

Nature's Medicine

RUNNING HEAD: Nature's Medicine

REVISED 24 September 2004

Nature's Medicine:
Empirical Constraint and the Evolution of Religious Healing
DRAFT

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Abstract

This paper examines how religiosity fosters biological success by promoting mental and physical health. My central claim is that religious healing is grounded in fitness-enhancing understandings of the world as supernatural. I employ evolutionary task analysis to develop several testable hypotheses about the design of the psychological systems that generate religiosity to support individual wellbeing.

Keywords: biology, costly signalling theory, evolution, healing, mental health, religion, ritual.

Introduction:

Below I argue that religiosity is an adaptation that enhances individual fitness.¹ Recent adaptationist inquiry has concentrated on features related to social exchange and group functionality (Irons 2001; Wilson 2002; Sosis 2003; Bulbulia 2004). While such investigations have proved empirically fruitful [see (Bulbulia in press)], it appears that religiosity may perform functions either unrelated to social exchange, or related in novel ways. Below I explore the functionality of what I term “religious healing,” the capacity of religious cognition to improve the mental and physical wellbeing of religious individuals.²

Let me begin with two assumptions. First, I take it that religiosity is wide spread, even in isolated cultural lineages. Though there are cultural aspects to religion -- religious concepts, doctrines, and practices are handed down to us from others -- nevertheless core psychological features of religious cognition remain invariant. Agents in all cultures and epochs develop motivating convictions relative to supernatural or sacred realities, and these convictions are variously normative on their lives. Agents in all cultures also express and cultivate these motivating convictions through religious rituals. Supernatural commitment in children appears to be the default setting, emerging from a

¹ By “religiosity” I mean dispositions to form motivating beliefs in supernatural beings, powers, and places. I use the term “religion” and its cognates as synonyms for “religiosity.” I note this convention departs from ordinary language, which includes institutional and other meanings.

² Improvement other than through reciprocity with others, for clearly, social exchange improves wellbeing: we are, in innumerable ways, made by each other.

severe poverty of stimulus (Bering 2004; Kelemen 2004; Bering in press). We are born to believe (Bering, per comm.) While it is true that many adults avow no religion, their unbelief appears to flow from specifically modern conditions, and even here latent theisms may intrude (Bering and Johnson (in press)). All evidence points to religiosity as a human universal, an aspect of biological endowment. Without further argument, I'll assume it so [for discussion, see (Bulbulia under review).]

Second, I will proceed as if the gods do not exist. This is, of course, a controversial assumption. Indeed, if religiosity really is a human universal, then this stance is universally contestable. Is it warranted? Clearly naturalists should not be committed a priori to the unreality of the gods. Whether the gods exist is a contingent fact about the world -- possibly true, possibly not -- thus a matter for discovery not stipulation. Furthermore, it would be arrogant to require (without argument) that some of the best theological minds are wrong. Yet looking to past scientific success, it is clear that explanations that make no appeal to the gods hold up better over time than explanations that do. So I take it that if we can leave the gods out of our naturalistic explanations for why we come to believe in the gods, then so much the better.³

Given that 1) religiosity is a dimension of human nature and 2) religiosity errs (at least "often errs") finding a naturalistic explanation for religion becomes more pressing. Our cognitive capacities evolved to regulate internal states and track, negotiate, and manipulate objects and agents in distal environments (Godfrey-Smith 1996; Godfrey-Smith 2002). In most cases, getting the world wrong exposes an organism's neck to selection ("There is no tiger in that field;" "That lake isn't so wide to swim;" "These vipers make good bed fellows.") Moreover error brings opportunity costs: in

³ On reflection, this methodological naturalism may be attractive to religious persons as a position they take prior to theological reflection. For different religions frequently commit both to different conceptions of the gods, as well to atheism about the gods of other religions. There may be theologically sophisticated ways of reconciling discrepant religious outlooks. But taken at face value – and in the way most religious agents assume – religious outlooks are incompatible. Christians don't believe in the Hindu god Ganesh; Muslims to not believe in Buddhist reincarnation; Ralien aliens are outré among Hassidic Jews. And these religious outsiders need some explanation for why individuals of other faiths come to such contrary convictions – for example of alien cloners -- erroneously. Whatever one's ultimate theology, in my view, it ought to begin with good science.

contemplating the heavens, we forego thinking about real and pressing fitness concerns. So why did selection tolerate religious dispositions in our species?

Perceptual Errors as Fitness Enhancing

Clearly selection may tolerate perceptual error within adaptive thresholds. For example, selection may allow perceptual twitchiness where the costs of false positives are lower than the costs of missed positives (Sterelny 2003). Caution may simply be more efficient, and so more evolvable, than perfection.

Some cognitive psychologists view religious errors as side effects of our social minds. They argue that religiosity flows from hair-trigger response mechanisms dedicated to tracking agency in the world. The idea is that we are better safe than sorry when it comes to finding intentional agents (especially persons) at large. So we find them even when they are not there. And this projective tendency enables belief in gods to take root (Guthrie 1993; Guthrie 2001). This story can't be right. The gods aren't ordinary persons (Boyer 2001), people don't register them only (or even generally) in perceptually ambiguous settings, and we don't generally build alters and worship as a response to person sightings [for discussion see (Bulbulia in press)]. Many cognitive psychologists concede this point, yet argue that multiple developmentally entrenched cognitive systems collectively produce god-centred religiosity as a by-product. Hypersensitive agency detection goes part of the way, though other mechanisms chime in to jointly evoke the elaborate supernaturalisms of our theological imaginations [see (Atran 2002; Boyer 2003; Atran 2004)]. And if cost of this psychological noise is on average low, selection will turn a blind eye. Below I show how these costs may be adaptive, artefacts of functional design. First I seek a general account for how structured cognitive error may benefit agents.

Considering the familiar example of self-deception. Robert Trivers notes that self-deception of one's moral goodness and competence may advance one's self interest (Trivers 2001). Suppose I wish to convince you that I am trustworthy and reliable, that I will always act in your best interest, and effectively. Suppose further that I've not

always been so “beneffective” in the past. If past is precedent, then an accurate assessment of my value to you is, say “15% reliable and 4% effective.” Who would stake much on such odds? All things equal, an optimal strategy on my part will be to deceive, for example to say: “I am 100% effective and 100% reliable.” But it is hard to get away with lying (Frank 1988). Audiences search faces and vocal intonations for emotional sincerity, which is tough to fake.⁴ Emotional responses are processed in areas of the brain situated outside of conscious control (Ramachandran and Blakeslee 1998). Where deception is self-conscious, audience scrutiny can give up the lie.

Now imagine my self-judgement is biased to favour my goodness and reliability. Suppose I can blot out the past, and fully convince myself that I am worth your while. If so, then I am self-deceived. But that self-deception serves self-interest. For when I am deceived, I may better deceive others. Getting that region of the world occupied by (unreliable) me wrong therefore has strategic value. Believing self-inflating falsehoods helps me to secure valuable exchange with others, at least initially, before a new record of unhelpfulness uncovers the deceit (Trivers 2001).⁵ We can compare the outcomes:

Accuracy v. Strategic self-deception

Judgment	Display options	Outcome
I am 13% trustworthy and 4% effective	1. Lie ineffectively or 2. Tell a scary truth	No friends

⁴ Run this experiment: observe yourself in a mirror consciously advertising your goodness and effectiveness while silently recalling your shortcomings, and judge whether you are credible.

⁵ I note that agents may REALLY be beneffective and come to believe they are, and represent themselves as such. So “self-deception” here departs from ordinary usage, for it does not imply that the beliefs are necessarily false. Instead, it implies that such beliefs are over-determined by the psychological mechanisms that generate them, irrespective of how the world is. Whether you are beneffective or not, selection will target psychological architecture that prompts you to think you are. This point is exactly analogous with respect to religiosity. When I suggest that religion is strategic self-deception or illusion, I do not claim that the world necessarily contains no gods. I only claim that agents will tend to believe in gods of a specific type, no matter how the world stands. That is, tendencies to such beliefs are over-determined by psychological mechanisms (given specific developmental and social conditions). As a methodological naturalist, I leave the gods out of the explanatory equation.

I am 100% beneffective	Trustworthiness	Friends (at least initially)
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Suppose, plausibly that:

Average fitness effects of outcome [no friends] < Average fitness effects of outcome [friends (at least initially)]

Then all things equal, selection will ratify tendencies to self-deception as a form of strategic investment in exchange futures.

We can add to Trivers's analysis by noticing that the strategy self-deception-to-deceive operates under empirical constraints. For example, the strategy works best when agents are blithely unaware of it. To the extent that I am conscious of distortion and bias, I am less deceived, and so, less effective at deceiving others. To be robust, the strategy needs to be buried from consciousness. The systems controlling self-deception are thus 1) constrained by assessment confidence.

Moreover, the strategy must be restricted. I do not get everything about myself wrong. I do not mistake core metabolic requirements, shutting down my liver or respiratory system -- turning a deathly shade of green to get you interested in me. I do not convince myself "I am a Neil Armstrong," to secure your attention. I do not hold my hand to the fire saying "I will do anything for you." I merely think of myself as decent and trustworthy, as a way to getting you to think the same. Deception and bias is directed to inferences about my goodness and effectiveness. The representations employed by the system are thus 2) constrained by its problem domain.

Finally, deception works best when motivationally insulated from other problem domains. In areas unrelated to exchange, misjudgements of worth may bring significant harms. For reliable self-assessment is generally helpful, for example, when contemplating a desert crossing or estimating foot speed relative to a gaining predator. Compartmentalised deception will be favoured over forms that make information globally available to other problem domains. An optimal system will therefore be structured by 3) encapsulation constraints.

Applying qualitative task analysis to self-deception helps us to understand the system's biological functionality, but it also places more formal quantitative analysis within empirical reach. For once we have defined the constraints under which self-deception operates, we can unravel further intricacy in psychological design by testing 1) the degree to which agents are aware of their distorted self-images; 2) the degree to which these distortions are limited to self-evaluation; 3) the degree these self-evaluations are motivationally encapsulated from other problem domains where the distortions may bring harm. To ratchet inquiry forward we need to assign values to constraint parameters (no easy problem). Here I will simply be interested in describing these parameters.

Most importantly for our purposes, this analysis reveals a basic evolutionary pressure at work. It shows that cognitive error may sometimes form the basis of an exquisite reproductive strategy. Error need not be viewed as a disadvantage or as harmless noise. Where the strategy self-deception-to-deceive-others is structured, there are few costs to getting the world wrong. Quite the opposite -- and crucially -- accuracy carries the disadvantage. Error may occasionally prove to be one of nature's myriad ways of insulating organisms from its fires.

Generalising: if N is the average fitness effect of a disposition to form accurate judgements of the world, and UN is average fitness effect of a structured misunderstanding of the world, then selection will tend, all things equal, to ratify UN , or:

All things equal, if $UN > N$, then UN

How do we know whether selection has targeted and amplified cognitive error? As with other adaptations, we look for evidence of design: functionality, intricacy, efficiency, encapsulation, integration, and overarching mesh [(Sterelny 2003) pp. 101-104].

In the next section, I consider whether religiosity employs structured error to promote fitness by supporting reciprocity and social exchange. The argument in this section is not novel, but I include it for audiences unfamiliar with the adaptationist literature. (Those familiar may want to skip this account). I also include this discussion because the analysis of religious healing requires an appreciation of how religious morality relies on specific distortions of the world as supernatural. For, as we shall see,

the functions of religiosity in these domains (reciprocity and healing) both overlap and diverge, with important implications for the cognitive design housing our religious instincts.

Religiosity as an adaptation for exchange

I briefly consider a familiar adaptationist approach to religious cognition, which explicates how systems structured to produce religious belief (a variety of UN) fuel success by securing cooperation.

Consider the prisoner’s dilemma. Two prisoners, “Ricardo” and “Slone” are held for a crime. Each faces the same choice, to turn the accomplice in (defect) or to remain silent (cooperate). The time each will serve in prison depends in part on this choice, and in part on the choice of the accomplice, and the options for each are exactly symmetrical. Thus, there are four possible outcomes for each prisoner:

1. **IF I defect, and my accomplice co-operates THEN I go free, and he gets 10 years.**
2. **IF I defect and my accomplice defects THEN I get 9 years in prison, and he gets 9 years.**
3. **IF I co-operate and my accomplice co-operates THEN I get 1 year in prison, and he gets 1 year.**
4. **IF I co-operate and my accomplice defects THEN I get10 years in prison, and he goes free.**

The Prisoners’ Dilemma (N-conditioned)

	Ricardo	
	Defect	operate
Slone Defect	-9	10
Slone Co-operate	-9	1

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The prisoners should want to co-operate as a happy compromise. Clearly, even though mutual co-operation is not as good as freedom, it is better than 9 or 10 years in jail. Co-operation is strictly efficient. However, all things equal, an agent who seeks to maximize self-interest -- a “rational” agent -- will always choose to defect. Defection strongly dominates cooperation: defection always yields fewer years in prison, no matter what the other agent chooses. A large class of social interactions conform to this pattern (Frank 1988). Wherever interests overlap imperfectly, strictly efficient co-operation comes under threat. Thus, generalised prisoner’s dilemmas menace the social fabric [see (Schelling 1960)].

Importantly, structured supernatural illusions help agents to resolve generalized prisoners dilemmas. Imagine Ricardo and Sloane falsely come to believe that cooperation always brings the best outcome. Each is convinced that if he defects something worse than the maximal sentence will happen. Call this outcome “CHOP.” Suppose further that each believes that if he cooperates something better than freedom will happen, call this outcome “LOTTERY.” Here, “CHOP” and “LOTTERY” are just variables. LOTTERY could be terrible (lips cut off) yet less terrible than CHOP (lips and legs cut off). What matters is that for each:

The subjective value of cooperation > the subjective value of defection.

Assume the real (N) payoff matrix remains fixed. All that has changed is the perception of the relevant outcomes. Because the causation required to make such belief true exceeds anything in nature, we can call this form of interaction “The supernatural illusion game.”

The supernatural illusion prisoners’ dilemma (MSN conditioned)

	Ricardo Defect	Ricardo Co-operate
Sloane Defect	Chop -9	Lottery- 10
	Chop -9	Chop - 9
	Chop	Lottery -

Sloan Co-operate	+0 Lottery -9	1 Lottery -1
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Clearly we can see that in this game, structured erroneous judgment, when shared, motivates strictly efficient exchange, rendering both agents better off. Here we have a version of UN, call it “moral super-nature” or MSN. It appears that where MSN-outlooks are shared:

All things equal, MSN > N, thus MSN

As with other forms of self-deception, the illusion functions strategically. Dispositions to believe in policing gods fuel an agent’s success in communities that share such commitments.

As with self-deception, the systems controlling MSN judgments are constrained by 1) assessment certainty, for increases in degree of supernatural commitment strengthens reciprocity. The system is also bounded by its 2) problem domain and by 3) encapsulation constraints, for religious representations must be configured to police exchange, and religious commitments must not interfere with the exigencies of life in other domains (Bulbulia 2004). For example, believing in Donald Duck (problem domain error) and hunting him for food (encapsulation error) will very likely reduce rather than improve fitness.

But is it correct to say that MSN-co-operators carry an advantage over N-defectors? Not quite: defection in a one-off prisoner’s dilemma always pays better than cooperation. This raises a critical point. Selection will only endorse MSN strategies if N-defectors can be kept out. Playing against defectors, supernaturalists will always receive the worse possible sentence, what game-theorists call “the sucker’s payoff.” Transposing the game to biological landscapes, and iterating it, selection will quickly snuff MSN-co-operators out, yielding a population of defectors [for a similar discussion see (Skyrms 1996)]. To flourish, religious co-operators must evolve the capacity to identify other religious co-operators. Thus religious cognition must further satisfy a

recognition constraint. But how may MSN co-operators find and exchange only with other MSN co-operators?

Selection needs to equip religious agents with the capacity to produce signals that only religious persons can reliably produce. It must find a cue that is only available to those who believe in supernatural reward. This further recognition constraint is far from trivial. For what could count as such a signal? Comparing the fitness benefits of the relevant strategies:

Signal + defection > Signal + cooperation

In exploring the functionality of religious signals, adaptationists have examined how the practical costs of religion have adaptive value, noting that the various emotional, material, and opportunity costs, and the risks associated with religious practice enable religious agents to identify each other [For excellent empirical testing of this theory see (Sosis 2000; Sosis and Bressler 2003; Sosis and Ruffle 2003; Sosis and Ruffle 2004).] Costly religious signals are configured to assess the presence and strength of religious commitments, satisfying the recognition constraint, thus enabling selection to endorse religious dispositions.⁶ As this research has been reviewed elsewhere (Sosis 2003; Sosis and Alcorta 2003; Bulbulia in press), I consider how religious illusions may fuel success by fostering individual health and healing.

Religious Healing

We've seen how religious errors help agents to forge stronger and more stable alliances. The strategy MSN is an instance of the rule: where **UN > N, then (all things equal) UN**. I now consider how religious illusions may help to maintain and improve an agent's mental and physical health – so improve fitness through channels beyond MSN

⁶ Religious signals are either direct (for example emotional display) or indirect (for example ritual display. For all direct signals: **Signal → IFF MSN**. For all indirect signals: **The subjective value of cooperation - signal costs > The subjective value of defection - signal costs – subjective weighting of potential retribution costs**.

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reciprocity, or linked to it in novel ways. Common religious understandings enable individuals to coordinate their activities, but religiosity also appears to strongly coordinate the internal states of individuals. Religiosity binds us to groups, but it also binds us to ourselves.

There is a large and growing literature on the positive effects of religiosity and ritual participation on individual health. In a systematic review of over 1600 articles on religion and health, Koenig and colleagues conclude:

...the majority of studies indicate that religiousness is associated with less coronary artery disease, hypertension, stroke, immune system dysfunction, cancer, and functional impairment, fewer negative health behaviours (e.g., smoking, drugs and alcohol abuse, risky sexual behaviours, and sedentary lifestyle), and lower overall mortality...”(Koenig, McCullough et al. 2001) p. 394.

Moreover, with respect to mental health, the authors conclude:

In the majority of studies, religious involvement correlated with:

- Well-being, happiness, and life satisfaction
- Hope and optimism
- Purpose and meaning in life
- Higher self-esteem
- Adaptation to bereavement
- Greater social support and less loneliness
- Lower rates of depression and faster recovery from depression
- Lower rates of suicide and fewer positive attitudes toward suicide
- Less anxiety
- Less psychosis and fewer psychotic tendencies
- Lower rates of alcohol and drug use or abuse
- Less delinquency and criminal activity
- Greater marital stability and satisfaction [(Koenig, McCullough et al. 2001) p. 228]

The data suggest that religiosity buffers religious agents from poor mental and physical health, and early death. However, we must take care in any adaptationist extrapolation. Benefits accrue unevenly to different forms of religiosity and practice (Park, Cohen et al. 1990), and to different age groups (Neighbors, Jackson et al. 1983), and some studies suggest that religiosity may exacerbate stress as well (Strawbridge, Shema et al. 1998) [For discussion of the costs and benefits of religiosity see (Pargament 2002)]. Clearly the following equations are too simplistic:

1. **religion = good health**
2. **more religion = more good health,**

Furthermore, most studies on religion and health have been conducted in North America and Europe. Yet the life conditions of first world nations are substantially different to those of our hunter-gather ancestors. The health effects of religion may therefore owe to some aspect of modern culture not directly related to religion. For example, religious persons may have better access to medicine and healthcare or may be more likely (for unrelated reasons) to seek help. More basically, religious persons may be genetically predisposed both to religion and to good health, or may express deeper personality traits that cause them to refrain from novel unhealthy lifestyles, as well as to worship at the altar. To test these relationships we require controlled experiments, yet it is difficult to run experiments on hunter-gatherers because such communities are exceedingly rare in McWorld. Perhaps most importantly, such communities tend to be religiously homogenous, rendering randomized trials more difficult (Lee, DeVore et al. 1999). So even if we could find participants we would lack many of the proper controls.

Nevertheless Koenig et. al.'s data correlating religiosity with improved health are overwhelming positive. Moreover we know that religiosity and healing having been interconnected throughout recorded history. Mesopotamian medicine of the 4th century B.C.E. interwove supernatural and natural elements, treating illness through magic and various herbal remedies. Ancient Chinese healing practitioners viewed disease as chaos caused by malevolent spirits who must be pacified, a common theme in most African traditions as well. In the Hebrew tradition, God is envisioned as the supreme cause of all fortune related to well being. From Deuteronomy: "I put to death and I bring to life, I have wounded and I will heal, and no one can deliver out of my hand" [Deuteronomy 32:39] [For discussion see (Prioreshi 1995) cited in (Koenig, McCullough et al. 2001) ch 2.] In hunter gatherer communities, healing arts are typically practiced by shamans -- religious experts thought to possess curative powers (Eliade 1972). In a recent book on the evolution of religious healing, James McClenon relates the therapeutic effects of shamanic healing to altered states of consciousness ("hypnotic effects" in McClenon's terminology). McClenon hypothesises that altered states of consciousness unleash the body's natural healing powers through placebo effects, though leaves these placebo

mechanisms unspecified (McClenon 2002; Bulbulia 2003; Sosis and Alcorta 2003).

Richard Katz's excellent studies on the Kung! people of the Kalahari Desert suggest there may be something to McClenon's claim. Katz's work documents the fundamental role that ecstatic healing dances play in the ritual life of a contemporary hunter-gatherer community, noting that "The full range of what in the West would be called physical, psychological, emotional, social, and spiritual illnesses are treated at the healing dance" and that "Nearly every Kung...can describe how the healing dance has cured someone" [(Katz 1984)p. 54; see also (Katz, Biesele et al. 1997).]

Given the antiquity and universality of religious healing, it is at least plausible to hypothesise (with McClenon) that selection targeted religion to improve individual health. But what is the nature of this psychological design that is attuned to religious healing? I pursue this answer through evolutionary task analysis.⁷

Call the variety of religious outlook that promotes healing and wellbeing "healing super-nature" or **HSN**. Call agents disposed to believe these outlooks, HSN-agents, and practices motivated by HSN-outlooks, HSN-practices. It may well be that religious healing works because religious traditions employ and retain healing technologies that are causally effective – medicines and therapies that work irrespective of HSN-outlooks. For all we know, religious healing may flow from specific cultural inventions.⁸ But I am interested in whether the perceived causal properties of HSN-outlooks themselves, together with the relevant practices these judgments motivate, promote wellbeing.

⁷ More formal, quantitative modeling requires measurable knowledge of the evolutionary trade-offs of HSN and a means of comparing these quantities to those delivered by other (evolvable) cognitive designs. The relevant information for such modeling is difficult to secure. On the general epistemological problems (and opportunities) for quantitative evolutionary modeling of cognition see [(Sterelny 2003) pp.106-116.]

⁸ At any rate, I am not confident that such healing effects can be explained through cultural inheritance mechanisms. The list of the drugs employed by healers in near recorded history include: moss from the skull of victims of violent death, viper's flesh, crab's eyes, live frogs and worms, fox lung, oil of brick, ants and wolves, saliva of a fasting man, bile, and other such marginalia [(Shapiro and Shapiro 1997) pp. 13-14.] Many such remedies and therapies were potentially very harmful. After surveying thousands of ancient medicines and treatments, Shapiro and Shapiro conclude, "The panorama of treatment since antiquity provides ample support for the conviction that, until recently, the history of medical treatment is essentially the history of the placebo effect" [(Shapiro and Shapiro 1997) pp. 13.]

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Consider the following mechanisms through which HSN-agents may benefit over N-agents, by harbouring structured illusions.

Stress mitigation. Numerous studies suggest that psychological stress adversely effects health (Rabin 2002). Stress typically emerges from particular judgements of how things stand in the world, judgments related to stressors. I look at my bank account, believe it accurately reflects my financial position, and sweat coldly. Reflecting on the stable and enduring conditions related to health in the ancestral environment, it is credible to suppose that ancestral life was replete with stressors. Whatever the landscape, culture, and epoch, Pleistocene environments were framed by threat, damage, pain, loss, and suffering. Cosmides and Tooby have described the ancestral world as a camping trip that never ends (Cosmides and Tooby 1992). Yet life in the ancestral world was in many respects worse: no first aid, no potent antibiotics, no police or animal control, no indoor heating, little scientific medicine and dentistry, high child mortality, and low life expectancy. In such a world, I suggest, there is scope for psychological dispositions to misapprehend miserable reality. Comparing outlooks:

Stressful World v Healing super-nature (HSN)

Judgment	Response	Outcome
Stressful World	Dread, fear, malaise, anxiety, depression, despair, angst, lower immune function, elevated blood pressure, elevated triglycerides, elevated LDL cholesterol...etc.	Poor health
Healing Supernatural World	Joy, hope, calm, optimism, courage, greater immune functioning, lower blood pressure...etc.	Good health

Thus, where:

HSN damaging stress < N damaging stress,

then

All things equal, HSN > N, thus HSN

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I suggest that such stress reducing outlooks are a species of supernatural understanding because the stress diminishing reality HSN-agents imagine to alleviate stress exceeds any plausible naturalistic account of the world. HSN-agents must not be less aware of or attuned to stressors. A muted behavioural response to the class 'all stressors' is an evolutionary death sentence. Stress mitigating judgments operate under significant empirical constraints. Not all things are equal, and these constraints need to be unpacked. Obviously, one such constraint is substantial prior cognitive complexity. HSN-agents must be capable of elaborate second order reflection about their desires, circumstances, relationships, projects and plans, possible futures, the minds of other agents, and other complex cognitive activity. We shouldn't expect to discover that rodents believe in gods that will save them.

In understanding the empirical constraints under which HSN-agents operate, we can bring the design features of into clearer focus, as well as begin to see the sorts of pressures influencing the cultural selection of supernatural healing concepts and related practices.

Constraint and design

We have seen before that the systems that control self-deception and moral supernatural outlooks are constrained by 1) assessment confidence. This constraint also applies to HSN-outlooks. An agent that doubts her judgment of healing super-nature is more likely to feel stress and anxiety and so, all things equal, more likely to suffer damage. Doubt corrodes adaptive functionality, so the model predicts that HSN judgments will tend to certainty.

Moreover, the model predicts HSN-representations will be functionally adjusted to the task of reducing damaging stress, that is, will be sensitive to 2) healing problem domains. There are fairly elastic parameters to the conceptual configurations capable of performing this task. To consider a few examples:

1. HSN = belief that stressors are unreal. For example, we believe that we live in a world of appearances, where the reality our senses convey is illusionary, concealing a deeper, truer, better less stressor-infested reality. Suffering is

displaced when we appreciate that the cause of suffering is misunderstanding.
(Varieties of Buddhism express this view).

2. HSN = belief stressors are real, but in proper perspective, not genuinely stressful. For example, we believe that whatever happens, this real world is only passing, and there is a better world to come, one lacking stressors. Though real, suffering is held to be only temporary. (The view of many Christianities).
3. HSN = stressors are real, and genuinely stressful, but relatively speaking there are far worse states of affair. For example, in the world to come the impious will be committed to eternal punishment, while the pious will endure an eternity of neutral existence. In such outlooks, stressors recede in importance relative to an appreciation of how bad things could get. (A perspective expressed by Greek religion).
4. HSN = stressors are real, but necessary for better life. For example: we interpret the slings and arrows of life as tests, which if met with fidelity to God's way, leverage reward in a better life to come (Varieties of Western monotheisms endorse this image.)
5. HSN = stressors are real, but the gods or ancestors will help us combat them. For example, the gods have given us healing substance that we can use to fight disease (A view found in !Kung religious outlooks.)

While the class of representational structures capable of animating a functional HSN-outlook appears to be fairly large, it is not unbounded. For example, HSN-outlooks must be vague enough to avoid easy empirical disconfirmation, lest assessment certainty wane. And for reasons I will discuss below, an optimal system must integrate HSN-outlooks to the religio-moral tradition of an agent's community, that is, to shared MSN-outlooks. The model thus predicts HSN-agent sensitivity to religiosity of her exchange group. Though audiences often value shamanic virtuosity and novelty (Overholt 1986), it is unlikely that agents will invent healing religions out of thin air. I will not get very far in a closed religious community, say the Amish, by draping my healing practice with Greek religious folklore. Religious representations and practices not only mediate our

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relationship to stressors in the world, they mediate our relationship to each other, and this constrains their expression, a point I examine in more depth below.

Critically HSN-outlooks are bounded by strong 3) encapsulation constraints. Though agents may benefit by belief in healing super-nature, they also remain susceptible to harm from stressors. And stress-responses are not usually, on average, more damaging than indifference (again, clearly not all things are not equal). There are strong biological benefits to noticing and responding to stressors in appropriate circumstances, and to feel dread, anxiety, concern, and other “negative” feelings. It is useful to experience strong fear as the bull charges or to suffer strong anxiety for a lost child. Such feelings motivate powerfully adaptive responses; they are part of a broader functional design that mediates our relationship to the world. Therefore HSN-practices must be inferentially and motivationally encapsulated to a strong degree. Notice that the encapsulation constraint here (as with self-deception, and moral supernaturalism) cuts against assessment certainty. The haemorrhaging of certainty in supernatural belief to other problems domains is potentially lethal. If we believed without limit that this world is only an illusion, then why bother with the exigencies of life; why care at all about any stressors that comes our way?

Given the assessment certainty constraint, the model predicts a high level of conviction in expressions of commitment to healing super-nature. But for **HSN > N**, these expressions must not generally interfere with global adaptive functionality. Hence the model predicts that HSN-agents will be of two minds. They will strongly believe that the gods protect and heal, but in most problem domains will nevertheless act as if they do not -- that is, act for their own safety and success. Similarly, HSN-agents will believe that the world is better than it is, only where the net effects of this belief, on average, tend not to hinder adaptive prospects. The world cannot be so favourable that you let go of life's demands.

Here I am exploiting task analysis to infer design features. These conjectures are motivated by fairly qualitative considerations about how an ideal design would work. Yet it is possible to render these conjectures more precise through experimental testing. For example, it would be interesting to compare how participants who score high for healing super-nature certainty compare with non-HSN controls in their reactions to a variety of

perceived stressors. If confidence in a better world is not globally dysfunctional, then the encapsulation hypothesis is probably correct. Moreover, if confidence promotes health, then we can be more confident in the theory that the religiosity of healing supernatural agents is an adaptation to promote wellbeing.

2. Healing supernatural world really does decrease stressors. The fact that HSN agents benefit from their cognitive dispositions brings further real evidence against N-interpretations and in favour of supernatural illusion. Notice that the world really does lose real stressors when people are benefited by supernatural understandings – namely, there is an actual decrease in the instance and threat of illness. On the other side, where accurate assessments of stressful world cause bad health, accuracy in judgments may well compound negative trends in well-being; poor health actually makes the world more stressful over time, with successive negative impacts on health. Thus HSN religiosity is not causally inert. It drives a genuine reduction in stress and misery, altering the selective landscape. Through activity that supports their healing supernatural outlooks, HSN-agents are actively engaged in a form of niche construction(Odling-Smee, Laland et al. 2003).

Somewhat paradoxically, the strategy of illusion here manufactures genuine supporting evidence favouring healing supernatural outlooks, and vice versa. For comparing both ways of judging the world we find:

Evidence for Healing Supernatural World

Judgment	Patient Outcome	Healers Outcome
Stressful World	Poor health	Further evidence for stressful world
Supernatural world	Good health	Further evidence for supernatural world

In an optimal design, HSN agents will seek and harbour evidence backing their broader judgements in healing super-nature: they will be HSN-biased. Such agents will find religious healing important enough to remember, and will factor these memories into their assessments of reality, though again in ways globally encapsulated from other problem domains. Were this further disposition to develop, it would likely manifest itself in cultural selection. For in a community of HSN-biased agents, it is predictable

that instances of religious healing become imbedding in the lore of their community (viz. the Katz quotation: “Nearly every Kung...can describe how the healing dance has cured someone”). An optimal design will further downplay, ignore, or rationalise failure. For a !Kung healer “Sometimes you heal and god helps you. Sometimes you heal and heal and heal, and you lose the person”[(Katz 1984) p. 55]. It would be fairly straightforward to bring empirical precision to these hypotheses. For we need only test whether HSN agents are subject to confirmation biases that support the overarching functionality of their healing understandings. To strengthen confidence, an optimal system will render even rare successes cognitively salient. Given this optimum, we can look to see how closely our minds match it, and revise this qualitative model accordingly in light of the results.

Shared information and motivation flow for healing and moral super-nature

Earlier we examined how moralistic illusions may benefit individuals by supporting co-operative exchange in prisoner's dilemmas. Notice: though both HSN and MSN illusions must be strongly encapsulated from broader problem domains, an optimal psychological design will integrate information flow within these systems. That is, HSN agents will be MSN agents and vice-versa. We have an adjective in English to describe such agents, “religious.” Notice that if the gods that heal and the gods that enforce reciprocity generally belong to the same theological outlook (or indeed are imagined as one and the same), then functionality in each domain can be mutually supporting.⁹

[HSN + MSN systems] = [religiosity system] // encapsulated from other problem domains

The potential for mutual supporting information channels becomes clear when we consider evidence flow. For HSN healing supports MSN outlooks:

Healing as evidence for Moral Super-nature

Judgment	Patient Outcome	Inference
Stressful World	Poor health	Further evidence that gods do not care about the faithful

⁹Recall: “I put to death and I bring to life, I have wounded and I will heal, and no one can deliver out of my hand” [Deuteronomy 32:39] Does this verse evoke moral or healing super-nature? Answer: both.

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Healing Supernatural world	Good health	Further evidence that the gods reward the faithful
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Moreover **MSN** co-ordination effects may support broader **HSN** perspectives:

Policing as evidence for Healing Super-Nature

Judgment	Inference	Outcome	Inference
Prisoner's Dilemma	Reduced cooperation	More misery	Further evidence for stressful world
Policing Supernatural world	More exchange	Less misery	Further evidence for Healing Supernatural world (the gods have blessed us)

Not only is internally translucent religious information mutually supporting, an optimal design will display unevenness and bias in the systems that employ such evidence. Though the results of religious healing may be used to prop up religious morality, and vice versa, in an optimal design confirmation biases will be positioned to mitigate unsupportive inferences. Though bad things frequently happen to good people, the model predicts that we will nevertheless come to believe in healing and moral super-nature – that the gods protect and reward the faithful. Looking at inferential processing:

Super-nature supporting evidence → utilizable by the [MSN, HSN] religiosity system // generally encapsulated from practical problem domains

Unsupportive evidence → possibly utilizable by practical problem systems // generally encapsulated from the [MSN, HSN] religiosity system

Clearly, the functions of supernatural moral and healing illusions may sometimes stand in tension. Though moralistic gods are potential benefactors (reward the faithful) in their capacity to harm, they are also potential stressors. Policing supernatural agents concepts are generally uncanny, and frequently motivate precisely because they project stressors. Moreover healing supernatural gods may be poorly suited to performing tasks as

moralizing police agents. (A pillow is poor instrument with which to guard.) Hence, religious agents inhabit a multifarious problem environment. The systems that control religiosity must sort tasks by considerations of relevance, cost-to-gain, and feasibility – computationally difficult problems. It may be that the religiosity system exploits fairly simple heuristics: e.g. when in trouble, shift to HSN emphasis, when co-operating, shift to MSN emphasis. However, I doubt whether dumb and dirty heuristics are functionally optimal. Mutually supportive information flow suggests such a picture is far too crude (for example, the heuristic “When in pain, think about my moral shortcomings” or “When at the healing dance, observe for signs of piety” seem possible). And more basically, culturally selected norms may strongly mediate interpretations (“When in pain think of Jesus on the cross” etc). Such norms are difficult to predict from sketchy blue prints of internal psychological design. Very basically the model suggests that the reality that most religious persons accept will neither be uniformly fire-and-brimstone nor uniformly pie-in-the-sky, and different supernatural elements will be made available by these subsystems. Whether psychology has anything specific to say about these relations remains a matter for empirical discovery. The point of qualitative task-analysis here is to place the possibility of intricate and partially discordant functions on researchers radar screens.

3. Alternative to Ancestral Narcotics. It is interesting that religious agents tend to avoid unhealthy lifestyles (Koenig, McCullough et al. 2001). I conjecture that religious understandings benefit by serving as a healthy substitutes for more damaging forms of stress management. We can lump these damaging alternatives under the heading “ancestral narcotics,” while assuming variance within this category. Religiosity may well help agents indirectly as healthful alternatives to other more destructive practices for coping. Clearly, the evolutionary benefits of religious dispositions must factor the loss of the additional health costs that flow from partaking of ancestral alternatives to stress management. If these costs were 1) relatively high and 2) stable (above a threshold) and 3) healing religiosity reliably displaced them, then there would have been additional evolutionary pressures favouring the HSN systems and practices.

Opportunity costs in reducing HSN (assuming ancestral drugs)

Judgment	Perception	Response	Outcome
Stressful world	Stress, Dread, Fear, Malaise, Anxiety, Depression, Despair	Need hemp (or deleterious drug)	Poor health
Supernatural world	Life is better than it appears	Lower stress	Good health

Moreover, if as I suggested above, the very maintenance and restoration of health may be used as evidence for healing super-nature, then an optimal system will favour cultural practices and arrangements that discourage or prohibit their use. HSN-agents will be biased to look after their health, for global (MSN and HSN) religiosity is best supported when agents are actually made well by it. If, as I suggested above, healing and moral religious perspectives are integrated, the systems controlling religious healing may deploy fearful supernatural representations to produce the relevant motivations, but this will evolve as an embedded psychological strategy only where:

Average damaging stress of MSN concept < average damaging effect of prohibited ancestral narcotic.

The matter here appears to be fairly speculative. To understand the significance of this pressure we require 1) detailed knowledge of variation in Pleistocene practices and lifeways and 2) alternatives available natural selection. My hunch is that the pressure to healthfulness is real but displaced to cultural selection. HSN-agents are probably not internally guided to avoid unhealthy lifestyles. For gene-selections trial and error algorithms are time consuming and wasteful. It may require hundreds or thousands of generations to embed an adaptive instinct. Yet cognitive agents equipped with language and sufficient brainpower are able to optimize their chances by attuning to accretions of cultural know-how. The capacity for culture is no meagre power. Cultures enable the gradual accumulation of information relevant to survival in diverse habitats without death

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by trial and error. We need not be born with innate encyclopaedias if we can learn encyclopaedias from others (and what has been discovered is not lost over time.) Hence sensitivity to cultural wisdom about health may be far more evolvable than detailed internal knowledge of what makes us well. Because selection appears to have favoured dispositions to learn what is “healthy” over reliance on purely instinctive knowledge, we can predict scope for variation among groups in the lifestyles and practices. Not all cultures will get it right, and some may get it positively wrong (viz. remedies involving scorpions, etc.)

It is fortuitous the model predicts what is obviously true. For clearly, some religious cultures are more harmful than others. Consider Jonestown, Aztec blood religions, drug cults and suicide/terrorist organisations, none of which offer examples of practices healthy to one's genes. Similarly, HSN-healers may (“may” because they do) use genuine narcotics. These may help to evoke altered states of consciousness that heal. But they may also provide a strong evidential base for broader religious understandings, for when the doors of perception are opened gods rush in. Hence, when all costs are factored, ancestral narcotics may prove more healthful, on balance than their total avoidance. At any rate, it is easy to see how ancestral narcotics could appear to be healthful – even if not – and so persist in lore and practice of a community over time, for (I am told) drugs feel good.

Importantly, we can be more certain that religious practices will not be maximally healthy. Recall that the functions of religion's subsystems do not perfectly overlap. We have observed that in order for MSN-co-ordinators must satisfy the recognition constraint. To do this, they must produce and evaluate costly signals that authenticate altruistic intention. Such ostentatious resource expenditures –starvation, circumcisions, walking on knees, and so forth –are by their very nature often risky and sub-maximally healthy, for to work they must incur reproductive costs.

In spite of cultural variation and signalling costs, we can be certain that religiosity has produced more aggregate wellbeing than harm, for otherwise selection would have muted religious dispositions. It remains interesting that even in the modern world religiosity tends to advantage rather than significantly harm religious agents. And we

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know that for religiosity to become entrenched in human nature, religions employing net-damaging practices could not have been the norm.

Ritual and social influence. MSN rituals will tend to be public because it is through the costs associated with these practices that MSN co-operators are able to satisfy the recognition constraint, a point I revisit below. More directly, public displays of conviction render HSN-outlooks more plausible for all, rendering the HSN system more effective. In a classic experiment on conformity, Sherif demonstrated that individuals in groups tend to converge in their interpretation of ambiguous events (assessment of the perceived movement of a fixed light point projected in the dark, or the “autokinetic effect.”) This convergence effect holds even though revised communal judgments frequently differ from initial individual assessments. Moreover, Sherif observed variation in the assessments between isolated groups (Sherif 1935). Groups differ, but individuals within groups converge. Subsequent studies revealed that individuals not only express common judgments in public, but also in private, ruling out social pressures to conform (Sherif 1936). Moreover these convergent judgments persist over time (Rohrer, Baron et al. 1954). Such experiments suggest that individuals are prone to adopt the opinions and attitudes of those around them. Given social influence, common expressions of healing religious understandings in public may serve to bolster confidence in such understandings among individuals in groups. For:

Social influence

Social Group	Group judgment	Individual Response	Outcome
Secular	Miserable world	Stress and low immune Response	Poor health
Religious	Healing SN World	Low stress and normal or high immune response	Good health

While the cost to individuals of such expressions is relatively low, the aggregate benefits to each individual participating in rituals of public avowal are high. Public forums shore up commitment to the idea that the world is an enchanting place – they strengthen assessment confidence -- a commitment that brings health by mitigating the damaging effects of stress. This suggests a further constraint on the cultural selection of healing

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ritual. Where healing success is probable, or at least not subject to easy disconfirmation, agents the model predicts that agents will seek to practice religious healing in public events. It seems to me that this hypothesis could be tested by an extensive survey of healing rituals.

Practices of non-zero sum exchange. It is important to notice that HSN-practices of healing are non-zero exchange games between spiritual healers and patients. Placing to the side the exchange of any real goods (say, commodities or payments that patients give to healers, causally effective medicines that healers give to patients, etc.) there are direct but intangible benefits that flow to ritual participants. Clearly in entering into this arrangement, patients enjoy the prospect of enhanced health and the reduction in perceived environmental stressors that such ritual practice brings. But healers also benefit through enhanced social prestige and status, which increase their prospects for exchange and advancement in other domains. Effective healers obtain real evidence of their usefulness to others – of their genuine beneficetiveness.

Fellowship effects

Healer's benefit

Healer's Judgment	Healer's Response	Patient's Response	Patient Outcome	Healers Outcome
Stressful World	Not worth healing effort	I am in trouble (stress, dread, fear, malaise, Anxiety...)	Poor health	I could not heal
Supernatural World	Worth healing effort	I am worthy of healing effort (hope, calm, contentment, courage...)	Good health	I am benefactive 1. (self esteem, joy, contentment...) (direct benefit) 2. public prestige (indirect benefit of reciprocity)

Moreover by becoming well, patients also contribute intangible goods to the community. For their wellness provides real evidence to others (not just themselves) favouring HSN-outlooks.

Patient's gift through healing

Judgement	Outcome	Resource gift of social influence
Stressful world	Poor health	Further evidence to others world is stressful
Healing supernatural world	Good health	Further evidence to others that world is Supernatural

So it appears that public display of HSN-healing promotes the social interests of healers and patients, and their audiences, with few costs, and hence (all things equal) all parties share an interest in parting of HSN healing practice.

Costly signalling

Of course, “healers” need not be loan shamans. The presence of a community of parties interested in restoring health can serve both to reduce stress and to strengthen social bonds for all. For the patient, the gathering of a community is a hard-to-fake signal that the community supports an agent and wishes for her restoration to health and wellbeing. For the community, clear signals of commitment to one or several sick individuals is also indicative of commitment to each other, of the all-for-one understanding that binds large groups. This is particularly vivid in instances where persons are in conflict with each other. Whatever tensions divide a group, all present express unity in a common cause, that of helping the sick among them. Moreover, in this helping act, an audience expresses its commitment to the broader religiosity (integrated HSN+MSN-outlooks) that binds them together.

Moreover, a patient’s resorted health may serve as a reliable signal of the patient’s commitment to a religious outlook. If assessment certainty improves HSN-healing, and if healing and moral supernatural judgments belong to a single over-arching spiritual outlook, then HSN-wellness is a hard-to-fake signal capable of authenticating MSN exchange. For only those who believe (beyond a threshold of assessment certainty) will be healed:

Health as costly signal of commitment

Judgement	Intention	Perception	Outcome	Signal	*Group Effect
Secular world	Defect	World is miserable	Bad health	Signal of possible intention to defect	Weaker Group (commitment and health)
Enchanted world	Cooperate	World is better than it appears	Good health	Costly signal of commitment	Stronger Group (commitment and health)

The clear prospects for costly signalling in public religious healing rites can help to fuel reciprocal exchange, benefiting individuals and also the groups they inhabit. Hence

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selection may have targeted the stress-reducing effects of religious outlooks as a means for bolster religious morality. Among patient signallers, an optimal design will advertise and amplify evidence of religious healing to potential exchange audiences. Moreover, among audiences, an optimal design will target religious healing as hard-to-fake evidence of religiosity. This seems to me an intriguing possibility indeed, one worth pursuing empirically by assessing the degree to which evidence of religious healing renders patients more trustworthy in prisoner's dilemmas that favour defection.

Conclusion

Time to summarise the argument. At the outset, I suggested that religious thought is both a human universal and error prone. This presents a problem to naturalists. Given the costs of religious error, it appears selection should have weeded out religious tendencies. In the past several years, adaptationists have thrown new light on religiosity by viewing dispositions to religious error and cost as adaptations that help to police social exchange and to build stronger communities. But religiosity appears to do more than merely facilitate and enhance reciprocity through policing. There is overwhelming evidence suggesting that religious agents live healthier and longer lives, evidence that can be only partially explained by the benefits uniquely available to social creatures. It may well be that selection has endorsed religious cognition because it assists in regulating individual wellbeing in ways either unrelated to social exchange, or related in unexamined ways. To bring substance to this approach, I began with the familiar case of self-deception, exploring how structured dispositions to error may be selected as strategic responses to social environments in which deceiving others relies critically on our ability to deceive ourselves. I noted that self-deception works best too when it is 1) complete; 2) targeted to exchange; and 3) encapsulated from other problem domains. I then noted how the moralistic religious belief facilitates the solution of prisoner's dilemmas, thus allowing selection scope for targeting psychological dispositions to believe in the moralistic gods of one's exchange group. Here too, the illusions work best when complete, targeted to exchange, and encapsulated from other problem domains. Turning to religious healing, I considered how beliefs in healing super-nature may reduce

damaging stress responses. If so, then such beliefs will work best when 1) complete; 2) targeted to stress reduction and 3) encapsulate from other problem domains. I used this analysis to develop several hypotheses about the systems that control religious healing. For example, I noted that in promoting wellbeing, religious healing actually does make the world a less stressful place. Because these effects add to the overall credibility of religious assessments, I suggested that an optimal cognitive design would render such facts salient. For similar reasons, I hypothesised that the systems that prompt and control moralistic and religious super-natures will be internally integrated, with fluid information flow, though collectively encapsulated from other systems geared to other problem environments. I then explored the dynamics of religious healing in groups, examining how religious healing through public ritual brings novel benefits to healers, patients, and their audiences. Finally, I conjectured that religious healing may in part function as a costly signal of religious commitment, and remarked on the experimental evidence could bear on the matter.

If any of this turns out to be correct, it would suggest the psychosomatic systems regulating health and healing might well be optimized for social inputs, as well as for personal expressions of care and concern. If so then evolutionary approaches to religious healing may hold lessons for contemporary healthcare advocates. In the modern world, patients are easily shunted away to the confines of hospitals and made into largely anonymous beings. In this retreat to an enclave, patients are often disconnected from potential sources of wellbeing, namely, their family and community. Whatever the benefits of modern healing environments (don't get me wrong, there are many) these environments do not seem well structured to accommodate healing religiosity.

It should be apparent from the provisional nature of this enquiry that the naturalistic study of religious healing is in its early phases. My hope is that this paper will motivate further empirical studies of the cognitive design that supports nature's medicine.

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September 2004

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