RELIGION'S INNATE ORIGINS

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1. Introduction

This chapter envisions religion, in general, and awareness of the supernatural, in particular, as a converging by-product of several cognitive and emotional mechanisms that evolved under natural selection for mundane adaptive tasks (Atran 2002). As human beings routinely interact they naturally tend to exploit these by-products to solve inescapable, existential problems that have no apparent worldly solution, such as the inevitability of death and the ever-present threat of deception by others. Religion involves costly and hard-to-fake commitment to a counterfactual world of supernatural agents that master such existential anxieties (Atran & Norenzayan, in press). The greater one's display of costly commitment to that factually absurd world – as in Abraham's willingness to sacrifice his beloved son for nothing palpable save faith in a "voice" demanding the killing – the greater society's trust in that person's ability and will to help out others with their inescapable problems (Kierkegaard 1955[1843]).[i]

This framework for understanding religion is informed not just by my reading of our culture's religious history, but by cross-cultural experiments with colleagues and ethnographic sojourns among Lowland Maya (Mesoamerica), Druze mountaineers (Middle East), Pashtun nomads (Central Asia), Tamil Hindu farmers (South India), Ladakhi Buddhist tanshumants (Himalaya).

2. The Supernatural Agent: Hair-Triggered Folkpsychology

A growing number of converging cross-cultural experiments on "domain-specific cognition" emanating from developmental psychology, cognitive psychology and cognitive anthropology indicate that human minds are innately endowed with core cognitive faculties, or "modules," for understanding the everyday world of readily perceptible substances and events (for overviews, see Atran 1989, Hirschfeld & Gelman 1994, Sperber et al. 1995, Pinker 1997). These 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 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, crystal ball, Arab tilsam [talisman]) or beings that can pass through solid objects (angels, ghosts, ancestral spirits) (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.

Religions invariably center on supernatural agent concepts, like gods, goblins, demons, witches, good fairies, bad fairies and jinns. Here, I concentrate on the concept of AGENCY, a central player in what cognitive and developmental psychologists refer to as "folkpsychology" and the "theory of mind." AGENCY evolved hair-triggered in humans to respond "automatically" under conditions of uncertainty to potential threats (and opportunities) by intelligent predators (and protectors). From this perspective, AGENCY is a sort of "Innate Releasing Mechanism" (Tinbergen 1951) whose proper evolutionary domain encompasses animate objects but which inadvertently extends to moving dots on computer screens, voices in wind, faces in clouds, and virtually any complex design or uncertain circumstance of unknown origin (Guthrie 1993; cf. Hume 1957[1756]).

Numerous 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, Csibra et al. 1999).[ii] Such a biologically-prepared, or "modular," processing program would allow rapid and economical reaction to a wide – but not unlimited – range of stimuli associated statistically 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, Geary & Huffman 2002).

Our brains, it seems, are trip-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.). 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 (Alexander 1989). 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)

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. Similarly, serpent-like devils and demons are culturally ubiquitous (Munkur 1983), perhaps evoking and addressing a primal fear shared by our primate line (Mineka et al. 1984).[iii]

From an evolutionary perspective, it's better to be safe than sorry regarding the detection of agency under conditions of uncertainty. 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. 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).

In addition, humans <u>conceptually</u> <u>create</u> information to mimic and manipulate conditions in ancestral environments that originally produced and triggered our evolved cognitive and emotional dispositions (Sperber 1996). Humans habitually "fool" their own innate releasing programs, as when people become sexually aroused by make-up (which artificially highlights sexually appealing characteristics), fabricated perfumes or undulating lines drawn on paper or dots arranged on a computer screen, that is, pornographic pictures.[iv] Indeed, much of human culture – for better or worse - can be arguably attributed to focused stimulations and manipulations of our species' innate proclivities.[v]

These manipulations can activate and play upon several different cognitive and emotional faculties at once. Thus, masks employ stimuli that trigger our innate, hyperactive facial-recognition schema. Masks also employ stimuli that activate, amplify and confound emotions by highlighting, exaggerating or combining certain facial expressions. Moreover, like two-dimensional drawings of the Nekker cube for which there is no stable three-dimensional interpretation, masks can produce feelings of unresolved anxiety or "uncanniness." In many religious ceremonies, for example, as a mask rotates away (e.g., clockwise) from an onlooker, who now gazes on the mask's hollow back, the onlooker perceives a three-dimensional face emerging in the other direction (counterclockwise) from inside the back of the mask (cf. Dawkins 1998). Such manipulations can serve cultural ends far removed from the ancestral adaptive tasks that originally gave rise to those cognitive and emotional faculties triggered, although manipulations for religion often centrally involve the collective engagement of existential desires (e.g., wanting security) and anxieties (e.g., fearing death).

Recently, numbers of devout American Catholics eyed the image of Mother Theresa in a cinnamon bun sold at a shop in Tennessee. Latinos in Houston prayed before a vision of the Virgin of Guadalupe, whereas Anglos saw only the dried remnants of melted ice cream on a pavement. Cuban exiles in Miami spotted the Virgin in windows, curtains and television afterimages as long as there was hope of keeping young Elian Gonzalez from returning to godless Cuba. And on the day of the World Trade Center bombing, newspapers showed photos of smoke billowing from one of the towers that "seems to bring into focus the face of the Evil One, complete with beard and horns and malignant expression, symbolizing to many the hideous nature of the deed that wreaked horror and terror upon an unsuspecting city" ("Bedeviling: Did Satan Rear His Ugly Face?," <u>Philadelphia Daily News</u>, 14 Sept. 2001).

In all these cases, there is culturally-conditioned emotional priming in anticipation of agency. This priming, in turn, amplifies the information value of otherwise doubtful, poor and fragmentary agency-relevant stimuli. This enables the stimuli (e.g., cloud formations, pastry, ice cream conformations, sounds of dubious origin) to achieve the mimimal threshold for triggering hyperactive schemata for facial-recognition, body-movement recognition and sound-recognition that humans possess for identifying agents.

In sum, 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 hair-

triggering of an agency-detection mechanism that readily promotes supernatural interpretation and is susceptible to various forms of cultural manipulation. Cultural manipulation of this modular mechanism and priming facilitate and direct the process. Because the phenomena created readily activate intuitively given 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.

3. Metarepresenting Counterintuitive Worlds: A Theory of Mind Experiment

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 <u>as fiction</u> 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, <u>without our having to actually live through (or die in) the situations we imagine</u>. It affords us the capacity to <u>model the world in different ways, and to conscientiously change the world by entertaining new models</u> 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 <u>only</u> 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, Sousa, Barrett and Atran (2004) 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 (<u>k'in</u>), principal forest spirits (<u>yumil k'ax'ob'</u>, "Masters of the Forest"), and other minor spirits (<u>chiichi'</u>) 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. Thus, 33% of the 4-year-olds

said that people would think tortillas were in the container versus 77% of 7-year-olds. In contrast, no significant correlation was detected between answers for God and age [*r(46) = .06*].

Collapsing over ages, Yukatek children attribute true beliefs according to a hierarchy of human and divine minds, one in which humans and minor spirits are seen as easier to deceive, Mental states of humans were perceived as different from those of God ($Z = 3.357$, $p = .001$), and those of Masters of the Forest and the Sun god ($Z = 1.89$, $p = .06$ for both). God is seen as all-knowing, and local religious entities fall somewhere in the middle (Figure 1). Lowland Maya believe God and forest spirits to be powerful, knowledgeable agents that punish people who overexploit forest species. For adults, such beliefs have measurable behavioral consequences for biodiversity and forest sustainability. 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 <u>different</u> from parents and other people

4. Existential Anxiety: An Experiment on What Motivates Religious Belief

If supernatural agents are cognitively salient and possess hidden knowledge and powers, then they can be invoked to ease existential anxieties such as death and deception that forever threaten human life everywhere. This section summarizes an experiment that I recently undertook with psychologists Ara Norenzayan and Ian Hansen linking adrenaline-activating death scenes to increased belief in God's existence and the efficacy of supernatural intervention in human affairs.

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. But only the placebo group 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 primed each of three groups of college students with one of three different stories (Table 1): 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 <u>New York Times</u> 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 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 9-point scale.

Results show that strength of belief in God's existence and in the efficacy of supernatural intervention (Figure 2) are reliably stronger after exposure to the death prime than either to the neutral or religious prime, $F(2, 74) = 3.77$, $p = .03$ (no significant differences between either uneventful story). This effect held even after controlling for religious background and prior degree of religious identification.

Terror Management Theory (TMT) maintains that cultural worldview is a principal buffer against the terror of death. Accordingly, TMT experiments show that thoughts of death function to get people to reinforce their cultural (including religious) worldview and derogate alien worldviews (Greenberg et al. 1990; Pyszczynski et al. 1999). According to TMT, then, awareness of death should enhance belief in a worldview-consistent deity, but diminish belief in a worldview-threatening deity. Our view suggests that the need for belief in supernatural agency overrides worldview defense needs for death-aware subjects.

To test this idea, in a follow-up, 73 American undergraduates were told the prayer groups were Buddhists in Taiwan, Korea, and Japan. Supernatural belief was measured either shortly after the primes, or after a significant delay between the primes and the belief measures. When the primes were recently activated, as expected there was a stronger belief in the power of Buddhist prayer in the death prime than in the control prime, $\underline{F}(1, 33) = 6.65$, $\underline{p} = .01$. Remarkably, death-primed subjects who previously self-identified as strong believers in Christianity were <u>more</u> likely to believe in the power of Buddhist prayer ($\underline{r}(33) = .37$, $\underline{p} = .03$). In the neutral (control) condition, there was no correlation between Christian identification and belief in Buddhist prayer. Given a choice between supernatural belief versus rejecting an alien worldview (Buddhism), Christians chose the former. This finding is difficult to explain in terms of bolstering a cultural wordview.

In a cross-cultural extension, 75 Yukatek-speaking Maya villagers were tested, using stories matched for event structure but modified to fit Maya cultural circumstances. They were also asked to recall the priming events. We found no differences among primes for belief in the existence of God and spirits (near ceiling in this very religious society). However, subjects' belief in efficacy of prayer for invoking the deities was significantly greater with the death prime than with religious or neutral primes, $\underline{?}^2(2, \underline{N} = 75) = 10.68$, $\underline{p} = .005$. Awareness of death more strongly motivates religiosity than mere exposure to emotionally nonstressful religious scenes, like praying. This supports the claim that emotionally eruptive existential anxieties motivate supernatural beliefs.

We found no evidence for differences in recall of priming events after subjects rated their strength of belief in God and the efficacy of supernatural intervention. With this in mind, note that uncontrollable arousal mediated by adrenergic activation (e.g., subjects chronically exposed to death scenes) can lead to Posttraumatic Stress Syndrome if there is no lessening of terror and arousal within hours; however, adrenergic blockers (e.g., propranolol, guanfacine, possibly antidepressants) can interrupt neuronal imprinting for long-term symptoms, as can cognitive-behavioral therapy (work by Charles Marmar discussed in McReady 2002:9). Heightened expression of religiosity following exposure to death scenes that provoke existential anxieties may also serve this blocking function (Atran 2002b). We plan to test the further claim that existential anxieties not only spur supernatural belief, but these beliefs are in turn affectively validated by assuaging the very emotions that motivate belief in the supernatural.

5. Conclusion

All of this isn't to say that <u>the</u> function of religion and the supernatural is to promise resolution of all outstanding existential anxieties anymore than <u>the</u> function of religion and the supernatural 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 on. Religion has no evolutionary functions <u>per se</u>. 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 in the supernatural owes, in part, to success in accommodating these elements. There are other factors in this success, involving naturally-selected elements of human cognition. These include the inherent susceptibility of religious beliefs to modularized (innate, universal, domain-specific) conceptual processing systems, such as folkpsychology, that favor survival of the supernatural within and across minds.

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Table 1. **Three stories with matching events used to prime feelings of religiosity:
Neutral (uneventful), Death (stressful), Religious (prayer scene)**

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

Figure 1
What's in the container?
All Yukatek Maya Children's Responses
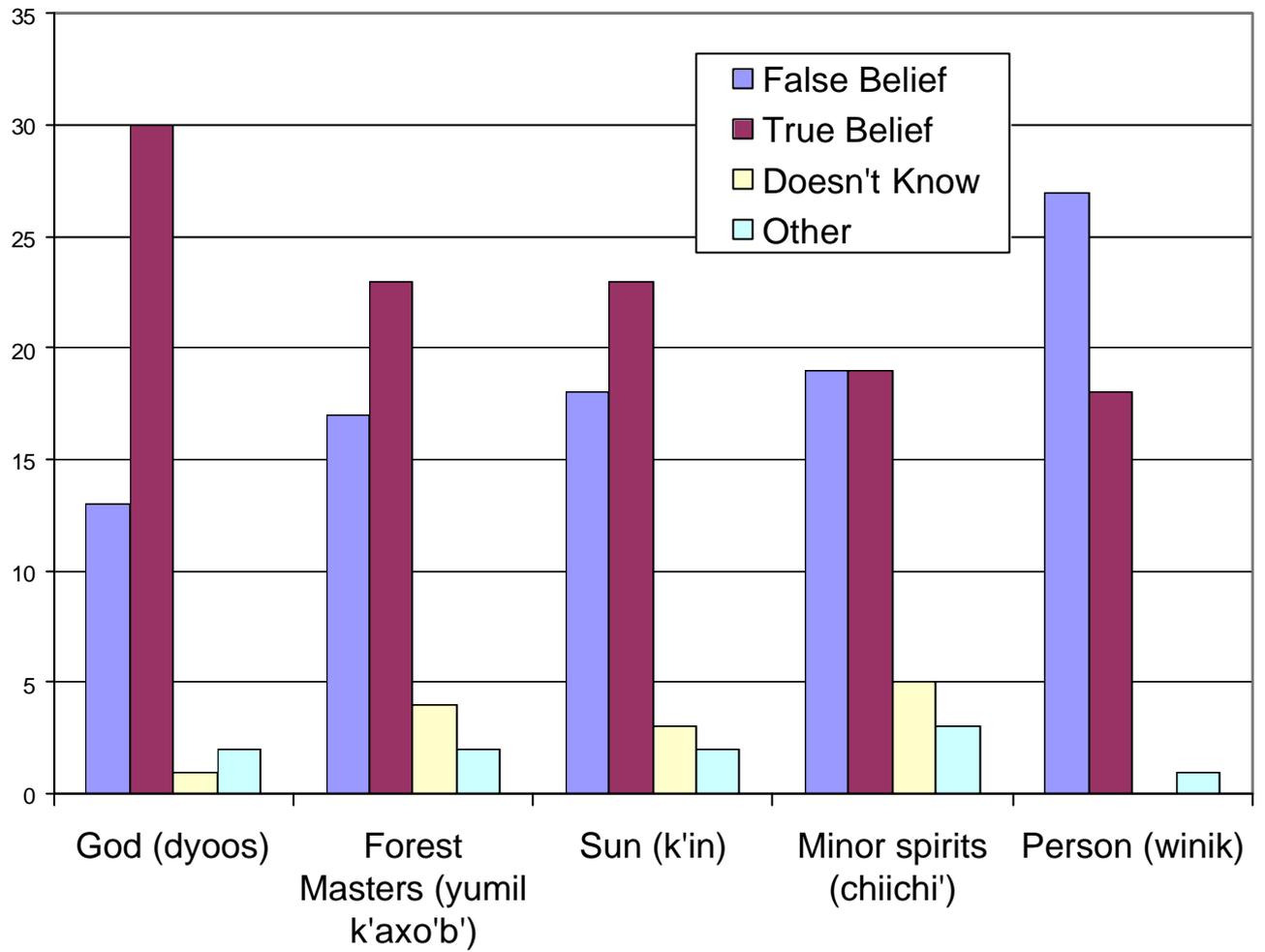
Figure 2

**Strength of belief in supernatural power after priming (neutral, religious or death) and
then reading a newspaper article about effects of prayer on pregnancy
(vertical bars represent margin of error at p = .05)**
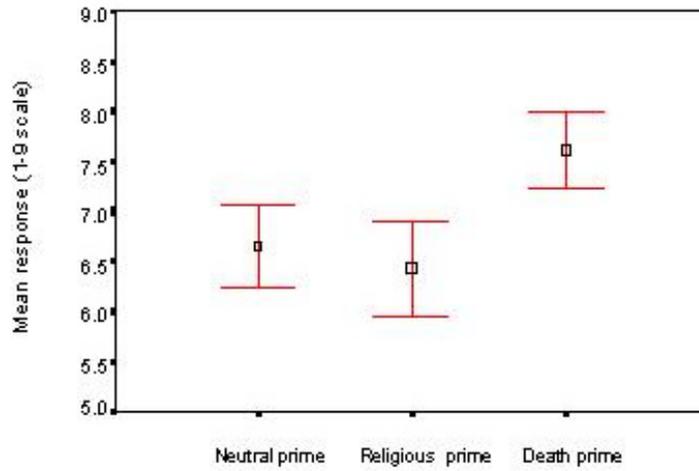
Notes

[i] Of course the outlines of the factually preposterous world that the person is committed to must be shared by a significant segment of society, lest the person be considered a mentally deviant psychopath or sociopath (e.g.,child abuser and would-be murderer).

[ii] For each natural domain, there is a proper domain and (possibly empty) actual domain (Sperber 1996). A proper domain is information that is the cognitive module's naturally-selected function to process. 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. Although clouds and wind occurred in ancestral environments, they had no functional role in recurrent task problems with animate beings. Similarly, 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 resulting 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.

[iii] Psychoanalytic (Freud 1990, Erikson 1963) and attachment (Bowlby 1969, Kirkpatrick 1998) theories hold that primary deities are surrogate parents who assuage existential anxieties. But 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.

[iv] Another example from ethology offers a parallel. Many bird species have nests parasitized by other species. Thus, the cuckoo deposits 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.

[v] A telling example is contemporary suicide terrorism (Atran 2003). Consider the "Oath to Jihad" taken by recruits to Harkat al-Ansar, a Pakistani-based ally of Al-Qaeda., which affirms that by their sacrifice they would help secure the future of their "family" of fictive kin: "Each [martyr] has a special place – among them are brothers, just as there are sons and those even more dear." As fictive kin, members of religious groups engage in indirect reciprocity (Alexander 1987), performing and profiting from many tasks that they could not do alone, one by one, or only with family (Nesse 1999). Unlike other primate groups, hominid groups grew to sizes (Dunbar 1996) that could not function exclusively on the basis of

kin-altruism (biologically-driven commitment falls off precipitously as genetic distance increases between individuals) or "tit-for-tat" direct reciprocity (ability to directly monitor trustworthiness in reciprocation decreases rapidly as the number of interactions between people multiply). Sacrificial displays for religious belief (e.g., taking one's time to attend church, giving part of one's wealth to charity) is almost always reckoned as sincere social commitment to one religious "family." Thus, "Among the Hebrews and Phoenicians… the worshipper is called brother (that is, kinsman or sister of the god)" (Robertson Smith 1972[1891]:44n2). "Brotherhood" is also the common term applied today among the Christian faithful and to the fraternity (ikhwan) of Islam. In the case of religiously-inspired suicide terrorism, these sentiments are purposely manipulated by organizational leaders, recruiters and trainers to the advantage of the manipulating elites rather than the individual (much as the fast food or soft drink industries manipulate innate desires for naturally scarce commodities like fatty foods and sugar to ends that reduce personal fitness but benefit the manipulating institution). No "group selection" is involved, wherein individual fitness is sacrificed so that overall group fitness can increase relative to the overall fitness of other, competing groups (cf. Wilson 2002). All that is involved is cognitive and emotional manipulation of some individuals by others.