committing to nonkin. Still another ridge encompasses panhuman mental faculties, or cognitive “modules,” like folkmechanics, folkbiology, folkpsychology. Folkmechanics is this ridge’s oldest part, with links to amphibian brains. Folkpsychology is the newest, foreshadowed among apes. Only humans appear to metarepresent multiple models of other minds and worlds (Tomasello et al. 1993), including the supernatural.

Human experience lies along this evolutionary landscape, usually converging on more or less the same life paths - much as rain that falls anywhere in a mountain-valley landscape, drains into a limited set of lakes or rivers (Kauffman 1993, Sperber 1996). As humans randomly interact and “walk” through this landscape, they naturally tend towards certain forms of cultural life, including religious paths. Cultures and religions don’t exist apart from the individual minds that
constitute them and the environments that constrain them, any more than a physical path exists
apart from the organisms that tread and groove it and the surrounding ecology that restricts its
location and course. Individual minds mutually interact within this converging landscape in an
open-ended time horizon, exploiting its features in distinctive ways. The result is socially
transmitted amalgamations that distinctively link landscape features with cognitive, affective,
and interactional propensities. This produces the religious and cultural diversity we see in the
world and throughout human history.

Nevertheless, all religions follow the same structural contours. They invoke supernatural agents
to deal with emotionally eruptive existential anxieties, such as loneliness, calamity and death.
They have malevolent and predatory deities as well as more benevolent and protective ones.
These systematically, but minimally, violate modularized expectations about folkmechanics,
folkbiology and folkpsychology. And religions communally validate counterintuitive beliefs
through musical rituals and other rhythmic coordinations of affective body states. Finally, these
landscape features are mutually constraining. They include evolved constraints on emotional
feelings and displays, modularized conceptual and mnemonic processing, and social
commitments that attend to information about cooperators, protectors, predators, and prey.
References


Table 1. Examples of intuitive statements (INT), bizarre (BIZ), minimally counterintuitive (MCI), maximally counterintuitive (MXCI) counterparts in counterbalanced design.

<table>
<thead>
<tr>
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<th>Version 1</th>
<th>Version 2</th>
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<tbody>
<tr>
<td><strong>INT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Crumbling ice</td>
<td>Crystallizing ice</td>
<td></td>
</tr>
<tr>
<td>2. Crystallizing Glass</td>
<td>Crumbling Glass</td>
<td></td>
</tr>
<tr>
<td>3. Gossiping child</td>
<td>Chanting Child</td>
<td></td>
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<tr>
<td>4. Chanting man</td>
<td>Gossiping Man</td>
<td></td>
</tr>
<tr>
<td>5. Grazing cow</td>
<td>Wandering Cow</td>
<td></td>
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<tr>
<td>6. Wandering deer</td>
<td>Grazing Deer</td>
<td></td>
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<tr>
<td><strong>BIZ</strong></td>
<td></td>
<td></td>
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<tr>
<td>7. Nauseating cat</td>
<td>Dangling Cat</td>
<td></td>
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<tr>
<td>8. Dangling squirrel</td>
<td>Nauseating Squirrel</td>
<td></td>
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<tr>
<td>9. Blinking newspaper</td>
<td>Floating Newspaper</td>
<td></td>
</tr>
<tr>
<td>10. Floating pencil</td>
<td>Blinking Pencil</td>
<td></td>
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<tr>
<td><strong>MCI</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Giggling seaweed</td>
<td>Sobbing Seaweed</td>
<td></td>
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<tr>
<td>12. Sobbing oak</td>
<td>Giggling Oak</td>
<td></td>
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<tr>
<td>13. Cursing horse</td>
<td>Admiring Horse</td>
<td></td>
</tr>
<tr>
<td>14. Admiring frog</td>
<td>Cursing Frog</td>
<td></td>
</tr>
<tr>
<td>15. Solidifying lady</td>
<td>Melting Lady</td>
<td></td>
</tr>
<tr>
<td>16. Melting grandfather</td>
<td>Solidifying Grandfather</td>
<td></td>
</tr>
<tr>
<td><strong>MXCI-Control</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Cheering limping turtle</td>
<td>Chattering Climbing Turtle</td>
<td></td>
</tr>
<tr>
<td>18. Chattering Climbing pig</td>
<td>Cheering Limping Pig</td>
<td></td>
</tr>
<tr>
<td><strong>MXCI</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Squinting wilting brick</td>
<td>Squealing Flowering Brick</td>
<td></td>
</tr>
<tr>
<td>20. Squealing flowering marble</td>
<td>Squealing Wilting Marble</td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Three stories with matching events used to prime feelings of religiosity: Neutral (uneventful), Death (stressful), Religious (prayer scene)

<table>
<thead>
<tr>
<th></th>
<th>Neutral</th>
<th>Death</th>
<th>Religious</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A mother and her son are leaving home in the morning</td>
<td>A mother and her son are leaving home in the morning</td>
<td>A mother and her son are leaving home in the morning</td>
</tr>
<tr>
<td>2</td>
<td>She is taking him to visit his father's workplace</td>
<td>She is taking him to visit his father's workplace</td>
<td>She is taking him to visit his father's workplace</td>
</tr>
<tr>
<td>3</td>
<td>The father is a laboratory technician at Victory Memorial Hospital</td>
<td>The father is a laboratory technician at Victory Memorial Hospital</td>
<td>The father is a laboratory technician at Victory Memorial Hospital</td>
</tr>
<tr>
<td>4</td>
<td>They check before crossing a busy road</td>
<td>They check before crossing a busy road</td>
<td>They check before crossing a busy road</td>
</tr>
<tr>
<td>5</td>
<td>While walking along, the boy sees some wrecked cars in a junk yard, which he finds interesting</td>
<td>While crossing the road, the boy is caught in a terrible accident, which critically injures him.</td>
<td>While walking along, the boy sees a well-dressed man stop by a homeless woman, falling on his knees before her, weeping.</td>
</tr>
<tr>
<td>6</td>
<td>At the hospital, the staff are preparing for a practice disaster drill, which the boy will watch</td>
<td>At the hospital, the staff prepares the emergency room, to which the boy is rushed.</td>
<td>At the hospital, the boy's father shows him around his lab. The boy listens politely, but his thoughts are elsewhere.</td>
</tr>
<tr>
<td>7</td>
<td>An image from a brain scan machine used in the drill attracts the boy's interest.</td>
<td>An image from a brain scan machine used in a trauma situation shows severe bleeding in the boy's brain.</td>
<td>An image from a brain scan that he sees reminds him of something in the homeless woman's face.</td>
</tr>
<tr>
<td>8</td>
<td>All morning long, a surgical team practices the disaster drill procedures</td>
<td>All morning long, a surgical team struggles to save the boy's life.</td>
<td>On his way around the hospital, the boy glances into the hospital's chapel, where he sees the well-dressed man sitting alone.</td>
</tr>
<tr>
<td>9</td>
<td>Make-up artists are able to create realistic-looking injuries on actors for the drill.</td>
<td>Specialized surgeons are able to re-attach the boy's severed feet, but can not stop his internal hemorrhaging.</td>
<td>With elbows on his knees, and his head in his hands, the man moves his lips silently. The boy wants to sit beside him, but his father leads him away.</td>
</tr>
<tr>
<td>10</td>
<td>After the drill, while the father watches the boy, the mother leaves to phone her other child's pre-school.</td>
<td>After the surgery, while the father stays by the dead boy, the mother leaves to phone her other child's pre-school</td>
<td>After a brief tour of the hospital, while the father watches the boy, the mother leaves to phone her other child's pre-school.</td>
</tr>
<tr>
<td>11</td>
<td>Running a little late, she phones the pre-school to tell them she will soon pick up her child.</td>
<td>Barely able to talk, she phones the pre-school to tell them she will soon pick up her child.</td>
<td>Running a little late, she phones the pre-school to tell them she will soon pick up her child.</td>
</tr>
<tr>
<td>12</td>
<td>Heading to pick up her child, she hails a taxi at the number nine bus stop</td>
<td>Heading to pick up her child, she hails a taxi at the number nine bus stop.</td>
<td>Heading to pick up her child, she hails a taxi at the number nine bus stop.</td>
</tr>
</tbody>
</table>
Footnotes

[1] We make no conceptual distinction between “culture” and “society” or “mind” and “brain.”

[2] This framework is also informed by the first author’s ethnographic sojourns among Lowland Maya (Mesoamerica), Druze mountaineers (Middle East), Pashtun nomads (Central Asia), Tamil Hindu farmers (South India) and Ladakhi Buddhist tanshumants (Himalaya).

[3] Evolutionarily, at least some basic emotions preceded conceptual reasoning: surprise, fear, anger, disgust, joy, sadness (Darwin 1965[1872], Ekman 1992). These may have further evolved to incite reason to make inferences about situations relevant to survival decisions. Existential anxieties are by-products of evolved emotions, such as fear and the will to stay alive, and of evolved cognitive capacities, such as episodic memory and the ability to track the self and others over time. For example, because humans are able to metarepresent their own selves and mentally travel in time (Wheeler et al. 1997), they cannot avoid overwhelming inductive evidence predicting their own death and that of persons to whom they are emotionally tied, such as relatives, friends and leaders. Emotions compel such inductions and make them salient and terrifying. This is “The Tragedy of Cognition.” All religions propose a supernatural resolution in some minimally counterfactual afterlife.

[4] Experiments with adults in the United States (Barrett & Keil 1996) and India (Barrett 1998) further illustrate the gap between theological doctrine and actual psychological processing of religious concepts. When asked to describe their deities, subjects in both cultures produced abstract and consensual theological descriptions of gods as being able to do anything, anticipate and react to everything at once, always know the right thing to do, and be able to dispense entirely with perceptual information and calculation. When asked to respond to narratives about these same gods, the same subjects described the deities as being in only one place at a time, puzzling over alternative courses of action, and looking for evidence in order to decide what to do (e.g., to first save Johnny, who’s praying for help because his foot is stuck in a river in the USA and the water is rapidly rising; or to first save little Mary, whom He has seen fall on railroad tracks in Australia where a train is fast approaching).

[5] One distinction between fantasy and religion is knowledge of its source. People know or assume that public fictions (novels, movies, cartoons, etc.) were created by specific people who had particular intentions for doing so. Religious believers assume that utterances or texts connected with religious doctrines are authorless, timeless and true. Consequently, they don’t apply ordinary criteria of relevance to religious communications to figure out the speaker’s true intentions or check on whether God is lying or lacking information (Sperber & Wilson 1986). Timelessness implies that cues from the surrounding environment, background knowledge and memory are all equally relevant. So God’s message can apply to any context, and to each context in indefinitely many and different ways.

[6] Psychoanalytic (Freud 1990, Erikson 1963) and attachment (Bowlby 1969, Kirkpatrick 1998) theories hold that primary deities are surrogate parents who assuage existential anxieties. But ethnographic reports indicate that malevolent and predatory deities are as culturally widespread, historically ancient and as socially supreme as benevolent deities. Examples include cannibalistic spirits of small-scale Amazonian, sub-Saharan African and Australian aboriginal societies as well as bloodthirsty deities of larger-scale civilizations that practiced human sacrifice, such as Moloch of the Ancient Middle East, the death goddess Kali of tribal Hindus and the Maya thunder god Chaak. Psychological findings on false-belief tasks (see below) further indicate that beliefs about people are not the basis of beliefs about God because the developmental trajectories of these two belief sets diverge from the outset.

[7] Science, like religion, uses metarepresentation in cosmology building: for example, in analogies where a familiar domain (e.g., solar systems, computers, genetic transmission) is used to model some initially less familiar system (e.g., atoms, mind/brains, ideational transmission). In fact, science and religion may use the same analogies; however, there is a difference in these uses. Science aims to reduce the analogy to factual description, where the terms of the analogy are finally specified, with no loose ends remaining and nothing left in the dark: atoms are scientifically like solar systems if and only both can be ultimately derived from the same set of natural laws. Whereas science seeks to kill the metaphor, religion strives to keep it poetic and endlessly open to further evocation. In religion, these
ideas are never fully assimilated with factual and commonsensical beliefs, like a metaphor that meta-represents the earth as a mother but not quite, or an angel as a winged youth but not quite.

[8] According to Boyer (1994, 1997, 2000), bodiless supernaturals are counterintuitive because they think and act but lack physical substance. The matter is not so simple. First, experiments with infants and adults indicate that ordinary intuitions about causal agents do not require any knowledge or perception of material substance, only the expectation (perhaps never actually realized) that there ultimately is a physical source of intentional action (Csibra et al. 1999). Ontological violations block such expectations being realized even in principle (e.g., invisible agents versus heard but unseen beings). They countermand rules for eventual processing, not actual perception. Second, not all mental states are equally bound to ordinary intuitions about bodies. Recent studies indicate that children from five years on up more readily attribute epistemic mental states (see, think, know) to beings in the afterlife than psychobiological mental states (hunger, thirst, sleepiness) (Bering & Bjorklund 2002). Ordinary distinctions between mind and body (e.g., dreaming) thus seem to provide at least some intuitive support for extraordinary beings with disembodied minds (Hobbes 1901[1651]).

[9] Barrett and Nyhof (2001:79) list as common items: “a being that can see or hear things that are not too far away”; “a species that will die if it doesn’t get enough nourishment or if it is severely damaged”; “an object that is easy to see under normal lighting conditions.” Such items fall so far below ordinary expectations communication should carry some new or salient information that Barrett and Nyhof (2001:82-83) report: “common items were remembered so poorly relative to other items.... In some instances of retelling these items, participants tried to make the common property sound exciting or unusual.” In other words, some subjects tried to meet minimum conditions of relevance (Sperber & Wilson 1986). For the most part, common items failed these minimum standards for successful communication.

[10] A paired-samples t-test revealed superiority of intuitive (INT) over minimally counterintuitive beliefs (MCI), M=1.28 vs. M=1.09 respectively, t(79) = 4.01, p<.001.

[11] Highest degradation was observed in the Mostly MCI and All INT conditions, conforming to an inverse quadratic function, F(3, 89) = 4.49, p<.05. Memory degraded least in the Mostly INT condition, and increased as the proportion of MCI beliefs increased, resulting in a linear trend, F(2, 65)=3.53, p=.06.

[12] Analysis of variance showed that beliefs about God are statistically flat across age groups, whereas beliefs about people change: F(1, 44) = 6.51, p = .01.

Fig. 1. Immediate recall for USA students by proportion of Intuitive (INT) and minimally counterintuitive (MCI) beliefs.

Fig. 2. Delayed 1-week recall for USA students by proportion of Intuitive (INT) and minimally counterintuitive (MCI) beliefs.

Fig. 3. Delayed 1-week recall for USA students by proportion of Intuitive (INT), bizarre (BIZ), minimally counterintuitive (MCI) and maximally counterintuitive (MXCI) beliefs (error bars, 95% confidence interval).
Fig. 4. Memory degradation over 1-week (immediate minus delayed recall) for USA students by proportion of intuitive (INT) and minimally counterintuitive (MCI) beliefs.

Fig. 5. Memory degradation over 1 week (11-12) and over 3 months (11-13) for Yukatek Maya by proportion of intuitive and minimally counterintuitive beliefs (error bars, 95% confidence interval).

Fig. 6. Percentage of Yukatek Maya children's attributions of false beliefs to God and persons by age.
Fig. 7. Percentage of responses (all groups) to persons and various supernatural agents.

Fig. 6. Strength of belief in God’s existence after priming (neutral, religious or death) (error bars, 95% confidence interval)

Fig. 9. Strength of belief in supernatural power of prayer after priming (neutral, religious or death) (error bars, 95% confidence interval)