# Toward a Cognitive Ecology of Religious Concepts: An Example from the Tyva Republic

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## ABSTRACT

*Using data collected in the Tyva Republic, the present work sheds light on the dynamic nature of religious cognition. In doing so, it reveals important patterns in the representation and distribution of religious concepts in this remote corner of the globe. This paper first introduces a cognitive ecological account of religion by examining human representational structures and how they interact with features of the natural environment. It then discusses this interaction in light of some Tyvan folktales followed by a report of how Tyvan spirit-masters' forms correspond to type of landmark; anthropomorphic spirit-masters are associated with regions whereas zoomorphic spirits are associated with discrete resources. It concludes by highlighting a number of important questions that emerge from a cognitive ecological view of religious concepts.*

Keywords
religious concepts, cognitive ecology, Tyva Republic, ritual behavior,
MCI theory, schema theory

## Introduction

Leading cognitive theories of religion focus on the form and retention of religious concepts (Boyer 1996, 2001; Boyer and Ramble 2001; Norenzayan et al. 2006) and ritual behavior (McCauley and Lawson 2002; Whitehouse 1996,

2000, 2004), and how intuitive cognitive processes about supernatural agents can be inconsistent with culturally "correct" postulates (Barrett 1998, 1999; Barrett and Keil 1996; Purzycki in press; Purzycki et al. 2012; Slone 2004). These research strategies have produced a rich body of novel insights into the universal features of religious cognition. However, by virtue of their focus, they do not address the dynamic and distributed nature of religious systems. As such, they often lack an accounting of religious cognition in context.

Using data collected in the Tyva Republic (Tyva), the present work introduces a more dynamic view to the discussion. First, it briefly characterizes a cognitive ecological view of religion. Then, it discusses the differences between types of conceptual incongruities by delineating the differences between "counterintuitive" and "counterschematic" concepts. This discussion is followed by a brief depiction of one aspect of Tyvan religion and then presents data that serve to develop a model that accounts for how spirits' forms correspond to objective features in the landscape of Tyva. It concludes by detailing a number of key questions for future pursuits.

## Cognitive approaches to religious concepts

While contemporary cognitive accounts of religious concepts largely focus on how the mind constrains religious thought, a cognitive ecological view would examine how the environment both constrains and often appears to be an extension of cognitive processing (see Chemero 2009; Clark 2008; Hutchins 1995). This view "points to the web of mutual dependence among the elements of an ecosystem" (Hutchins 2010, 706), and begs for cross-culturally attentive cognitive anthropological inquiry (see Beller et al. 2012; Bender and Beller 2011; Bender et al. 2010 for further discussion). A cognitive ecological approach to religion therefore offers a more dynamic view of religious cognition than those offered by most contemporary approaches. As religious worldviews are embedded components of socioecological contexts and these contexts vary around the world, this warrants attention.

### *A cognitive ecological account of religious concepts*

Cosmides and Tooby (2000) define a cognitive niche as "the use of contingent information for the regulation of improvised behavior that is successfully tailored to local conditions" (53; see too Clark 2006; Laland et al. 2000; Odling-Smee 1996; Pinker 2010; Tooby and DeVore 1987). Bulbulia (2008) identifies religion as a cognitive niche insofar as it is

> a system of organized behavior and knowledge, together with whatever artifacts and other symbolic structures (musical scores, texts, religious architecture) that is supported, retained, improved, and transmitted at least in part because we pos-

sess cognitive capacities to believe and morally commit to supernatural realities and purposes. (Bulbulia 2008, 21)

If religious systems are niches in which people navigate, and these niches vary in accordance with local conditions, then our religious cognition should vary accordingly. Accounting for context is crucial in order to examine this possibility. However, in order to understand context, we have to understand how evolved, pan-human cognition interfaces with our external socioecological contexts.[1] In essence, a cognitive ecological account of religion entails examining the dynamic relationships between cognitive architecture, concept, external primes and their conceptual correspondences. Let us turn to an example to illustrate this point.

In Sir Keith Vivian Thomas' (1971) monumental study of the folk religious traditions of medieval England, he notes that "The worship of saints was an integral part of the fabric of medieval society and was sustained by important social considerations. Individual churches had their own patron saints, and strong territorial associations could give hagiolatry an almost totemic character" (27). Pursuing this line of thought, he continues to note that

> Local loyalties could thus sustain an individual's allegiance to a particular saint. But the worship of saints in general depended upon the belief that the holy men and women of the past had not merely exemplified an ideal code of moral conduct, but could still employ supernatural power to relieve the adversities of their followers upon earth. Diseases, like occupations and localities, were assigned to the special care of an appropriate saint, for in the popular mind the saints were usually regarded as specialists rather than as general practicioners. (28)

In this case, patron saints were associated with not only specific maladies, but also with specific places (see Arnold-Forster 1899). Believers hold and transmit these conceptual couplings, but the mapping of specific diseases onto saint-church couplings relies on some understanding of said illnesses and the belief that one could get relief from them through supernatural means. Without diseases, this system would be significantly different; people would not go to specific churches for specific diseases they didn't have. Nevertheless, priests' and parishioners' mental models of diseases and their correspondences to churches and saints affected their decisions and thoughts in remarkable ways. How, then, in light of contemporary models of the human mind, can we make sense of this system?

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1. This interface is precisely where cognitive anthropologists focused their attention prior to the "cognitive revolution" (see D'Andrade 1981). In fact, an entire issue of *Topics in Cognitive Science* 4(3) devotes itself to the question of anthropology's relationship to cognitive science.

*Levels of mental representation*

One of the leading cognitive theories of religious concepts is called "minimal counterintuitiveness theory" (MCI Theory). In some forms, it posits that religious concepts violate deep, evolved intuitions people have about categories of objects in our world (Boyer 1996, 2001; Boyer and Ramble 2001; Norenzayan et al. 2006). This retention-based approach to religious concepts attempts to explain why religious concepts are so "catchy" (Sperber 1996) and has produced a large body of work (Barrett et al. 2009; Harmon-Vukić et al. 2012; Johnson et al. 2010; Purzycki 2010b; 2011a; Pyysiäinen et al. 2003; Slone et al. 2007; Tweney et al. 2006; Upal 2010).

Cognitive scientists have made a compelling case that humans are equipped with both intuitive ontologies and inferences about objects that fall into those categories (see Boyer and Ramble 2001; Carey 2009; Keil 1996). These conceptual domains are often listed as ARTIFACT, PERSON, ANIMAL, and PLANT (Atran 2002; Boyer 2008; Pyysiäinen 2004). According to the general story, we have a number of default intuitions undergirding these domains. Among other things, we tend to grant agency to PERSONs and ANIMALs, we expect solid objects not to be able to pass through one another due to cognitive systems of folkphysics, and we often essentialize species' membership. Religious concepts often *violate* these assumptions in two ways: *breaches* and *transfers* (Boyer and Ramble 2001; Barrett 2008). Such concepts are "minimally counterintuitive."

*Breaches* simply violate a default assumption. So, levitation breaches folkphysical assumptions. The notion that "people who transform into other animals" breaches species-specific essences. *Transfers* apply deep assumption reserved for one ontological category to that of another. "Bears that can talk to people" transfers linguistic ability to ANIMALs, and "roses that know your secrets" transfers mental states to PLANTs. These concepts all violate deep assumptions and are thus MCI concepts. Because they are often grounded in the quotidian, however, they "*need little in the way of overt cultural representation or instruction to be learned and transmitted*" (Atran 2002, 96, 268; Atran and Norenzayan 2004, 720).

However, in and of itself, the aforementioned illness-saint-church model has little if anything to do with violations of evolved intuitive ontologies. If Uncle Jim has water brash, for instance, he has to go find out which saint is responsible for this ailment *and* where the church under that saint's jurisdiction is. These are learned, "overt culturally represented" associations mentally stored as conceptual *schemas*. While often conflated with the default assumptions associated with ontological categories,[2] *schematic* assumptions and associations are more

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2.  While some focus on *how much* counterintuitiveness concepts have (Barrett 2008; Bar-

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specific, more flexible, and are more accessible to conscious manipulation than intuitive assumptions (Barrett 2004, 2008; Boyer and Ramble 2001; Purzycki 2010b, 2011a; Purzycki and Sosis 2010). According to the cognitive anthropological tradition, shared schemas are *cultural* schemas (Alba and Hasher 1983; D'Andrade 1981, 1992, 1995, 122–149; Strauss and Quinn 1997).

MCI concepts violate deep assumptions we have about the world. A "counterschematic" concept might violate something we typically associate with *specific* concepts, or what Boyer and Ramble (2001) call "encyclopedic information" (537). To illustrate, when we think of a rose, we might think of "red," "thorns," "love," and so forth. These conceptual units and their relationships form our "rose schema." This schema is embedded in our "plant schema" as well. However, the notion of "a rose that dreams" violates domain-level intuitions for PLANTs by transferring agency to a nonagent. However, "a rose colored with the MacLean Clan tartan" violates the schematic model we have for colors of roses.[3] Likewise, a "cat-furred rose" merely applies a schematic unit typically reserved for cats to roses. In the case of Pan or the devil, "men with horns and goat legs," merely applies informational units associated with goats to our schematic prototypes of men. By themselves, these concepts do not, however, violate deeper inferences about PLANTs, ANIMALs, or PEOPLE.

A "cat-furred rose that wants you to purchase it" violates both rose-schema expectations *and* transfers agency to PLANTs, thus having parallel violations.

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ret et al. 2009; Harmon-Vukic et al. 2012; Norenzayan et al. 2006; Tweney et al. 2006), *where* violations occur is a question that has slipped past many researchers. As such, some MCI research conflates concepts that violate domain-level inferences (i.e., *bona fide* MCIs) with specific, factual, learned, and often culturally shared information about objects (i.e., counterschematic concepts). For instance, a number of studies (Atran and Norenzayan 2004; Gonce et al. 2006; Norenzayan et al. 2006; Tweney et al. 2006) that use the same or very similar concepts consider "swimming cow," "admiring frog," and "melting lady" (or "grandfather") just as counterintuitive as "giggling seaweed," "arguing car," and "limping newspaper." Note here that the former three are all possible by virtue of reality or by construal. Cows swim perfectly fine, ladies and grandfathers likely melt under the right conditions, and frogs are readily perceived as admiring other frogs. However, seaweed does not giggle, cars do not argue (at least verbally), and newspapers don't limp. While giggling seaweed and arguing cars apply agency and verbosity to nonverbal agents, it is not clear how a "limping newspaper" violates inferences derived from deeper cognitive structures. The other items are simply uncommon and do not violate ontological assumptions about ANIMALs or PERSONs at all.

3. Of course, there are degrees of counterschematicness (for lack of a better word). A "rose colored with the MacLean clan tartan" is considerably more novel than "a polka-dotted rose." This is likely by virtue of the regularity of readers' exposure to "polka-dotted" than "MacLean clan tartan."

Purzycki (2011a) found that people find statements with *schematic* violations with (e.g., "a sheep that demands its wool back") and without MCI content (e.g., "a goose that drinks really cheap whiskey") are more humorous than those only with deeper MCI violations (e.g., "a tulip that listens to people") or no violations at all. Moreover, concepts with parallel violations were remembered significantly better than those with only one type of violation and statements with no violations at all (Purzycki 2010b). In sum, violations of schematic models affect us differently than violations of domain-level assumptions.

Barrett (2008) has since developed MCI Theory by characterizing five cognitive processes that "do not necessarily map onto genuine ontological distinctions" (see above). They do, however, define MCI content: "Spatiality, Physicality, Biology, Animacy, and Mentality" (317). While he makes a distinction between intuitive and schematic knowledge (a "bright green ferret" does not count as counterintuitive in the technical sense, 337), his model is exclusively devoted to coding for violations of the former. In his scheme, transfers appear in capitalized superscript on the left of an object whereas breaches appear in lowercase superscript on the right of a concept. So, a "rose that thinks" would be a case of transferring mentality to a plant ($^{M}$ROSE) whereas "an invisible rose that thinks" would consist of a transfer of mentality *and* a breach of intuitive physics ($^{M}$ROSE$^{P}$). How, then, does this apply to the saint-ailment-church system of medieval England?

The idea that the saints could perform magical healing from beyond the grave through relics, rosaries, and printed copies of various gospels might violate folk-biological principles. Moreover, the saints are invisible and thus breach principles of folkphysics (PERSON$^{p+b}$). Whether or not such violations were explicitly stated among people remains unknown. The conceptual coupling between *specific* saints, illnesses, and churches, however, violates no deeper intuitive processes. A cognitive ecological account of this system would inquire about the nature of these conceptual relationships, how they link to external features of the environment, and why these links make sense in a particular context. In this case, the "geographic distribution" of saint concepts corresponds to *their* churches and is a matter of schematically represented models of saint-ailment-church correspondences. Together, these associations constitute important cultural models.

The very idea that this pattern of the cultural distribution of the saint-specialization coupling was sustained by "local loyalties" for which individuals rallied in religious communities; people altered their behavior according to illnesses and travelled to specific churches for relief. The presence of illnesses also played a role in perpetuating such a system. That these distributions took on "an almost totemic character" and were arguably maintained not necessar-

ily because of their counterintuitive content, but because there were particular conditions that drove people to maintain these models. Let us now turn to a case with an actual totemic system.

## Field site

### *Tyvan spirit-masters*

The Tyva Republic (Tyva, also popularly known as "Tuva") is a small southern Siberian republic in the Russian Federation. Its national religions are shamanism and Buddhism and these are intertwined with traditional forms of totemism and animism. Roughly half of the total population of 243,000 lives in Tyva's two urban centers whereas the other half lives in small villages and/or are pastoralist herders of various livestock (Aksyanova 2009). One of the older traditions of the region is the spirit-master and ritual cairn complex.

Spirit-masters (*cher eezi*, literally "master of the place," plural *cher eeleri*[4]) are locally specific spirits that "own" various regions. Discrete resources have their masters as well, although they are terminologically specified as "master of the natural spring" (*arzhaan eezi*), "master of the fire" (*ot eezi*), etc. They are *not* nonagents with transferred agency (e.g., a mountain that knows things), and *not* "spirits of the forest," but rather agents who are "out there." While not the only type of spiritual agent in the complex pantheon of Tyvan religion, a considerable amount of the local lore consists of humans' interactions with these beings (Samdan 2004). Upon entering or leaving a region, before hunting, upon gathering water at natural springs, people ritualistically pay homage to these spirits for good luck and/or thanks for use of the resource. *Cher eezi* are primarily concerned with ritual behavior and the maintenance of the resources and regions they own (Purzycki 2010b, 2011b).

Like many Inner Asian traditions, Tyvans regularly make offerings to local spirit-masters at ritual cairns (*ovaa*). These are typically placed on locally recognized territorial and political borders (Humphrey 1995; Markov 1976). Tyvans conduct rites at *ovaa* in transit and during collective, seasonal rituals. Of the former, travelers make offerings of money, tobacco, prayer ties and ribbons for continued luck whereas the latter are often rationalized as a means to fertile pastureland for grazing and consist of larger sacrifices. For the spirit-masters of particular resources, offerings are made near the resource itself (e.g., tying ribbons or flags to a nearby tree). The following stories—a majority of which were published elsewhere (Purzycki 2010b)—illustrate the relationship

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4. Unless otherwise noted, I treat all Tyvan nouns as group nouns when pluralized for the sake of consistency and clarity

between place and spirit-master and further examines the significance of counterschematic information. I discuss these using Barrett's (2008) coding scheme to point to the counterintuitive properties of spirit-masters.

*Folktales*

One explanation of Tyvan religion contains nothing that explicitly violates default inferences of ontological categories. Note that in this translation, instances of the word "spirit" in the original Tyvan were "master" (*ee*):

> Everyone prays to the *arzhaan* [natural spring] because they are alive. All of the *arzhaan* have their spirits. The spirit of Adargan Arzhaan of Sagly is a small marmot. It appears to shamans and lamas. It protects that place. So a man should pray to it. They say there is a bird in this *arzhaan*. It also appears. We can notice it at night when it makes noise. All of these *arzhaan* have their spirits. That is why every Tyvan prays to his *arzhaan*, his lands. If we take, for example, Ubsa-Khöl [a lake], its spirit is a big bull. Each place has its spirit…That is why a Tyvan prays when he is on the road even if he can't see the spirits. (Purzycki 2010b, 29–30)

The idea that natural springs are alive might be the transference of biological properties to nonbiological entities ($^B$SPRING), but the passage indicates that this is metaphorical insofar as the masters of these resources are distinct from the resources themselves. The only indication of counterintuitiveness in the above story is the idea that Tyvans pray to these masters who "appear to shamans and lamas" thus breaching physical assumptions about marmots (MARMOT$^P$) and birds (BIRD$^P$), but only to a select few. Any other MCI content must be inferred regarding agents without readily apparent bodies; beyond the counterschematic notions that shamans have the ability to see things laypeople cannot (i.e., it violates what we know about *most* people, not HUMANs generally), rather than any counterintuitive features of spirits.

> A herder recounted a second-hand story of someone's interaction with a *cher eezi*:

> Some people or horse herds happen to meet the land spirits. [Once] a man was seen [by a herder] near the fire. He was having tea. Then he said to the young herder: "They say that you are a great fighter. Let's try your strength." They began fighting. The young man won twice against that strange man. But then the strength of the strange man began to increase. The horse herd was afraid and ran away from this strange opponent. [The young man] came to our yurt and told us everything that had happened to him. It was a land spirit. (Purzycki 2010b, 30)

Aside from the "man's" strength increasing and the horses' ensuing fear, there is nothing particularly strange about this story. Moreover, increased strength—even supernormally—does not violate any default assumptions about domain-level concepts or fit into Barrett's coding scheme. If anything, it is countersche-

matic only if we assume that his strength increased in unusual amounts.

Take the following story, which addresses another interaction with a *cher eezi*. In it, there is an explicit counterschematic concept:

> In the place Terektig of Mungash-Ak one of our relatives…went across the taiga to hunt and met a deer there. When he shot it and came up to it, he saw that its horns were very thick. When he came back home, he was killed the same night…It is a real story which happened last year. That deer was the land spirit of Mungash-Ak…A normal deer cannot have such thick horns. And that deer's horns were too thick. (Purzycki 2010b, 30)

Here, it is clear that something particularly special about a particular deer marks it as a supernatural being. It is a violation of what Tyvans know to be features of a "normal deer." This concept also does not fit into Barrett's coding scheme. While the narrative implies supernatural events, there is nothing in this story that violates intuitive ontologies.

Similar explanations were offered regarding the deaths of two lamas who attempted to "awaken" the spirit of a ritual cairn:

> There is a big *ovaa* in Kungurtug. As it had not been sanctified for a long time, it fell asleep. When people decided to make it alive again by praying to it, they invited shamans and lamas, but they refused to wake that *ovaa*. The shamans and the lamas were afraid of waking it because they thought the *ovaa*'s spirit was too strong for them. Then they invited two lamas from Ulan-Ude, Buryatia and they made the *ovaa* alive again. Afterward, one of the lamas died on the way back home and the other died three days after having returned. (Purzycki 2010b, 32)

In these two stories, the men's deaths are all merely cases of *post hoc ergo proper hoc* reasoning. Presumably, the relationship between the deaths and the individuals' acts is a supernatural one, but there is not counterintuitive content in that relationship. The story mentions a spirit, although its explicit articulation does not contain any notable counterintuitive properties. Tyvans use these examples as *evidence* of spirit-masters.

Other strange phenomena are also indicators of *cher eezi*. One musician in Kyzyl relayed a story his grandfather told him:

> Once he was in a village to go shopping. On his way back to his campsite, he had to pass an *ovaa* and didn't stop there. Soon, he had to cross a river. On the bank of the river, his horse stopped and he couldn't do anything to get it to go across. When he tried to make his horse move, it seemed to him that the river got bigger. So he had to make 1 or 2 more km to his campsite and he did it quickly and he felt he was very frightened, he was trembling. He remembered that he hadn't stopped at the pass and he started to sprinkle food and alcohol and pray and after that, his horse moved.

Here is a similar case of misfortune resulting in the interaction with a spirit specifically associated with a cairn, yet the river's getting bigger and the relationship between the horse's action and the ritual are the only violations of expectations, and they are not counterintuitive in the technical sense.

In another case, there is a hint of counterintuitiveness in the discussion of the *cher eezi*.

> If you meet any land spirit, you must not tell anyone. The land spirits do not want to be seen by everyone. That is why you must keep silent. If you tell somebody about the meeting, your life will become unlucky. The land spirit asks you to keep silent. In some cases, one can be very happy in life after meeting the land spirit. In many stories, the land spirit of this place is usually a woman. But she has been seen as a large snake as well. She is very beautiful. A hunter who meets her usually falls in love with her. They meet often. Then the spirit master asks him to leave his family and go with her. But he doesn't want to go with her and becomes afraid. So to get rid of the land spirit, he must ask him or her to fulfill impossible things or tasks. For example, to find an eight-legged green horse and so on. And the land spirit has to go to find it because its love is strong.
>
> (Purzycki 2010b, 30–31)

Here we see one implied case of a *cher eezi*'s ability to shift its form is a breach of biological essence (PERSON[b]). Notably, these spirits are characterized as entirely visible; they do not *want* to be seen. Like the abnormally-horned deer, the "eight-legged green horse" contains violations of schematic prototypes of deer, not of intuitive cognitive processes.

Note too, that consistently in these stories, affected luck is the consequence of violating spirit-masters' desires, not active punishment or anger on their part. In the following case, we see the only case of an MCI explicitly stated among the interview data I collected:

> Long ago a very rich man lived in this region, but he dressed like a very poor person. He even wore two different boots. During the war [World War II] he gave all of his cattle to the front. One day he met a land spirit who suggested playing chess with him. He [the spirit] was invisible. But then when they drank *araga* [fermented milk], the land spirit appeared before the man. The old man told no one about this incident. Soon he became rich again, thanks to that land spirit.
>
> (Purzycki 2010b, 31)

In this case, a spirit-master becomes visible after drinking *araga*, thus breaching intuitive folkphysical properties (PERSON[p]).

By most of Tyvans' accounts, MCIs merely appear to play a latent role in their discussions of spirit-masters. Moreover, what marks these spirits' significance is, by and large, their counterschematic content, not their domain-level violations. In other words, these stories are marked by the strangeness of *particular*

entities in the natural world, not by deeper intuitive processes. There is also considerable variation in spirit-masters' forms and their respective domains of mastery. There appeared, too, to be an association between anthropomorphic spirits to regions and zoomorphic spirits with discrete resources. These observations suggest the significance of schematic models' interactions with the natural environment, something to which the dynamic view of cognitive ecology points.

If such couplings exist beyond chance, then there should be statistically significant relationship between spirit-master type and resource of mastery. In order to more systematically test whether or not this was the case, I collected free-list data regarding the content and geographical distribution of spirit-master concepts. This method represents the closest approximation to a naturalistic free-recall task. Rather than exposing participants to various types of concepts and having them free-recall items later, this method elicits recall of actual religious concepts in a natural setting.

## Free-lists

### *Methods*

Participants were asked to free-list as many *cher eezi* and their places of mastery as they could with the following instructions: "Please list as many places and their spirit-masters as you can. They can be regions, places, families' places, and others. Please be as specific as possible. Here are some examples: Adargan Arzhaan—small marmot, Ubsa-Khöl—large bull, and Bayan-Kol—beautiful woman on a horse." These examples were drawn from the examples above and placed in a table format to provide clear instructions on how to organize responses.[5] Participants free-listed items immediately after answering basic demographic and religiosity questions and were not allowed to revise them upon completion of other tasks.

Spirit-masters were coded dichotomously for anthropomorphic or zoomorphic forms. Two items—the *diireng* (devlish imp) and *khei chüveler* (pl., literally "invisible things"; wicked phantasms) were coded as anthropomorphic. Places were coded dichotomously as either discrete resources (e.g., lakes, rivers, trees) or borders, regions, and other places with vague borders (e.g., mountain ranges, political districts). In Tyva, lakes' names are marked with "Kol" or "Khöl" (lake) and villages are often named after these lakes. Unless villages were explicitly referred to, all such cases were coded as discrete resources as the towns are named in reference to these bodies of water. So, while "Süt Khöl"

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5. It was necessary to have examples for illustrative purposes, but ones that did not have counterschematic or counterintuitive content which would lead participants to include such information. The precedent for including only intuitive information was set by the ethnographic data detailed above.

(Milk Lake) is coded as a discrete resource even though the village at the base of the mountain on which the lake rests goes by the same name, "Pii-Xem Arzhaan village" (Pii-River Spring Village) is coded as a region.

## Participants

Data were collected in various locations throughout the capital city of Kyzyl (e.g., schools, clinics, research institutes, etc.) with the help of a research assistant. Only participants ($n = 43$, $M_{age} = 36.50$, $SD = 12.64$, 24 women) who could read and write Tyvan fluently were recruited.[6]

## Results

On average, participants listed 1.70 places ($n = 73$, $SD = 1.06$) and 1.81 *cher eezi* ($n = 78$, $SD = 1.16$) as some individuals listed multiple spirit-masters for a single place. Places listed without a corresponding spirit-master or place of mastery and those items listed generically (e.g., *arzhaan eezi, taiga eezi*) or from other regions (e.g., Mongolia) were not counted in the following analyses.

The types of places listed ranged from vaguely defined places such as regions, mountains, and mountain passes to discrete resources such as lakes, rivers, natural springs, and trees. Overall, Tyvans were not any more likely to list regions, mountains, and passes ($n = 38$, $M = 0.86$, $SD = 0.93$) than they were to list discrete resources ($n = 34$, $M = 0.77$, $SD = 0.71$), $t(43) = 0.46$, $p = 0.65$. However, participants were more likely to list anthropomorphic ($n = 49$, $M = 1.11$, $SD = 1.08$) than zoomorphic ($n = 29$, $M = 0.66$, $SD = 0.61$) spirit-masters, $t(43) = 2.25$, Bonferroni adj. $p = 0.03$.

Regarding spirit-master concepts' counterintuitiveness, only four (5.1%) items explicitly resembled anything with counterintuitive content:  ghosts of those who committed suicide, a "man-spirit," the "invisible things," and the *diireng,* if we assume they are all invisible (MAN[P]). However, ten items (12.8%) were listed with clear or potential *counterschematic* features:  a three-legged camel, a woman missing one breast, a woman missing a leg, a green, blue,[7] or red bull, a fish-scaled bull, a girl with horns, a horse-headed person, and a many-headed person. All have a particular element that violates standard *schematic* models of the specific beings in question, not domain-level inferences. If we assume "a

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6.  Tyvan literacy rates are "near universal" (Harrison 2000, 10), and literacy rates in Russian specifically has been documented as 85% (http://www.ethnologue.com/show_language. asp?code=tyv, Accessed November 29, 2012). In 2002, 99.6% of Tyvans claimed Tyvan as their native language (Chevalier 2010), but the overall literacy rates for the Tyvan language can be confidently assumed as quite high.

7.  It is impossible to tell from the data regarding whether bulls are blue or grey as *kök* is the same word for both colors.

Table 1. Table for spirit-master form by place of mastery

| Place of Mastery | | Zoomorphic | Anthropomorphic | Total |
|---|---|---|---|---|
| | | **Spirit Form** | | |
| **Discrete Resource** | Count | 27 | 11 | 38 |
| | Expected Count | 14.13 | 23.87 | 38 |
| | % within Place | 71.05 | 28.95 | 100 |
| | % within Spirit | 93.10 | 22.45 | 48.72 |
| | % of Total | 34.62 | 14.10 | 48.72 |
| | Std. Residual | 3.42 | -2.63 | |
| **Region** | Count | 2 | 38 | 40 |
| | Expected Count | 14.87 | 25.13 | 40 |
| | % within Place | 5.00 | 95.00 | 100 |
| | % within Spirit | 6.90 | 77.55 | 51.28 |
| | % of Total | 2.56 | 48.72 | 51.28 |
| | Std. Residual | -3.34 | 2.57 | |
| **Total** | Count | 29 | 49 | 78 |
| | Expected Count | 29 | 49 | 78 |
| | % within Place | 37.18 | 62.82 | 100 |
| | % within Spirit | 100.00 | 100.00 | 100 |
| | % of Total | 37.18 | 62.82 | 100 |

big, long worm," "a big black wolf," and "large bulls" are uncommonly large and "beautiful women" are exceptionally beautiful, then the majority of items contained counterschematic content.

In terms of the relationship between spirits' forms and associated resources, a chi-square demonstrated that there is a significant pattern of spirit form and resource of mastery: spirit-masters of wider regions (districts, mountains, mountain passes, forests) were significantly more likely to be anthropomorphic spirits than spirit-masters of discrete resources (lakes, natural springs, and trees), which were more likely to be zoomorphic ($n = 78$, $\chi^2 (1) = 35.15$, $p < 0.001$, $\varphi_c = 0.67$). The odds ratio indicates that discrete resources are 33.8 times more likely to be associated with zoomorphic spirits than anthropomorphic spirits. This pattern shows a stronger presence if we include forests and taiga among discrete resources ($\chi^2 (1) = 36.40$, $p < 0.001$, $\varphi_c = 0.68$). For this analysis, the odds that discrete resources are associated with zoomorphic spirits are 46.6 times more likely than their association with anthropomorphic spirits. Table 1 reports the crosstabulations of this second chi-square analysis. This confirms a strong conceptual coupling between *cher eezi* form and feature of the external environment.

Discussion

Even though there may be counterintuitive content underlying Tyvans' explicit conceptions of spirit-masters (particularly breaches in physics or perhaps the ability to appreciate humans' prayers; $^M$ANIMAL$^P$), the present work points to the importance of schematic content and how it corresponds to landmarks in the natural environment. As spirits' forms in Tyva conform to a significant pattern rooted in the objective world, and these forms and associations are schematically represented, this emphasizes the significance of schematic content over deeper inferences. A crude model of these relationships is illustrated in Figure 1. In light of this model, a number of compelling questions arise with significant implications for further pursuits.

Why are spirits represented in different forms? There are a number of ways to address this question (e.g., historically, through interpretation, etc.), but external features of the environment may shed more light on the formation and stability of such cultural models than strictly cognitive psychological approaches can. Entire regions, mountain ranges, and mountain passes all have significantly less interpersonal accountability and predictability (Figure 1). In other words, for travelers or residents, there are more variables to take into consideration and more chances of risk at such places. The boundaries of a lake or stream are fairly easy to identify and monitor. Anthropomorphic spirits, therefore, may boost accountability. Many have found that moralistic deities are more often found in state-level societies where anonymity and uncertainty is heightened (Johnson 2005; Lahti 2009; Roes and Raymond 2003; Sanderson 2008; Stark 2001; Swanson 1960; Wallace 1966) and countries with more existential insecurity are typically more religious (Barber 2011). Is it the case that in specific places of heightened uncertainty, supernatural agents are more likely to be anthropomorphic?[8] This appears to be the case in Tyva, but other traditions should be assessed to see whether or not this is the case.

Human-like spirits are also associated with *human* territories marked with ritual cairns. These serve as indices of agency both human and supernatural alike. In Tyva, cairns mark the places of regional, anthropomorphic spirit-masters while zoomorphic spirit-masters are largely associated with discrete natural resources where people also make offerings.[9] Importantly, one need not even

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8.  As documented elsewhere (Purzycki in press, 2011b), there appear to be no significant differences in knowledge or concern attributions between anthropomorphic or zoomorphic spirit-masters, but these studies focused on their knowledge of moral and nonmoral information rather than ritual and conservation behaviors about which spirit-masters are primarily concerned.

9.  In my experience, visiting the neighbors of my hosts to collect water at natural springs always
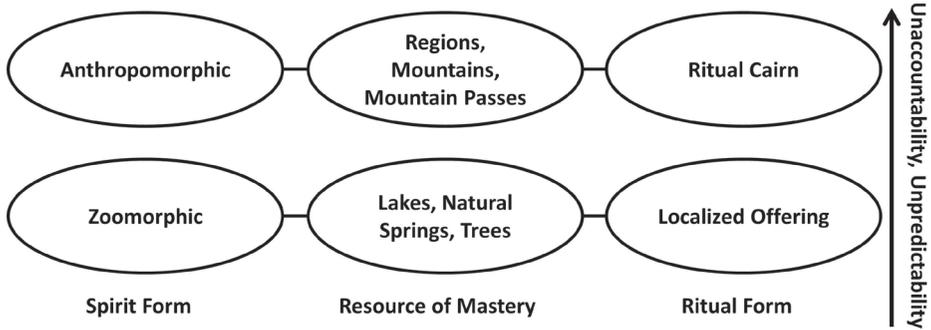
Figure 1. Relationship between *cher eezi* form, place of mastery, and ritual form.

know the form of the local spirit-master to perceive its presence; if you see a cairn, you make an offering just as you would at a natural spring. As such, aside from telling stories of spirit-masters, their perceived presence is grounded in geography with corresponding rituals. Quite possibly, then, ecological con-straints stimulate the need for ritual and *this* predicts cognizing supernatural agencies and their form. In other words, the "catchiness" of religious concepts is externalized by geography and corresponding ritual spaces.

MCIs make mundane objects, animals, and plants, particularly special among their domain-level (e.g., ANIMAL and HUMAN) confederates. Schematic viola-tions, however, not only distinguish entities from their species-specific confeder-ates, but they also concretize entities in a way that MCIs fail to do; countersche-matic entities are more probable and verifiable than MCIs. Recall that the stories often included cases of humans interacting with spiritual agents; hearing a bird and seeing a deer with abnormally thick horns are drawn from the local ecology and indicate to Tyvans that supernatural agents are out there in the natural world. The above accounts generally included accounts of peoples' interactions with spirits; these agents are quasi-corporeal; tangible, yet ethereal at the same time. This leads to other important questions that have not been previously entertained.

Does the relative salience of counterschematic and MCI content fluctuate across socioecological contexts? Is counterschematic content typical for totemic spirits associated with specific people and places? In Tyva, MCI content of vari-ous spirits appears to be a constant, but latent feature of *cher eezi*. It may be the case that given the relatively low frequency of contact with those outside

entailed an offering to the arzhaan eezi and the neighbors would observe us doing so. Among the reindeer herding Tozhu of northeastern Tyva, Donahoe (2003) suggests that "their rela-tionship to wild animals is still predominantly a social one based on trust, mediated by the *cher eeleri*' and that the spirit-masters are indeed the "owners" wild animals (112). Before hunting, the Tozhu make an offering to the master of the forest.

of one's immediate surroundings, reports of counterschematic beings might be salient enough for retention; as MCI concepts are less accessible to scrutiny, it may be that concepts of rare and strangely colored animals are "catchy" enough under certain circumstances. In other words, counterintuitiveness may vary cross-culturally due to ecological factors. Specific spirit-masters may therefore function to further specify places. When religious concepts are grounded in objective features in the world such as territory and resources, this may minimize explicit counterintuitive content in religious communication. These are empirical questions and cross-cultural work—as ever—is of the utmost necessity in order to address them.

## Conclusion

The present work suggests that religious concepts are not merely "catchy" ideas, but rather constituent parts of a dynamic system. A cognitive ecological view of religion stresses the importance of examining such a system and the present work demonstrates that this view can be extremely useful in furthering our understanding of religious cognition. Moreover, this view lends itself to the investigation of whether or not similar patterns function to conceptually isolate resources for efficient regulation (see Atran et al. 2002; Lansing 1991; Lansing and Kremer 1993; Rappaport 1979, 2000) and/or to facilitate ritualized communication with other people (Purzycki 2010b).[10]

This too suggests that coordination problems forge the relationship between religious cognition and ritual. As Tyvan spirit-masters are, in fact, geographically "rooted" in particular patterns, this is just as much a matter of human cognition as a matter of the selection pressures that may have favored this pattern of beliefs and practices. If it is the case that religions do solve locally specific socioecological problems (Alcorta and Sosis 2005; Purzycki and Sosis 2009, 2010, 2011; Purzycki et al. in press; Shariff et al. in press), this pattern suggests that religious concepts will converge around those problems and *this* heightens the retention and stability of religious concepts. A cognitive ecological view attends quite well to the nexus between culture, cognition, and context. In the case of religion, it both points to the dynamic nature of religious systems' content and logic as well as generates important questions regarding the nature of religious cognition and how it may systematically vary according to context.

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10. As Tyvans are traditionally nomadic pastoralists, the "secular utility" (Durkheim 2001 [1915]; Wilson 2002) of such a system may be the strengthening of social bonds required for cooperative interactions and managed resource exploitation. Indeed, Tyvans deem those who regularly engage in cairn piety more trustworthy than those who do not (Purzycki and Arakchaa 2013, see too Sneath 1992).

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## References

Alba, Joseph W., and Lynn Hasher. 1983. "Is Memory Schematic?" *Psychological Bulletin* 93(2): 203–231.

Aksyanova, G.A. 2009. "Principal Findings of the Twentieth-Century Population Studies in Tuva." *Archaeology Ethnology and Anthropology of Eurasia* 37(4): 137–145. http://dx.doi.org/10.1016/j.aeae.2010.02.015

Alcorta, Candace, and Richard Sosis. 2005. "Ritual, Emotion, and Sacred Symbols: The Evolution of Religion as an Adaptive Complex." *Human Nature* 16(4): 323–359. http://dx.doi.org/10.1007/s12110-005-1014-3

Arnold-Forster, Frances. 1899. *Studies in Church Dedications: or, England's Patron Saints*. London: Skeffington and Son, Piccadilly.

Atran, Scott. 2002. *In Gods We Trust: The Evolutionary Landscape of Religion*. Oxford: Oxford University Press.

——— and Ara Norenzayan. 2004. "Religion's Evolutionary Landscape: Counterintuition, Commitment, Compassion, Communion." *Behavioral and Brain Sciences* 27: 713–770. http://dx.doi.org/10.1017/S0140525X04000172

———, Douglas Medin, Norbert Ross, Elizabeth Lynch, Valentina Vapnarsky, EdilbertoUcan Ek, John Coley, Christopher Timura, and Michael Baran. 2002. "Folkecology, Cultural Epidemiology, and the Spirit of the Commons: A Garden Experiment in the Maya Lowlands, 1991–2001." *Cultural Anthropology* 43(3): 421–450.

Barber, Nigel. 2011. "A Cross-National Test of the Uncertainty Hypothesis of Religious Belief." *Cross-Cultural Research* 45(3): 318–333. http://dx.doi.org/10.1177/1069397111402465

Barrett, Justin L. 1999. "Theological Correctness: Cognitive Constraint and the Study of Religion." *Method and Theory in the Study of Religion* 11: 325–339. http://dx.doi.org/10.1163/157006899X00078

———. 1998. "Cognitive Constraints on Hindu Concepts of the Divine." *Journal for the Scientific Study of Religion* 37: 608–619. http://dx.doi.org/10.2307/1388144

———. 2004. "Counterfactuality in counterintuitive religious concepts." *Behavioral and Brain Sciences* 27: 731–732. http://dx.doi.org/10.1017/S0140525X04230175

———. 2008. "Coding and Quantifying Counterintuitiveness in Religious Concepts: Theoretical and Methodological Reflections." *Method and Theory in the Study*

*of Religion* 20: 308–338. http://dx.doi.org/10.1163/157006808X371806

———, and Frank C. Keil. 1996. "Conceptualizing a Nonnatural Entity: Anthropomorphism in God Concepts." *Cognitive Psychology* 31: 219–247. http://dx.doi.org/10.1006/cogp.1996.0017

———, Emily R. Burdett, and T. J. Porter. 2009. "Counterintuitiveness in Folktales: Finding the Cognitive Optimum." *Journal of Cognition and Culture* 9(3): 271–287. http://dx.doi.org/10.1163/156770909X12489459066345

Beller, Sieghard, Andrea Bender, and Douglas L. Medin. 2012. "Should Anthropology Be Part of Cognitive Science?" *Topics in Cognitive Science* 4: 342–353. http://dx.doi.org/10.1111/j.1756-8765.2012.01196.x

Bender, Andrea, and Sieghard Beller. 2011. "The Cultural Constitution of Cognition: Taking the Anthropological Perspective." *Frontiers in Psychology* 2: 1–6. http://dx.doi.org/10.3389/fpsyg.2011.00067

———, Edwin Hutchins, and Douglas Medin. 2010. "Anthropology in Cognitive Science." *Topics in Cognitive Science* 2(3): 374–385. http://dx.doi.org/10.1111/j.1756-8765.2010.01082.x

Boyer, Pascal. 1996. "What Makes Anthropomorphism Natural: Intuitive Ontology and Cultural Representations." *The Journal of Royal Anthropological Institute* 2(1): 83–97. http://dx.doi.org/10.2307/3034634

———. 2001. *Religion Explained: The Evolutionary Origins of Religious Thought.* New York: Basic Books.

———. 2008. "Cognitive Tracks of Cultural Inheritance: How Evolved Intuitive Ontology Governs Cultural Transmission." *American Anthropologist* 100(4): 876–889. http://dx.doi.org/10.1525/aa.1998.100.4.876

Boyer, Pascal, and Charles Ramble. 2001. "Cognitive Templates for Religious Concepts: Cross-Cultural Evidence for Recall of Counter-Intuitive Representations." *Cognitive Science* 25: 535–564. http://dx.doi.org/10.1207/s15516709cog2504_2

Bulbulia, Joseph. 2008. "Meme Infection or Religious Niche Construction?: An Adaptationist Alternative to the Cultural Maladaptationist Hypothesis." *Method and Theory in the Study of Religion* 20: 67–107. http://dx.doi.org/10.1163/157006808X260241

Carey, Susan. 2009. *The Origin of Concepts*. Oxford: Oxford University Press. http://dx.doi.org/10.1093/acprof:oso/9780195367638.001.0001

Chemero, Anthony. 2009. *Radical Embodied Cognitive Science*. Cambridge: MIT Press.

Chevalier, Joan F. "Bilingualism and Literacy in the Republic of Tyva." *Sibirica* 9(1): 1–22.

Clark, Andy. 2006. "Language, Embodiment, and the Cognitive Niche." *Trends in Cognitive Sciences* 10(8): 370–374. http://dx.doi.org/10.1016/j.tics.2006.06.012

———. 2008. *Supersizing the Mind: Embodiment, Action, and Cognitive Extension*. Oxford: Oxford University Press.

Cosmides, Leda, and John Tooby. 2000. Consider the Source: The Evolution of Adaptations for Decoupling and Metarepresentation. In *Metarepresentations: A*

*Multidisciplinary Perspective*. edited by Dan Sperber, 53–115. Oxford: Oxford University Press.

D'Andrade, Roy G. 1981. "The Cultural Part of Cognition." *Cognitive Science* 5(3): 179–195. http://dx.doi.org/10.1207/s15516709cog0503_1

———. 1992. "Schemas and Motivation." In *Human Motives and Cultural Models,* edited by Roy D'Andrade and Claudia Strauss, 23–44. Cambridge: Cambridge University Press. http://dx.doi.org/10.1017/CBO9781139166515.003

———. 1995. *The Development of Cognitive Anthropology*. Cambridge: Cambridge University Press. http://dx.doi.org/10.1017/CBO9781139166645

Donahoe, Brian R. 2003. *A Line in the Sayans: History and Divergent Perceptions of Property among the Tozhu and Tofa of South Siberia*. Unpublished Dissertation, University of Indiana.

Durkheim, Émile. 2001 [1915]. *The Elementary Forms of Religious Life*. Oxford: Oxford University Press.

Gonce, L., Upal, M. A., Slone, D. J., and Tweney, D. R. 2006. "Role of Context in the Recall of Counterintuitive Concepts." *Journal of Cognition and Culture* 6(3): 521–547. http://dx.doi.org/10.1163/156853706778554959

Harmon-Vukić, Mary, M. Afzal Upal, and Kelly J. Sheehan. 2012. Understanding the memory advantage of counterintuitive concepts. *Religion, Brain and Behavior* 2(2): 121–139. http://dx.doi.org/10.1080/2153599X.2012.672816

Harrison, David. 2000. *Topics in the Phonology and Morphology of Tuvan*. Doctoral Dissertation, Yale University.

Humphrey, Caroline. 1995. "Chiefly and shamanist landscapes in Mongolia." In *The Anthropology of Landscape: Perspectives on Place and Space*, edited by Eric Hirsch and Michael O'Hanlon, 135–162. Oxford: Clarendon Press.

Hutchins, Edwin. 1995. *Cognition in the Wild*. Cambridge: MIT Press.

———. 2010. "Cognitive Ecology." *Topics in Cognitive Science* 2(4): 705–715. http://dx.doi.org/10.1111/j.1756-8765.2010.01089.x

Johnson, Claire V. M., S. W. Kelly, and Paul Bishop. 2010. "Measuring the Mnemonic Advantage of Counter-intuitive and Counter-schematic Concepts." *Journal of Cognition and Culture* 10(1): 109–121. http://dx.doi.org/10.1163/156853710X497194

Johnson, Dominic D. P. 2005. "God's Punishment and Public Goods: A Test of the Supernatural Punishment Hypothesis in 186 World Cultures." *Human Nature* 16: 410–446. http://dx.doi.org/10.1007/s12110-005-1017-0

Keil, Frank C. 1996. *Concepts, Kinds, and Cognitive Development*. Cambridge: The MIT Press.

Lahti, David C. 2009. "The Correlated History of Social Organization, Morality, and Religion." In *The Evolution of Religious Mind and Behavior,* edited by Eckart Voland and Wulf Schiefenhövel, 67–88. New York: Springer. http://dx.doi.org/10.1007/978-3-642-00128-4_5

Laland, Kevin N., John Odling-Smee, and Marcus W. Feldman. 2000. "Niche Construc-

tion, Biological Evolution, and Cultural Change." *Behavioral and Brain Sciences* 23: 131–175. http://dx.doi.org/10.1017/S0140525X00002417

Lansing, Stephen J. 1991. *Priests and Programmers: Technologies of Power in the Engineered Landscape of Bali*. Princeton: Princeton University Press.

———, and James N. Kremer. 1993. "Emergent Properties of Balinese Water Temple Networks: Coadaptation on a Rugged Fitness Landscape." *American Anthropologist* 95(1): 97–114. http://dx.doi.org/10.1525/aa.1993.95.1.02a00050

Markov, G. E. 1976. *Kochevniki Azii: Struktura khoziaistva obschestvennoi organizatsii [Nomads of Asia: Structure of Household and Collective Organizations]*. Izdatelstvo Moskovskogo Gosudarstvennogo Universiteta.

McCauley, Robert N., and E. Thomas Lawson. 2002. *Bringing Ritual to Mind: Psychological Foundations of Cultural Forms*. Cambridge: Cambridge University Press. http://dx.doi.org/10.1017/CBO9780511606410

Norenzayan, A., Scott Atran, Jason Faulkner, and Mark Schaller. 2006. "Memory and Mystery: The Cultural Selection of Minimally Counterintuitive Narratives." *Cognitive Science* 30: 1–30. http://dx.doi.org/10.1207/s15516709cog0000_68

Odling-Smee, F. John. 1996. "Niche Construction, Genetic Evolution and Cultural Change." *Behavioural Processes* 35: 195–205. http://dx.doi.org/10.1016/0376-6357(95)00055-0

Pinker, Steven. 2010. "The Cognitive Niche: Coevolution of Intelligence, Sociality, and Language." *Proceedings of the National Academy of Sciences* 107 (Supplement 2): 8993–8999. http://dx.doi.org/10.1073/pnas.0914630107

Purzycki, Benjamin G. 2010a. "Cognitive Architecture, Humor and Counterintuitiveness: Retention and Recall of MCIs." *Journal of Cognition and Culture* 10 (1–2): 189–204. http://dx.doi.org/10.1163/156853710X497239

———. 2010b. "Spirit Masters, Ritual Cairns, and the Adaptive Religious System in Tyva." *Sibirica* 9(2): 21–47. http://dx.doi.org/10.3167/sib.2010.090202

———. 2011a. "Humor as Violation and Deprecation: A Cognitive Anthropological Account." *Journal of Cognition and Culture* 11(1–2): 217–230. http://dx.doi.org/10.1163/156853711X568752

———. 2011b. "Tyvan *Cher Eezi* and the Socioecological Constraints of Supernatural Agents' Minds." *Religion, Brain, and Behavior* 1(1): 31–45. http://dx.doi.org/10.1080/2153599X.2010.550723

———, and Tayana Arakchaa. 2013. "Ritual Behavior and Trust in the Tyva Republic." *Current Anthropology* 54(3):381–388.

———, and Richard Sosis. 2009. "The Religious System as Adaptive: Cognitive Flexibility, Public Displays, and Acceptance." In *The Biological Evolution of Religious Mind and Behavior,* edited by Eckart Voland and Wulf Schiefenhövel, 243–256. New York: Springer. http://dx.doi.org/10.1007/978-3-642-00128-4_17

———. 2010. "Religious Concepts as Necessary Components of the Adaptive Religious System." In *The Nature of God: Evolution and Religion,* edited by Ulrich

Frey, 37–59. Marburg: Tectum Verlag.

———. 2011. "Our Gods: Variation in Supernatural Minds." In *Essential Building Blocks of Human Nature,* edited by Ulrich J. Frey, Charlotte Störmer and Kai P. Willführ, 77–93. New York: Springer-Verlag. http://dx.doi.org/10.1007/978-3-642-13968-0_5

———, Omar Haque, and Richard Sosis. in press. "Extending Evolutionary Accounts of Religion beyond the Mind: Religions as Adaptive Systems." In *The Evolution of Religion: Critical Perspectives and New Directions,* edited by Fraser Watts and Léon Turner.

Purzycki, Benjamin G., Daniel N. Finkel, John Shaver, Nathan Wales, Adam B. Cohen, and Richard Sosis. 2012. "What Does God Know? Supernatural Agents' Access to Socially Strategic and Nonstrategic Information." *Cognitive Science* 36(5): 846–869. http://dx.doi.org/10.1111/j.1551-6709.2012.01242.x

Pyysiäinen, Ilkka. 2004. *Magic, Miracles, and Religion: A Scientist's Perspective*. Walnut Creek: AltaMira Press.

Pyysiäinen, Ilkka, Marjaana Lindeman, and Timo Honkela. 2003. Counterintuitiveness as the hallmark of religiosity. *Religion* 33(4): 341–355. http://dx.doi.org/10.1016/j.religion.2003.09.001

Rappaport, Roy A. 1979. *Ecology, Meaning, and Religion.* Berkeley: North Atlantic Books.

———. 2000. *Pigs for the Ancestors: Ritual in the Ecology of a New Guinea People*. Long Grove: Waveland Press.

Roes, Frans L., and Michel Raymond. 2003. "Belief in Moralizing Gods." *Evolution and Human Behavior* 24: 126–135. http://dx.doi.org/10.1016/S1090-5138(02)00134-4

Samdan, Zoya. 2004. *Chylbyga Ainy Kanchap Syyrypkanyl?: Tyva Ulustung Burung-Chugaalary [How Was the Monster-Moon Chased?: Ancient Tales of Tuvan People.* Kyzyl: Tyvanyng Nom Üdurer Cheri.

Sanderson, Stephen K. 2008. "Religious Attachment Theory and the Biosocial Evolution of the Major World Religions." In *The Evolution of Religion: Studies, Theories, and Critiques,* edited by Joseph Bulbulia, Richard Sosis, Erica Harris, Russell Genet, Cheryl Genet, Karen Wyman, 67–72. Santa Margarita: Collins Foundation Press.

Shariff, Azim, Benjamin G. Purzycki, and Richard Sosis. in press. Religions as cultural solutions to social living. In Cohen, A. B. ed. *New Directions in the Psychology of Culture*. Washington, DC: American Psychological Association.

Slone, D. Jason. 2004. *Theological Incorrectness: Why Religious People Believe What They Shouldn't*. Oxford: Oxford University Press.

Slone, D. Jason, Lauren Gonce, Afzal Upal, Kristin Edwards, and Ryan Tweney. 2007. "Imagery Effects on Recall of Minimally Counterintuitive Concepts." *Journal of Cognition and Culture* 7(3): 355–367. http://dx.doi.org/10.1163/156853707X208558

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Sneath, David. 1992. "The Obo Ceremony in Inner Mongolia: Cultural Meaning and Social Practice." *In* Altaic Religious Beliefs and Practices, edited by Géza Bethlenfalvy, Ágnes Birtalan, Alice Sárközi, and Judit Vinkovics, 309–318. Budapest: Research Group for Altaic Studies.

Sperber, Dan. 1996. *Explaining Culture: A Naturalistic Approach*. Malden: Blackwell Publishing.

Stark, Rodney 2001. "Gods, Rituals, and the Moral Order." *Journal for the Scientific Study of Religion* 40(4): 619–636. http://dx.doi.org/10.1111/0021-8294.00081

Strauss, Claudia, and Naomi Quinn. 1997. *A Cognitive Theory of Cultural Meaning*. Cambridge: Cambridge University Press.

Swanson, Guy E. 1960. *The Birth of the Gods: The Origin of Primitive Beliefs*. Ann Arbor: University of Michigan Press.

Thomas, Keith. 1971. *Religion and the Decline of Magic*. New York: Charles Scriber's Sons.

Tooby, John, and Irven DeVore. 1987. "The Reconstruction of Hominid Behavioral Evolution through Strategic Modeling." In *Primate Models of Hominid Behavior*, edited by W. Kinzey, 183–237. Albany: State University of New York Press.

Tweney, Ryan D., M. Afzal Upal, Lauren O. Gonce, D. Jason Slone, and Kristin Edwards. 2006. "The Creative Structuring of Counterintuitive Worlds." *Journal of Cognition and Culture* 6(3): 483–498. http://dx.doi.org/10.1163/156853706778554904

Upal, M. Afzal. 2010. "An Alternative Account of the Minimal Counterintuitiveness Effect." *Cognitive Systems Research* 11(2): 194–203. http://dx.doi.org/10.1016/j.cogsys.2009.08.003

Wallace, Anthony F. C. 1966. *Religion: An Anthropological View*. New York: McGraw-Hill.

Whitehouse, Harvey. 1996. "Rites of Terror: Emotion, Metaphor and Memory in Melanesian Initiation Cults." *The Journal of the Royal Anthropological Institute* 2(4): 703–715. http://dx.doi.org/10.2307/3034304

———. 2000. *Arguments and Icons: Divergent Modes of Religiosity*. Oxford: Oxford University Press.

———. 2004. *Modes of Religiosity: A Cognitive Theory of Religious Transmission*. Walnut Creek: AltaMira Press.

Wilson, David Sloan. 2002. *Darwin's Cathedral: Evolution, Religion, and the Nature of Society*. Chicago, IL: The University of Chicago Press. http://dx.doi.org/10.7208/chicago/9780226901374.001.0001

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