

Putting Religious Ritual in its Place:
On Some Ways Humans' Cognitive Predilections
Influence the Locations and Shapes
of Religious Rituals

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The cognitive science of religion brings the methods and findings of cognitive sciences to the study of religion. *Maturationally natural systems* are perceptual, cognitive, and action systems that arise in human development and that are intuitive, instantaneous, automatic, domain specific (by the end of their development), woefully underdetermined by evidence and, thus, sometimes subject to illusions. Cognitive by-product theorists hold that much religious belief and practice turns on engaging maturationally natural systems, which arise in human minds on the basis of considerations that have nothing to do either with religion or with one another. Introducing minor variations in the outputs of maturationally natural systems produces modestly counter-intuitive representations, which are attention grabbing, memorable, inferentially rich, and communicable. Some even motivate people to transmit them. These are characteristics of culturally successful representations. Humans' *Hazard Precaution System* includes maturationally natural systems for avoiding environmental contaminants and for producing ordered environments. Both include principles that cut across cultures, however particular cultures may tune the systems in question. Religious rituals routinely exploit these predilections in ways that have implications for their shapes and locations. They cue participants' contamination avoidance systems, and they take advantage of human preoccupations with environmental order and vertical symmetry.

The cognitive sciences study the mind/brain from multiple analytical levels, ranging from molecular neuroscience all the way up to the ethnographies of cultural anthropology. They employ at least three types of theories that explore (1) systems' structures, (2) systems' operations in the short term (which can extend at least as far as the life span of individual human beings), and (3) processes in extremely large scale systems over long periods of time

such as the evolution of mind/brains over a few million years (McCauley 2009). Darwinian gradualism suggests that the brains of *Homo sapiens sapiens* have not undergone any especially radical or rapid transformations, certainly at the level of gross anatomy, over the last sixty thousand years even though the archaeological findings do demonstrate both radical and rapid transformations in human cultures during that time. Although substantial changes in the frequencies of some traits in human populations (e.g., lactose tolerance) have occurred within the last ten thousand years, any modifications in the standard cognitive machinery with which human beings come equipped have probably been minor and few during the period in question. Consequently, cognitive scientists have reason to hold that the *natural* features of human minds that influence the shapes and locations of cultural forms, including religious ritual, have probably changed little since human prehistory.

In the first and longest section of this paper I will lay out a general account of some natural features of human cognition that a variety of cognitive theorists have maintained undergirds religious rituals. In the second section I will then examine one example of a maturationally natural system that religions enlist, and in the final section I will *briefly* explore how such features of human cognition affect the shapes and locations of religious rituals.

Maturationally Natural Cognition and the By-Product View

Natural Cognition

What Aspects of Cognition Come to Us Naturally? By “natural” cognition, I refer to perceptions, beliefs, and actions that arise in an instant and are familiar, intuitive, and accomplished without reflection. I have in mind here the wide range of things that we think, so to speak, without thinking. We know about someone’s emotional state from his or her facial expression, bodily comportment, or tone of voice. We know that an utterance is linguistically ill-formed even though we are often incapable of articulating any principles that would show why. We have no problem inferring that people who have come into contact with some contaminant may themselves be contaminated. Such knowledge is grounded in assumptions and inferences that seem to occur to us effortlessly, immediately, and automatically. In fact, they are so effortless, immediate, and automatic that we tend not to notice them. We find them the unremarkably *normal* ways that we see, understand, and act in the world.

Natural cognition is so familiar that our presumptions about its soundness are usually *unapparent* to us. *What* we seem to know and *that* we seem to

know it are *so transparent* that we take no notice of either. Research in moral psychology has yielded the phenomenon known as “moral dumbfounding” (Haidt 2001, 2006; Thagard 2010). Presented with scenarios that elicit strong moral intuitions, participants in experiments find themselves incapable of supplying even what *they* take to be persuasive arguments in support of their moral convictions. When forced to ponder various intuitive beliefs, we not only realize that we possess them, we often are surprised to learn, our initial confidence in them notwithstanding, that they are false. For example, human beings’ intuitions about many aspects of basic mechanics, for example, the path of a ball that is being dropped by someone who is walking, are typically false (McCloskey 1983; McCloskey et al. 1980; McCloskey et al. 1983).

It is no more obvious to us how *many* of these things we know, in no small part because we have known them for so long. These natural expectations that we have about the world leap into consciousness when they are violated, consequently an easy way to reveal how plentiful these assumptions are, is to begin to catalogue our negative knowledge. Human beings know that water does not retain the shape of its container when it is poured out, that hand tools do not indulge in midnight snacks, that we do not breathe through our elbows, that skunks have no opinions about America’s balance of payments deficit, that it is not fair for one person to get all of the food, when many have come to share a meal, and on and on and on.

Natural Cognition Comes in Two Varieties. Much natural cognition results from extensive training, education, or practice in some domain or other. After a good deal of practice, most drivers become so skilled at maneuvering their automobiles around that the act of driving becomes largely automatic. One minute with a novice driver in a moving car in traffic will suffice to remind experienced drivers how much they have come to take for granted. The *practiced* naturalness they have acquired in driving is a cultural feat through and through.

Cognitive predilections that enjoy a practiced naturalness regularly result in domains where skilled teachers have, quite consciously, provided repeated lessons, often in specially designed environments that are structured to facilitate novices’ acquisition of some skill or knowledge. Piano teachers help to gradually instill a practiced naturalness in the perception, cognition, and action of their pupils. For pupils much about attaining such practiced naturalness is a conscious achievement too. Initially, pupils must not merely attend to the tasks at hand, they must concentrate. With considerable practice or experience, though, ways of perceiving or thinking or acting often become *second nature*.¹

Practiced naturalness is the naturalness that comes with expertise. Experts not only have ready familiarity and developed intuitions in some

domain; they also possess enhanced perceptual acuity, inferential efficiency, and memory for that domain (Chase and Simon 1973). Expertise in many domains, however, can be quite widespread. Although very few people in any city are expert pianists, tens of thousands of people will possess expertise with regard to that city's subway system. Many know how to operate fare machines and how to get from one location to another by way of the various subway lines. If such mundane knowledge does not seem to rise to the level of expertise, then reflect for a moment about the challenges you faced the last time you had to use the subway system in a major city with which you were not familiar. One of the newcomer's prominent impressions in such circumstances is how swiftly all of the experienced riders do everything.

Humans remember when they acquired skills and knowledge for which they have obtained a practiced naturalness. People remember when they learned how to read and write and when they learned how to ride a bike. By contrast people do *not* remember when they learned how to comprehend and produce speech or when they learned how to chew food or walk. These are just some of the many considerations that distinguish practiced naturalness from ways of perceiving, thinking, and acting that I call *maturationally* natural. It is the maturationally natural variety of our natural cognition that will be the focus in the remainder of this paper.

Maturationally Natural Cognition

Humans Undertake Maturationally Natural Matters on Their Own. Humans pursue maturationally natural ways of perceiving, thinking, and acting, spontaneously – unlike reading, writing, and riding a bicycle. No one teaches human beings how to distinguish human faces from one another or how to talk or crawl or walk or chew food. Older people regularly exhibit their competencies with such matters, but they rarely, if ever, *instruct* children (let alone consciously instruct them) about how to manage such perceptual, cognitive, and practical tasks. Again, unlike reading, writing, or riding a bicycle, no one invented these maturationally natural abilities, and their acquisition relies no more on artifacts than it does on instruction or consciously prepared environments.

Maturationally natural capacities generally appear early in life, and humans typically have command of most of them by school age. That people do not recall when they acquired such capacities is, largely, a function of the fact that most develop during the period of childhood amnesia, when humans show little long term declarative memory for anything. But the criterion still holds for maturationally natural capacities that develop after the period of childhood amnesia, such as the tuning of the human visual

system in carpentered environments to have a particular sensitivity to corners (McCauley and Henrich 2006).

Culture Tunes Maturationally Natural Capacities. Culture certainly infiltrates and tunes other maturationally natural capacities in addition to the visual system. If a baby is raised in a French speaking community, the baby will learn to speak French. But if that same baby were raised in a Hindi speaking community, it would learn to speak Hindi. A child's learning to speak a particular language, however, is distinguishable from the more general preparedness of infants the world over to acquire a natural language in the first few years of life. Diverse cultural arrangements have no important impact on the schedule for children's mastery of maturationally natural capacities, which occur in *every* culture (See, for example, Callaghan et al. 2005 for suggestive evidence on this point pertaining to theory of mind). Throughout our species' history, children have learned to walk, to speak some language, to understand others' mental states, and, eventually, to identify potential mates no matter how culture cloaks such items and activities. Maturationally natural capacities, in short, arise regardless of cultures' peculiarities.

Maturationally Natural Capacities Address Problems Closely Connected to Human Survival. The pervasiveness of such maturationally natural capacities across cultures probably turns on the fact that they address problems that are fundamental to human survival – such as distinguishing agents from other things in the environment, understanding the syntax of an utterance, and knowing what to do in the face of an environmental contaminant. The matters that maturationally natural capacities address are so fundamental to human survival that their acquisition virtually defines the course of what we take to be *normal* development. Parents of children who fail to manifest these maturationally natural capacities will take those children to medical professionals, if such resources are available, to find out what is wrong. Many maturationally natural capacities, such as locomotion, are fundamental to the survival of a wide range of species, not just *Homo sapiens sapiens*. That at least introduces the plausibility of an extended phylogenetic heritage for some of these capacities.

Maturationally Natural Capacities End Up as Domain Specific. Maturationally natural capacities constitute domain specific systems at the end of their development, if not at the beginning. Considerable controversy surrounds the origins of these capacities and the principles of learning by means of which people acquire them. Evolutionary psychologists (e.g., Cosmides and Tooby 1994) maintain that the appearance of many of these capacities in human development results from the operations of innate, domain specific mental modules that evolved to handle just those tasks. By contrast, what might broadly be called “learning theorists” (e.g., Tomasello 1999) hold

that humans come by most of what they know on the basis of general inductive abilities supplemented, perhaps, by but one task-specific module in particular, viz., theory of mind, which is concerned with understanding the contents of other humans' mental states. Armed with a natural appreciation of others' communicative intentions and fed input from culture, humans and human cultures have progressively ratcheted themselves up to steadily more impressive intellectual achievements.

Regardless of which of those accounts captures the correct etiology for the acquisition of various maturationally natural capacities (each theory may capture some of the truth about nearly all maturationally natural capacities or all of the truth about some of them), developmental psychologists differ little about what children seem to know by the time they reach school age (i.e., around seven years of age). They may not even know that reading and writing exist, but all normal seven year old children know how to speak their communities' languages. They may have never seen a bicycle, but they all know how to walk and even how to adjust their gait, without the slightest thought, as they walk over uneven terrain. They may have no idea how to deal with the dangers of electricity, but they are quite confident about how to conduct themselves around an environmental contaminant.

It is not just the principles of learning that guide the acquisition of one maturationally natural capacity or another that may vary. Again, developmental psychologists do not disagree about the fact that children, or adults for that matter, deploy different principles of inference for the various domains that maturationally natural capacities address. Children carry out inferences on the basis of different substantive principles about linguistic form, about how uneven terrain must be for them to change their mode of locomotion from walking to climbing, and about the handling that is required for managing solids as opposed to liquids. Intriguing experimental evidence suggests that even adults have different conceptions of inferential norms when they carry out inferences pertaining to social contracts compared to inference in other domains (Stone et al. 2002).

Maturationally Natural Systems Operate on the Basis of Distinctive Cues. Maturationally natural systems engage automatically on the basis of detecting a few particular cues. Because they typically address matters of considerable importance to human survival, maturationally natural systems usually leap to particular perceptions, judgments, or actions and ask questions later. Inputs that satisfy a few cues, which are *reliable enough*, trigger these systems' operations. They kick into gear even when their outcomes are woefully underdetermined by the available evidence (humans rarely act on the basis of demonstrative inferences). And that is the way we would want things most of the time with most of the matters that maturationally natural systems tackle.

Issues of conscious recall or conceptual nuance or concerns with coherence or integration with the rest of our knowledge do not delay these systems' operations. This contributes to their speed. So too do their restrictions on the number of confirmation relations, i.e., on the number of those cues, which are reliable enough, that need to be detected in the process of identifying items from their forms. Jerry Fodor (1983: 70) underscores how useful this can be, citing Ogden Nash's sage advice that "If you are called by a panther / don't anther" (Fodor 1983: 70). Panther identification is something that humans always want accomplished with spectacular efficiency and that we do not wish to have encumbered by numerous cognitive requirements for confirming panther properties mentally as a precondition for us being able to take action.

The sensitivity of maturationally natural systems to but a small subset of all of the potentially relevant information available with regard to some stimulus, in effect, constitutes sets of biases in perception, cognition, and action. Such biases render their owners susceptible to corresponding perceptual, cognitive, and practical illusions. It is easy to recognize the biases and corresponding illusions in other species. Whether it is the moth that is attracted to the flickering candle, the frog who leaps to nab a flying bee-bee, or the males of a variety of species that seem ready for liaisons with just about anything in sight that even vaguely resembles a female, we can readily spot those creatures' biases and their resulting illusions. It is our own biases and illusions that we are less clear about. Humans' responses to motion pictures are probably the best illustration of our own susceptibilities. Coordinating a sound track with variations in patterns of light on a two dimensional screen can create for us whole new three dimensional worlds. They are filled with people and events that we effortlessly perceive and make judgments about (including social and psychological judgments) and that elicit our emotions and bodily reactions.

More often than not, both the operations of maturationally natural capacities and their effects take place beneath the level of consciousness. Usually, the detection of critical cues, the inferences drawn, and their mental and practical impacts transpire with little, if any, conscious recognition. The susceptibility to the Muller-Lyer illusion (Figure 9.1) of the overwhelming majority of this paper's readers evinces the (culturally tuned) biases in their visual systems for detecting corners and edges. They cannot help themselves from seeing the line connecting the inverted arrow heads at the top as longer than the line connecting the ordinary arrow heads at the bottom, and this is true even *after* readers measure the lines to confirm that they are, in fact, the same length. Their conscious knowledge of the facts is incapable of eliminating the illusion, indicating that the functioning of the maturationally

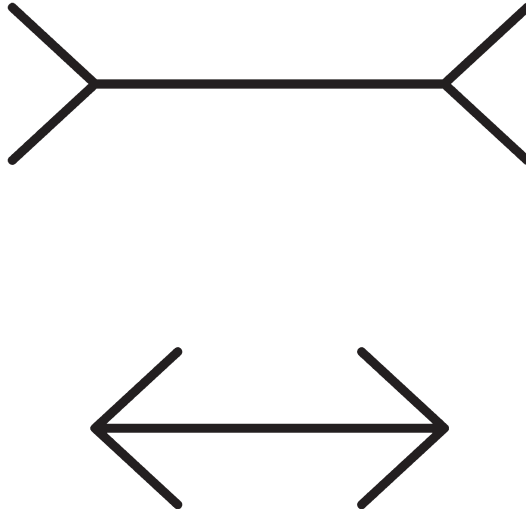


Figure 9.1 The Müller-Lyer illusion (image by author)

natural system is cognitively impenetrable. Such *persisting illusions* are sure signs of the functioning of biased maturationally natural systems.

For the most part, humans are no more conscious of their cognitive biases and the cognitive illusions that result than they are of their mental operations that exhibit them. For example, researchers found that posting a picture of a pair of eyes on the wall, as opposed to a picture of flowers, elicited significantly more honest behavior from people participating in an honor system for paying for cups of coffee from their otherwise unsupervised office coffee pot (Bateson et al. 2006). It seems that people are far more likely to conform to rules for cooperation when they detect that they are being watched, *even when the detection is unconscious*.

Amos Tversky, Daniel Kahneman, and their colleagues have documented numerous cognitive biases (or “heuristics”) that human beings deploy when they undertake tasks calling for probabilistic inference (Kahneman et al. 1982; Gilovich et al. 2002). For example, contrary to the overwhelming majority of participants’ intuitive judgments, the probability that Linda, who was a bright, outspoken philosophy major in college and who was active in a variety of causes concerned with questions of justice, is both a bank teller and a feminist cannot be greater than the probability that she is a bank teller. (The probability of a conjunction can never exceed the probability of its least probable conjunct).

Cuing Maturationally Natural Systems Often Involves Powerful Emotions. Often the cuing of such mental systems stimulates powerful feelings in human beings as well as characteristic intuitions and behaviors. Those emotional effects are often transparent not just to observers but sometimes even to the participants themselves. Consider, for example, the feelings and behaviors associated with (a) perceptions of contaminated food, or (b) the inability of an informant who is socially equal to make eye contact, or (c) unfairness in assessments, or (d) the influence of recognized social hierarchies in the distribution of opportunities and resources. All other things being equal, the human beings in each of these scenarios typically experience distinctive feelings that can readily propel them into characteristic behaviors – here, respectively, acts and attitudes of avoidance with (a), wariness with (b), complaint with (c), and deference with (d) – even though they may be completely unable to articulate those judgments or anything about either their emotional responses or the motives for their actions.

Some Candidate Domains. As noted earlier, over the past two decades especially debates have raged anew about the origins of human knowledge. Very roughly, the evolutionary psychologists and their allies have emphasized nature while learning theorists (who have dominated the social sciences) have stressed nurture. The notion of maturational naturalness circumvents those debates. Distinguishing between our natural cognition and those mental processes that require conscious, effortful thought and careful, time-consuming reflection is a necessary step for further distinguishing between the two types of natural cognition that I have outlined here. Crucially, distinguishing maturationally natural knowledge from the forms of (non-natural) cognition that can only attain cognitive naturalness on the basis of prolonged experience or practice provides a means for characterizing most, if not all, of the cognitive achievements that the evolutionary psychologists wish to highlight without any need for a commitment to either their nativism about the origins of these systems or particularly strong claims about those systems' modularity.

Since maturational naturalness is a more general characterization of perceptual, cognitive, and action systems that does not demand either innate origins or fully modular architectures, most of the candidates that the evolutionary psychologists offer of innate cognitive modules will almost certainly qualify as maturationally natural systems. (It is primarily by eschewing automatic nativist assumptions that maturational naturalness can be distinguished from the evolutionary psychologists' innate cognitive modules, as many of them also reject the full-blown account of modular architecture defended by Fodor (1983: 47–100).

The scores of domains that the evolutionary psychologists target, then, are

probably all candidate domains as maturationally natural systems. The most prominent example is, undoubtedly, natural language, since Chomsky's claims (e.g., Chomsky 1972) for its innate modularity precede the evolutionary psychologists' proposals by two decades. Others include *perceptual capacities* such as our abilities to recognize and distinguish human faces (Kanwisher et al. 1997; Kanwisher 2000), *cognitive capacities* bearing on topics as diverse as the basic physics of solid objects (Baillargeon et al. 1986; Spelke et al. 1992) and theory of mind (Avis and Harris 1991; Callaghan et al. 2005), and *action capacities* such as the avoidance of environmental contaminants (Rozin and Nemeroff 1990; Rozin et al. 1993; Rozin et al. 1995; Nemeroff and Rozin 1994; Hejmadi et al. 2004).

The By-Product View of (Much) Religious Cognition

The By-Product View Finds No Natural Unity in the Cognitive Foundations of Religion. Cognitive scientists of religion who advocate the so-called "by-product" view of religious cognition hold that religious ideas and forms are *naturally appealing* to the human mind because they are largely rooted in maturationally natural cognitive dispositions. They suggest that religious beliefs and behaviors emerge from routine variations in the functioning of components of our normal mental machinery. Religions variously activate a diverse collection of cognitive inclinations that enjoy neither a logical nor a functional unity. *Cognitively speaking* religions enlist a variety of ordinary, maturationally natural psychological propensities, which are, otherwise, mostly unconnected with one another. The standard features of religious mentality and conduct are cobbled together from various susceptibilities of a compilation of sundry psychological dispositions that develop in human minds on the basis of very different considerations – different both from one another and from anything having to do with the roles they might play in religions.

Latent Susceptibilities of Cognitive Dispositions. Dan Sperber (1996: 66–67) differentiates cognitive *dispositions*, which are adaptive, from the *susceptibilities* for which they are responsible. Dispositions are genuine adaptations and, thus, have what Sperber calls a "*proper domain*." The materials and the problems, which those materials presented, constitute the proper domain that the disposition evolved to manage (well enough). The proper domain of a disposition is, however, but a subset of its *actual domain*. Its actual domain is made up of all of the items and circumstances sufficient to rouse the disposition. Although those additional items and circumstances played no role in either the evolution or the development of the disposition, they are no less capable of exploiting that system's latent susceptibilities, producing

what are best understood as intellectual and behavioral *by-products* of that disposition (Tremblin 2006: 44). The moth's attraction to the candle's flame, the frog's consumption of flying bee-bees, and those preoccupied males' interests in anything remotely resembling females are all by-products of the various dispositions of the species in question.

Broadly speaking, the by-product account of religion's cognitive foundations contends that when some cognitive disposition's actual domain exceeds its proper domain, it is capable of erring, in effect, on the side of liberality. It can yield perceptual, cognitive, or practical false alarms. Crucially, cultures and their religions everywhere take forms that manipulate our maturationally natural cognitive predilections (recall the comments about movies above). They have developed all sorts of ways of stimulating false positive responses by activating the relevant perceptual, cognitive, or action systems. The question remains, though, why only some of the resulting representations that these false alarms create persist in populations of human minds.

The proposed answer of by-product theorists is that the persisting representations are the ones that survive the culling wrought by a process of *cultural* selection. What makes representations cognitively and psychologically appealing constitutes some of the most important selection forces here. Cultural selection is based largely on humans' maturationally natural systems, since they include all of the unconscious and automatic dispositions of mind that all humans share.

Features of Culturally Successful Representations. By introducing only minor variations into the operations and outputs of maturationally natural systems, religions produce modestly, often minimally, counter-intuitive representations. The modest counter-intuitiveness of religious representations *attracts attention*. Experimental findings suggest that such modest counter-intuitiveness of representations also facilitates the recollection of those representations (Barrett and Nyhof 2001; Boyer and Ramble 2001). Representations that are *easily remembered* have a clear advantage over those that are not. This is particularly important for understanding cultural transmission in non-literate cultures.

People also have an interest in retaining and transmitting representations that enable them to solve problems. A representation's promise on that front turns largely on its *inferential potential*. The operations of maturationally natural systems include a large body of *default inferences*. If we know, for example, that something is an agent, we know automatically that it has aims and goals, that it desires to accomplish those aims and goals, that it pursues courses of action for bringing about its aims and goals, that it does not desire to be foiled in those pursuits, etc. Their abilities to attract attention, to facilitate recall, and to address problems by means of automatically available

inferences help to insure that those representations are *communicable*. These features make them easy to transmit.

It will also aid the cultural success of a representation, if it also *motivates* people to transmit it. For example, if part of some idea is that rewards will accrue to those who transmit that idea, all else being equal, that will contribute to that idea's persistence in a population of human minds. Like magic and music and civil ceremonies and superstition, religion largely results from the responses of fallible perceptual, cognitive, and action heuristics, which are enshrined in human minds, to conditions that are not part of those dispositions' proper domains but that elicit their operations, nonetheless.

Modern human minds' maturationally natural dispositions have rendered them susceptible to generating and retaining a variety of representations, beliefs, and practices that presume modestly counter-intuitive arrangements, i.e., representations that do not absolutely conform to our unreflective expectations. These include *representations* of fairy-god-mothers, talking wolves that can plausibly be mistaken for elderly women, and Superman, *beliefs* in everything from Lassie, Santa Claus, elves, and leprechauns to ancestors, angels, and gods, and *practices* such as theater, parades, concerts, and ritual. These variations appear in everything from folk tales, fantasy, and fiction to comic books, commercials, and cartoons. What precise forms these representations, beliefs, and practices take are mostly a function of what is in the air locally and, needless to say, not all of them are religious. So, what I have been describing is only *part* of the story about religion, but it is an important part. In the next section, I explore an illustration of how religions exploit maturationally natural dispositions of mind that can bear on rituals' shapes and locations. In the final section, I will briefly examine some of their possible implications on that front.

Enlisting Hazard Precautions

Hazard Precautions and Contamination Avoidance

Contamination Avoidance as Part of a Hazard Precaution System. Human beings the world over possess a repertoire of tactics for dealing with what they perceive as contaminants in their environments. Pierre Lienard and Pascal Boyer (2006) hold that this concern with contaminants is part of a larger evolved "Hazard Precaution System" (see Szechtman and Woody 2004). This Hazard Precaution System is concerned with a variety of dangers that our prehistoric ancestors faced, such as "predation, intrusion by strangers, contamination, contagion, social offence and harm to offspring" (Lienard and Boyer 2006: 12).

Hazard Precautions as Evolved Systems. The appearance of hazard precautions in human development certainly qualify as maturationally natural phenomena, and the proponents of an overall Hazard Precaution System maintain that it is an adaptation of the human mind that arose on the basis of natural selection. Evidence for the origins of these Hazard Precaution Systems in the evolution of our species does not depend merely on the fact that caution about these matters seems so transparently adaptive. A number of other considerations point in the same direction. First, humans and monkeys seem to have similar natural fears. Rhesus monkeys' observations of other rhesus monkeys' fear of snakes sufficed on the basis of a single trial to induce such fears in the observers. By contrast, no matter how often rhesus monkeys observed other rhesus monkeys' (apparent) fear of flowers and bunnies, experimenters could not induce those fears in the observers (Blaney and Millon 2008: 123). In short, humans exhibit similar predilections with respect to fearing snakes (Öhman and Mineka 2001; 2003). Second, human beings exhibit facilitated conditional reasoning about hazard precautions (Stone et al. 2002). Third, the fact that hyper-vigilance about such matters (such as repeated hand washing, lock checking, and closet ordering) effectively characterizes the most prominent features of obsessive-compulsive disorder (OCD) suggests that OCD may be malfunctioning of fundamental, maturationally natural systems (Mataix-Cols et al. 2005). In addition, although the Hazard Precaution System seems to outfit us for handling a wide range of dangers, it does not have unlimited scope. Specifically, it does not instill any automatic caution concerning threats to life and limb that have arisen during human history (in contrast to human *prehistory*), such as tobacco, electricity, guns, and automobiles.

Contamination Avoidance as a Principled System. Although some of the items and substances that constitute contaminants differ from one culture to the next, concerns about items and substances associated with animals' bodies (including, of course, human bodies) such as meat, blood, and excrement possess a psychological salience that cuts across cultures. So too does the movement of substances across our bodily borders (Rozin et al. 1995). Regardless of what people in a particular culture take to be contaminating, their conduct with regard to those contaminants seems to be regulated by principles all humans share.

Among those principles are presumptions that contaminants need not be perceptible. In particular, they may be invisible or so small as to be unseen. The imperceptibility of a contaminant makes ascertaining its transmission vectors all the more difficult. Prudence, therefore, dictates maintaining a safe distance from contaminants. A second principle is that *any* contact with a contaminant may introduce risk. Even the slightest contact may suffice to convey the *full* risk associated with the contaminant (Rozin et al. 1993).

Contamination Avoidance as a Principled System – to a Fault. Getting rid of contamination is also tricky business. Recall that maturationally natural cognitive systems fire instantly and automatically and, typically, operate below the level of consciousness. Even when they know that the glass has been disinfected, experimental participants refuse to drink from a glass that they know had earlier contained a cockroach. The point here is that the putatively evolved dispositions in question were adaptations to prehistoric conditions in which the notion of disinfecting was not an option. *Disinfection* is not a computable input to this maturationally natural contamination avoidance system. So, participants remain needlessly cautious (Boyer 2001: 119–120; Rozin et al. 1993). Ample evidence from the ancient world indicates, as the theory would predict, that people possessed the same contamination avoidance principles then and that they acted accordingly. Thus, the maturationally natural systems at stake predate the invention of the germ theory of disease.

Ordered Environments as Hazard Precautions

Ordered Environments as Hazard Precautions. As noted, the Hazard Precaution Repertoire is concerned with more things than just contaminants. In addition to propensities to fear and, thus, avoid contaminants as well as snakes and spiders, it is also hypothesized to include special sensitivities to disruptions or threats to social relations, to off-spring, and to domestic environments. The latter consideration seems particularly likely to bear on spatial features of rituals.

Many young children and OCD patients display profound concern for the elaborate ordering of personal possessions (Boyer and Lienard 2006). The connections of ordered environments and of having everything in its place with the detection of intruders may provide insight about the emotional reassurance that both children and OCD patients seem to derive from such arrangements. Imposing some order on objects in a domestic environment is a good means for ascertaining whether someone has violated that space. The intruder's movements are almost guaranteed to disturb that order. Violations of visible patterns, alignments, and symmetries make intrusions conspicuous.

The Psychological Prominence of Vertical Symmetry. Symmetries in the ordering of objects in some setting or symmetries in the design of the setting itself enjoy a particular prominence for human minds. The human visual system finds symmetry along a *vertical* axis arresting and manages it with greater efficiency than any other direction of symmetry (Wenderoth 1994). The human penchant for producing symmetry along the vertical axis

is manifest in every human culture. Humans manufacture all sorts of tools, structures, buildings, and spaces that are vertically symmetrical. The fact that only one circumstance, viz., facing another animal straight-on, reliably approximates such arrangements in nature again suggests an evolutionary rationale for such a preference. It will always be important to know whether the animal we have spotted (who, incidentally, may also be staring at us) is predator, prey, or conspecific, and it will often be important to know it *fast*.

Another Example of Religions Enlisting Maturationally Natural Systems

Hazard Precautions Do Not Exhaust the Maturationally Natural Systems that Religions Exploit. The final section will focus on some of the implications for ritual of religions enlisting these intuitive hazard precautions. These various hazard precautions, however, are by no means the only maturationally natural systems that religions engage. Space limitations require that one quick further illustration must suffice.

Religions Recruit the Human Penchant to Comprehend and Produce Natural Language. That religions employ natural language is no surprise. Humans talk pretty much all of the time. But *that* is not the question. The question is whether or not religions engage natural language *by virtue of its status as a maturationally natural system*. They do. Christianity is but one of dozens of religions exhibiting glossolalia or speaking in tongues (May 1986). Participants in ecstatic states are alleged to be speaking in unknown languages. With regard to its *production*, whether glossolalia involves more than the simple repetition of a few syllables or not, the by-product theorist predicts that the utterances will overwhelmingly utilize the phonemes of the speaker's native language in utterances that exhibit prosodic features that are quite similar to routine talk. It is on the *comprehension* side, though, that the impact is most direct. When humans hear human voices producing utterances that have these characteristics of linguistic activity, they cannot help themselves from hearing it *as language*. (Try to hear someone else's speech as mere sound without immediately and involuntarily processing it as language). The point is that when humans hear glossolalia, their minds automatically draw the inference that it is linguistic activity and, thus, that it must mean something, which, of course, instigates a mental search for what it, in fact, means.

Implications for the Shapes and Locations of Religious Rituals

Opportunities for Enlisting Contamination Avoidance in Religious Rituals

Recruited Maturationally Natural Systems Make Some Ritual Arrangements More Probable. None of the considerations that I have reviewed demand some particular ritual arrangement, but they do make some arrangements more probable than others. Following the organization of the previous section, I will take up contamination avoidance first and then turn to ordered environments and symmetry.

Cuing Contaminants and Cleaning Them Up. The two clear implications of the discussion of contamination avoidance for the shapes and locations of religious rituals concern the behaviors for cuing the presence of contaminants and the probable measures required for carrying out ritual cleansings. Although the first are the conditions for the second, in what follows, I will take them up in opposite order.

All of that Washing! Probably the most obvious clue that religious rituals have something to do with cuing contamination avoidance systems is the pervasive concern for purification and for washing things in so many religious rituals (Boyer and Lienard 2006). This stretches from the multiple ritual baths that the sponsors of a performance of an Agnicayana ritual (McCauley and Lawson 2002) take to the relatively perfunctory sprinklings with a few drops of water that many Christians employ in blessings and baptisms (Lawson and McCauley 1990). Religious rituals involve the (ritual) washing and cleaning of people, animals, artifacts, and spaces (such as buildings, cemeteries, and fields). Why are participants in religious rituals all over the world so concerned about the cleanliness of things that, most of the time, it is obvious are not just clean already but have, in fact, been specially cleaned in advance just for the ritual occasion?

Religions Engage the Maturationally Natural Contamination Avoidance System. On the by-product view of religious belief and practice, that preoccupation with cleansing and purifying in religious rituals is the inevitable result of cuing people's contamination avoidance systems. Human beings can employ a variety of means for cuing the presence of contaminants. When people noticeably divert their paths, as if they were walking around some invisible obstacle and then returning and proceeding in the original direction that they were walking, they cue others' contamination avoidance systems. When people repeatedly monitor some location, this too can trigger inferences about contaminants. People may also engage in special motor routines appropriate to a contaminant by using exaggerated care in handling or transporting something or in conspicuously assuring that some liquid does

not spill or that some object does not touch others. They may use special protections or shields for substances, artifacts, or spaces. They may stipulate that special, (ritually) qualified religious authorities are the only persons for whom it is safe to approach or handle some items or traverse some spaces. They may also post guards.

A roughly comparable analogy in the secular world is the way that law enforcement officials may demarcate crime scenes with police tape and the forms of conduct that they exhibit and impose on others with regard to that space and the objects in it. Whether with crime scenes or with religious rituals, the point is that once humans' contamination avoidance systems are cued, a wealth of inferences becomes available to them about how to conduct themselves with regard to those items or settings. (Recall the brief review of salient principles informing humans' contamination avoidance systems above).

Religions Invert the Contamination Avoidance System. In most religious rituals, religions *invert* the system's normal operations, since, if anything, *it is the people themselves who are the contaminants*. Inducing participants' awareness of some sacred object or space creates the need to purify participants ritually. The danger is that they might contaminate the holy artifact or the sacred place. Much of the time the contamination in question is the people's *moral* contamination. That religious participants might need to be cleansed *multiple* times before they are eligible to be near or touch or consume some sacred material squares perfectly well with the fact that ridding oneself or something else of contamination can be a formidable challenge. Because contaminants can be imperceptible, people who have carefully bathed and turned out in their very best attire may, nonetheless, still need to be ritually purified.

Differentiating Reserved Ritual Spaces from Ones that are More Publically Available. Relevant ritual locations should disclose evidence of demarcating reserved ritual spaces from more publically available ritual spaces. The border between the two might be directly marked by physical barriers, by changes in height, by changes in light and darkness, by changes in color or patterns, and more. On the other hand as noted above, it might be marked less directly by diverting pathways around some space or by stations for guards. On the safe distance principle, the allocation of space *per participant* between any two areas will probably be disproportionate in favor of the ritual space that is more reserved.

Water, Water Everywhere But Not a Drop to Drink. Humans use water in every culture to clean things, and all of the available evidence suggests that it is nearly as pervasive in ritual cleansings. There is, then, every good reason to expect rituals of purification to have either sources of water conveniently at hand or artifacts and systems designed both to transport

and store quantities of water that are sufficient for cleansing ritual objects or participants. The waters would be for cleansing, as opposed to quenching thirst and, presumably, the accompanying artifacts would reflect the first function rather than the second.

Opportunities for Enlisting Ordered Environments in Religious Rituals

Order and Symmetry in Ritual Settings is Patent. That religious ritual settings are ordered and symmetrical very nearly goes without saying. The principle of *everything in its place* applies more directly in ritual than, perhaps, in any other context. In literate societies, ritual manuals explicitly specify spatial arrangements. Purposely designed containers, such as jars, cases, and cabinets, protect and order ritual artifacts. The imposition of order extends not only to objects but to persons as well. People are regularly ordered in ranks and files (e.g., for prayers in mosques). Special clothing, which must also be kept orderly, designates entitled ritual practitioners.

Vertical symmetry is the norm for most religious architecture and icons. Churches, cathedrals, mosques, and temples are so routinely symmetrical vertically that it is where they are not that stands out (such as the spires of Chartres Cathedral). Although icons often involve variations on perfect symmetry, they typically retain a balance in their design along the vertical axis. Hindu icons may have multiple pairs of arms, but they do not have three arms on one side and one on the other. Although the correlation is not perfect (consider, for example, bee hives), human beings tend to regard order and symmetry as a reliable sign of the presence of designing minds.

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Notes

- 1 I wish to express my gratitude to Tom Kasulis for pointing out to me how naturally the well-worn English idiom to the effect that something has become “second nature” captures my notion of practiced naturalness.

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