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The cultural evolution of shamanism

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Abstract: Shamans, including medicine men, mediums, and the prophets of religious movements, recur across human societies. Shamanism also existed among nearly all documented hunter-gatherers, likely characterized the religious lives of many ancestral humans, and is often proposed by anthropologists to be the “first profession,” representing the first institutionalized division of labor beyond age and sex. In this article, I propose a cultural evolutionary theory to explain why shamanism consistently develops and, in particular, (1) why shamanic traditions exhibit recurrent features around the world; (2) why shamanism professionalizes early, often in the absence of other specialization; and (3) how shifting social conditions affect the form or existence of shamanism. According to this theory, shamanism is a set of traditions developed through cultural evolution that adapts to people’s intuitions to convince observers that a practitioner can influence otherwise unpredictable, significant events. The shaman does this by ostensibly transforming during initiation and trance, violating folk intuitions of humanness to assure group members that he or she can interact with the invisible forces that control uncertain outcomes. Entry requirements for becoming a shaman persist because the practitioner’s credibility depends on his or her “transforming.” This contrasts with dealing with problems that have identifiable solutions (such as building a canoe), in which credibility hinges on showing results and outsiders can invade the jurisdiction by producing the outcome. Shamanism is an ancient human institution that recurs because of the capacity of cultural evolution to produce practices adapted to innate psychological tendencies.

Keywords: anthropology; culture; division of labor; evolution; magic; professions; religion; shamanism; trance

A patient, debilitated by the bulbous, blood-bloated ghosts swarming through her body, sits in an unlit igloo.¹ She is joined by an *angakok* – a magician and medicine man – who crouches in the corner, his body draped in a caribou skin.

The *angakok* is unlike himself: One of his helper spirits has possessed him, and it speaks in a rapid, strange language through his mouth. The illness-causing ghosts respond with fright, abandoning the sick person’s body before hiding outside of the igloo. The *angakok* sends his spirit helpers in pursuit, while members of the onlooking audience coax the evil ghosts back with half-lies: “Come in, come in,” they say, “somebody here is waiting for you.”

The evil ghosts return and are slaughtered. The *angakok* attacks them with his snow knife, slaying as many as he can. When he’s finished, blood covers his hands, unadorned proof of the killing.

In the days afterward, the patient slowly recovers.

Or, in the days afterward, the patient dies. The shaman expresses a fatalistic regret: In the end, the ghosts were too numerous. One man can kill only so many ghosts when a person has broken so many taboos.

who enter trance to provide services. Because my objective is to identify the social and cognitive foundations of a more general, cross-cultural suite of practices and beliefs, I follow authors who prefer a broad definition of shamanism (e.g., Peters & Price-Williams 1980; Samuel 1990; Wallace 1966; Wright 2009). This usage contrasts with more specific definitions, such as reserving shamanism for the practices of Siberian peoples (see discussion in Price 2001) or using restrictive criteria such as death-and-rebirth initiations, soul journey trances, and animal helper spirits (Winkelman 1990). Although many of these traits appeared in societies outside of Siberia and Central Asia (Eliade 1964), they lack generality and exclude the trance-healing practices of many societies, including ones commonly referred to as *shamanic* (e.g., Kendall 1985; Loeb 1929; Nadel 1946). The ensuing discussion therefore includes not only the trancing witch doctors of hunter-gatherer societies, but also the ecstatic prophets of religious movements, the mediums of chiefdoms, and the marginal cultists of contemporary states.

Cross-cultural analyses of shamanism aim to recognize the particular cultural traits that are universally associated

1. Introduction

The Inuit *angakok*, like the Mentawai *sikerei* (Loeb 1929), the Korean *mu* (Kendall 1985), the Azande *boro ngua* (Evans-Pritchard 1937), the !Kung *n/um k’ausi* (Katz 1982), and the Quaker founder George Fox (Thomas 1971a), is a shaman. I here define *shamans* as practitioners

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with this institution. This research has converged on a set of practices and beliefs that nearly always characterizes shamanic traditions (Charles 1953; Eliade 1964; Harner 1990; Peters & Price-Williams 1980; Vitebsky 1995a; Winkelman 1986a; 1986b; 1990):

1. The practitioner enjoys jurisdiction over the treatment and diagnosis of a select set of problems, most frequently serving as a healer and diviner.

2. The practitioner is believed to have special powers that normal individuals either possess to a less developed degree or lack completely. These always include some means of seeing or interacting with invisible forces. But they also can include flight, invisibility, immunity to fire, and control of weather and animals.

3. The practitioner engages in a temporary trance state for at least some of his or her interventions. Definitions of trance vary considerably in the anthropological literature, from those that claim universal neurological states (Harner 1990; Winkelman 2000) to those that emphasize social conceptions of special powers (Rouget 1985). Nevertheless, most usages concur that trance represents a temporary state that appears psychologically and behaviorally distinct from normal human functioning. The behavioral manifestations of trance differ within and across populations but include “trembling, shuddering, horripilation, swooning, falling to the ground, yawning, lethargy, convulsions, foaming at the mouth, protruding eyes, large extrusions of the tongue, paralysis of a limb, [etc.]” (Rouget 1985, p. 13). The cultural interpretation of this trance state is also variable and can include spirit possession (reviewed in Lewis 2003) and soul journeying (reviewed in Eliade 1964), as well as special sight (e.g., Azande: Evans-Pritchard 1937), boiling healing energy (e.g., !Kung: Katz 1982), or several of these changes simultaneously (e.g., Akawaio: Wavell et al. 1988).

4. Entrance into the practitioner class is restricted, typically by ritualistic initiations (e.g., death and rebirth, ritual surgery, magical treatment of body parts) or dramatic experiences (e.g., violent illness, epileptic fits, asceticism). Communities often regard individuals with some innate peculiarity, such as perennial illness (Lebra 1966; Schefold 1988), an extra finger (Bernstein 2008), epilepsy (Nadel 1946), or ambiguous sexual identity (Coleman et al. 1992; Peletz 2006), as more capable of becoming shamans.

A final important characteristic is that shamans represent a profession, often the only such group in many small-scale societies (La Barre 1970; Rogers 1982). By *profession*, I mean a class of individuals with entry requirements whose unique expertise or abilities provide them jurisdiction over the treatment or diagnosis of some problems. For shamans, entry requirements can include prolonged training from other shamans, special initiations, or spontaneous events, such as serious illness (Eliade 1964). This usage of *profession* is based on definitions in the sociological literature, such as those by Abbott (1988, p. 8) and MacDonald (1995, p. 1), who respectively described professions as “exclusive occupational groups applying somewhat abstract knowledge to particular cases” and “occupations based on advanced, or complex, or esoteric, or arcane knowledge.”

Shamanism has existed in most documented human societies, including the majority of hunter-gatherers. Eliade

(1964) famously reviewed ethnographic descriptions of shamans around the world, documenting similarities in practice and mythology between Siberian shamanism, on the one hand, and practitioners in Asia, the Americas, and Oceania, on the other. Winkelman (1986a; 1986b; 1990) coded a modified subsample of the Standard Cross-Cultural Sample and found trance practitioners in 43 of 47 societies surveyed. A recent review of hunter-gatherer religion found shamans in 29 of 33 hunter-gatherer societies examined (Peoples et al. 2016)²; of the remaining 4 societies, the recent ancestors of one (the Siriono) likely had shamans (Walker et al. 2012; see also sect. 6.2), whereas an ethnographer noted that members of another (the Mbuti) visited “the local witch doctor” of nearby farmers (Putnam 1948, p. 340). Importantly, shamanism is not restricted to small-scale societies; see, for example, the *benandanti* cult of medieval Italy (Eliade 1975); Romanian folkloric traditions (Eliade 1975); Neolithic China (Chang 1999); Tibetan Buddhism (Samuel 1993); contemporary Korea (Kendall 1985); founders of religious sects in 20th-century Japan (Blacker 1975); trance channeling in the contemporary United States (Hughes 1991); Hebrew prophets (Newsom 1984); early religious leaders of the Camisards (Knox 1950), Quakers (Thomas 1971a), and American spiritualists (Albanese 1992); and neo-shamans in Sweden (Lindquist 1997) and the United States (Braun 2010).

That shamanism appears so regularly in human societies, especially among hunter-gatherers, suggests that it characterized the lives of many ancestral humans as well. Inferring the existence of shamanistic practice from archaeological findings is notoriously tenuous (Dubois 2009), but researchers nevertheless have argued prehistoric shamanism from burial sites (Grosman et al. 2008) and art (Dowson & Porr 2001; Lewis-Williams & Dawson 1988).

The recurrence and similarity of shamanic traditions highlight several puzzles: (1) Why do these particular beliefs and practices so frequently develop in concert? (2) Why do shamans constitute the only professional class in many societies? (3) Which conditions determine the existence or collapse of shamanism? These questions have remained largely absent from the evolutionary and psychological literatures, despite considerable progress in the study of religion (for exceptions, see Rossano 2007; Winkelman 2002; Wright 2009). Meanwhile, the puzzle of shamanism has attracted the attention of major anthropological theorists since the discipline’s inception (e.g., Evans-Pritchard 1937; Frazer 1922; Lévi-Strauss 1963a; 1963b; Malinowski 1948; Mauss 1902/2001; Tylor 1883), but as Narby and Francis (2001, p. 8) concluded in their collection of writings on the topic from the last half-millennium, “even after five hundred years of reports on shamanism, its core remains a mystery.”

This article presents a novel theory of shamanism based in universal cognitive dispositions and cultural evolutionary processes. The theory proposes that shamanism is a suite of practices developed through cultural evolution that adapts to people’s intuitions to convince observers that a practitioner can influence otherwise uncontrollable events. The shaman does this by transforming in the eyes of the community, during both initiation and trance, assuring group members that he or she can interact with the invisible forces that control unpredictable, significant outcomes.

The article is structured as follows. I begin by reviewing alternate theories of shamanism in section 2. In section 3, I elaborate on the logic of the proposed theory, providing empirical and theoretical support from psychology and cultural evolution. I use section 4 to explain three central features of shamanic traditions: the jurisdiction, trance, and what I call transformative practices. Section 5 concerns why shamanism professionalizes in the absence of other specialization, and section 6 concludes with predictions for how shifting social conditions should mediate the transformative practices and, in some instances, contribute to shamanism's collapse.

2. Alternate theories of shamanism

The most salient features of shamanism to early Western observers were practitioners' use of sleight of hand and their ostensible psychological pathology (Krippner 2002; Narby & Huxley 2001). These led authors to frequently describe the practice as either a form of charlatanism (Diderot 1765/2001; Gmelin 1751/2001) or psychopathology (Devereux 1961b; Novakovsky 1924; Silverman 1967). Although both perspectives explain some features of shamanism, ethnographic observations challenge their simplicity. That shamans seem to believe in their and others' powers undermines a basic charlatan hypothesis (Elkin 1977; Evans-Pritchard 1937; Métraux 1944). Meanwhile, shamans in many societies do not suffer from an abnormal psychology, yet these traditions exhibit the same patterns in practice and mythology (e.g., Australia: Elkin 1977; Bhutan: van Ommeren et al. 2004; Akawaio: Wavell et al. 1988). Furthermore, neither charlatanism nor psychosis can explain the jurisdiction of shamans or the use of trance for problem-solving. A comprehensive theory of shamanism should explain these inconsistencies.

Many authors have proposed that shamanism and related practices provide benefits to clients or the group (Achterberg 1985; Sax 2014), such as through ritually induced social cohesion (Frecka & Kulcsar 1989), therapeutic effects mediated by placebo or hypnosis (Kaptchuk 2002, 2011; McClenon 1997), and the psychological comfort that comes from addressing uncertainty (Achterberg 1985; for a more general discussion of magic, see Malinowski 1948). As with charlatan or psychosis hypotheses, accounts emphasizing benefits do not explain many cross-cultural patterns, including the early professionalization of the practice or the reasons certain practices are considered effective. Moreover, aside from mixed results from psychology (Calin-Jageman & Caldwell 2014; Damisch et al. 2010), studies and ethnographies finding support for ritual efficacy tend to rely on reported outcomes by clients or other community members (e.g., Kleinman & Sung 1979; Raguram et al. 2002; Sax 2009). Thus, it appears that most evidence of ritual efficacy concerns the community *perception* of outcomes. This does not invalidate accounts emphasizing benefits, but it suggests that shamanism may be sustained because of a perception of results.

Many approaches examine how patterns in human social and cultural life, such as incest taboos (Fessler & Navarrete 2004; Lieberman et al. 2003) and folk biology (Atran 1998), reflect universal proclivities resulting from evolved psychological mechanisms (Sperber 1985; 1996a; Sperber

& Hirschfeld 2004). Winkelman's (2000; 2002) neurotheological theory of shamanism adopts this approach. The theory attributes the recurrent emergence of shamanism to (1) psychological effects of universal trance states and (2) the benefits that the shaman provides. According to this theory, trance states elicited by dancing, hallucinogens, and other triggers have an "integrative" effect on cognition, allowing crosstalk among modules evolved for theory of mind, social intelligence, and natural history. This integration enhances practitioners' social abilities, allowing them to provide useful services to the group and individual clients. Invoking cultural traditions that leverage aspects of our core psychology to produce group-level benefits, the neurotheological theory resembles recent theorizing on the cultural evolution of prosocial religion (Atran & Henrich 2010; Norenzayan 2013; Norenzayan et al. 2016; Purzycki et al. 2016).

The neurotheological theory, although ambitious, suffers from important shortcomings. Especially problematic is the central argument that shamanism involves a cross-culturally consistent trance state that integrates various aspects of cognition. First, it is unclear what an "integrated" mode of consciousness is, considering that normal human cognition involves communication and cooperation among functionally differentiated regions (Hagmann et al. 2008; Sporns 2011). Second, research on altered states of consciousness suggests that different trance states involve non-analogous changes in physiology and cognition (Farthing 1992; Vaitl et al. 2005). Altered states induced by sensory deprivation, for example, disengage the individual from her surroundings, broaden attention, promote cognitive flexibility, and stimulate sensory dynamics (richness, vividness, synesthesia, hallucinations) (Barabasz & Barabasz 1993; Suedfeld 1980; Vaitl et al. 2005). By contrast, research conducted with pathologically starving patients suggests that extreme dieting produces the opposite effects (Ben-Tovim & Walker 1991; Grunwald et al. 2001; Roberts et al. 2007; Vaitl et al. 2005). The contrasting effects of different trance states challenge the neurotheological theory, because, not only do trance states vary considerably around the world, but also there even exists within-culture variation or variation among otherwise similar traditions. For example, the trance state of the Japanese *miko*, which involves "violent shaking of the clasped hands" and "stertorous breathing or roaring," differs in all of its manifestations from that of the ascetic, who enters a "deep, comatose state of suspended animation," his body remaining "an empty husk" (Blacker 1975, pp. 22–23). Relatedly, although their shamanic institutions share many features, the Warao's musically induced meditative trance contrasts starkly with the narcotic trance of the Yanomamö, which includes yelling, rolling on the ground, and a seeming loss of physical control (Olsen 1975; 1998).

To sum up, explanations of shamanism have focused on features including charlatanism, the practitioner's ostensible psychopathology, and clients' belief in the effectiveness of interventions. No account, however, sufficiently explains the entire suite of features, including dramatic initiations, trance states, professionalization, and the jurisdiction of the shaman (healing and divination). Additionally, many accounts have been critiqued for failing to incorporate the role of social interactions and recent historical processes in shaping shamanism (Atkinson 1992).

3. Proposing the cultural evolutionary theory of shamanism

I propose that shamanism is a suite of practices developed through cultural evolution to convince observers that an individual can influence otherwise uncontrollable outcomes. In particular, the shaman is an individual who violates intuitions of humanness to convince group members that he or she can interact with the invisible forces who control unpredictable, important events.

In this section, I present this theory in full, organizing it into several sections before synthesizing them and discussing how this theory generates hypotheses for the constituent features of shamanism. The sections consider (1) the psychology of superstition; (2) the cultural evolution of plausible-seeming interventions; (3a) the importance of interacting with invisible agents; and (3b) the practice of violating notions of humanness to support claims of superhuman abilities.

The theory as proposed in this section is rooted in two conceptual foundations. Research in *the cognitive underpinnings of magic and religion* has revealed how built-in, adaptive components of human psychology predispose us to adopt certain false beliefs and engage in magical thinking (Atran & Henrich 2010; Boyer 2001; Guthrie 1995; Kirkpatrick 1999; Legare & Souza 2012). The primary psychological mechanisms invoked in the proposed theory are those involved in (and presumably evolved for) adopting beliefs (error management: Johnson et al. 2013), mentalizing (Frith & Frith 2003), developing causal explanations (Keil 2006; Lombrozo 2006), and ascribing and inferring human characteristics (“humanness”) to and from other individuals (Haslam et al. 2013). *Cultural evolutionary theory*, on the other hand, describes how the differential transmission and adoption of cultural traits lead some beliefs, practices, and institutions to propagate at the expense of others, giving rise to adaptive culture like igloos and spears, as well as magical interventions and seemingly maladaptive practices (Boyd & Richerson 1985; Claidière et al. 2014; Mesoudi 2016; Sperber 1996a; Sperber & Hirschfeld 2004).

Note that many aspects of the cultural evolutionary theory of shamanism have been previously articulated, including the shaman’s role in dealing with uncertainty (Buyandelgeriyin 2007; Wright 2009), the function of initiation practices in delineating shamans from the rest of the group (or in supernaturalizing them) (Eliade 1964), and the dramatic nature of trance (Rouget 1985; see references in Peters & Price-Williams 1980). However, no account has synthesized these observations into a coherent framework or illustrated how they develop from core psychological dispositions or cultural evolutionary processes. Thus, it remains unknown why humans seem to so reliably produce this particular constellation of practices and beliefs.

3.1. Individuals adopt superstitions to influence significant outcomes that are random and uncontrollable

Humans choose solutions to deal with problems, such as denying a pregnant woman smelly meat to protect her child or rubbing a rock to win a baseball game. The cognitive mechanisms for choosing among solutions must

contend with the uncertainty of whether a strategy actually works. For example, denying a pregnant woman smelly meat may seem to guarantee a healthy child sometimes but not always; similarly, rubbing a rock may appear to ensure victory in a baseball game sometimes but not always. Individuals therefore rely on psychological heuristics to select among strategies and beliefs. Systematic errors by these heuristics lead individuals to adopt interventions that have no causal relationship to their intended outcome (Foster & Kokko 2009; Johnson et al. 2013; McKay & Dennett 2009; Vyse 2014); following previous authors, I refer to these causally innocuous actions as *superstitions*³ (Foster & Kokko 2009; Ono 1987; Skinner 1948; Vyse 2014). That similar behaviors can be induced in other species (e.g., Skinner 1948) suggests that these cognitive mechanisms have deep evolutionary histories.

Individuals are most likely to adopt superstitions when (1) the potential benefit of that intervention working is high, and (2) the intervention is followed by a successful outcome some proportion of the time (Beck & Forstmeier 2007; Foster & Kokko 2009; Johnson 2015; Ono 1987; Vyse 2014). Thus, superstitions can be thought of as bet-hedging strategies: As long as the outcome sometimes occurs after the intervention (e.g., the baseball team wins sometimes after rubbing the rock), and the cost of the intervention is sufficiently low compared with the potential benefit, an individual will benefit on average from adopting those strategies (see error management: Johnson et al. 2013; McKay & Efferson 2010).⁴ Consequently, contexts in which people are not fully able to control fitness-relevant outcomes and in which success occurs randomly are most amenable to superstitious thinking (Greenaway et al. 2013; Keinan 1994; Legare & Souza 2014; Whitson & Galinsky 2008). This accounts for, among other things, (1) the use of magic for catching wild game and inviting rain; (2) the profusion of magic in the wake of deadly epidemics (e.g., Ashforth 2011); and (3) the prevalence of superstitions in Western societies, such as those surrounding gambling and sports (Burger & Lynn 2005; Henslin 1967). Moreover, within these domains, those activities with the most uncertainty and the largest benefit invite the most superstition. For example, Trobriand Islanders use magic for open-sea fishing, where “the yield varies greatly,” but not for inner lagoon fishing, which promises “abundant results without danger and uncertainty” (Malinowski 1948, p. 30). Because it sustains beliefs in ineffective interventions, the psychology of superstition provides the basis for shamanic traditions.

Hereafter, I refer to those outcomes most susceptible to superstition (uncontrollable, fitness relevant, and random) as *uncertain outcomes* (see Fig. 1). Examples of uncertain outcomes include illness healing, crops failing, and famine ending. These differ from outcomes that are controllable (e.g., the production of fire), outcomes that are uncontrollable but unimportant (e.g., a butterfly landing on one’s arm), and outcomes that are uncontrollable and important, yet never occur (e.g., winter never coming).

3.2. People’s adoption strategies drive the selective retention of effective-seeming interventions

Cultural evolution occurs as some cultural variants are adopted and transmitted more than others (Blackmore 1999; Boyd & Richerson 1985; Sperber 1996a).⁵ The

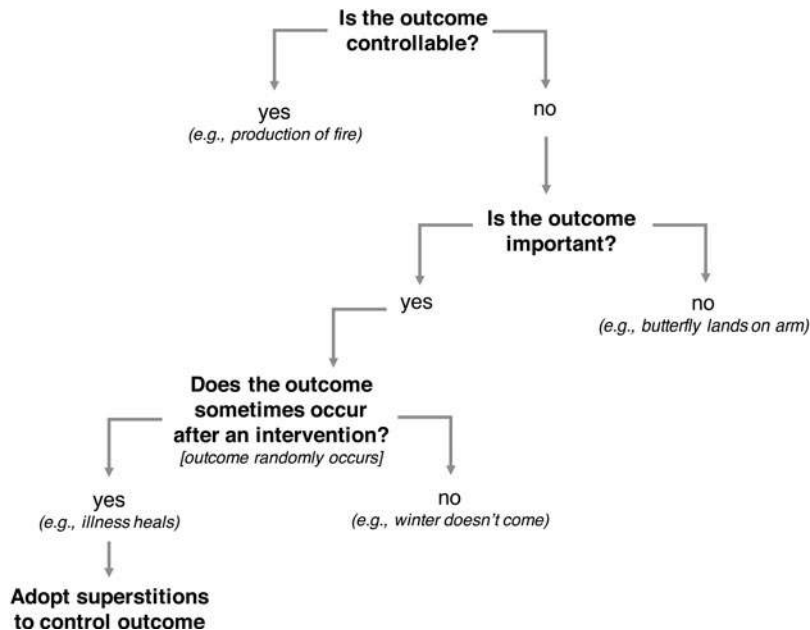


Figure 1. Kinds of outcomes. Individuals will develop superstitions to influence or learn about the timing of uncertain outcomes (uncontrollable, important, and random). The importance of the outcome to the individual's perceived welfare and the frequency with which it occurs after an event are both continuous variables, but they are presented in this diagram as binary for simplification.

direction of cultural evolution, and whether its products are adaptive, thus are often consequences of individuals' adoption strategies (Henrich 2015; Richerson & Boyd 2008). When outcomes are observable, immediate, and predictable, individuals easily can choose innovations based on their effectiveness (Rogers 2003). For example, an individual can gauge whether some tweak to a spear allows it to fly farther, deciding to retain the successful tweaks. As people repeat this adoption strategy over time, technology will become more effective at ensuring outcomes. In short, cultural evolution can produce efficient technologies, such as spears, when the outcomes of innovations are immediate, observable, and predictable.

In the case of superstitions, cultural evolution cannot produce efficient technologies because the practices are, by definition, ineffective. But some innovations will still seem more effective because of innate or cultural intuitions about causality. Consequently, individuals will retain and transmit those practices that seem most plausible, driving the cultural evolution of practices adapted to our intuitions about efficacy. For example, Legare and Souza (2012) showed that individuals regard magical procedures with more steps and specific times as more efficacious, likely biasing which magical practices spread. Similarly, innate intuitions about how substances spread through contact perpetuate beliefs in contagious magic (Nemeroff & Rozin 2000; Rozin et al. 1986).

Note that the cultural evolution of plausible-seeming practices should be accelerated once shamans exist and compete for clients. Some shamans find techniques that better convince onlookers of their superior efficacy; these techniques are expected to be maintained over time as other shamans copy them (Boyd & Richerson 1985; Henrich & Gil-White 2001; Schlag 1998, 1999) or as successful practitioners train more initiates. Many ethnographers have observed intense competition among shamans

that should drive this cultural selection. Among the Azande, practitioners amassed prestige as effective doctors and were "envious of the encroachment" of rivals who threatened their wealth and reputation (Evans-Pritchard 1937, p. 245). Ona shamans of Tierra del Fuego faced off in public: Practitioners attained states of magical trance, and observers judged them according to the intensity and duration of trance, among other characteristics (Chapman 1982). Similar competitive displays occurred among the Tlingit and the Netsilik (Balikci 1963; De Laguna 1972). In postsocialist Mongolia, Buyandelgeriyn (2007, p. 132) observed that "clients [chose] a shaman on the basis of a careful search with diviners, lamas, and clients about an individual's power, disposition, and the level of satisfaction with that individual's service." In all of these instances, clients choose practitioners according to their credibility and perceived ability, selecting for practices that promote these metrics.

The autobiography of the Kwakwaka'wakw shaman Quesalid (see Boas 1930; Lévi-Strauss 1963a) provided a telling example of how competition among shamans could drive the cultural selection of plausible-seeming interventions. Quesalid described learning how to duplicitously produce a bloody tuft of down as a purported physical embodiment of illness. He then discovered, however, that the nearby Koskimo shamans lacked this method, and in performing it before them and their audiences, attracted much more credibility while disgracing his rivals. Although Quesalid did not describe the subsequent diffusion of the technique, he recounted how other shamans implored him to share his secrets; one presumably even used his virgin daughter to tempt Quesalid.

In summary, individuals' preferences for effective superstitions fuel the cultural evolution of plausible-seeming magical practices. Once shamans exist, the competition among them should accelerate this process.

3.3. Violating notions of humanness to apparently influence uncontrollable outcomes

In this section, I argue that the cultural selection for plausible superstitions leads to people claiming to engage with the invisible entities (e.g., deities, spirits) who control unpredictable events. To convince potential clients that they have these special powers, these practitioners must ostensibly transform into entities distinct from normal humans.

3.3.1. People explain unpredictable outcomes with invisible, agentic forces. Outcomes that seemingly occur randomly, such as winning the lottery, being struck by lightning, or recovering from illness, cannot be accounted for by predictive theories, because the causal forces escape human perception. To explain these events, individuals invoke causal, agentic forces, including God, fate, witchcraft, spirits, and moral justice (Baumard & Chevallier 2012; Gorsuch & Smith 1983; Gray & Wegner 2010; Harris & Giménez 2005; Legare et al. 2012; Legare & Gelman 2008; Lerner 1980; Lupfer et al. 1996; Pepitone & Saffiotti 1997; Woolley et al. 2011). These agents are usually invisible (e.g., gods, spirits), although sometimes visible actors intervene through invisible means (e.g., witches); nevertheless, I refer to them here as *invisible forces* or *invisible agents*. Researchers have found that the tendency to attribute rare events to invisible forces occurs across cultures and throughout development (Banerjee & Bloom 2015; Heywood & Bering 2014; Swanson 1964; Wright 2009), although both age and cultural context mediate it (Norenzayan & Lee 2010; Woolley et al. 2011). Moreover, ethnological studies have identified the pervasive human tendency to attribute illness and (mis)fortune to the whims of invisible agents (Murdock 1980; Swanson 1964).

There remains a lack of consensus among psychological researchers on why humans explain anomalous outcomes with invisible agents, but growing research suggests that sociocognitive biases and cultural transmission both play crucial roles (Banerjee & Bloom 2014b; Gorsuch & Smith 1983; Heywood & Bering 2014; Norenzayan & Lee 2010). Humans possess cognitive adaptations for attributing mental states (Frith & Frith 2003), which seem to predispose individuals to recognize intention and purpose in the world (Guthrie 1995). For example, Banerjee and Bloom (2014a) found that individuals with a greater tendency to think about mental states (highly paranoid people and highly empathetic people) are more likely to infer purpose and intention in life events. This tendency then becomes reinforced with socialization and related cultural beliefs (Norenzayan & Lee 2010; Woolley et al. 2011).

The relevance of unseen causality for shamanism is that, to be considered most effective as superstitious problem-solvers, practitioners should observe and manipulate the otherwise invisible causal forces. This would mean, for example, talking to spirits, identifying sorcery-caused illness, or being possessed by deities who can then converse with other community members. Doing any of these requires convincing others that the practitioner has abilities that normal humans lack or otherwise possess to a less developed degree.

3.3.2. People more readily attribute superhuman abilities to strange individuals. The psychological foundations of

supernaturalness have been less thoroughly investigated than superstition or explanations for rare outcomes. However, research suggests that attributions of special powers derive, in part, from a perception that an actor violates basic notions of folk biology or psychology.⁶ For example, Catholicism has long used the occurrence of unexplainable events (or “miracles”) to infer whether an individual has a relationship with the supernatural. A well-known class of miracles is healing otherwise incurable illness (Vidal 2007), a criterion that continues to be used today (Duffin 2016). But communities also use other signs of non-ordinariness to infer a relationship with demons or divinities, including unexplained pregnancies, perennial illness, and even apparently psychotic behavior (Keitt 2005a; Kleinberg 1992).

Research into dehumanization provides further preliminary evidence for a connection between supernaturalization and deviating from conceptions of humanness. Among North Americans, white subjects tend to dehumanize black targets, attributing to them fewer human-unique emotions (such as sympathy) and implicitly associating them with apes (Costello & Hodson 2014; Goff et al. 2008). Relatedly, white subjects preferentially ascribe superhuman qualities, for example, super-strength and heightened pain tolerance, to black people as relative to other whites (Dore et al. 2014; Hoffman & Trawalter 2016; Trawalter et al. 2012; Waytz et al. 2015). More work in the psychology of humanness will elucidate whether and how these observations are linked (although see below for some proposed mechanisms).

Lastly, stories of individuals with superpowers illustrate how the ascription of non-normal abilities requires that a person be different from other humans, either at birth or through some transformation. This is best exhibited in superhero narratives, of which “the origin story is certainly a prominent and popular trope” (Hatfield et al. 2013, p. 3). Whether they concern a bite from a radioactive spider (Spiderman), extraterrestrial heritage (Superman), or underlying genetic mutations (the X-Men), origin stories involve “transformative events that set the protagonist apart from ordinary humanity” (Hatfield et al. 2013, p. 3), justifying the character’s non-human abilities. Although fictional, these stories reveal people’s conceptions of what is required for one to possess supernatural powers.

The mechanisms by which people attribute supernatural abilities to biologically or psychologically strange individuals have yet to be understood, but existing work suggests at least three possible psychological pathways. First, observers may have cognitive human *templates* (Boyer 2001) or *concepts* (Carey 2009) that delineate what is possible for a normal person; claiming abilities beyond these therefore requires departing from these conceptualizations. By this mechanism, deviating from humanness is a prerequisite for supernaturalness; people would need to use other behaviors or displays to convince observers of special abilities. Second, people’s thinking about aberrant behavior may be similar to how they think about anomalous events; that is, supernatural involvement may be the most salient or plausible explanation they have to decipher these occurrences (Gopnik 1998; Keil 2006). Finally, people may have existing mental models of supernatural agents which designate how those agents think or how their bodies work. By defying notions of humanness in patterned ways, practitioners move towards these

models of supernaturalness. In line with this hypothesis, psychologists have found that Western people conceive of supernatural agents as differing fundamentally from humans, most often in possessing human-unique capabilities, such as thought and self-control, while lacking those shared with animals, such as hunger and pain (Demoulin et al. 2008; Gray et al. 2007; Haslam et al. 2008). The supernaturalization of black targets by white subjects, as well as many ethnographic descriptions of shamans being more animal-like (Ojamaa 1997), indicate that perceptions of individuals as being more bestial similarly promote ascriptions of special (animal) powers.

Regardless of the mechanism, converging lines of evidence suggest that people attribute supernatural connections or powers to individuals who deviate from conceptions of humanness. Therefore, for an individual to convince her group mates that she possesses the special ability to commune with invisible forces, she must transform in the eyes of the community or otherwise assure them that she is different from normal humans.

I propose that many features of shamanism, including trance, peculiarity, initiation practices, and self-denial, are selectively retained because they serve to transform the practitioner. By this hypothesis, trance is a drama of strangeness, comprising displays of foreign behavior that bolster the practitioner’s invocations of supernatural

powers. Meanwhile, the initiation practices, self-denial, and peculiarity of practitioners appear to convince the community that the practitioner is more stably biologically and psychologically strange. Individuals claim to have a new skeleton, to have died and come back to life, and to have been operated on by spirits (Eliade 1964), because doing so assures the community that the person has transformed into an entity different from normal humans, capable of abilities inaccessible to normal bodies. I review the ethnographic support for these hypotheses in section 4 and relate them to the professionalization of shamanism in section 5.

3.4. Synthesis: The cultural evolutionary theory of shamanism

Some highly important outcomes are uncontrollable and random (Fig. 1). Cognitive mechanisms for decision-making and developing explanations predispose people to (1) adopt causally innocuous interventions (superstitions) to influence these events, and (2) believe in unseen causal forces that control these uncertain outcomes.

Individuals prefer to use those interventions that appear the most effective, selecting for practices that are adapted to intuitions of causality and efficacy (Fig. 2). The most successful-appearing practices involve practitioners claiming to recognize and interact with the invisible causal agents

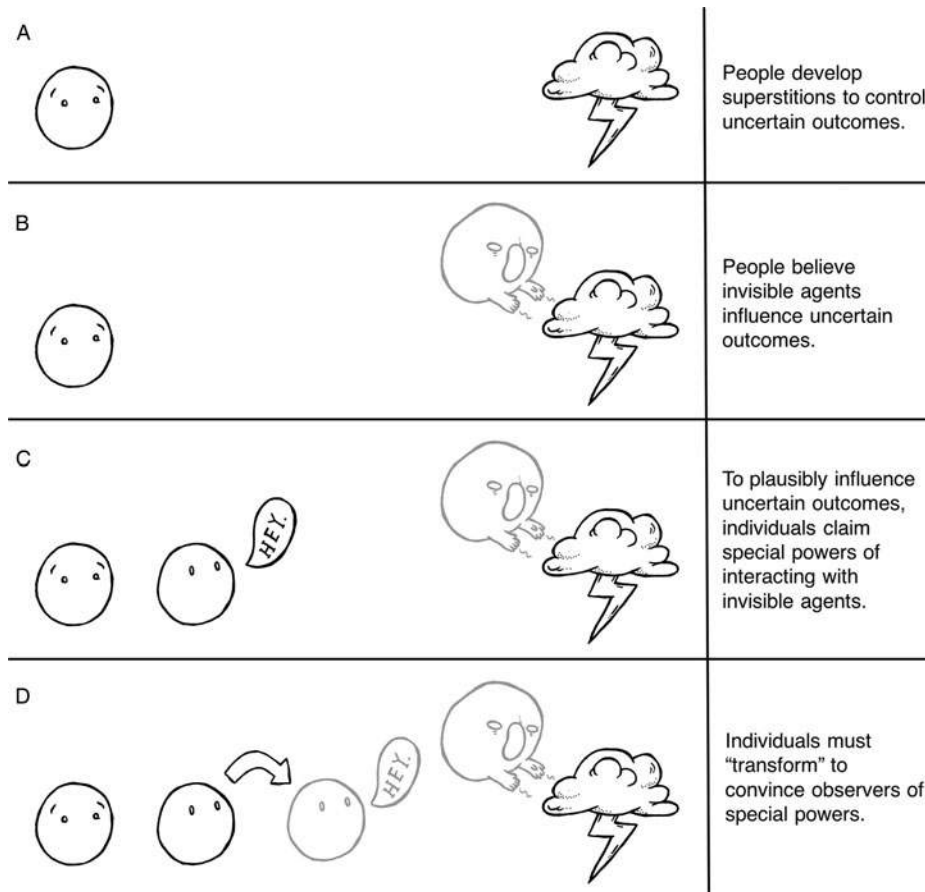


Figure 2. Individuals’ desire to find treatments selects for interventions that are the most plausible. When outcomes of uncertainty are controlled by invisible forces, cultural selection favors individuals who claim special abilities of interacting with those forces. To increase their credibility, those individuals must violate folk intuitions of humanness, resulting in trance, transformation practices and mythologies, and the predisposition for peculiar individuals to be shamans.

that determine whether these outcomes occur. These practitioners must convince group mates of their non-normal powers while warding off constant invasion from others aiming to invade their jurisdiction. This selects for transformation- practices and mythologies (e.g., asceticism, claims of death and rebirth), which convince observers that the practitioner is different and capable of performing feats otherwise impossible for normal human bodies. Practitioners also need to indicate to observers their supernatural powers while administering their interventions, driving the cultural evolution of displays of behavioral strangeness, or trance.

This theory is agnostic as to whether shamans provide benefits to clients or the group. It posits only that the practices surrounding shamanism develop to promote observer perception of efficacy. Although these might provide benefits through the placebo effect⁷ (Kaptchuk 2002; 2011; Kaptchuk & Miller 2015; Kleinman & Sung 1979), those added benefits are not necessary for the emergence or maintenance of the practice.

4. Explaining the core features of shamanism

To this point, I have used theoretical and empirical insights from psychology and cultural evolution to propose a cultural evolutionary theory of shamanism. In this section, I examine how the theory explains three core features of shamanism: the jurisdiction of shamans, dramas of strangeness during interventions (trance), and practices that serve to transform the shaman.

4.1. The shaman's jurisdiction focuses on controlling uncertainty

According to the cultural evolutionary theory, shamans should have jurisdiction over influencing and delivering information about outcomes that are unpredictable, fitness relevant, and uncontrollable (uncertain outcomes).

Comparative ethnographic evidence supports this claim. Winkelman and White (1987) coded 115 magico-religious practitioners across 45 societies, encompassing priests, trance practitioners, and cultural notions of witches and sorcerers. Seventy-five practitioners representing 43 societies used trance to provide services, qualifying them as shamans. Using their dataset, I calculated how frequently shamans had jurisdictions over uncertain outcomes as compared to how often they offered services in other domains.⁸ Figure 3 presents the findings.

Shamans overwhelmingly offered control over important, uncontrollable outcomes. The most pervasive and important uncertain outcome among humans is recovering from serious illness: Trance practitioners treated it in every society examined. Successes and failures in food acquisition, including helping to find game and reap successful crop yields, represent another class of important, uncontrollable events: Shamans assisted in promoting these activities in 91% of societies. Weather is similarly random and uncontrollable and bears dramatically on people's lives: Trance practitioners were coded as controlling weather patterns in 65% of societies. Lastly, shamans provided otherwise inaccessible information (divination) in all societies surveyed. This included information about the cause of illnesses, guilt, future events, and the locations of lost or stolen objects.

Figure 3 also illustrates that shamans irregularly contributed to other aspects of social life. Although they assist in various life cycle activities, including birth, funerals, and initiations, and they enjoy leadership roles, such as in military affairs or coordinating economic activities, shamans serve these roles much less frequently than they help overcome uncertainty. This difference is more pronounced when removing chiefdoms and states and examining small-scale societies specifically (see Fig. 3). Notably, those two domains that appear most commonly outside of uncertainty seem the consequence of shamans' magical interventions. First, they were coded as mediating or settled disputes in 60% of the societies – but this is likely inflated because the coders included divining guilt as reflective of judiciary influence. Second, shamans' pronounced role in funerary activities, corresponding with some researchers' observations of shamans as psychopomps (Bäckman & Hultkrantz 1978; Eliade 1964; Hultkrantz 1993), seems a result of their unique relationship with the spirit world. Still, that shamans have roles outside of uncertainty suggests that their liminal status affords them a special prestige that translates into leadership and ceremonial positions.

Ethnographies reveal that, when shamans provide services outside of those in Figure 3, these also involve controlling uncertain outcomes. For example, in addition to calling wild game, healing illness, and controlling weather, Netsilik shamans stopped the cracking of ice, which endangered camps and was uncontrollable but resolved randomly (Balıkcı 1963). Majangir shamans (southwestern Ethiopia) not only divine, treat illness, and influence natural events, but also more generally “confer protection and good luck” (Stauder 1972, p. 156). Haida shamans cured illness, foretold events, and divined the locations of stranded whales, but they also accompanied war parties to warn of unpredictable ambushes and point out auspicious places to attack (Corlett 1935).

Note that these jurisdictions and abilities apply to the practitioners of Abrahamic religions as well. For example, Thomas (1971a, p. 26) wrote about medieval Christian saints:

“By the twelfth and thirteenth centuries the *Lives* of the Saints had assumed a stereotyped pattern. They related the miraculous achievement of holy men, and stressed how they could prophesy the future, control the weather, provide protection against fire and flood, magically transport heavy objects, and bring relief to the sick.”

Pentecostal and charismatic priests habitually engage in healing and divination (Csordas 2007). Some scholars even accredit the recent proliferation of these movements, which now comprise more than a quarter of all Christians, to the centrality and allure of divine healing (Brown 2011).

A final prediction regarding jurisdiction is that shamans will exist as long as uncertain outcomes exist – that is, as long as there are important, uncontrollable events that individuals want to influence or about which they want information. I review this prediction in section 6.2.

4.2. Trance is a drama of strangeness

Trance (or ecstasy) is a famously ambiguous and ill-defined concept (Rouget 1985). Contemporary researchers often implicitly or explicitly regard it as an altered state of consciousness that shares a common neurophysiological basis

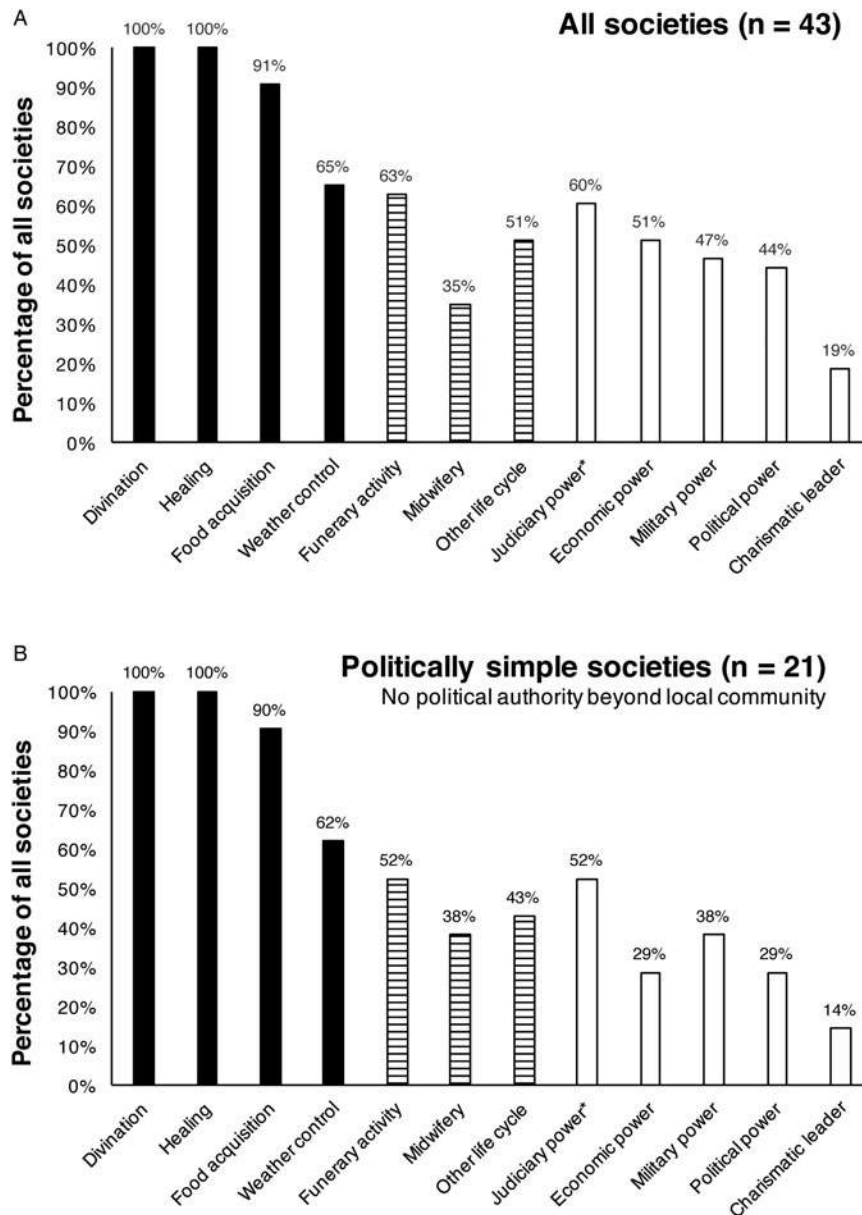


Figure 3. Percentage of societies in which shamans provide a given service or role, according to coding by Winkelman and White (1987), organized by all societies (A) and politically simple societies (B). *Filled black bars* signify a jurisdiction that involves influencing or providing information about uncertain outcomes; *striped bars* indicate assisting or ceremonially overseeing life cycle activities (funerals, birth, initiations); *white bars* denote decision-making in other domains of social life. *Judiciary power* is noted with an asterisk because it includes overcoming uncertainty (divination of guilt). See main text for details and note 8 for a discussion of methods.

across societies and stimulates similar experiences (Achterberg 1985; Harner 1990; Hove et al. 2016; Winkelman 1986a; 1986b; 2004). For example, Harner (1990) argued for the existence of a Shamanic State of Consciousness (SSC), while Winkelman (2000) hypothesized the “integrative mode of consciousness.”⁹ In contrast to these claims, however, growing research in altered states of consciousness has shown that states brought on by sensory deprivation, drumming, starvation, meditation, hallucinogens, relaxation, and other inducements produce profoundly different physiological and psychological effects (Vaitl et al. 2005).

The proposed cultural evolutionary theory of shamanism hypothesizes trance to be a drama of strangeness. By violating folk intuitions for how a human should behave,

practitioners convince onlookers of their heightened supernatural powers or experiences. This hypothesis does not necessitate that trance states have the same neurological and physiological correlates across societies, although similar triggers (e.g., hallucinogens and music) likely produce analogous experiences.

The theatrical nature of trance does not mean that an individual engaged in it is faking. In fact, cultural selection should favor interventions that convince both the client and the shaman of the shaman’s ability, as long as the client’s perception of successful treatment is influenced by the shaman’s faith (see the benefits of self-deception: Hartwig & Bond, Jr. 2014; ten Brinke et al. 2012; Trivers 2000, 2011). Medical researchers have found that physician expectations increase the magnitude of the placebo effect,

suggesting that the shaman's confidence does indeed influence client belief (Crow et al. 1999; Gracely et al. 1985; Gryll & Katahn 1978). Consequently, cultural selection should develop practices that change the felt experience while making the shaman's behavior seem as non-human as possible. For example, the healing songs that so frequently characterize shamanic ceremonies may culturally evolve to engage this genuine-seeming superhuman state.¹⁰ Future research will reveal whether songs involved in shamanic ceremonies exhibit convergent features around the world that serve this function.

This hypothesis of trance makes several unique predictions that diverge from the accounts of Harner (1990) and Winkelmann (2000). Here, I consider three: (1) Trance states should include other spectacles to promote perceptions of supernatural powers, aside from non-human behaviors; (2) Trance practices including more humanlike behaviors are perceived of as less genuine; and (3) Reframing trance behaviors as natural parts of human behavior undermines them as indications of supernatural powers or connection.

4.2.1. Trance states include other displays that promote perceptions of supernatural powers. If trance states are culturally selected to assure observers that the practitioner has special powers, these performances should incorporate other spectacles that promote this perception, aside from

displays of strangeness. Ethnographic accounts of trance frequently document exhibitions of purported superhuman abilities, supporting this prediction. Table 1 presents a selection of examples.

4.2.2. Trance performances including more humanlike behaviors are considered less genuine. If the strangeness of a practitioner's behaviors in trance evidences their supernatural connection, observers should use the normalcy of behavior as an indication of false trance. Accounts of dubious observers support this prediction. Monguor shamans of China were considered inauthentic if, in their trance states, they responded frightfully to the crack of a whip and if their bodies bled when they sat on thorns (Schröder 1952). Meanwhile, Blacker (1975, p. 263) described how a Japanese community complained of the unenergetic performance of a possessed shaman: "The *miko*'s performance had been so languid that it was difficult to realize that she was possessed at all." This was in contrast to a previous shaman, whose dramatic divinations included violent flailing, levitation, and screaming in a bass voice, inviting questions and enthusiasm from the crowd. The author later concluded: "In every case we noticed that a trance was approved by the village as 'good' and genuine when the medium's behavior was violent, inhuman, and strange. Behavior ordinary or human—as in a decorous waving of the wand or a polite use of language—was

Table 1. *Some displays of superhuman abilities that occur during trance performances*

Superhuman ability displayed	Selected societies (with sources)
Immunity to fire, including walking on and swallowing hot coals	Fon (Herskovits 1938, p. 165) Ivilyuqaletem (Hooper 1920, p. 331) Japanese (Blacker 1975, pp. 250–51) !Kung (Marshall 1965, p. 272) Mentawai (Schefold 1988, p. 202) Nakhi (Rock 1959, p. 801) Nlaka'pamux (Teit 1900, p. 362) Paiute (Park 1938, p. 57) Tlingit (Emmons and De Laguna 1991, p. 373) Yahgan (Gusinde 1961, p. 1354)
Immunity to other pain and injury, including walking on swords and being stabbed without bleeding or suffering lasting harm	Azande (Evans-Pritchard 1937, p. 189) Koreans (Lee 1981, pp. 149, 211) Koryak (Jochelson 1905, pp. 51–52) Kyrgyz (Castagné 1930, p. 87) Saami (Karsten 1955, p. 61) Wanapum prophet Smohalla (Mooney 1896, p. 719)
Possessing inaccessible knowledge, especially speaking languages one does not otherwise know	Evenks (Jochelson 1905, p. 51–52) Greeks (Herodotus and Godley 1925, p. 135) Haida (Swanton 1905, p. 38) Ifugao (Barton 1946, p. 121) Jahai (Eliade 1964, p. 96) Monguor (Schröder 1952, p. 29) Wintu (DuBois 1935, p. 97) Yakut (Sieroszewski 1902, p. 314)
Physical impossibilities, including removing one's nose, creating matter, turning water into blood, and freeing oneself from chains	Apache (Opler 1941, pp. 263–64) Chukchi (Bogoras 1909, pp. 444, 448) Mapuche (Métraux 1942, pp. 313–14) Nuxalk (McIlwraith 1948, pp. 566–67)

instantly condemned as weak and unconvincing” (Blacker 1975, p. 277).

Note that this also provides an example of cultural selection: Preferentially patronizing shamans with inhuman trances should promote the retention and spread of those practices.

4.2.3. Trance practices lose legitimacy when they are absorbed into normal human functioning. The examples above illustrate that trance composed of normal human behaviors fails to convince observers of a practitioner’s power. By the same logic, this hypothesis predicts that trance will lose legitimacy if it becomes absorbed into normal human functioning. This is what occurred in 16th- and 17th-century Europe (Heyd 1981; Keitt 2004, 2005a). Natural philosophers argued that trance behaviors were within the purview of normal human functioning; officials in the Church promoted these arguments to delegitimize local practitioners and maintain their monopoly on the supernatural. For example, Huarte de San Juan argued that the intense concentration of prolonged prayer could lead to a loss of sense of touch (Keitt 2005a). This naturalization invalidated trance behavior as a sign of supernaturalness, raising the standards for indications of supernatural connection.

4.3. Initiation practices and self-denial serve to transform the shaman

According to the cultural evolutionary theory of shamanism, the practices involved in becoming a shaman convince an individual’s group mates that the initiate has transformed, making one’s claims of supernatural powers more credible. Those individuals with biological or psychological peculiarities more easily become shamans because they pay lower costs to convince their group mates of their liminal nature.

4.3.1. Initiation practices indicate biological or psychological change or strangeness. Shamanic initiation practices frequently involve an individual acting in foreign ways or otherwise transforming, famously reviewed by Eliade (1964); some examples are presented in Table 2. According to a Nomlaki person (northern California), “When a person starts to become a doctor, he gets out of his head; he won’t talk but just stands around as though he doesn’t know you, like a man who is unconscious. His eyes, ears, and nose may be bloody, and instead of tears, blood is in his eyes. He gets and worse, just like a dog with running fits, and finally he runs off” (Goldschmidt 1951, p. 358).

Yaghan initiates had to painfully rub their faces until a new layer of skin supposedly appeared (Gusinde 1961). Among the Andaman Islanders, one could become an *oko-jumu* by dying and coming back to life (Radcliffe-Brown 1964). Such individuals were thought capable of communing with the dead, granting them insight into “curing illness and in preventing bad weather” (Radcliffe-Brown 1964, p. 178). Claims of initiates dying and then enjoying new powers are common in shamanic initiations. Winkelman and White (1987) reported that trance practitioners in nine societies of 43 were said to experience death and rebirth during initiation or trance.

Other frequently occurring shamanic initiations similarly involve the candidate’s body or physiology changing. These include, for example, magical treatment of an initiate’s eyes or ears (Fig. 4), claims of surgery or dismemberment by spirits or other medicine men, debilitating illness, and bodily insertions of crystals, magical shells, or dust (Table 2). Wilbert (1987a) observed how heavy tobacco consumption among South American shamans helped transform initiates’ eyes and voices, making credible claims of otherworldly senses. Citing the shamans’ “acuteness of vision, night vision, wakefulness, a caraña-masked raspy voice, a furred or rough tongue, and a pungent body odor” (Wilbert 1987a, p. 195), the author further hypothesized that the physiological effects of tobacco also legitimated the shamans’ supposed affinity with jaguars. Among the Igbo, men staged a performance in which they killed a dog, removed its eyes, and then allegedly replaced a healer-initiate’s eyes with the animal’s (McCall 2000). The ethnographer quoted an informant who said, “Now he will be able to see spirits just as dogs are able to see spirits” (McCall 2000, p. 27).

4.3.2. Group mates conceive of ascetic practices as transforming initiates. Becoming a shaman frequently involves observing periods of asceticism and other costly practices, not only during initiation but also throughout one’s tenure as a shaman as well. According to coding by Winkelman and White (1987),¹¹ at least one trance practitioner in 49% of societies observed prohibitions on sex either during training or in preparation for ceremonies, shamans in 53% of societies refrained from eating certain foods, and those in 72% of societies underwent social isolation. Shamans in 83% of societies observed at least one of those forms of self-denial. The proposed theory hypothesizes that observing these practices convinces one’s group mates of one’s psychological or biological foreignness.

Observers’ interpretations of a person’s self-denial or pain have not been systematically studied, but psychological and ethnographic research suggests that people conceive of these experiences as transformative – an intuition captured in adages such as “no pain, no gain” and “what doesn’t kill you makes you stronger.” For example, Hoffman and Trawalter (2016) found that the white perception of black people having a heightened pain tolerance is driven by folk intuitions about the transformative nature of hardship.

Ethnographers, group members, and practitioners commonly intuit that austerity serves to extricate a practitioner from “his ‘normal’ state ... [turning] him into another man” (Mauss 1902/2001, p. 51). For example, Rasmussen (1930, p. 55) quoted the Inuit shaman Igjugarjuk: “True wisdom is only to be found far away from people, out in the great solitude, and it is not found in play but only through suffering. Solitude and suffering open the human mind, and therefore a shaman must seek his wisdom there.” Blacker’s (1975) Japanese interlocutors described similar transformative effects of ascetic living; one shaman claimed that subsisting on pine needles was “conducive to the development of second sight and clairaudient hearing” (p. 87). Other Japanese shamans testified that “it was just when they felt that cold, hunger, and sleeplessness had brought them to the verge of collapse that they suddenly felt themselves flooded with a new and mysterious strength. With this

Table 2. Purported shamanic initiation practices involve a biological or psychological transformation of the initiate.

Practice	Selected societies (with sources)
Death and rebirth, including through illness and supposed ingestion and regurgitation by monsters	Andaman Islanders (Radcliffe-Brown 1964, p. 178) Aztec (Corlett 1935, p. 166) Bororo (Métraux 1944, p. 203) Inuit (Thalbitzer 1909, p. 454) Maidu (Gifford 1927, p. 244) Mapuche (Métraux 1942, p. 315) Nuba (Nadel 1946, p. 29)
Surgery, dismemberment, or magical treatment of body parts, especially eyes, ears, and head	Anmatyerre (Spencer & Gillen 1904, pp. 480–81) Dayak (Gomes 1911, p. 178) Haitians (Métraux 1959, p. 200) Igbo (McCall 2000, p. 207) Mentawai (Loeb 1929, pp. 68–69) Yanomamö (Jolic 2008)
Transmission of magical substances, including dust, crystals, magic shells, and the phlegm of existing shamans	Aranda (Spencer & Gillen 1899, p. 524) Azande (Evans-Pritchard 1937, pp. 224–226) Chamicuro (Tessmann 1930, p. 406) Kwakwaka'wakw (Boas 1930, p. 4) Manasi (Métraux 1943, p. 25) Maori (Best 1924, p. 245) Ojibwa (Corlett 1935, pp. 124–25) Pima (Russell 1908, p. 257) Wudjbalug (Elkin 1977, p. 75)
Spontaneous biological or behavioral anomaly, including serious illness, excessive bleeding, self-harm, isolation, epileptic fits, and frenzies	Buryats (Mikhailowskii & Wadrop 1895, p. 87) Evenks (Mikhailowskii & Wadrop 1895, p. 85) Japanese prophet Deguchi Nao (Blacker 1975, p. 133) Koreans (Kendall 1985, pp. 37, 57) Niassans (Loeb 1935, p. 155) Nomlaki (Goldschmidt 1951, p. 358) Uzbeks (Basilov 1995)



Figure 4. A Mentawai shaman (*sikerei*) treats an initiate's eyes with turmeric and other potent, magical substances so that he can see otherwise invisible spirits.

access of power they felt themselves to be different people from those they had been in the past” (pp. 102–3).

The above ethnographic anecdotes reveal that practitioners use self-denial and self-harm to promote a perception of change and ensuing supernaturalization. Future work will uncover the particular psychological mechanisms by which these prohibitions indicate to observers that a practitioner transforms.

4.3.3. Initiation practices and self-denial do not signal cooperative intent.

A potential alternative interpretation of these practices, and of costly prohibitions in particular, is that they indicate that a practitioner is a cooperative group member, through signaling either commitment or belief (for discussions of cooperative costly signaling, see Bulbulia & Sosis 2011; Irons 2001; Sosis 2004). Given that communities often fear shamans as potentially malicious sorcerers (Brown 1989; Whitehead & Wright 2004), such a hypothesis at first seems plausible. However, at least four lines of evidence suggest that a cooperative costly signaling hypothesis fails to explain the observances of shamans.

Cooperative costly signals indicate cooperative intent either through demonstrating an intention to stay in the group (commitment) or by showing that an individual subscribes to a religious system that also includes cooperative

beliefs (belief). But many of the austere practices of shamanism qualify as neither of these. First, many observances do not exhibit the requisite features of a commitment signal. Commitment signals involve suffering a cost now to reveal one's intention of staying in a relationship (and reaping benefits later) (Bulbulia & Sosis 2011; Posner 2000). For example, gifting a diamond ring reveals that an individual is willing to suffer the large costs today, because he intends to collect the benefits of a pair-bonded relationship over the long term. Thus, commitment signals require that the benefits are offset in time from the costs. However, many taboos on shamans (and on magico-religious practitioners, more broadly) occur perennially, such as throughout the life course or during every ceremonial period. According to Winkelman and White's (1987) dataset,¹² shamans in 49% of societies refrained from sex, food, or social contact during ceremonies. Because a practitioner pays the costs of the taboos and reaps the benefits of social living simultaneously, observing the prohibitions cannot signal his or her intention to stay in a group.

Second, while many of these behaviors do not signal commitment, they also fail to bespeak adherence to charitable religious rules or beliefs. This is because an individual easily can observe the prohibitory practices (e.g., self-denial during ceremonies) without believing in the enforcement supporting the cooperative ones (e.g., beliefs in afterlife).

The third line of evidence suggesting that self-denial fails to signal a cooperative disposition is that people often believe it to foster abilities required for distinctly malicious activities, such as sorcery. For example, among the Jivaro, both shamans and malevolent sorcerers "must induce [spirit darts from which they derive power] to remain in their bodies by purifying themselves. They spend months in jungle isolation, fasting and practicing sexual abstinence" (Brown 1989, p. 8). Similarly, the Barama River Carib claimed that observing austerities helped transform one into a *kanaima*, a shadowy spirit bent on revenge (Gillin 1932), while English people of the early modern period believed in black-fasting, "a maleficent activity designed to secure the death of some specified victim" (Thomas 1971a, p. 512; see the account of Mabel Brigge in van Patten 1983). In other instances, self-denial is said to cultivate abilities unrelated to cooperative intent. For example, the Canela believed that observing taboos helped develop a person not only into a shaman, but also into "a great warrior, a tireless runner, or a reliable hunter" as well (Crocker 1990, p. 317). The Haida made similar claims, connecting self-denial to "success in hunting, fishing, war, etc." (Swanton 1905, p. 40). These examples reveal that people regard observing costly prohibitions as cultivating some dimension orthogonal to cooperativeness.

Finally, the many examples reviewed reveal that emic perspectives of shamanic austerities emphasize transformation and supernaturalization rather than demonstrating a cooperative nature.

5. On the professionalization of shamanism

In most hunter-gatherer societies with shamanic traditions, shamanism represents the only profession (La Barre 1970; Rogers 1982). In this section, I use the proposed theory to explain why.

To reiterate, by *profession*, I mean a class of individuals with entry requirements whose unique expertise or abilities provide them jurisdiction over the treatment or diagnosis of some problems. This does not presume a professional organization, nor does it necessitate full-time specialization. Note that, according to this definition, variation in skill does not qualify as a profession. For example, some individual might be especially proficient at canoe making, and people might know him as such and favor his canoes. However, unless a group of canoe makers exists who enjoys jurisdiction over making canoes, and becoming a canoe maker involves observing entry requirements, there is no profession.

5.1. Shamanism professionalizes because individuals must transform to claim the jurisdiction

According to the sociology of professions, individuals want to claim jurisdiction over the treatment or diagnosis of some problem, such as healing illnesses or mediating conflict, because doing so carries material and social benefits. By *jurisdiction*, I mean that a party has a claim over providing some service (Abbott 1988). The benefits of holding a jurisdiction come from having a unique skill or ability that others prize, which ensures compensation for services, social prestige, and valued social partners (Tooby & Cosmides 1996). Shamans across societies receive payment in exchange for their services (Rogers 1982), including pigs and coconuts (Mentawai: Loeb 1929), tobacco (Ojibwa: Ritzenthaler 1963), yams and sponges (Pohnpei: Riesenberg 1948), freshly killed deer (Miwok: Powers 1877), sexual partners (Guyana: Roth 1915; Inuit: Stefánsson 1914), and slaves (Haida: Corlett 1935). Becoming a shaman also provided a way for low-status individuals to attain prestige, such as in some hierarchical societies of the Pacific Northwest (Gunn 1966), while in other instances, shamans were regarded as attractive sexual partners. For example, Katz (1982, p. 186) quoted the !Kung shaman Toma Zho: "The women really did like the healers. Whenever I see one who is getting num [healing energy], I say, 'Think of the sex the guy's going to get!'"

Sociologists studying professions in industrial societies have identified several conditions under which parties maintain jurisdiction over problems (Abbott 1988). First, parties should have unique skills or expertise that others believe are necessary for diagnosing the problem, administering the treatment, or inferring the treatment from diagnosis (Coy 1989; Freidson 1970). For example, physicians are considered the chief healers in many industrial societies because of a conception that their university training grants them the exclusive know-how in diagnosing and treating ailment (Freidson 1970). Likewise, shamans should maintain jurisdiction if people believe that only shamans have the skills or abilities necessary for controlling uncertain outcomes. Second, a party maintains its jurisdiction when competitors purporting to possess alternative interventions are unable to invade and subsequently dominate the jurisdiction (Abbott 1988). Mechanisms preventing such invasion include the perceived inferior efficacy of alternate interventions, as well as the current party enforcing barriers to competition, as was the case with medieval guilds (Ogilvie 2014).

To this point in the paper, I have argued that an individual aiming to invade the shaman's jurisdiction has to

observe the existing transformative practices or devise novel ways of garnering supernatural credibility. Some hopeful shamans may convince their group mates of their competence because of lucky early successes or inherent strangeness (e.g., having an extra finger), but according to the proposed theory, most individuals need to transform in the eyes of the community. These transformative practices, including long bouts of asceticism or ceremonies of supposed eye replacement and surgery, represent entry requirements for holding the jurisdiction. They in turn create a separate class of individuals (those who have transformed) uniquely capable of influencing uncertain outcomes. Consequently, shamanism professionalizes: A class of individuals with entry requirements develops with near-exclusive jurisdiction over some services.

Shamanism professionalizes because individuals typically must invest in transformative practices to be considered capable of influencing uncertain outcomes. In contrast, jurisdictions involving technical knowledge (such as making canoes or cooking sago) do not professionalize because individuals are capable of producing technical outcomes without having to observe entry requirements. The professionalization of technical knowledge requires that only those individuals who have observed some entry requirements are capable of providing the service. This in turn requires that either (1) some individuals enjoy a monopoly over technical knowledge, or (2) technical knowledge is sufficiently complicated such that it requires prolonged, intensive training. Neither of these typically holds true in small-scale societies. High levels of interaction and limited personal privacy make technical knowledge difficult to conceal, even when actors explicitly try to control it (e.g., Lindstrom 1984). Moreover, the simplicity of physical technology means that “imitators can often replicate new techniques after only minimal observations” (Suchman 1989, p. 1272). The difficulty of controlling technical knowledge is illustrated by the ease and rapidity with which technologies such as the domesticated sweet potato (Wiessner 2002), the horse (Haines 1938), and the bow and arrow (Bettinger & Eerkens 1999) diffused through societies. The horse is notable: Not only did adoption require special knowledge for use and care, but also societies actively opposed its diffusion, as demonstrated by the Spaniards’ laws against Native Americans riding horses (Haines 1938).

In summary, entry requirements are maintained for jurisdictions over uncertainty: Individuals must observe transformative practices to convince onlookers of their competency. In contrast, in small-scale societies, entry requirements are difficult to maintain for technical jurisdictions: Technical knowledge easily spreads, and technology is simple enough so individuals outside of the jurisdiction can produce the outcome.

5.2. Self-serving barriers to entry do not explain shamanism’s professionalization

Prohibitions on novices sometimes advantage existing practitioners, suggesting that shamans use entry requirements for self-serving ends. For example, Canela initiates were forbidden from having sex with young girls, although they were permitted to enjoy sexual relationships with postmenopausal women (Crocker 1990), removing a source of

sexual competition for adult shamans. The !Kung healer Kau Dwa explained that novices must first eat food specifically prepared by and shared with an existing practitioner; otherwise, they risk death (Katz 1982).

Despite evidence of selfish rule-making, it cannot by itself explain the existence of entry requirements for becoming a shaman. Self-interested rule enforcement necessitates that these individuals already have supernatural credibility (Singh et al. 2017) – but it fails to explain the source of this credibility. The cultural evolutionary theory, which posits that gaining supernatural credibility involves transformative displays, addresses this gap while also explaining entry requirements. Thus, self-interested enforcement can exacerbate entry requirements, but the need for practitioners to transform to gain credibility seems to explain their existence in the first place.

6. Social conditions affect the practices and existence of shamanism

Although the constituent practices and beliefs of shamanism recur around the world, many aspects of it vary across contexts, while some societies fail to sustain shamanic traditions. In this section, I use the cultural evolutionary theory first to explain how social conditions can mediate the intensity of shamanic practices and then to postulate why shamanism is absent in some societies.

6.1. Competition and the benefits of shamanhood mediate entry requirements

I have established that initiation practices and requirements convince observers of a practitioner’s transformation, justifying claims of supernatural powers. According to the cultural evolutionary theory, these practices can then intensify or relax, depending on the competition for the jurisdiction.

Figure 5 illustrates a hypothetical scenario in which a shaman’s investment in credibility-building practices (e.g., asceticism, death and rebirth, trance) carries costs, while increasing clients’ willingness to pay the practitioner (benefits). This willingness reflects the clients’ increasing faith in the practitioner’s abilities, although it asymptotes because clients can only pay so much. Note that the practitioner prefers to invest some amount (i_0), but that competition from other practitioners should push this investment up until the benefits of shamanhood are equivalent to the costs of investment (i_1). This trend resembles a more general phenomenon observed in economics wherein competition for clients drives up the (perceived) quality of the service (Domberger & Sherr 1989; Matsa 2011; Mazzeo 2003; Olivares & Cachon 2009).

Ethnographic observations support the prediction that greater competition promotes practitioner investment in credibility-building practices, while reductions in competition co-occur with lower investments. For example, I presented earlier the anecdote of an unenergetic possession performance in a Japanese community. This reduced investment seemed a consequence of a decline in competition: Blacker (1975, p. 263) observed that the community “had to make do with the present creature, despite her feebleness, because she was the only *miko* left in the entire area.”

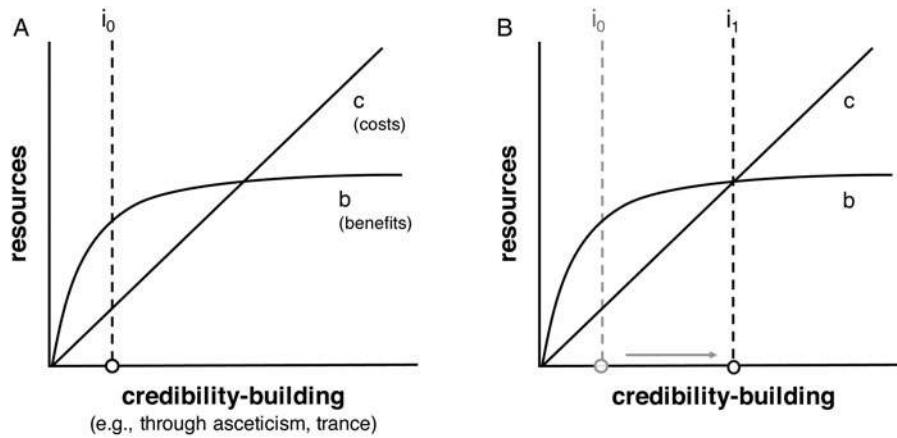


Figure 5. A hypothesized relationship between a practitioner’s investment in credibility-building practices and payoffs. (A) A self-interested practitioner should maximize the difference between the benefits from clients (b) and the costs of investing in credibility (c), denoting an investment of i_0 . (B) Competition among practitioners will push the level of investment as far as (but not passing) the point at which costs equal benefits (i_1).

Some hopeful shamans will pay a lower cost to convince observers of their non-normality (see Fig. 6). These individuals, who might possess an extra finger (Bernstein 2008), ambiguous sexual identity (Coleman et al. 1992; Peletz 2006), or epilepsy (Loeb 1924), thus can garner more credibility and more easily attract a clientele.

Formalizing the intuitions reveals other pathways by which social dynamics impact shamanic practice. For example, if clients’ willingness to pay goes up, practitioners should invest more in credibility-building practices, providing a hypothesized mechanism for how asceticism elaborates with increasing societal wealth (Baumard et al. 2015). Relatedly, the entry requirements should become less demanding when clients’ willingness to pay decreases, such as if shamans become less valued. This seems to explain the loosening of taboos involved in becoming a Comanche medicine person. As the jurisdiction of traditional doctors gave way to Western medicine,

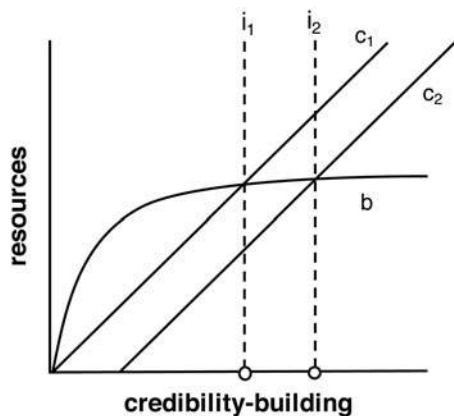


Figure 6. Some practitioners will pay lower costs (c_2 compared with c_1) for the same level of credibility because of inherent violations of humanness, early random successes, and so forth. These individuals can attract credibility past the point that normal practitioners can (up to i_2 , as compared with the normal investment limit of i_1), more easily invading jurisdictions.

a Comanche medicine woman observed that the taboos discouraged an increasingly acculturated youth from becoming shamans. Thus, she “[deleted] certain tabus from her Medicine way in order to make the acquisition of her powers more palatable to a twentieth-century Comanche” (Jones 1972, p. 43).

If clients become less willing to pay but the entry requirements for becoming a shaman cannot change, fewer initiates should enter, contributing to the collapse of the institution. This seems to have occurred in with *vegetalista* traditions among Peruvian mestizos (Luna 1984). Luna (1984) remarked, “None of the four informants I worked with has a successor. They all complain that young people are not interested or are not able to endure the diet and continence necessary for learning from the plants.”

I have considered how competition for the jurisdiction should maintain and mediate entry requirements for becoming a shaman. But as stated in section 5.1, as long as observers afford special expertise to shamans, existing practitioners can capitalize on their influence to selfishly erect barriers to entry. For example, fearing encroaching competition, shamans might ratchet up the intensity of entry requirements, justifying the barriers in their esoteric knowledge or singular communication with the supernatural. Evans-Pritchard (1937) observed a failed attempt at this among the Azande, when the foreign witch doctor Bögwözu tried to impose taboos on novices to control the flood of new shamans.

Whether entry requirements develop emergently or intentionally, the outcome is the same. The intensity of these requirements is partly determined by the competition for this jurisdiction and the benefit that controlling the jurisdiction provides. Entry requirements that are too high discourage initiates from becoming shamans.

6.2. Conditions for collapse

Shamanism is widespread, but it is not ubiquitous. Although shamans in various forms have continued to populate Western industrialized societies (e.g., Ferguson 1928;

Hughes 1991; Lindquist 2004), people patronize them much less frequently than they did in other cultural contexts. Similarly striking is their variability among small-scale societies and among hunter-gatherers, in particular. Shamanic traditions existed in North and South America, Europe, Asia, Africa, and Oceania (Corlett 1935; Eliade 1964; Peters & Price-Williams 1980), yet ethnographers reported their absence among hunter-gatherers such as the Tiwi, the Siriono, the Mbuti, and the Hadza (Peoples et al. 2016).

What explains variation in shamanic traditions among hunter-gatherers and the practice's more recent collapse in Western industrialized societies? The cultural evolutionary theory of shamanism identifies at least seven conditions under which shamanism should dissolve:

1. *The benefits of shamanism decrease, but entry requirements are unchanging.* I discussed above that the benefits of shamanism can change when clients' willingness to pay decreases. If the entry requirements do not change in concert, fewer or even no new initiates should join, weakening or destroying the institution. Nevertheless, this does not explain why clients would be less willing to patronize shamans.

2. *Cultural complexity declines.* Shamanism is a complex set of practices, often involving ceremonies, initiations, mythologies, and music. Therefore, like other forms of complex culture, it can disappear following demographic fragmentation, isolation, and bottlenecks (Henrich 2004; Shennan 2001). This likely explains the absence of shamans among the Siriono (Peoples et al. 2016), who also lacked musical instruments, games, poison, watercraft, and firemaking knowledge (Holmberg 1969; Isaac 1977). Cultural phylogenetics reveal that the ancestors of the Siriono almost certainly had shamans, but that this practice was lost along with canoes, corporate structure, and other cultural traits (Walker et al. 2012), possibly driven by the demographic destruction following European colonization.

3. *Powerful parties control jurisdiction.* Parties competing for the jurisdiction of controlling uncertainty will campaign against shamanism if they possess sufficient power. This is best exemplified in the actions taken by various Christian churches towards local magicians and prophets. For instance, Catholic churches in late medieval England approved of supernatural rituals "prescribed by God and the Church," such as those pertaining to the Mass, holy water, and the healing activities of saints – "the remainder was diabolical and to be abhorred" (Thomas 1971a, p. 255). Following the Reformation, the Spanish Catholic Church controlled access to the supernatural by using science to delegitimize trance: "Inquisitors often pointed out how physical infirmities and natural forces at work within the human body could simulate supernaturally infused spiritual gifts" (Keitt 2005b, p. 77).

The final four conditions correspond with basic components of the theory as presented in Figure 2. Modifying any of these will affect shamanism:

4. *A society experiences less uncertainty.* According to this theory, and the writings of many other researchers (Malinowski 1948), magical practices result from individuals trying to control important, uncontrollable events. As individuals are better able to deal with this uncertainty – or if they confront less of it – they will depend less on shamans. Although a

world completely devoid of uncertain outcomes seems implausible, Hart and Pilling (1960) offered this hypothesis to explain the absence of shamanism among the Tiwi. Citing the adequate rainfall, the consistent food supply, a dearth of dangerous animals, the rarity of tropical diseases, climatic docility, and the absence of antagonistic neighbors, the ethnographers concluded, "[The Tiwi] never invented magic to control their environment because their physical environment was on the whole a satisfactory and not a hostile universe" (Hart & Pilling 1960, p. 88).

5. *People do not think that invisible forces influence uncertain outcomes.* People across societies believe that invisible forces influence uncertain outcomes. Murdock (1980) reported that every society in the SCCS believed that some illness was caused by supernatural forces, while psychologists have found that even atheists believe that anomalous events are driven by purposeful forces (Banerjee & Bloom 2015). Nevertheless, the cultural evolutionary theory predicts that ceasing to attribute causality to invisible forces should drive the dissolution of shamanism.

6. *People do not think that humans are capable of interacting with invisible forces.* In some instances, people will believe that it is impossible to engage with invisible forces through practitioners, despite accepting that these forces exist. Shamanism should not exist under these circumstances.

7. *Trance behaviors no longer indicate non-humanness (or supernaturalness).* The theory hypothesized that trance behaviors are dramas of strangeness, used to convince onlookers of a person's non-human abilities or interactions. I have discussed how the naturalization of trance led people to turn to other means of communicating their otherness.

Thomas (1971a) implicated these changes, especially points 4, 5, and 6, in England's waning reliance on magical interventions, although some changes were more impactful and longer lasting than others. For example, he reviewed evidence paralleling the decline of magic with an improved capacity for people to protect themselves against capriciousness (point 4 above), such as through insurance and firefighting technologies. But he also argued that "magic lost its appeal before the appropriate technical solutions had been devised to take its place" (p. 656). Supposedly more important in the decline of magic were the changes discussed in points 5 and 6: a tendency toward believing that events occur according to natural laws, and in the cases of an interfering God, believing that human actions are devoid of supernatural effect (Thomas 1971a).

The origins, timing, and pervasiveness of these intellectual changes are highly debated among historians (Bailey 2006; Scribner 1993; Walsham 2008), and addressing them exceeds the scope of this paper. Still, the substitution of mystical explanations with naturalistic ones has been neither ubiquitous nor permanent (Saler 2006). Humans everywhere are endowed with the same sociocognitive biases that so routinely steer us into believing in unseeable, purposeful forces and the powers of supernaturalized humans. Many Westerners, although familiar with scientific epistemologies, continue to subscribe to an enchanted worldview, one populated with out-of-body experiences, chains of reincarnation, transmissible healing energy, and suspicions of witchcraft (Partridge 2005). This cosmology in turn supports a gamut of contemporary trance

practitioners – the channelers (Hughes 1991), neo-shamanic journeyers (Lindquist 2004), charismatic healers (Robbins 2004), and other specialists who, in inspired and altered states, resemble the shamans of ancient and recent human history.

7. Conclusion

Previous accounts have conceived of the shaman as a charlatan, a psychotic, an inspired priest, a performer, a psychoanalyst, a guardian, and a doctor. Following this theory, I propose an addition to the list: the shaman as cheesecake. That is, the shaman as “an exquisite confection crafted to tickle the sensitive spots of our mental facilities” (Pinker 1997, p. 534). In the same way that cultural evolution and bakeries have devised sweets configured for our Stone Age sense organs, cultural evolution and ingenious performers have assembled myths and customs that hack our psychologies to placate our anxieties.

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NOTES

1. This description of the Inuit *angakok* comes from accounts by Balikci (1963) and Rasmussen (1929).

2. The authors concluded that shamanism existed in 26 societies, rather than 29. However, ethnographies from the Aka, the Botocudo, and the Sandawe strongly suggest the presence of shamans (Sandawe: Grzelczyk 2016; Aka: Hewlett et al. 2013; Botocudo: Minuendajú 1946).

3. Note that *superstition* here is defined solely by whether or not an intervention has an effect on its intended outcome. It thus contrasts with some colloquial uses of the word, which focus on whether or not an explanation is naturalistic. For example, consider two pregnancy taboos, one that is functional but is described through supernatural means (e.g., pregnant women should not eat rotting flesh because it angers a deity) and one that is ineffective but is legitimated through purportedly naturalistic mechanisms (e.g., pregnant women should not eat legumes because the iron endangers the baby). According to the usage in this paper, the second taboo (naturalistic and ineffective) would qualify as a superstition, while the first (supernatural and effective) would not.

4. Mathematical models and empirical work with humans and other animals have found that organisms rely on social learning more under conditions of greater uncertainty (Boyd & Richerson 1988; Morgan et al. 2012, 2015; van Bergen et al. 2004). This shift in reliance from private information to cultural information may help sustain superstitious beliefs.

5. The cultural evolutionary story here combines (and rejects aspects of) models proposed by Boyd and Richerson and co-authors (BRC) (e.g., Boyd & Richerson 1985; Henrich 2015; Richerson & Boyd 2008) and Sperber and co-authors (SC) (e.g., Claidière et al. 2014; Sperber 1996a; Sperber & Hirschfeld 2004). It resembles models by BRC by invoking the imitation and selective retention of successful-seeming cultural variants

while appreciating that this cultural selection should drive the emergence of complex technologies. It diverges from models by BRC in ignoring or downplaying the involvement of cultural group selection (Boyd & Richerson 2010; Richerson et al. 2016) and stressing that functional technologies emerge from individuals adopting what *seems* to work (rather than from, for example, purely copying the variants of the successful or prestigious). The proposed model resembles approaches by SC by emphasizing how our evolved cognition (and cultural beliefs) bias which variants are transmitted and adopted. It is agnostic as to whether the preferential adoption of cultural variants comes from selection or reconstruction.

6. The point made in this section is distinct from minimal counterintuitiveness (MCI) theory (Boyer & Ramble 2001; Purzycki & Willard 2015; Sperber 1996b). MCI contends that minimal violations of basic inferences (e.g., a plant that vanishes) persist because they are memorable; I argue that individuals violate folk notions of humanness to increase the plausibility of their claims of supernatural abilities.

7. Researchers frequently cite the placebo effect as a potential mechanism by which the shaman provides benefits to community members (Achterberg 1985; Kleinman & Sung 1979; McClenon 1997). However, shamans alternatively may end up harming community members by triggering a placebo response. The shaman's presence may indicate to the organism that it is receiving genuine medical care, leading it to either mitigate symptoms that would protect it (nausea, pain) or re-allocate resources to self care (Humphrey 2002b). If the shaman is a false indication of genuine care, re-allocating resources or mollifying symptoms might be maladaptive, further endangering the patient.

8. The dataset is available for download at https://www.researchgate.net/profile/Michael_Winkelman2/publications?category=data. Shamans were determined to be those practitioners who use trance to provide services (variable 209, codes 1–7). For tabulating the frequency with which shamans had different jurisdictions, I used all of the codes concerning social roles (political powers: variables 13–16; lifecycle activities: 17–19) and then the four general domains of uncertainty available in the dataset: health care (variable 68); socioeconomic activities (variable 160; validated with variables 161, 163, 165, and 167); and weather control (variable 48). To organize societies by complexity, I merged Winkelman and White's (1987) database with the *Ethnographic Atlas* (Gray 1999), choosing corresponding societies based on shared culture names and shared bibliographic materials. I used EA-variable 33 (*Jurisdictional hierarchy of local community*) to distinguish between complex societies (code>1) and simple societies (code=1). Note that the Paiute and Tuareg each corresponded with several societies in the *Ethnographic Atlas*, but all Paiute societies were coded as simple, while all Tuareg societies were complex.

9. Winkelman (2000) differentiated among three main types of altered state of consciousness – soul journey shamanism, meditation, and possession – but regarded all of them as enabling the integrative mode of consciousness.

10. The proposed theory offers at least two hypotheses for why shamanism is so frequently linked to music: (1) Songs engage a credible-seeming trance state (see also Rouget 1985), and (2) songs bolster client or community credulity. These hypotheses make divergent predictions about which songs will be selectively retained. Assuming that people respond similarly to music around the world, however, both of these hypotheses predict common musical features of shamanic healing songs across musical systems.

11. The following variables were used: sex prohibition, initiation (variable 188); sex prohibition, ceremonial (variables 214 and 240); food prohibition, initiation (variable 189); food prohibition, ceremonial (variables 215 and 241); social isolation, initiation (variable 190); social isolation, ceremonial (variables 216 and 242).

12. For variables used, see codes pertaining to ceremonies in note 11.

Open Peer Commentary

Increased affluence, life history theory, and the decline of shamanism

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Abstract: I applaud Singh's proposition to use evolutionary psychology to explain the recurrence of shamanistic beliefs. Here, I suggest that evolutionary mechanisms (i.e., life history theory) also can explain the variability of the distribution of shamanism. When resources are abundant, individuals become more patient and more open minded to the point that science becomes cognitively attractive and may replace magic.

In the target article, Singh makes some suggestions as to when shamanism should decline, proposing, for example, that shamanism should decline when people stop believing that invisible forces are powerful, that human beings can interact with them, and that trance reveals supernatural power. Singh's suggestions, however, do not explain the decline. Instead, they only move the question one step further: Why did people stop believing in invisible forces?

One common suggestion to explain the decline of magic is Malinowski's theory (cited by Singh) that people believe less in magic when they start being better able to deal with uncertainty in their daily lives (Malinowski 1954). Yet, it is striking that the decline of shamanism (and, more generally, magic) started before any real advancement of modern medical techniques. For example, the early modern English stopped using magical techniques and believing in supernatural agents and supernatural powers *before* the alternative (science) started showing any effect. As Thomas (also cited by Singh) notes in *Religion and the Decline of Magic*:

The fourteenth-century Lollards who renounced the Church's supernatural protection against disease and infertility had no effective alternative to put in its place. Their doctrines gave them spiritual security, but no new means of material aid ... In the later seventeenth century the more general rejection of magic was still unaccompanied by the discovery of new remedies to fill the gap. It is often said that witch-beliefs are a consequence of inadequate medical technique. But in England such beliefs declined before medical therapy had made much of an advance. (Thomas 1971b)

How can the decline of magic be explained? An important factor might be the unprecedented increase in living standards experienced by English people (and more generally, by Europeans and Americans) from the seventeenth century onward (Allen 2001; Broadberry et al. 2015; Morris 2013). Indeed, affluence has predictable effects on human psychology (for a recent review, see Pepper & Nettle 2017) and can alter the dynamic of cultural evolution (Baumard & Chevallier 2015; Baumard et al. 2015). In particular, recent research inspired by life history theory has shown that, in a harsh environment, when resources are low and unpredictable, individuals tend to be more short-term oriented, more risk averse, and more conservative. By contrast, in an affluent environment, individuals are future oriented, risk prone, and open minded.

This variability makes sense from an evolutionary perspective. When resources are high:

1. Organisms can allocate resources to activities that have high but delayed benefit because they can afford to wait (Houston & McNamara 1999).

2. Organisms can allocate resources to high-risk/high-reward activities with unpredictable benefits because they can afford to take a loss (Nettle 2009).

3. Organisms can invest in activities that have a moderate return on investment because they already have filled more vital and basic needs (food, self-protection, social status) (Kenrick et al. 2010).

In line with the predictions of life history theory, a range of studies have shown that the level of resources has a strong effect on:

1. People's relation to the future (Cornelisse et al. 2013; Ifcher & Zarghamee 2011; Lerner et al. 2013; Yesuf et al. 2008)

2. People's tendency to invest in high-risk/high-reward actions (Cohn et al. 2015; Dohmen et al. 2011; Guiso & Paiella 2008; Guiso et al. 2013; Kandasamy et al. 2014) and to be optimistic and confident about one's ability to influence the environment (Haushofer 2013; Lundberg et al. 2007; Poortinga et al. 2008) and

3. People's tendency to be explorative, open-minded, and non-conformist (Cashdan & Steele 2013; Gelfand et al. 2011; Murray et al. 2011)

Life history theory thus predicts that, when an individual is poor and must focus on a small range of priorities, most actions should appear as hopeless, risky, and counterproductive. By contrast, when the same individual is rich and has filled basic needs, a lot of opportunities now must appear as fruitful, safe, and promising; therefore, the individual should be optimistic and confident in the ability to transform the world. Because such individuals have filled their basic needs, they also should see materialistic rewards as less interesting and find exploratory and gratuitous actions more enjoyable. They also should be less afraid of social disapproval and, consequently, more independent minded.

The rising standards of living experienced by Europeans thus could have changed individuals' psychology from a pessimistic, conformist, and conservative outlook to a more optimistic, non-conformist, and progressive one. As a result, Europeans would have started being more confident in the capacity to change the world, to propose new theories, and to test them. In turn, this optimism would have made the experimental method and the rationalistic approach of psychology more appealing. This is despite the fact that, in the seventeenth century, there was no evidence yet that experiments and science could really improve people's situations. As Thomas (1971b) writes: "The change was less a matter of positive technical progress than of an expectation of greater progress in the future ... It marked a break with the characteristic medieval attitude of contemplative resignation."

To put it in another way, we are claiming that, because science is highly counterintuitive (McCauley 2011) and requires a lot of time and resources, it is to be expected that individuals will deem science worth attention and investment only when they start being optimistic and patient.

To conclude, evolutionary psychology has the potential to explain both the recurrence of the belief in shamanism (as in Singh's article) and its variability.

Shamanism within a general theory of religious action (no cheesecake needed)

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Abstract: Singh places the understanding of shamanism within the cognitive/evolutionary psychology of religion but is then sidetracked by presenting unhelpful analogies. The concepts of "superstition" as a

general term for religious rituals and of “superstitious learning” as a mechanism accounting for the creation of rituals in humans reflect an underestimation of the human imagination, which is guided by cognitive/evolutionary constraints. Mentalizing, hypervigilance in agent detection, and anthropomorphism explain the behaviors involved in religious illusions (or delusions).

Singh proposes to integrate the study of shamanism into the broader framework of the cognitive/evolutionary psychology of religion and offers a behavioral description of shamanism as “a suite of practices developed through cultural evolution that adapts to people’s intuitions to convince observers that a practitioner can influence otherwise uncontrollable events” (sect. 1, para. 7).

The vignette that opens the article presents the basic elements of the practice: a dramatic performance by persons who use their bodies to generate genuine ecstasy based on fake physical evidence, leading to some closure, if not resolution (Porterfield 1987). It may fail completely, but closure will be offered. Although disease entities are sometimes displayed as physical, the ultimate death and life power lies with the spirit world. This notion is commonplace, even in the absence of shamans and in the presence of biomedicine (Legare et al. 2012).

In specifying the psychological mechanisms involved in religious practices, Singh seems to ignore the cognitive approach he claims to embrace. The choice of *superstition* to describe evolved religious practices is less than enlightening. We may regard these ineffective behaviors as based on illusions (or delusions), but calling them superstitions lacks a theoretical connection.

Directing the reader to Skinner’s notion of superstitious learning does not help, because this notion is less significant than the reality of human cognition for religious actions. The implied connection between practices referred to as *superstition* and *superstitious learning* is misleading. Using our anthropomorphic vocabulary, Skinner (1948) describes an animal that is trying to determine causality and reaches a mistaken inference. By the time an animal forms a mistaken inference, an average human creates a theory of everything (mostly borrowed from cultural traditions). Burger and Lynn (2005) and Henslin (1967), cited by Singh, demonstrate how the process of creating superstitions in humans is conscious and the connection to reinforcement unclear.

Observational learning in humans (Bandura et al. 1966) involves superior cognitive abilities and shortcuts. This is how humans may acquire large chunks of symbolic and practical behaviors. I may suffer from triskaidekaphobia (fearing number 13) not because of any negative experiences with the number, but because of what I learned from peers. The history of religion is filled with failed prophecies, sometimes repeated, that don’t shake up the believers most of the time; they carry on with the help of their beliefs and in the absence of any reinforcement. Finding excuses for lacunae in theorizing comes naturally to shamans, academics, and the rest of humanity.

The basis for all religious practices is an imagined interaction with spirits (Beit-Hallahmi 2015). Humans, like pigeons, reach mistaken inferences, but their reasoning is affected by mentalizing (i.e., fantasizing about other human minds or the minds of spirits). Mentalizing, hypervigilant agent detection, and anthropomorphism explain the development of rituals Singh calls superstition.

An example of the way humans believe they pacify angry spirits, great and small, is found in Genesis 8:20–22:

And Noah builded an altar unto the Lord; and took of every clean beast, and of every clean fowl, and offered burnt offerings on the altar. And the Lord smelled a sweet savour; and the Lord said in his heart, I will not again curse the ground any more for man’s sake; for the imagination of man’s heart is evil from his youth; neither will I again smite any more every thing living, as I have done. While the earth remaineth, seedtime and harvest, and cold and heat, and summer and winter, and day and night shall not cease.

Could animal or human sacrifice (Sanday 1987) be the result of superstitions learning? The notion of savory offerings came from

fantasies about *other minds* (or *spirit minds*), rather than from any reinforcement schedules.

How are shamans different from other religious practitioners? What is the difference between shamanic practices and the Noah ritual, which aims at keeping humanity (and the cosmos) from extinction? Shamanic performances and general-purpose devotional or apotropaic rituals are predicated on (1) the same cognitive shortcuts and (2) the same notion of spirit contact. Singh quotes observations about one culture in which shamans “confer protection and good luck,” but all religious practices and practitioners everywhere are assumed to do that.

Accounts of shamanic success belong in the genre of miracle narratives, which assure us that, even if the universe is not totally benign, benevolent forces may intervene on our behalf if we know how to contact them. Miracles are tied to the presence of spirits, if around a saint’s tomb or during a trance. Spirit contact may be intense and brief, in shamans, or less intense and permanent, in a holy site. If acts of worship contribute to safeguarding human existence or tribal welfare, the focus in shamanic acts is on concrete problems and not the cosmic order. Those who specialize in divination and healing enjoy a lower status compared with religious leaders charged with offering insights into the fate of the cosmos and the minds of great spirits. Still, the closure offered by shamanic performances contributes to the illusion of cosmic equilibrium.

Singh ends the article with a puzzling metaphor: the shaman as cheesecake, that is, the shaman as “an exquisite confection crafted to tickle the sensitive spots of our mental facilities” (Pinker 1997, p. 534). This is taken from Pinker’s *How the Mind Works*, and what Singh left out reads “music is auditory cheesecake.” Pinker claimed that music has no evolutionary value, just as others have claimed that religion is a byproduct of valuable evolved mechanisms; I share their views. Pinker’s cheesecake metaphor seems particularly ill chosen (Carroll 1998; Davies 2010), if only because the worst cheesecake still has some nutritional value. Singh has shown convincingly that the shaman’s acts are based on deception; however, he is so eager to remind us that all religious practices and interventions are illusionary or delusional that he has decided to embrace this image, which detracts from the value of his analysis.

Shamanism and efficacious exceptionalism

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Abstract: Shamans can have efficacy at healing through botanical remedies and in observational and advisory functions through cognitive strengths, while shamanic acts of strangeness are likely honest signals of these qualities. Given this potential for shamanic practices to have true efficacy and the capacity for honest signaling, we expect efficacy will influence the spread, persistence, and loss of shamanic practices.

Singh argues that shamans need not be effective to be successful; shamanism will spread because convincing others that they can interact with invisible forces is sufficient. Although this may be true in a narrow sense, we argue that, because these practices are often linked to *actual* efficacy, effectiveness likely plays a larger role in observed features of shamanism than Singh presents. We suggest that, *ceteris paribus*, effective practices will outcompete ineffective ones and that many superhuman shamanic acts are not just illusions of strangeness, but are direct, honest signals of qualities related to effectiveness and power of influence.

Therefore, effectiveness is important for understanding the cultural evolution of shamanism and the features of shamanic practices found across cultures.

To illustrate the potential for effective practices, we first consider healing. Shamans might successfully treat disease by either treating the underlying causative agents through medicine or providing support during healing. The first of these often is proffered through botanical remedies, many of which have been found to have some efficacy; some have even contributed to the development of Western drugs (Heinrich & Gibbons 2001). Psychotropic drugs commonly employed by shamans (e.g., tobacco, marijuana, and ayahuasca) also have antiparasitic or purgative effects (Andritzky 1989; Hagen et al. 2009; Roulette et al. 2014; 2016; Sullivan et al. 2008). Psychotropic properties, bitterness, and obvious effects such as vomiting are clear signals of plants' toxicity; thus, they may serve as clear signals of antibiotic activity – cues that humans and other animals likely have evolved to seek out for their antiparasitic properties (Hagen et al. 2013). In other words, shamans use substances with medical efficacy, even if they do so without understanding the mechanisms of action.

Second, shamans might be particularly adept at recognizing hidden patterns and thus might be able to intuit many things effectively. Despite their unpredictability, human and animal behaviors do exhibit predictable patterns. A good shaman is able to recognize patterns of all kinds, in a process that might be facilitated by some trance or hallucinogen usage: "Ayahuasqueros use this imaginative power of the drug to teach unsuccessful hunters to recognize animals and their behavior. The hunter in the trance state has to imagine an animal and project it onto a natural setting; then he describes it to the shaman who corrects his vision" (Andritzky 1989). The same theory of mind skills useful for predicting animal behavior are useful for thinking about human minds, as well; this is further evinced by the often central role of shamans as psychiatrists, consultants, and organizers in the judicial, economic, and sociopolitical spheres (see Fig. 3 in the target article).

Third, shamans systematically serve as repositories of knowledge. Shamans have remarkably rich cosmological views and wisdom traditions that are otherwise unknown to the laity; they also recognize that other practitioners have different powers and understandings (Purzycki 2012). Shamans are often individuals who are particularly good at remembering and organizing botanical and other knowledge, preparing recipes (e.g., ayahuasca, which is fairly complicated to prepare), knowing their clients, and discovering new patterns in the world. Singh argues that it is unlikely that shamans possess technical knowledge, such as specialized botanical knowledge, because limited personal privacy and frequent interaction would make it hard to conceal such information. This might be true for the most common remedies; most individuals can and do learn about these remedies because they will need them frequently. This is not true of specialized knowledge used less frequently, however. In this case, a specialist who carves out a niche as a centralized repository could be quite successful (Sugiyama & Scalise Sugiyama 2003). Such a specialist would not have to actively conceal knowledge, because it is simply too costly for other individuals to acquire it. Indeed, the ethnographic record is replete with examples of societies in which medicine people cultivate niches with specialized knowledge and power. Some even have specific titles indicating their expertise (Feraca 1998; Grim 1983).

If we posit that shamans possess specialized, effective skills and abilities, then it is no stretch to see performances of strangeness as honest signals of many of these abilities. Initiation rituals, demonstrations of pain resistance, and other dramatic performances are honest signals of willpower, commitment, and physical constitution. Further, considering how often hereditary shamans (Crow Dog & Erdoes 1995) and/or kin-specific ritual orders (Whiteley 1998) appear in the ethnographic world, it should be no surprise if many of these behaviors indicate genuine, even partly heritable qualities. For example, shamans may possess traits such as

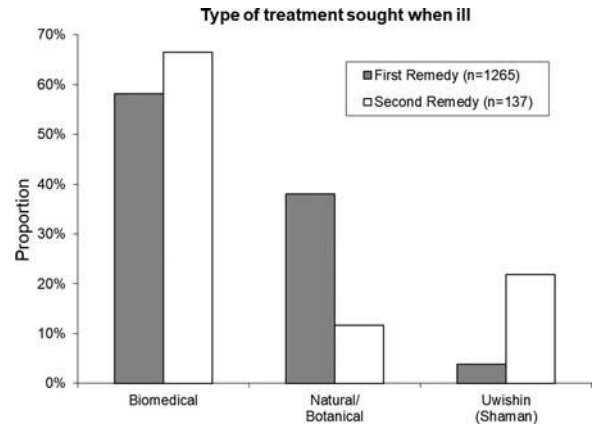


Figure 1. (Blackwell & Purzycki) Type of treatment sought by Shuar who identified themselves as having been ill during the 2 weeks preceding a census survey of villages. Treatments were grouped as biomedical (doctor, health promoter, auxiliary health promoter, aerial ambulance), natural or botanical, or shaman (*uwishin*). Individuals who did not recover after seeking treatment were asked whether they sought additional treatment (second remedy). *Uwishin* were much more likely to be sought out as a secondary rather than primary remedy (OR = 7.08, 95% CI = 4.30–11.50, $p < 0.001$). From Blackwell (2009).

cytochrome P450 polymorphisms that facilitate detoxification (Ingelman-Sundberg et al. 2007); by repeatedly consuming psychotropic substances, shamans exhibit that they have the knowledge to prepare recipes and the constitution to detoxify toxic substances. Such traits may be important for shamans who expose themselves to many plant toxins, both through preparation of treatments and because shamanic knowledge is sometimes gained through something like trial-and-error testing of different plants. Indeed, Singh quotes older shamans' lamentations that "young people are not interested or are not able to endure the diet and continence necessary for learning from the plants" (Luna 1984).

Given the potential for shamans to have some efficacy in a variety of domains and the potential for shamanic performances to signal true qualities, it is unrealistic to think efficacy will have little effect on the persistence and diversification of shamanic traditions. Shamans do compete with one another, as do their ideas and practices. Any practice that is actually effective would likely be favored over those that are not. In fact, Singh overlooks one of the key reasons for the collapse and loss of shamanic practices in recent times – competition with Western medicine, which is often even more effective at healing. Amongst the Shuar of Ecuador, individuals are more likely to pursue Western medicine first, turning to shamans only as a secondary remedy when Western medicine fails (Fig. 1). Paradoxically, this preference for Western remedies might provide a piece of key evidence supporting our assertion that effectiveness does matter in the selection and persistence of shamanism.

Enjoying your cultural cheesecake: Why believers are sincere and shamans are not charlatans

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Abstract: Cultural evolution explains not just when people tend to develop superstitions, but also what forms these beliefs take. Beliefs that are more resilient in the face of apparent refutations and more susceptible to occasional confirmation stand a greater chance of cultural success. This argument helps to dispel the impression that shamans are mere charlatans and believers are “faking it.”

Among many other insights into shamanism and supernatural belief, Singh has offered a useful decision tree for sorting different types of events and deciding when people are likely to develop superstitions. Superstition-prone events are those that are “uncontrollable, fitness relevant, and random” (sect. 3.1, last para.). I want to extend Singh’s cultural evolutionary analysis to the nature of the superstitious beliefs themselves. It is one thing to explain *when* people tend to develop superstitions, and another to explain what form those superstitious beliefs will take. One dividend of such an analysis is that it helps to dispel the impression of charlatanry and insincerity in shamanistic traditions and, indeed, in religious traditions in general.

What sorts of supernatural powers do people attribute to shamans? Singh’s classification of events provides a clue: People are unlikely to consult a shaman to bring about events that, though desirable and uncontrollable by natural means, will just never occur (e.g., preventing winter from coming). Why not? The reason is obvious. Belief in a magic ritual for halting the turn of the seasons would never be culturally stable, because it would lead invariably to disappointment. A similar point applies to beliefs about how to identify shamans. People might believe that a true shaman, when stabbed during a trance state, will not bleed, but they are unlikely to stab him in the heart or around the arteries.

This points to a problem that all supernatural beliefs – including those about the powers of shamans – have to confront in the real world: the potential destabilization of predictive failure. Now, unlike belief in an eternal summer, superstitions about events that are uncontrollable and random (from the limited epistemic perspective of believers) will at least result in occasional success. Even so, assuming that the interventions are causally innocuous (i.e., don’t work), there will still be plenty of failures to account for. And though people are prone to confirmation bias, that does not mean they are immune to blatant refutations. How do beliefs in supernatural powers survive on a meager diet of confirmations and in the teeth of falsification?

Some misbeliefs are more resilient than others. Based on a cultural evolutionary framework, we can expect that overly fragile beliefs will be extinguished sooner or later, and that more resilient beliefs will survive. Beliefs can be resilient against falsification by providing more interpretive leeway to explain away failure. For example, rituals involving a relatively complex chain of steps are more resistant to falsification than straightforward ones. Given that rituals are causally opaque (Boyer & Bergstrom 2008), their efficacy can be inferred only indirectly by observing the outcome. If the desired result fails to appear, that could mean the ritual doesn’t work, but it could also mean that it was not carried out properly.

Because they contain more things that can go wrong, complex rituals provide more opportunities for retroactive *ad hoc* explanations (what Evans-Pritchard [1937] called “secondary elaborations”) to account for predictive failure, compared with more straightforward rituals. This line of reasoning may explain how rituals *become* more complex (Legare & Souza 2012), as elements are added (or existing ones repeated) to explain why the ritual has failed on a particular occasion. Resilience is enhanced also by making the diagnosis more complex, as in the opening anecdote of Singh’s article. A shaman kills a number of evil ghosts, but the patient dies anyway. Well, he laments, “in the end, the ghosts were too numerous.” Is this expressing fatalistic regret, as Singh put it, or is it better to say that the shaman is drawing a reasonable explanatory inference and might even change his procedure next time?

Beliefs also are better protected against refutation when they allow for subtle feedback loops between diagnosis and remedy (Boyer 1994, p. 144). For instance, shamans might try out different procedures until one appears to work and then use this observation to settle on a diagnosis. The same feedback loop can occur in the client’s choice of shaman. If people believe that different shamans have different areas of expertise, they can shop around until they observe some improvement. In this way, the belief in shamanic powers itself is never threatened.

Finally, resilience is provided by the nature of the supernatural agents in question. In general, people are more likely to profess belief in supernatural agents that are capricious, moody, inscrutable, inattentive, and unpredictable, because such beliefs provide better resources for explaining failure. Gods who move in mysterious ways are culturally more successful than those who move in more reliable ways (Boudry & De Smedt 2011).

By appreciating how cultural evolution makes supernatural beliefs more resilient and less vulnerable to refutation, we can better understand the semblance of charlatanry. Skeptics have long asked rhetorically: Why don’t people pray for an amputated limb to grow back if they really believe God is omnipotent? Why all the crutches and braces in the grotto of Lourdes and not a single wooden leg or glass eye (France 1894)? When Meyer Fortes invited an informant to perform a rain dance for him, the man replied, “Don’t be a fool, whoever makes a rain-making ceremony in the dry season?” (Tambiah 1990, p. 54). A skeptic may ask, “Doesn’t this show that it’s all a sham?” Anthropologists and scholars of religion often express incredulity in the face of such incongruent behavior (Chaves 2010). When one looks at the evasive behavior of believers, the studious avoidance of potentially threatening observations, and the convenient resort to *ad hoc* explanations, one is left with an impression of insincerity (Boudry & Coyne 2016; Humphrey 1995).

But a cultural evolutionary framework helps to dispel this impression. Beliefs have evolved to become resilient and immune to refutation, which does not (necessarily) involve deliberate deceit or hypocrisy on the part of believers. The functional rationale of resilience is relocated on the level of the cultural representations themselves (Dennett 2006). If the cheesecake recipe has been fashioned by cultural evolutionary forces, there is no particular reason to doubt that the consumers genuinely enjoy it.

Missing links: The psychology and epidemiology of shamanistic beliefs

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Abstract: Singh provides the skeletal elements of a possible account of shamanism-like beliefs in many human societies. To be developed into a proper theory, this model needs to be supplemented at several crucial points, in terms of anthropological evidence, psychological processes, and cultural transmission.

Manvir Singh’s target article outlines a possible account of widespread shamanistic beliefs. Singh must be commended for avoiding otiose terminological quibbles (there is a family resemblance here, so the challenge is to explain the recurrence of similar beliefs, rather than survey the denotation of “shamanism”) and for addressing the issue as one of cultural evolution informed by evolutionary theory. A focus on shamanism also serves as a reminder that, as far as we know, in the contexts in which humans evolved, the most widespread religious behaviors had

no consistent doctrines, organizations of priests, fixed liturgy, communities of believers, or straightforward connection to moral prescriptions or prosocial attitudes.

To provide a serviceable hypothesis about the transmission of shamanism-related belief, Singh's model will require considerable additions and refinement with respect to the anthropological record, the psychological processes involved, and the mechanisms of cultural transmission, respectively.

As concerns the ethnographic database, there are many relevant variations within the family resemblance described by Singh (i.e., exceptional mental states and notion of superhuman agency associated with the management of misfortune and uncertainty). In particular, the ways in which people construe the special powers and activities of a shaman vary a lot (Vitebsky 1995b) among quasi-medical analogies (Gellner 1994); analogies to hunting and predator-prey interaction (Hamayon 2003); fights for the ownership of souls (Mallart Guimerà 2003; Stepanoff 2014); attempts to reassemble dissociated souls (Crocker 1985); and many more. The point here is not that a model of shamanism should accumulate details and variants for the sake of documentation, but that observed variations in conceptions of shamans and their work may offer good terrain on which to test more precise hypotheses about the conditions of cultural transmission, as detailed below.

Regarding the underlying cognitive processes, Singh describes the situations using shamanism as those in which there is uncertainty about outcomes and no clear way to reduce that uncertainty. He also argues that people typically construe such outcomes in terms of agency (spirits, gods, souls, etc.) rather than general causal principles. The crucial connection between misfortune and superhuman agency, however, cries out for an explanation. In section 3.3.1., Singh mentions that "sociocognitive biases" are involved here; that, of course, is a label, not an explanation. One cannot blame Singh for not finding a solution to this difficult, unsolved problem, but it is crucial to recognize that this important part of the puzzle is missing.

To explain cultural transmission (explaining why these representations are recurrent in many places), Singh refers to "cultural evolution," but there is no precise connection to models of cultural transmission. For example, in section 3.3.1., Singh alludes to prestige and conformity biases (Boyd & Richerson 1985), which are indeed observed in many domains of transmission but may not be relevant here. The biases in question would require either (1) that shamanism actually provides good outcomes (so people keep practicing it, free-riding on the trial-and-error of previous generations, as Boyd and Richerson showed that they do for technology=conformity bias), or (2) that shamans are prestigious independently of their practice (so people imitate the shamanistic rituals as a way to achieve that social status=prestige bias). Neither is the case, however; shamanism is not efficacious, and shamans have social clout only to the extent that they are thought to be efficacious. Incidentally, note that, in many places, shamans are feared or despised (Hugh-Jones 1996; Mallart Guimerà 2003; Stepanoff 2014, p. 65).

Singh's own summary description of shamanism suggests that we are dealing with what cultural transmission theorists would call a cognitive attractor, that is, a particular point in conceptual space more likely than others to be represented in people's recurrent beliefs (Claidière et al. 2014; Claidière & Sperber 2007). Specifically, what is observed here is a combination of (1) the assumption that concepts of superhuman agents are relevant to cases of uncertainty or misfortune, which is very common in many human societies; and (2) the assumption that demonstrations of publicly observable exceptional mental states indicate some special capacity in connection with those superhuman agents. This combination of assumptions was reinvented probably many times in human cultures. What makes it optimally relevant, such that people would tend to reconstruct it in such similar ways? As Singh points out, trance certainly suggests exceptional qualities. That is often interpreted in essentialist terms, suggesting

that shamans are internally different from other people. We still do not know, however, why that difference would be associated with better access to superhuman agents or a better capacity to bridle them.

Perhaps ethnographic accounts may be of help here, for example, showing how people perceive the counterintuitive properties of trance and possession (an agent is both here and somewhere else, controlled and in control) as an index of mastery rather than passivity (Cohen 2007). More generally, it would seem that the model can be made much better if attention to cultural variants is systematically connected to a rich psychology, rather than the simple conjecture that people need reassurance against uncertainty and comfort in misfortune.

Some needed psychological clarifications on the experience(s) of shamanism

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https://www.saybrook.edu/faculty/byname/Stanley_Krippner/

Abstract: The target article's use of core concepts is confused and excessively broad. Two main types of experiences have been described in relation to shamanism: magical flight and mediumship/possession. The first refers to visual and remembered experiences of events in other realms, the second to embodied experiences of ceding mental control and personality to a preternatural entity. These experiences grossly correspond to two main experience modalities exhibited by highly hypnotizable individuals in a secular setting.

A good cultural evolution theory of shamanism would be a welcome contribution to the literature, but the target article errs in core concepts and misrepresents the cited literature. We find other issues problematic (e.g., the disregard of the potential practical benefits of shamanism; see Kleinman 1980), but will concentrate on clarifying the alterations of consciousness related to shamanism. Singh defines shamans by their manifestation of trance, but misrepresents how the concept is used in the literature. Section 4.2 (Trance Is a Drama of Strangeness) implies that trance is produced by a number of techniques, including starvation, meditation, and relaxation that produce "different physiological and psychological effects" and cites an article by Vaitl et al. (2005). That article, which reviews the literature on 20 different alterations and inducing techniques, *only* refers to trance as one of them, characterized by narrowing of awareness, select focus, stereotyped behaviors, and lack of control brought about by repetitive drumming (Vaitl et al. 2005, p. 107). Even worse, Singh (sect. 4.2) equates trance and ecstasy, referring to Rouget's (1985) work, but Rouget specifically differentiated them. "Ecstasy and trance may therefore be characterized in relation to one another by a series of terms: Ecstasy (immobility, silence, solitude, no crisis, sensory deprivation, recollection, hallucinations); Trance (movement, noise, in company, crisis, sensory overstimulation, amnesia, no hallucinations)" (Rouget 1985, pp. 10–11; see also Cardeña 1992). Rouget considers them opposite poles of a continuum.

For Eliade (1964), only what Rouget refers to as *ecstasy* (etymologically referring to being outside of the body, and which may involve the use of hallucinogens) counts as shamanism. Its prototype includes a soul journey or magical flight in which the shaman leaves the physical body (which is mostly immobile or engages in repetitive movements) to experientially travel, sometimes imitating or "transforming" into an animal such as an

eagle, to another realm in which he or she may interact with other beings (Balzer 1996). Eliade thought that mediumship/possession (similar to Rouget's "trance"), involving the experience of becoming a vessel for a preternatural entity, is a later, "degenerate" version of shamanism. Empirical support for Eliade's conclusion of possession as a later cultural development was provided by both Bourguignon's (1976) and Winkelman's (1992) analyses, which place classical shamanism (or ecstasy) within hunting/gathering societies, and mediumship/possession within more sedentary, hierarchical societies.

Walsh (1990) stated that only ecstatic experiences imply mastery of the spiritual (or altered consciousness) realm, but mediumship/possession can become a controlled manifestation in which practitioners choose when and how to become possessed (e.g., Cardeña 1996). Hence, we endorse a definition of shamanism that includes both magical flight and mediumship/possession involving: (1) expertise in altering one's (and sometimes others') consciousness, or, in more emic terms, mediating between sacred and profane realms; (2) the ability to fulfill the needs of the community; and (3) social recognition (Heinze 1991; Krippner 2002). We are skeptical that the same cultural evolution processes can explain varying phenomena across different social organizations. To give but one example, a discussion of professionalization is likely to be more pertinent to the socially stratified milieu of mediumship/possession than of classical shamanism. Furthermore, we cannot think of a scholar who uses as broad a definition of shamanic practices and experiences as Singh does.

An important question is why ecstasy and trance have appeared throughout history and around the globe. An explanation with empirical grounding is that they refer to states that people tend to experience, whether in a Brazilian rainforest or in a secular laboratory setting. Research on the phenomenology of highly hypnotizable people has found that they tend to fall into two types: one more characterized by inward attention and vivid imagery or fantasy (more like ecstasy), and the other by a sense of low control and lack of remembrance (more like trance) (Barber 1999; Cardeña 1996/2005; Pekala & Forbes 1997; Terhune & Cardeña 2010; Terhune et al. 2011). These are approximate parallels, of course, and there are also differences. For instance, although some highly hypnotizables may spontaneously experience floating or flying out of the body (similar to a "magical flight") in hypnosis, they lack a cultural framework to interpret such experiences as referring to other realms of existence (Cardeña 1996; Cardeña & Krippner 2010).

This brings us to another point that is confusingly discussed in the target article. According to Singh, shamans usually go through initiation rituals to become members of guilds that regulate practice. Although this may occur sometimes, we have found far more evidence in our field observations and the literature that initiation and training provide an ethnoepistemology to make sense of unusual experiences and techniques to bring them under control, as the potential shaman might have suffered previously disorganized, uncontrolled, and dysfunctional episodes (Cardeña & Shaffer 2017; Halifax 1979). Thus, it is not that any strange experience or oddity is exploited by people wanting to be shamans (some individuals resist the call to become a shaman), but that they have unusual experiences and seek to bring them under control for their and others' benefit. *Contra* the target article, it is not uncommon to find that the manifestations of some traditional healers become less dramatic and strange as they develop mastery (e.g., Cardeña 1991).

Singh also makes other questionable statements. He mentions "the substitution of mystical explanations with naturalistic ones," apparently counterposing what he takes to be irrational with rational explanations. In reality, a number of eminent scientists throughout history (Einstein, Kepler, Newton, Oppenheimer, Planck, and Schrödinger, among others) have integrated a mystical perspective with logic and science (Bakan 1969; Russell 1917/1970). (The term *mystical* refers to a sense of interconnectedness

reality, not irrationality or anti-naturalism [Wulff 2014].) He also criticizes that phenomena such as out-of-body experiences can be experienced by "Westerners ... familiar with scientific epistemologies" even though having anomalous experiences does not imply irrationality or psychopathology, can be experienced by anyone with that propensity, and can be studied using the scientific method (Cardeña et al. 2014). A theory of shamanism needs to have a clear understanding of its explanandum and review the evidence carefully.

Genetic predilections and predispositions for the development of shamanism

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Abstract: Singh's cultural evolutionary theory of shamanism provides a valuable framework for understanding shamanism. We argue, however, that a full understanding of shamanism should incorporate the psychological predilections and genetic predispositions commonly found in individual shamans. In other words, only a small subset of individuals in a culture is prone or attracted to shamanistic practices, regardless of the evolutionary value of those practices.

Singh's cultural evolutionary theory of shamanism primarily illustrates the cultural traits that are selected for based on their efficacy in bolstering a shaman's credentials. Although identifying the functions that shamans practice is integral to understanding the development of shamanism, in the present essay we argue that not all individuals in a culture have the psychological predilections or genetic predispositions to become shamans.

Shamanism commonly involves not only a predictable cluster of practices, but also a predictable cluster of personal characteristics in its practitioners. As Singh described in his review, the profession of shamanism is limited to a select few who are recognized as possessing shamanic potential. This potential is designated not only by cultural practices, but also by psychological and medical conditions resulting from genetic predilections or predispositions such as epilepsy (and associated auras and seizures), ambiguous sexual identity, polydactylism, proneness to psychotic states, and personality disorders. Indeed, several of Singh's defining shamanistic characteristics imply underlying psychological propensities. For example, psychosis, by definition, is a psychological propensity toward delusions, hallucinations, and/or unusual or arcane speech and behaviors. Charlatanism implies a propensity to deceive and manipulate. A proclivity toward entering trance states implies an intentional or unintentional tendency to do so. We believe that the explicit incorporation of such personal factors is vital for a comprehensive theory of shamanism for several reasons.

First, cultural pressures alone are not sufficient to explain the initial emergence of shamanism within a culture. As Singh observes, shamanism is the *only* profession in a society in many cases. It is extremely improbable that the cultural demand for a practitioner capable of influencing uncertain outcomes has happened strictly by chance to be the only cultural demand to be capitalized upon in societies. Rather, it is far more likely that intrinsic personal characteristics have led individuals in societies to conclude and assert that they have dominion over uncertain outcomes and, in so doing, establish a tradition that capitalizes on cultural needs and demands.

Second, the cultural pressures described by Singh select for both genetic predispositions and behavioral practices. This implies that shamanism involves a distinct mix of both behavioral

practices and genetically influenced personal characteristics in almost all cultures. As an example, Singh presents the case of a shaman who possesses a genetically determined personal characteristic and attains higher credibility than a rival shaman who possesses equally convincing practices but lacks that credibility-bolstering characteristic. Because shamanistic practices often carry evolutionary costs (e.g., celibacy, starvation, chemical toxicity) and because many credibility-bolstering personal characteristics do not necessarily carry these costs, shamans who established their credibility strictly through cultural practices frequently would be at a disadvantage compared with shamans with additional beneficial personal characteristics. This implies the third and final reason to be discussed: The phenomenon of shamanism has biological, psychological, and cultural repercussions.

Many evolutionary psychologists have argued that the genes that contribute to the development of schizophrenia were selected for because of their association with shamanism (e.g., Polimeni & Reiss 2003). Despite myths to the contrary, however, schizophrenia is more often than not a highly debilitating disease, both socially and interpersonally. It is a highly genetically influenced disease of a polygenic nature (many genes, each with a small but cumulative effect), which may indicate that relatives of schizophrenic people may have similar propensities and related behaviors without the debilitating side effects. The same is true of related disorders such as schizotypal personality disorder, which is characterized by odd beliefs, magical thinking, highly superstitious behavior, and beliefs in telepathy, clairvoyance, or a sixth sense (e.g., Segal et al. 2006). Further, evidence suggests that schizophrenia and schizotypal personality disorder overlap substantially, both genetically and neurobiologically (e.g., Ettinger et al. 2014), such that the milder but highly related version of schizophrenia, that is, schizotypal personality disorder, may be particularly advantageous to shamans. In the same vein, the major personal characteristic implicated by the charlatanism hypothesis of shamanism, namely, deceitfulness and conning others, has been found ubiquitously in all cultures with individuals who have antisocial personality disorders, and the latter is also polygenic and highly genetically influenced (e.g., Rosenström et al. 2017).

Additionally, following the agricultural revolution, shamanism may have been a contributor to the co-evolution of cultures with local psychoactive substances, especially those that alter perceptions. The universal cultural practice of ingesting psychoactive substances dates back to pre-agricultural societies and was motivated primarily by shamanism, ritual, and medicine (e.g., Wadley 2016). Following the advent of farming, it appears that various cultures began to domesticate psychoactive substances, including those that alter perceptions and mood. Therefore, it is also theoretically possible that, if shamanism had not been common in ancient societies, many perception and mood-altering substances (such as psilocin, mescaline, and scopolamine) may have been less prevalent or less prestigious in subsequent generations.

The emergence, development, and repercussions of shamanic traditions all involve dynamic interaction between biological, psychological, and cultural factors. By viewing shamanism as only a suite of practices and focusing primarily on how shamanic practices have been shaped by cultural pressures, we think Singh presents a restricted view of shamanism. Nonetheless, the framework his theory provides is capable of organizing both the clusters of practices and personal characteristics commonly found in shamanism. Most importantly, it offers a convincing explanation as to why they have consistently emerged across numerous cultures and generations. It is our hope that this brief attempt to incorporate previous relevant data into Singh's model will illustrate the full utility and applicability of the cultural evolutionary theory of shamanism for future research.

The cultural evolution of war rituals

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Abstract: The cultural evolutionary processes outlined by Singh illuminate why ritualized behaviors aimed at controlling unseen forces and overcoming fear are common in warfare among many small-scale societies. They also suggest an explanation for the development of ritual specialists for war who are distinct from war leaders.

Singh proposes a plausible account for the emergence of shamanism in which the desire of agents to influence events drives cultural evolutionary processes in domains with unpredictable, fitness-relevant outcomes. No other domain of behavior is perhaps costlier than warfare, which likely had large selective consequences in human evolution and for which success is often uncertain (Glowacki et al. 2017; Rusch 2014). Singh's account points the way toward understanding two features common to warfare in many small-scale societies: first, the prevalence of behaviors that are often ritualized and aimed at controlling unseen forces, enabling warriors to overcome fear; and second, the development of a class of ritual specialists for warfare that are distinct from war leaders and who often do not participate in conflict themselves.

The outcome of war is uncertain, and failure may result in the loss of one's life. Fear commonly accompanies anticipation of conflict, both in contemporary militaries and among warriors of small-scale acephalous societies (Bell 1935; Chagnon 1977; Goldschmidt 1994). Although cultural systems contribute to incentivizing participation (Glowacki & Wrangham 2013; Zefferman & Mathew 2015), humans also adopt superstitious beliefs and behaviors to overcome anxiety and fear and increase self-confidence. Warriors in numerous societies carry amulets or use drugs and alcohol to mitigate fear (Goldschmidt 1994). With astonishing frequency, many of these interventions purport to make enemies unable to see or harm the warrior. For example, Tanga warriors of Papua New Guinea who carried a sprig of ginger around their necks were "coated in a suit of magic armour which neither axe nor spears ... could penetrate" (Bell 1935, p. 269), and Lakota participating in the Ghost Dance who wore "spirit shirts" were bulletproof (Bearor 2011). Soldiers in the Democratic Republic of the Congo rub emollients on their bodies to "make the bullets bounce off them" (Gettleman 2012). Nyangatom warriors in Ethiopia preparing for battle blow smoke on each other, believing that the enemy will not see them (Glowacki 2015), while among the Pokot of Kenya, spells are cast on the sandals of warriors to make their tracks invisible (Bollig & Osterle 2007).

Saliently, many societies also have prewar collective dances (Goldschmidt 1994) such as the Maori Haka, now better known for its role in sporting events. These synchronistic dances often include acting out elements of combat such as mock shooting and fighting, and the lyrics frequently contain descriptions of previous exploits, the shame that befell cowards, or incantations for success such as "let all my enemies stand fixed ... Let my hand go ... true to the wounding" (Bell 1935, pp. 268–70). Among the Nyangatom and Toposa, some participants in war dances fall into a trance state that functions as a signal of the warriors' bravery and eagerness to fight. Although one outcome of group synchronistic activities may be group bonding or fusion (Tarr et al. 2014), another less conspicuous function may be heightened self-confidence (similar to the effect of superstitions), reducing the incapacitating effects of fear and making success in combat more likely.

Although behaviors such as carrying talismans and observing ritual prohibitions (including refraining from sex) may occur without the intervention of ritual experts, warfare is a domain in which ritual specialists distinct from shamans are common. For example, the Pokot seek out ritual specialists who bless their guns (Bollig & Osterle 2007), whereas among the Turkana and Nyangatom, ritual specialists sleep with rocks or bullets next to their head so the enemy will not wake (Glowacki 2015; Gulliver 1951). Unlike war leadership, which is common even in small-scale societies (Glowacki & von Rueden 2015; Glowacki et al. 2016), ritual leaders frequently do not accompany warriors to battle; instead, they provide interventions before and after combat. One striking difference between war ritual specialists and shamans is that the former in many societies do not have the barriers to entry that shamans do, including long initiations or non-human features. This shows that the uncertainty of war can drive the use of superstitious interventions and the emergence of specializations without key elements of shamanism, raising questions about what additional features mediate the cultural evolution of shamanism.

Because warfare can produce group-functional benefits, cultural evolutionary processes may be especially acute, driving increased selection for behaviors that appear to induce success. Success in war may contribute to the rapid spread of those traits within and between groups, which is one reason many war rituals look similar despite groups' diverse origins.

The success of war ritual specialists can also drive the evolution of social complexity toward increasing centralization and hierarchy. War ritual specialists usually collect fees or a share of the spoils (Ellis 1951; Lamphear 1994), contributing to their wealth and influence. Insofar as the group is successful because of the actual or perceived intervention of the specialist, this may influence the social organization of the society as the ritual leader amasses wealth and power (Brown 1979). For example, among the Turkana in the 1800s, ritual specialists held minor influence until the unprecedented success of Lokerio, a ritual leader in campaigns against neighboring groups. Turkana success alongside Lokerio's increasing wealth and influence resulted in the war diviner role becoming a powerful post and centralizing authority, "transforming his office into a new form ... whose authority extended throughout every section of Turkana" (Lamphear 1994, p. 74). This resulted in a new "collective identity" and "primordial nationalism" (Lamphear 1994, p. 88).

The cultural evolutionary processes outlined by Singh are informative for understanding the suite of cultural practices that accompany war across human societies. Superstitions and rituals can promote self-confidence, dampen fear, and improve the likelihood of success at individual and group levels. They also can support ritual specialization, which, in some instances, qualitatively shapes social complexity. When scaled up, these processes explain why some groups succeed where others fail, especially in the domain of intergroup conflict.

Do shamans violate notions of humanness?

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Abstract: Singh proposes that shamans violate notions of humanness in patterned ways that signal supernatural capacities. I argue that his account, based on a notion of humanness that contrasts humans with non-human animals, does not capture people's understandings of supernatural beings. Shamanic behavior may simply violate human

norms in unstructured, improvised ways rather than contrast with a coherent concept of humanness.

Part of Singh's intriguing analysis of shamanism rests on a set of claims about how shamans violate norms of humanness to convince people of their special powers. To do so, he argues, they "ostensibly transform into entities distinct from normal humans" (sect. 3.3, para. 1). That artifice persuades others that they have supernatural abilities to observe and manipulate unseen causal forces that go beyond those of ordinary people.

Singh suggests that shamans may "defy ... notions of humanness in patterned ways" (3.3.2, para. 4), but he leaves the nature of those patterns unspecified. Indeed, his speculations on the subject verge on contradictory. On the one hand, he cites Ojamaa (1997) to argue that shamans often present themselves as animal-like. On the other, he implies that shamans lack animalistic properties when he proposes that the supernaturalness they cultivate is associated with "possessing human-unique capabilities, like thought or self-control, while lacking those shared with animals, like hunger or pain" (ibid).

These two diametrical accounts each plausibly capture some of the shaman's special capacities, such as the ability to endure suffering and privation, and the capacity to apprehend things beyond normal human perception. The animalistic account can accommodate tolerance of pain or hunger as brute insensitivity or bestial strength. It can also understand heightened perceptual abilities as animal acuity; non-human animals often are seen as superior to humans in perception, although inferior in cognition (Haslam et al. 2008). (This pairing of animalistic strengths and deficiencies arguably accounts for the findings of Waytz et al. [2015] on the simultaneous dehumanization and superhumanization of black Americans.) The uniquely human account can frame shamanic endurance as exceptional self-control rather than insensitivity, and shamanic acuity as occult cognition rather than aquiline perception.

One problem with these two accounts of shamanic deviations from humanness, aside from being in opposition, is that they both place the human-animal distinction front and center. The research evidence, however, indicates that beliefs about the attributes of supernatural beings are orthogonal to that distinction. In the mind perception model of Gray et al. (2007), the mind of God differs from that of humans on a dimension of Experience independent of the Agency dimensions that distinguishes humans from other animals. God shares our capacity for higher cognition and self-control, which animals lack, but God lacks the affective and conative attributes (e.g., hunger, pain, desire, pleasure) that humans and animals possess. Similarly, Haslam et al. (2008) suggest that the mental states believed to differentiate humans from supernatural beings are distinct from those seen as differentiating humans from animals. Animals are viewed as outperforming humans on perception, but supernatural entities are not; supernatural beings are viewed as outperforming us on disembodied cognition, whereas animals are seen primarily as lacking human emotional refinement.

In short, it is not clear how the human-animal distinction can make sense of the ascription of superhuman abilities to shamans, either on the view that shamans present themselves as animal-like or on the view that they project themselves as having uniquely human abilities to unusual degrees. Although Singh's ethnographic evidence shows that shamans often use an animalistic idiom to express their strangeness, how that idiom leads others to ascribe supernatural powers to them remains obscure.

One possible alternative explanation is that shamans, in fact, do not defy notions of humanness in a patterned way. Rather than departing in a systematic fashion from a particular notion of humanness—for example, humanness understood as those attributes that distinguish people from other animals—shamans simply may violate behavioral norms in any way that conveys strangeness in their cultural context. This view of humanness

violations as unpatterned and opportunistic is sometimes implied in Singh's work, where humanness is employed not as an idea with specific content, but as a content-less prototype of normality. The concept of humanness simply refers to the norm of familiarity in contrast to which the shaman's behavior demonstrates strangeness, foreignness, and non-normality. That this concept of humanness adds to the more basic concept of familiar or normative is not clear.

Singh writes that "trance is a drama of strangeness." The shaman may simply be an improvisational actor who is adept at performing strangeness, but does not specialize in any particular dramatic genre. Clarifying how shamanic behaviour relates to ideas of humanness requires a thorough analysis of the content of shamanic performance and whether it coheres around a particular concept of "human." Singh's work helps define the nature and importance of that task.

Biological foundations and beneficial effects of trance

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Abstract: Singh proposes a cultural evolutionary theory of shamanic practices, including trance. We argue that cultural factors are deeply intertwined with biological aspects in shaping shamanic practices, and the underlying biology is critical. We discuss the neural underpinnings of rhythm-induced trance, how they can facilitate insight, and how altered states can promote healing.

Why do trance states play a central role across shamanic traditions? In his cultural evolutionary theory of shamanism, Singh proposes that shamanic practices such as trance evolved to convince observers of the shaman's superhuman abilities. By adapting practices to the cognitive dispositions of their audiences, he suggests, shamans consolidated their powerful positions within their societies.

We agree that some cultural aspects, such as convincing observers, played a role in the evolution of shamanic practices and that certain practices are primarily theatrical. Singh's theory, however, focuses on the cognitive dispositions of the *observers* and neglects important cognitive states of the shaman. We argue that the evolution of shamanism is deeply intertwined with the biology of our brains, namely, the ability to experience altered states of consciousness. Altered states in the form of trance are the foundation of shamanism, and shamans enter trance to provide services and promote healing (Singh, target article; Winkelman 2010c). Recent experimental evidence supports the biological role of trance in facilitating insight and promoting healing through means such as psychoneuroimmunology. A comprehensive theory of shamanism must consider the biological underpinnings of trance and how altered states can confer beneficial effects in the domains of insight and healing.

Many techniques – including chanting, dancing, taking psychoactive substances, and drumming – are used to induce trance states (Vaitl et al. 2005); each technique may induce its own state (Walsh 2007). The drum is the central emblem of the shaman's practice. Monotonous drumming is used to induce trance across cultures, and the commonality suggests a common biological mechanism (Harner 1990; Winkelman 2010c). (Note that some traditions use complex polyrhythms, wherein the master drummer induces trance with sudden rhythmic

disruptions; this parallels the sudden induction techniques in hypnosis.) Drumming and music in general can have powerful effects on the body and brain (e.g., on heart rate, blood pressure, muscle tension, mood, biochemical responses for arousal, reward, immunity, and local and large-scale brain dynamics; e.g., Altenmüller & Schlaug 2012). Little research, however, has examined the neural mechanisms of rhythm-induced trance. The few early electroencephalography (EEG) studies (e.g., Neher 1962) were deeply flawed (Achterberg 1985).

We recently performed two studies on the neural underpinnings of rhythm-induced trance in experienced shamanic practitioners. In a functional magnetic resonance imaging (fMRI) study, we observed clear differences between trance and non-trance states in functional connectivity of large-scale brain systems. The observed network configuration in trance (e.g., coactive default and control network regions) likely enables an extended internal train of thought and perceptual decoupling (Hove et al. 2016). In a follow-up EEG study, shamanic practitioners had reduced brain responses (i.e., lower amplitude event-related potential components) to sounds during trance, which suggests decreased sensory encoding and elaboration during trance (Hove et al. 2017). Together, these fMRI and EEG studies suggest that monotonous drumming helps the shaman disengage from the sensory environment and enables an extended internal stream of thought.

These neural correlates of rhythm-induced trance closely parallel research findings on creativity and insight. Insights are associated with a shift away from sensory processing toward internal processing (Kounios & Beeman 2014). Additionally, insights are largely the product of unconscious processing and can be aided by imagery (Finke 1996; Kounios & Beeman 2014), which resonates with shamanic trance as an exploratory journey filled with vivid imagery and symbols (Achterberg 1985). Shamans report that their journeys are a major source of insight (Winkelman 2010c), and these recent neuroscience findings provide a plausible neural mechanism for how trance promotes insight. Rhythm-induced trance possibly evolved as a technology to increase insight – the shaman can enter an altered state to gain insight into high-dimensional complex problems such as food acquisition and for healing (physical, psychological, or social).

Altered states of consciousness can influence healing by other means. Trance may promote health by psychophysiological or psychoneuroimmunological means (Sidky 2009). The theatrical and ritual aspects of shamanic practices can strengthen the patient's belief in the shaman's power, as stressed by Singh, and in turn maximize psychoneuroimmunological effects for healing. Additionally, altered states can promote healing by fundamentally changing the individual's awareness of reality and the underlying disease state (de Rios & Winkelman 1989). Altered states can provide access to subconscious content and psychosomatic aspects that accompany or cause the disease, which then can be targeted.

The therapeutic value of altered states of consciousness has been rediscovered recently in psychiatry. Many recent studies show benefits of therapies that include psychoactive substances. For example, psilocybin, LSD, MDMA, and ayahuasca show promise for treating depression, anxiety, posttraumatic stress disorder, and drug addiction (Carhart-Harris et al. 2016; Gasser et al. 2014; Labate & Cavnar 2013; Oehen et al. 2012). In these therapies, induction of an altered state in the patient aims to provide a different perspective to access and confront psychological issues that are otherwise inaccessible. Thus, one might draw parallels between shamanic healing and the methods of modern psychotherapy and psychiatry.

In sum, we argue that trance emerged across shamanic traditions as a useful adaptation that can promote insight and healing. Trance and other altered states could promote well-being through a combination of facilitating insight, psychoneuroimmunology, changing perspectives, and emotional transformation. More empirical research is needed to evaluate these mechanisms.

We are sympathetic to a cultural evolutionary view of shamanism and the importance of convincing observers for some practices to take hold. The cultural and biological aspects, however, are deeply intertwined in the development of shamanism. A narrow interpretation of the cultural view might erroneously suggest that the biological aspects of trance are irrelevant or secondary. A long history in anthropology and other fields treats trance with circumspection; these views make performing research and publishing on trance especially challenging (Herbert 2011; Penman & Becker 2009).

Times are changing, however. Interest in shamanism is resurging (Walsh 2007), and recent research on trance and altered states shows the viability of neuroscience investigations and promising clinical applications. More rigorous research on trance is needed. With more data and improved understanding, some more theatrical practices will likely disappear, whereas other beneficial practices should grow and spread.

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Shamans as healers: When magical structure becomes practical function

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Abstract: Singh's analysis has much to be said for it. When considering the treatment of illness, however, he begins from a shaky premise about uncontrollability and, so, fails to make the most of what shamanic treatments – as placebos – can deliver.

Manvir Singh argues convincingly that shamans tick all of the boxes we might expect of a magical agent with the power to influence events over which normal human beings have no control. Yet, in the case of illness, to which his analysis is the most obvious fit, he seems to have misread the situation. He classes recovery from illness along with winning the lottery and being struck by lightning as an “outcomes that seemingly occur randomly ... cannot be accounted for by predictive theories, because the causal forces escape human perception” (sect. 3.3.1, para.1). True, illness can strike out of the blue, and there may be little people can do to prevent it. Once a person has been unlucky enough to be struck down, however, their return to health is not as unpredictable or, for that matter, as uncontrollable as Singh implies.

In our review of the evolutionary psychology of healing (Humphrey & Skoyles 2012), Skoyles and I described how, for human beings, the progress of recovery depends on a range of factors operating at the levels of physiology, psychology, and culture. To summarise:

1. Humans, like all animals, possess a highly effective suite of internal physiological healing mechanisms designed to beat back infection and repair bodily damage. This means that most people, most of the time, eventually recover of their own accord, even from serious illness.

2. Healing has intrinsic costs, however. For example, running a temperature to kill invading bacteria requires a 50% increase in metabolism, and antibody production uses up precious nutrients that are difficult to replace. So, although it may be desirable for patients to get well as soon as possible, it is essential they keep sufficient resources in reserve to cope with future challenges.

3. To make the best of this, the pace of recovery is regulated by a brain-based “health governor” designed by natural selection to manage the healing budget in the light of environmental information. This governor acts, in effect, like a hospital manager who must decide how to allocate resources on the basis of an inventory of what's available and a forecast of what the future holds.

4. A major consideration is the prospect of external help, especially if this suggests the present bout of illness will be short lived. Evidence of immediate environmental assets such as protection, food supplies, medicinal drugs, and tender loving care can provide such assurance; but it can be more speculative, as when there is good reason to believe that specific curative forces are being activated by someone else.

5. The health governor is potentially gullible. It cannot necessarily tell the difference between real and fake news or between a reasonable inference based on solid evidence and one based on a lie. This means that an empty promise of cure – a placebo – may be as effective as a valid promise in speeding up recovery.

6. Human beings have discovered and learned to take advantage of this loophole in the innate health management system. Although the deeper explanation remains hidden from everyone involved, placebo treatments of illness operate widely, at both individual and cultural levels. Shamanic healing rituals are a notorious example. When patients credit a shaman with supernatural powers to banish illness, they empower the shaman to activate their own innate capacities for self-cure.

Now, Singh has given us the best account yet of the logic that lies behind belief in shamanism. He thereby has provided the best explanation of why the treatments may, in reality, be able to do what is claimed. Yet, the surprise in this article is that Singh himself makes so little of this. For him, the fact that the treatments actually work is of secondary importance to the fact that everyone thinks they ought to work.

Why does he not make more of the practical benefits of placebo-mediated healing? I suspect it's because, in the spirit of Claude Lévi-Strauss, he is reluctant to concede that shamanism has evolved for dirty utilitarian reasons. He wants to see shamanism as a self-contained logical edifice that stands on its own as an appealing intellectual structure. No matter that it may be a flimsy house of cards; it deserves to survive because it is so theoretically appealing.

It is an admirably brave thesis, but I find it unduly purist and, more important, scientifically limiting. By discounting shamanism's potential for genuine cure, Singh is missing an obvious opportunity to explain not only why it survives as a cultural tradition, but also its historic origins.

Presumably, ever since human ancestors became capable of reflecting on their lived experience of illness, they looked for patterns. Surely, they noticed early on that recovery sometimes could be speeded up by the attentions of a trusted member of the community who did nothing other than bid the illness to depart. With no obvious physical cause to account for this action at a distance, they had to look for other explanations. Given the evidence that an ordinary human apparently was able to exert parahuman control over another person's body, it might well have made sense to conclude that this human was not as human as he seemed. Thus, the first faith healer perhaps was crowned as an honorary non-human with magical, animal powers. From there, it was a small step to the creation of a culturally recognised class of healers prepared to play up to and elaborate this role.

This jibes with Singh's account. Note the difference of emphasis, however: Singh explains why a shaman can be expected to be capable of miraculous healing. Yet, he does not raise the possibility that, historically, healing that appeared miraculous came first, and that it was this that inspired people to invent the concept of a shaman. Given that Singh draws parallels between shamanism and other religions, it's worth remarking that Jesus Christ was acclaimed as the son of God because he was seen to perform miracles, not the other way around (see my account of this and other examples in Humphrey 2002a).

Financial alchemists and financial shamans

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Abstract: Professional money management appears to require little skill, yet its practitioners command astronomical salaries. Singh's theory of shamanism provides one possible explanation: Financial professionals are the shamans of the global economy. They cultivate the perception of superhuman traits, maintain grueling initiation rituals, and rely on esoteric divination rituals. An anthropological view of markets can usefully supplement economic and psychological approaches.

The financial sector has generated more billionaires than any other part of the world economy (Peterson-Withorn 2016). Although financial intermediaries do play crucial roles in the economy – matching savers to borrowers, pooling risk across individuals, allocating capital – economists struggle to explain why money managers themselves command such enormous salaries, when there is overwhelming evidence that money management requires very little skill at all. In this commentary, I argue that Singh's cultural evolution theory of shamanism suggests a provocative solution to this puzzle.

Financial theory tells us that the prices of securities incorporate all relevant information, so that public information such as past prices and company news cannot be used to predict future prices. In this line of thinking, financial markets are *efficient* (Fama 1970). The key empirical evidence for this proposition is the fact that asset managers who actively buy and sell securities do not outperform the market as a whole (Jensen 1968; Wermers 2011). In fact, managers not only fail to outperform the market, but they also do not even systematically outperform *each other*: The top performers in one year tend to be average the following year (Malkiel 1995). If “a blindfolded chimpanzee throwing darts at the *Wall Street Journal*” could do as well as a typical fund manager, as the financial economist Burton Malkiel (2015) suggested, why are there so many billionaire fund managers (and so few billionaire chimpanzees)?

Singh's cultural evolutionary theory of shamanism suggests one hypothesis for why fund managers command such astronomical salaries: They are the shamans of the global economy. Just as cultural evolution has produced shamans believed capable of controlling unpredictable events such as weather and disease, so has cultural evolution produced financial shamans whose customers believe they are able to forecast stock prices accurately. On this account, the money management profession has adapted to the contours of the human mind.

The mystique surrounding financial professionals resonates with practices associated with shamans in small-scale societies. The metaphors we use to describe financial professionals allude to superhuman powers such as magic (“financial alchemy”) and omnipotence (“masters of the universe”). Cultural representations of financial professionals tend to emphasize their differences from ordinary humans, for example, exhibiting extreme greed (e.g., Oliver Stone's *Wall Street*) or hedonism (e.g., Martin Scorsese's *The Wolf of Wall Street*). Indeed, it is commonly believed that financial professionals are disproportionately psychopaths (Gregory 2014). To the extent that psychopathy violates our intuitions about normal human behavior, managers who cultivate this perception may be seen as likelier to possess superhuman powers of market divination. In this sense, (perceived) psychopathy may actually breed trust.

Like traditional shamans, money managers are initiated to their profession through grueling rituals that emphasize their superhuman qualities. Newly minted financial analysts routinely work more than 70 hours per week (Hewlett & Luce 2006), with 100+-hour weeks not unheard of. I once taught a student planning

a career in finance who seemed to take a certain pride in the high suicide rate in his aspiring profession. (It is interesting to note that the other group of professionals well known as working extreme hours – medical doctors – also may benefit from shaman-like qualities.) If financial professionals do not require sleep, who's to say that they cannot also predict the future?

Some financial professionals also are trained in divination rituals such as technical analysis and charting (e.g., Murphy 1999). A technical analyst examines the chart of a company's stock price, looking for patterns to foretell the future. Of course, a stock that has been rising is expected to continue rising, and a stock that has been falling is expected to continue falling. Technical traders search for a variety of more esoteric signs, too: the “head and shoulders” (two low peaks surrounding a high peak, believed to signal a trend reversal); the “cup and handle” (a large U shape followed by a smaller U shape, believed to prefigure a trend continuation); the “double top” (two peaks around the same price, believed to foretell a downturn); and many others. Never mind that these patterns have little or no predictive power (Malkiel 2015). Indeed, Malkiel has likened technical analysis to astrology.

Technical analysis is a textbook example of how we can be “fooled by randomness” (Taleb 2001), finding patterns in noise (Chapman & Chapman 1969; Johnson et al. 2014). Indeed, the plausibility of this practice likely fueled the human propensity for storytelling – a particularly critical aspect of judgment and decision making under conditions of “radical” or “Knightian” uncertainty (Knight 1921) in which precise probabilities cannot plausibly be assigned. Investment outcomes are a paradigmatic example of this (Tuckett 2011; Tuckett & Nikolic 2017). Studies in experimental finance confirm that investors rely on narrative thinking to anticipate prices (Johnson & Hill 2017; Johnson & Tuckett 2017). People not only project past trends into the future (Andreassen 1990), but also do so in sophisticated ways that have some kinship to the methods of technical analysts (Johnson et al. 2017). The practice of technical analysis is intuitively plausible – despite the evidence for its uselessness – as a consequence of deep-seated psychological tendencies.

Whereas the physical and biological sciences have made good headway in understanding weather and disease, social science has been less effective in understanding economic outcomes (Hayek 1989). Financial shamanism thus maintains plausibility in an industrialized world where other forms of shamanism have collapsed. Nonetheless, just as the mind (Pinker 1997) and culture evolve (Boyd & Richerson 1985), so do markets (Schumpeter 1942). In recent decades, far more assets have come to be passively rather than actively managed because of the flourishing market in indexed mutual funds (Marriage 2016) pioneered by companies such as Vanguard in the 1970s.

Our financial institutions are adapted to economic, political, and technological conditions, and they may well be adapted to the contours of the human mind, too. It is yet to be seen whether the forces of market evolution will further challenge the practice of active money management, even as cultural evolution seems to sustain it.

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A ritual by any other name

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Abstract: We question the privileged role of trance within the framework presented. The features that Singh suggests make it unique are not well demarcated from those of rituals more generally, and we challenge the depth of explanation presented for the mechanisms of trance. We outline the form of a solution, which may facilitate increased operational utility for the presented framework.

The target article is an ambitious attempt to layer a cultural-evolutionary framework on the phenomenon of shamanism. Within it, shamans – identified by their use of trance practices – are a product of widespread beliefs that uncontrollable environmental outcomes are influenced by supernatural agencies. Singh also suggests that competition among professionalized shamans begets selective pressure for the most efficacious-appearing shamanistic techniques, as dictated by cognitive heuristics and biases.

Cultural evolution is not the same as biological evolution, though we can use certain criteria from the latter as informative heuristics of the former. When assessing the framework offered from such an evolutionary perspective, however, the model provided frequently jumps among levels of analyses, discussing the phenomenon of shamanism as a cultural institution, selection pressures among shamanistic techniques, and individual cognitive biases. Although we recognize Singh's ambitious efforts to provide a multilevel framework, this does not remove the need for better demarcation of the processes and pressures operating at each level. In particular, we were left with many critical questions concerning why, within shamanism, trance occupies such a privileged transformative role. What makes trance more effective than other alternative ritual and cultural actions?

According to Singh, trance is a necessary feature of shamanism. Finding more precise definitions lacking, he opts for a more inclusive definition wherein trance is a temporary state characterized by a variety of unusual behaviors, with an equally varied set of culture-specific interpretations. Singh argues that what connects the diverse practices is the ability of trance performances to serve as “dramas of strangeness,” which act as markers of non-normality. Here, however, we run into an issue of circular logic: Labeling the effectiveness of trance performances to signal transformation as their core defining characteristic fails to explain *why* trance performances are particularly effective at this.

This is problematic, particularly when many alternative rituals seem to be equally capable of doing the epistemological heavy lifting Singh claims for trance. For example, weddings and initiations transform people, baptisms signify rebirth, and ascetic practices, such as fire-walking rituals (Xygalatas 2014), demonstrate abnormal levels of tolerance. Rituals, in general, do much of the other work of the shaman: They can manage uncertain outcomes effectively (Rudski 2001), alleviate anxiety associated with a lack of control (Norton & Gino 2014), and imbue objects with special significance (Kapitány & Nielsen 2015, 2016), all while serving as markers of identity (Sosis et al. 2007) and commitment (Irons 2001). Singh acknowledges that the possession of physical oddities and the performance of initiations and ascetic practices also serve as potent indicators of transformation. This leaves us with the question, though: What then separates such actions from the trance category in Singh's model? Is it just another name for dramatic rituals?

With rituals, the mechanisms of action are increasingly well understood:

They are generally costly, thus influencing the beliefs of those who observe them (Henrich 2009).

They arouse particular kinds of emotions, engendering predictable forms of reflection and reasoning (Whitehouse 2004).

Many of their features, such as synchrony (Fischer et al. 2013), causal opacity, and goal demotion (Kapitány & Nielsen 2015; 2016), reliably generate specific responses.

For trance to qualify as a cultural adaptation independent of ritual, it needs a far more nuanced and dissociable mechanism – particularly in light of the fact that rituals seem equally qualified for solving the stated evolutionary problem.

If trance is unique, it may rest on a point from which Singh is keen to distance his theory – namely that, although trances are diverse in form, they almost invariably involve some form of disruption to ordinary conscious processes, be it from communicating with or channeling some foreign consciousness, or the extension (or diminishing) of the practitioners' ordinary mentalities. We agree with Singh's criticism of theories that advocate a common neurophysiological experience or an “integrative mode of consciousness” as the common element of trance. One need not endorse such positions, however, to recognize the key role that mentality, and violations thereof, plays in the diverse array of trance practices, particularly among observers who generate the selective pressure on persuasive shamanistic techniques.

We suggest that this emphasis on mentality and violation of ordinary mental boundaries represents the core distinguishing feature of trance practices and why they occupy their privileged position within shamanism. Individuals across cultures display an early developing interest in their social worlds (Spelke et al. 2013) and follow a similar trajectory in their development of reasoning about others' minds (Liu et al. 2008; Wellman et al. 2001). Humans everywhere are quick to attribute agency to ambiguous events (Csibra 2008; Hamlin 2014) and to detect patterns and teleological purpose in nature (Kelemen 1999a; 1999b). Similarly, there is strong evidence that humans are intuitive dualists (Bloom 2004) who dissociate mental and physical processes, readily attributing mentality to the dead (Bering 2006; Bering & Bjorklund 2004; Huang et al. 2013).

Collectively, these tendencies represent a fertile, cross-culturally recurrent foundation that, at least partially, could account for the level of interest that surrounds individuals demonstrating unusual mental abilities and the ability to interact with unseen agents and mental forces. (For an illustration of such an approach applied to spirit possession, see Cohen [2007].) The theory that minimally counterintuitive concepts are especially memorable is subject to ongoing debate (Purzycki & Willard 2015); however, the basic insight that people attend to things that possess some striking features but otherwise accord to intuitive expectations seems well supported (Banerjee et al. 2013; Boyer 2001).

Our suggestion for the reasons trance should be privileged, the ways it might work above and beyond other ritual practices, and the extent to which shamans accord or contradict intuitions about mentality is admittedly speculative. Whether or not Singh agrees with our suggestion, however, a more functional definition and clearer set of trance-related hypotheses are warranted and can only improve his framework's coherence and explanatory power.

Commitment enforcement also explains shamanism's culturally shared features

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Abstract: The proposed explanation for the evolution of shamanism is not the only viable option. I sketch an alternative commitment hypothesis that views shamanism as an adaptation at the level of biological individuals or cultural groups. To the extent that these hypotheses make overlapping predictions about the culturally shared features of shamanism, we lack adequate evidence to discriminate among them.

Various anthropologists have described cultures in which sincere beliefs about witchcraft and sorcery apparently function as a mechanism for enforcing social commitments. For example, Elizabeth Colson's ethnography of the Gwembe Tonga describes a highland-dwelling population who managed to survive periods

of severe drought by sharing resources. Individuals often did so reluctantly, but in Gwembe society, it became expected that no one would deny a request to share. As Colson (1960) explains:

Willingness to share ... is based on more than shame or being thought selfish, or the desire to ensure further supplies. Behind demands there lies the implicit threat of sorcery. Not all people are sorcerers, but one cannot be certain that any particular person is not. It is best therefore to treat the petitioner as though he were a potential danger. (Colson 1960, p. 55)

Variations on this basic mechanism conceivably could enforce a wide range of social commitments. Even if you are fairly sure that your neighbour doesn't himself practice witchcraft, it is advisable to repay your debt, or else he might employ a shaman to smite you. Commitment problems are pervasive in social life, so we would expect this system to become established especially in societies with a standing belief in supernatural intervention and an absence of formal enforcement.

Notice that this commitment hypothesis involves a different model of cultural evolution from that outlined in the target article. Singh proposes that shamanism evolves by a process of cultural diffusion. In this view, variation and selection occur at the level of competing social scripts. By contrast, the commitment hypothesis proposes that selection occurs at the level of biological individuals or cultural groups. A biological individual might receive reciprocal benefits from the widespread fear of shamanic retribution. Alternatively, this belief might motivate altruistic behaviour, as seems to be the case for the Gwembe Tonga. Although all three proposals see shamanic beliefs as culturally transmitted, they disagree about the underlying causal process. Specifically, they disagree about which kind of fitness difference (among social scripts, biological individuals, or cultural groups) is the causally potent factor.

Singh argues that only diffusion explains the cluster of properties typically associated with shamanism across cultures. He does not consider in detail, however, how the commitment hypothesis might also explain this pattern. Take the tendency for shamans to have jurisdiction over important events, such as disease and crop failure. As Singh points out, these events are periodic, humanly uncontrollable, and fitness relevant. The fact that they are also disruptive makes them effective threats for motivating compliance.

Why might it be important for shamans to practice self-denial? Singh argues that this tendency must evolve through competition among shamanic scripts to appear credibly non-human. Alternatively, ritualized asceticism might function as a signal of self-restraint. To see why this might be important, we need only place ourselves within the supernatural belief system. Genuine shamans would wield Gyges-like power over us mortals. Our instinctive response would be to expel them from the community out of fear of abuse. Evidence that shamans lack interest in worldly pleasures would help placate such worries. Singh's strongest objection to this proposal, as I understand it, is that ritualized asceticism is not an honest signal of self-restraint. This objection, however, overlooks an interesting feature of this signalling system: Because supernatural forces are ultimately fictional, a shaman can't actually cheat. What matters is that members of the community tolerate the shaman's presence long enough to reap the fitness benefits without feeling threatened by the inequality in perceived power. Thus, although asceticism probably wouldn't guarantee against an actual threat of shamanic abuse, it provides adequate protection against an illusory one.

Why do shamans engage in trance? Perhaps this is interpreted as a signal of non-humanness, as Singh suggests. A simpler explanation, however, is that it contributes to the credibility of a shaman by serving as evidence of supernatural contact. The commitment model would predict that trance is most exaggerated in societies in which claims to shamanic authority are most in question, for example, when a culture comes under the influence of a competing religious system.

Perhaps the biggest challenge for the commitment model surrounds professionalization. If the threat of supernatural retribution helps enforce commitments, then why restrict access to a small class of professionals who have satisfied an initiation ceremony? The first thing to note is that cultures vary in the extent to which ordinary people are believed to have access to supernatural power. Evans-Pritchard, in his ethnography of the Azande, describes a population in which witchcraft was democratically accessible and covertly practiced. The result was a fairly unstable social system. People routinely accused community members of casting spells out of malice or personal gain. This gave rise to a second level of supernatural access, where oracles became the arbitrators of supernatural justice. As he explains:

Everyone is disliked by someone, and this somebody will someday fall sick or suffer loss and consult oracles about those who do not find favour in their eyes. But it is generally only those who make themselves disliked by many of their neighbours who are often accused of witchcraft and earn a reputation as witches. (Evans-Pritchard 1937, p. 114)

Such anecdotes suggest that democratic, covert access to supernatural power is not a stable enforcement mechanism because it often is suspected of being manipulated. Restricting supernatural access to a limited number of third parties, whose power is overtly displayed in ceremony, might help mitigate the level of perceived abuse.

To be clear, my aim in defending the commitment hypothesis is to make a broader methodological point: Rival models of cultural evolution often make overlapping predictions about the sorts of traits that will be cross-culturally shared. Thus, no amount of evidence in support of those universals could possibly serve to discriminate among the alternatives. A more promising strategy is to first determine the distinct patterns of cultural *variation* predicted by alternative hypotheses, and then review the anthropological literature to test those competing predictions (e.g., Linquist 2016).

Shamanism and the social nature of cumulative culture

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Abstract: Our species-unique capacity for cumulative culture relies on a complex interplay between social and cognitive motivations. Attempting to understand much of human behaviour will be incomplete if one of these motivations is the focus at the expense of the other. Anchored in gene-culture co-evolution theory, we stake a claim for the importance of social drivers in determining why shamans exist.

Singh's articulate and thought-provoking attempt to provide a framework for understanding the cultural evolution of shamanism presents a valuable contribution to the literature to explain a seeming oddity of human behavior. Although agreeing with many of his points, we believe the overall proposal falls short, because it does not adequately outline the evolutionary conditions and selection pressures for shamanism and the social and cultural control mechanisms which feed into them. To support claims that shamanism is an *adaptation* to the human cognitive machinery,

cost-benefit ratios need to be discussed; Singh pays little attention to the varied costs versus benefits of shamanistic practices for shamans, their clients, and the groups that they serve.

Humans are unique in their capacity to develop cumulative culture, namely, to invent new tools (or new ways of using old tools) and achieve desirable outcomes. These innovations get incorporated progressively into a population's stock of skills and knowledge, generating ever more sophisticated repertoires (Dean et al. 2013; Pagel 2012). This capacity is widely recognized as one of the most important contributors to our remarkable success as a species (Henrich 2015; Legare & Nielsen 2015). Most of us don't invent, however. Indeed, cumulative culture works because it is built around our capacity for high-fidelity copying that ensures behaviors that have proven valuable and successful are handed down from generation to generation.

High-fidelity cultural transmission and cumulation rely on our social drive toward in-group conformity. Once behavior is normative, and no compelling reasons for changing it exist, group-normative behaviors are transmitted faithfully across generations (consider the continued use of QWERTY keyboards). In Singh's analysis, this critical aspect of human cultural evolution is given short shrift. As Singh suggests, shamanism may have arisen partly to provide an avenue of control over the environment, but shamans may remain because they help maintain community integration and cohesion. By this reasoning, if shamans are replaced, it is because a stronger mechanism of in-group integration has arisen, not necessarily because of a more reliable means of controlling the environment. The social aspect of cumulative culture is pivotal and is something Singh misses entirely.

Singh defines shamanism as "a suite of practices ... that adapts to people's intuitions to convince observers that a practitioner can influence otherwise uncontrollable events" (sect. 1, para. 7) and contrasts this with technological developments – the assumption being that, unlike the former, the latter are tested and refined. Furthermore, Singh suggests shamanistic practices are "effective-seeming" in that they are, "by definition, ineffective" (sect. 3.2, para. 2). In so doing, Singh tacitly categorizes potential effects of shamanistic practices into *cognitive effects* (i.e., appealing to people's intuitions to convince others) and *environmental effects* (i.e., control of events such as illnesses and weather events). By sleight of definitional hand, he delimits all shamanistic practices as possessing cognitive effects but lacking in environmental effects. Certainly, cultural practices engaged in by shamans may be grounded on some cognitive machineries (see Sperber & Hirschfeld's [2004] discussion of folk biology and folk sociology). Nonetheless, this division into cognitive and environmental effects overlooks the significance of *social integrative effects* of shamanistic practices.

Clark and Kashima (2007) suggested that shared cultural stereotypes are maintained partly because communicators believe the stereotypes have social integrative effects; they believe they can affiliate with communication partners by telling stories conforming to shared stereotypes. Similarly, Kleinman and Sung (1979) suggest that *tāng-ki*'s shamanistic practices in Taiwan have behavioural and *social* gains in their treatments of health problems. In addition to "curing" individuals who believe in shamans, the ritualistic mutilations performed by *tāng-ki* (Chan 2009) activate empathy reactions and function as social signals of group commitment, which increase social bonding of individuals attending the ritual (cf. Fischer & Xygalatas 2014; Xygalatas et al. 2013). At the very least, those suffering from mental illnesses, along with the communities surrounding them, appear to perceive benefits of shamanistic practices as Singh noted (sect. 2, para. 2), which in turn may have real *social* benefits. These socially shared perceptions and experiences cannot be dismissed simply as mere *perceived* effectiveness of shamanistic practices.

Another aspect of the cost-benefit analysis that Singh misses is the potential importance of the cost *per se* as a significant factor maintaining shamanistic practices. Shamanistic features are

costly; their relevance needs to be shown and carefully calibrated for practitioners to avoid being exorcised, discriminated, or excluded from groups (Power 2017). Returning to *tāng-ki*, shamans are more likely to experience hallucinations, which is likely to lead to social stigma and exclusion (Cohen 2001). Yet, to the extent that these experiences can be channelled into culturally appropriate forms supporting and maintaining in-group norms, these individuals assume important social positions. Singh largely dismisses costly signalling (Bulbulia & Sosis 2011) as an explanation of shamans' transformation. We maintain that behaviors that are costly to individuals are likely to bring benefits to actors only if they are consistent with group norms.

If we are to better understand the widespread prevalence of shamanism, we need to better understand the associated costs and benefits that drive cultural selection of the phenomenon within an evolutionary framework. If changing social conditions decrease the need or effectiveness of shamans, what are the changed selection pressures for shamans and their clients? Figure 1 stops short of addressing this important issue, and section 6 sidesteps it.

To paraphrase Bennett Galef, we build cathedrals and walk on the moon while chimpanzees, our closest living animal relatives, continue to sit naked in the rain. This is largely because of our capacity for the retention of critical skills, the invention of new ones, and the capacity to pass both on from generation to generation. Embedded in this process are our dual needs to predict what will happen in our environment and to affiliate with those in our in-group. These capacities and needs combine to give us iPhones ... and shamans. Singh takes some steps toward this conclusion. We would like to see him take some more.

Psychosis is episodically required for the enduring integrity of shamanism

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Abstract: The target article advances several original concepts about shamanism, including prospective explanations for how shamanism could express itself in different cultural settings. Although the potential for "innate psychological tendencies" is acknowledged, the target article prematurely dismisses one such hard-wired feature of shamanism: psychosis.

The intergenerational transmission of elaborate cultural practices will typically possess low fidelity unless supported by innate (i.e., hard-wired) neural substrates. The institution of shamanism is akin to other identifiable cultural practices such as culinary traditions, sexual habits, and war rituals. The universality of such social practices seemingly is maintained by innate behavioral tendencies: hunger for culinary traditions, erotic feelings for sexual practices, and tribalism and aggression for war rituals. Without the constant presence of certain innate emotional systems, each cultural practice would eventually fade and disappear. The author is cleverly aware of this possibility and surmises that the "cognitive underpinnings of magic and religion" play a role in maintaining shamanism. I would argue, however, that the hypothesized neural substrate behind shamanism is characterized better by the phenotype of psychosis (while also recognizing that psychosis is closely related to magic and religion).

Cultural factors undoubtedly play a prominent role in creating the institution of shamanism, and it certainly is possible that such an identifiable social role would inevitably attract non-psychotic

practitioners; however, it also cannot be discounted that there is an anthropological literature replete with examples of psychotic-like behaviours in the personal histories of shamans (Ackerknecht 1943; Devereux 1961a; Laubscher 1937).

Over the years, I have learned that two common misconceptions prevent experts from appreciating a connection between psychosis and shamanism. The first is a failure to recognize that the majority of psychotic individuals do not live in a persistently disorganized mental state (this was true even before the advent of effective treatments). This means that most individuals with a psychotic disorder (e.g., schizophrenia, bipolar disorder) would have been capable of being shamans, most of the time. In any Gaussian distribution of phenotypic traits, the extremes do not typically represent the most adaptive phenotype. Similarly, the most grossly psychotic individuals would not necessarily have been shamans. However, when one combines the frequency of schizophrenia, schizotypal personality disorder (i.e., a milder form of schizophrenia), and bipolar spectrum disorders, a non-trivial frequency of aspirant shamans is produced (approaching 5%–10% of the general population). It is precisely this cluster of heritable diagnoses that have a special affinity for magico-religious discourse, as evident in their historical participation in cults, paranormal beliefs, possession states, and spiritual hallucinogenic use – social phenomena considered to be at the outskirts of both religion and psychosis. Accordingly, the eighteenth-century “epidemic” of schizophrenia was probably caused by a convergence of societal changes (i.e., secularization, industrialization, and greater government accountability), which intensified the disabling aspects of psychosis.

The second misconception around shamanism is an underappreciation for the similarity of the cognitive substructure of psychosis to basic religious ideation. According to cognitive theorist Pascal Boyer, a religious idea must incorporate a fact that specifically contradicts at least one defining characteristic of an ontological category (Boyer 2001). For example, a ghost may have the form of a person, but it lacks one essential quality (i.e., physical matter) integral to its ontological category (i.e., persons). Research studies consistently have found that about 60% of delusions and hallucinations contain outright religious themes (Rudaleviciene et al. 2008). If one broadens the definition of religiosity and tallies magico-religious themes, however, the frequency turns out to be much higher. For example, our research team observed that 25 of 26 patients with schizophrenia possessed plausible magico-religious themes inside of their delusions and hallucinations (Polimeni 2012, p. 191).

The target article concludes that shamanism is evolutionary “cheesecake,” but there are several compelling reasons to believe that the shamanistic phenotype is not a zero-sum game. One problem in the evolutionary study of behaviors is that there is often a failure to separate incidental actions from evolutionary effective activities. For example, not every manifestation of anger is evolutionarily advantageous, but, on average, the sum total of angry expressions provides phenotypic advantage. Similarly, not every shamanistic endeavor would have necessarily been evolutionarily advantageous. My own view is that some of the more sporadic shamanistic activities may have been more evolutionarily impactful (i.e., divining, out-group suspiciousness) compared with some of the more conspicuous shamanistic practices (spiritual healing, weather prophecies), which may simply have been incidental behaviors tolerated by evolutionary processes. Another notable feature of shamanism is trance, which has been neglected in most theories about shamanism, but skillfully examined in the target article.

One interesting idea in the target article is framing shamanism as one of the oldest professions; however, I propose that the better characterization – in keeping with ethological principles – is task specialization (similar to task specialists of eusocial insects) (Polimeni & Reiss 2002). It is noteworthy that two genetic mechanisms theoretically able to support task specialization (i.e., heterozygote

advantage and assortative mating) also may be relevant in the heritability of schizophrenia (Polimeni 2012).

Where schizophrenia is common, shamans are not; and where shamans practice, insanity becomes spiritual. The distinguished evolutionary psychiatrist John Price has argued that many of the evolutionary advantages of prehistoric religions are specifically dependent on contact with the gods being restricted to a sole individual (Stevens & Price 2000). Hunting and gathering societies are often forced to make arbitrary (i.e., random) decisions (e.g., when to plant crops, which new direction to hunt, if and when to attack or flee another group); having a sense that the gods are backing one choice puts the entire tribe on the same page, working together. The evolution of shamanism is indeed complex, and the target article capably examines some of the cultural aspects maintaining the institution of shamanism; however, it arguably misses the spark that gets the whole process going – the occurrence of intrusive psychotic experiences (containing magico-religious themes) in those individuals typically destined to be shamans.

Shamanism and psychosis: Shared mechanisms?

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Abstract: Individual-specific predispositions may precede the cultural evolution of shamanism and may be linked to it via principles of predictive coding. We have used these principles to identify commonalities between clinical and shaman-like non-clinical voice-hearers. The author may find this approach helpful in relating the experiences of shamans to those of their clients.

In a masterful and thorough review, Manvir Singh considers the cultural and cognitive origins of shamanism. He makes a compelling case: Shamans occupy a unique space in culture, and they adopt a unique state in the physical and metaphysical worlds to explain the inexplicable to their subjects and to render the world more predictable for them. We agree. Singh is quick, however, to dissociate the experiences and practices of shamans from the psychotic experiences (such as hallucinations, percepts without stimulus; and delusions, unreasonable beliefs) that are present in (but not exclusive to) serious mental illnesses such as schizophrenia. Here, we disagree.

In our own work, we have identified – in contemporary Western society – a group of people who experience daily auditory verbal hallucinations, who interpret those experiences metaphysically, and who share their experiences with non-voice-hearers as relevant messages from deceased relatives or other spirits (Powers et al. 2017a). Thus, these self-described clairaudient psychics appear to inhabit shaman-like roles. Their voice-hearing experiences, as assessed using scales developed to detect malingering of hallucinations, are largely indistinguishable from those of people with diagnosed psychotic illnesses who hear voices. The psychics, however, reported successful volitional control of their voice-hearing and experienced fewer negative and more positive consequences of these phenomena compared with patients with psychosis who hear voices (Powers et al. 2017a). We assert that these observations highlight potential commonalities between shamanism and psychosis, and we argue for a continuum of severity from odd and unusual experience, through shamanism, to psychosis (Powers et al. 2017a).

We interpret our findings in terms of the increasingly influential predictive processing view of mind and brain function, which holds that the brain reduces free energy by inferring the causes of our sensory inputs (Friston 2005). Perception, in this view, is an inference of the best explanation for those inputs based on our prior experiences and the current sensory evidence (Clark 2013). Hallucinations, then, may represent a bias towards those top-down prior experiences (Friston 2005; Powers et al. 2016; 2017a), which may be under volitional control in the psychics.

From this vantage point, we may make several connections to the review at hand. First, unusual experiences may involve occupying two separate sets of mental books – one for the real world and one for the psychotic reality. Such double bookkeeping often is discussed in the context of delusions, about which patients are sometimes curiously ambivalent (Sass 1994). This is one of the key aspects of shamanism that Singh highlights, and again, we find evidence for it in psychosis.

Second, Singh highlights the self-deception that must be required to convince oneself of one's shamanic abilities to successfully convince others. We find a similar proposal from Ed Hagen, the evolutionary biologist, when he considers delusional disorder: Such psychotic beliefs often involve grand conspiracies and significant inside knowledge on behalf of the patient that can be shared with others, sometimes for considerable secondary gain (Hagen 2008).

Finally, the predictive processing mechanism we favor may be the mechanism driving selection of shamans, as well as the experiences of those who seek their help. The dyadic interactions between shaman and client (Friston & Frith 2015), the psychotomimetic experiences driven by the ingestion of sacred entheogens (Corlett et al. 2009), and perhaps the non-pharmacological aspects of the shaman's routine increase free energy (and, therefore, uncertainty) for the client in a tolerable manner such that novel solutions can be created and adopted. Under this view, the shaman resolves impasses for the client by broadening their explanatory model space, and the degree to which this is accomplished may underlie success or failure as a shaman.

This latter view finds recent support in studies of expectancy-related phenomena, tying perceptual, social, and medication-related experiences into a common neurobehavioral framework (Schwarz et al. 2016). Viewing shamanism through the lens of hierarchy-spanning expectancy may reveal that some of the same factors driving the psychotic-like perceptual experiences of shamans also may be driving their placebo-like healing effects. Underlying this commonality of experience may be activity in common brain regions, including the nucleus accumbens, anterior cingulate cortex, and insula (Powers et al. 2017b; Schwarz et al. 2016).

Before broadly dismissing the relevance of psychotic experiences to shamanism, Singh may find much to support his thesis in considering the phenomenology and neurobiology of psychosis. He may also find a mechanism-free energy minimization through predictive processing – that may serve as a unit of selection for the occupational survival of shamans, as well as for the experiences that may have first driven them toward shamanism.

Shamanism and the psychosis continuum

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Abstract: Singh's cultural evolutionary theory of shamanism is impressive, but it does not explain why some people become shamans while others do not. We propose that individual differences in where people lie on a "psychosis continuum" could play an important causal role.

Briefly stated, my position is that the shaman is mentally deranged.

— Devereux (1956/2000, p. 226)

When the shaman is healing he is out of his mind, but he is not crazy.

— Inuit informant reported by Murphy (1976, p. 1022)

Singh's cultural evolutionary theory of shamanism provides a nuanced explanation for the recurrence of shamanistic practices across diverse cultures. Nonetheless, although his stated aim is to build a comprehensive theory of shamanism, his theory has a lacuna: It does not offer a satisfying account of *who* becomes a shaman. Singh mentions that it may be easier for individuals with "psychological peculiarities" to become shamans, but he says little about what these peculiarities entail or why they are important. In this commentary, we propose that continuum models of psychosis could illuminate the psychological profile of individuals who are most likely to pursue the shaman vocation.

The notion that shamanism is associated with psychosis – a serious loss of contact with reality typically involving hallucinations and delusions – has long been contentious. One of the earliest proposals in this vein was made by Silverman (1967), who argued that shamanism is a manifestation of schizophrenia (the primary psychiatric diagnosis associated with psychosis). Silverman claimed that shamanism and schizophrenia have closely related cognitive, experiential, and behavioral profiles. Indeed, he suggested that the only substantial difference between shamans and patients with schizophrenia is that shamans attain a greater level of cultural acceptance for their aberrant behaviors. However, Silverman's theory was built on psychoanalytic foundations that have subsequently fallen out of favor. More recently, Polimeni and colleagues (Polimeni 2012; Polimeni & Reiss 2002) have drawn on contemporary cognitive and evolutionary accounts of religion to develop a theory that likewise links shamanism and schizophrenia. Polimeni (2012) argues that, "people with a ... biological propensity towards psychosis were almost always placed in the role of shaman" (p. 168) and "the anthropological literature on shamanism reveals repeated patterns of psychotic experiences – commonly auditory hallucinations – occurring in young people soon to be shamans" (p. 154).

Proposals that shamanism is closely related to schizophrenia have met with sustained criticism (Luhmann 2011). Noll (1983) provided a particularly influential critique. He argued that there are several important differences between shamanic trance and psychotic episodes: Shamanic trances tend to have a voluntary onset and offset, are not overly negative, are consistent with cultural expectations about appropriate behavior for shamans, and serve community needs by procuring information and blessings from the spirit world. By contrast, episodes of psychosis are typically involuntary and highly distressing, are interpreted as "madness" by the community, and do not serve any obvious social function. We contend that it is particularly relevant that understandings of shamanic trance and "madness" are culturally negotiated. As we have argued elsewhere, scholars should be very cautious about pathologizing religious beliefs; just because it is notoriously difficult to identify a precise dividing line between religious beliefs and delusions does not mean that they are the same thing (Ross & McKay 2017).

We suggest that there is a middle path between equating shamanism with schizophrenia and disavowing any relationship whatsoever. Converging lines of evidence suggest that the positive symptoms of psychosis (particularly delusions and hallucinations) lie at the extreme end of a continuum of psychosis-like phenomena in the general population (Linscott & van Os 2013; van Os et al. 2000; van Os & Reininghaus 2016). We propose that individuals nearer the psychosis end of this psychosis continuum are more likely to become shamans than people who are not. There may be at least two reasons for this. First, frequent and vivid

psychosis-like experiences could be interpreted as evidence of “special gifts,” which could signal that shamanic training would be appropriate. Second, the process of shamanic training could intensify and refine psychosis-like experiences such that they are increasingly under voluntary control and are more consistent with cultural expectations about shamanism. Studies of prayer training in evangelical Christians provide evidence for each of these proposals. Imagination-based prayer practice (as opposed to conventional Bible study) increases the vividness of mental imagery, the frequency of the use of imagery, and the frequency of unusual sensory experiences associated with feeling God’s presence. Individual differences in sensory absorption are positively associated with the magnitude of some of these effects (Luhmann et al. 2010; 2013). On a related note, we suggest that shamanic training may cultivate an “intuitive cognitive style” (Stanovich 2011), which has been linked to the endorsement of paranormal explanations for anomalous experiences (Ross et al. 2017) and supernatural beliefs (Pennycook et al. 2016) in contemporary Western populations.

We are not aware of any existing individual differences in research on shamans in traditional societies that could be used to test our proposal directly. Quantitative evidence for a relationship between shamanism and a psychosis continuum, however, comes from research on a shaman-like role in the West: the psychic. Some people in Western societies have experiences of contact with the supernatural. Much like shamans in traditional societies, such individuals may undertake training to cultivate these experiences and make a vocation of contacting the spirit world to help members of their communities. A recent study of clairaudient psychics (people who report hearing voices from other realms) revealed that this group had hallucinatory experiences that share phenomenological characteristics with patients diagnosed with psychotic disorders (Powers et al. 2017a). Nonetheless, there were important differences. In particular, psychics had more control over the onset and offset of their voices, and their voices were less distressing – a pattern that looks remarkably similar to differences between shamanic trance and psychotic episodes identified by Noll (1983).

In this commentary, we have proposed that Singh’s cultural evolutionary theory of shamanism could be enhanced by drawing from continuum theories of psychosis to make predictions about *who* takes up this particular vocation. Nonetheless, caution is warranted. As we have noted, there appear to be important phenomenological differences between clinical hallucinations and non-clinical hallucination-like experiences. Consequently, a more nuanced, multidimensional model that treats psychosis as a complex constellation of phenomena rather than a particular *thing* likely will be needed to understand the causal pathways underlying psychosis in clinical populations and psychosis-like experiences in the general population (Luhmann 2017) – and, we would add, shamanism.

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An existential perspective on the psychological function of shamans

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Abstract: Shamans deal with events that involve the threat of death. They help buffer death anxiety because, through their claimed supernatural abilities, they can provide both hope for averting death and evidence for existence of a spirit world offering continuance beyond death. Thus, managing the threat of mortality probably played a major role in the development and maintenance of shamanism.

According to Singh, shamanism evolved by convincing observers that uncontrollable, uncertain events can be influenced by their ascribed supernatural abilities. These events include fundamental threats to life such as severe illness, crop failure, and famine. The need for control over such events is posited to be a driving force behind the development of shamanism. In addition to providing hope of averting lethal outcomes, the supernatural powers shamans claim and enact evidence of a spirit world. By doing so, these powers help validate belief systems that allow members of the culture to believe they have souls or spirits that continue beyond physical death. In this way, belief in shamans helps tribal members minimize their anxieties about death as a possible ultimate end of existence. Hence, we assert that the need to manage the potential for death anxiety has been a crucial driving force for the cultural evolution of shamanism. Our argument is based on terror management theory (TMT), a well-supported theory regarding how people cope with fear of death (Greenberg et al. 1986; 2014).

Terror management theory assumes a conflict between the innate desire to live and the awareness of one’s own death as a natural and inevitable event (Pyszczynski et al. 2015). This conflict produces an omnipresent potential for paralyzing anxiety, which the anthropologist Ernest Becker (1973) termed *terror of death*. If this potential terror were not minimized somehow, the pursuit of everyday activities would be unfeasible. According to TMT, as our ancestors became cognitively capable of being aware of their mortality, cultures were shaped to help their members manage their potential terror – and the more effectively they did so, the more that culture prospered. Cultural beliefs and rituals serve this indispensable anxiety-buffering function by giving enduring meaning, order, and permanence to existence. Thus, a wide range of aspects of cultures, such as norms, art, language, religion, and science, developed partly to serve this terror management function (Schindler et al. 2013; Solomon et al. 2004; 2015).

Religions and supernatural beliefs are effective for buffering death anxiety by promising not only help from spirits and deities in this life, but also paths toward a literal afterlife (Becker 1973; Vail et al. 2010). A variety of studies have supported the important role of supernatural beliefs in ameliorating concerns about mortality. Research shows that, after being reminded of one’s mortality, people show reduced defensive reactions when provided evidence of an afterlife or led to think about their religious faith (e.g., Dechesne et al. 2003; Jonas & Fischer 2006). Studies also have shown that reminding people of their mortality leads to more religiosity and stronger beliefs in supernatural agents (Norenzayan & Hansen 2006; Vail et al. 2012). In addition, challenging people’s religious beliefs makes death-related thought more likely to enter consciousness, whereas bolstering religious faith makes it less likely (e.g., Jonas & Fischer 2006; Schimmel et al. 2007).

Having briefly summarized the support for a TMT account of faith in the supernatural, we now address the development of shamanism. Singh asserts shamanism appears regularly in human societies, especially among hunter-gatherers. In explaining the development of shamanism, he argues that shamans’ central function is to offer control over important, uncontrollable outcomes by

having special, supernatural powers (e.g., interaction with the spirit world). Examples include illnesses healing, crops thriving, and famine ending. Evidently, the main events with which shamans deal include a threat of death. In fact, his analysis reveals that, in all investigated societies, shamans are concerned directly with at least one death-related threat. We therefore argue that the shamans' explicit job is largely to deal with threats of death and to protect people from them.

Furthermore, shamans provide several attributes that make them especially attractive anxiety buffers when it comes to matters of death. Shamans claim and enact supernatural abilities. They thereby provide proof to their community that a spirit world exists. These abilities thus allow hope not only for good outcomes in this life, but also for continuance beyond death in a next one. In this way, shamans facilitate both comfort and a sense of control of uncertain events during one's lifetime, and, importantly from a TMT perspective, psychological protection from the fear of no longer existing after death.

Interestingly, Norenzayan and Hansen (2006) directly investigated the effect of death on beliefs in shamans. In the study, one-third of all participants was asked to write their thoughts about their own death. Participants in two control groups wrote about either dental pain or participation in a team activity. All participants then read a newspaper article about the use of clairvoyant shamans for military purposes in the Cold War. Next, beliefs in shamans were assessed with items such as "The ancestral spirits that Shamans rely on probably exist." Results revealed stronger beliefs after having thought about one's own death in comparison to the control groups. This effect occurred especially among religious people, emphasizing the relevance of preexisting investment in a supernatural worldview (Vail et al. 2012). The findings of this study provide direct empirical support for our idea that belief in shamans serves a death-anxiety buffering function.

Overall, the cultural development of shamanism can be explained plausibly by humans' need to manage the threat of death, instead of merely controlling uncertain events, as suggested by Singh. Notably, we do *not* claim that providing feelings that events can be controlled is completely irrelevant. Our points are that the main events to control are those that could lead to death and that shamans also contribute to comforting beliefs about existing beyond death. Thus, shamans are, foremost, defenders against death. In fact, Singh himself stated that "cultural evolution and ingenious performers have assembled myths and customs that hack our psychologies to placate our anxieties" (sect. 7, last sentence). This is perfectly consistent with our point that death anxiety has played a major role in the development and maintenance of shamanism.

Therapeutic encounters and the elicitation of community care

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Abstract: Singh's analysis of shamanism is regarded as a contribution to the evolutionary study of healing encounters and evolutionary medicine. Shamans must create convincing healing spectacles, while sick individuals must convincingly express symptoms and suffering to motivate community care. Both have a shared interest in convincing onlookers. This is not restricted to shamanic treatment, but is still true in modern medical care.

Singh's work can be regarded as a useful contribution to the evolutionary science of healing developed by Fabrega decades ago (Fabrega 1997; Steinkopf 2017). One of Singh's main proposals is that those shamanic practices should succeed in the process of cultural evolution that create the strongest impression of effectiveness – irrespective of actual effectiveness. This commentary extends this argument by arguing that both shamans *and* their patients are engaged in an act of joint persuasion: Shamans strive to convince others that their actions are effective therapies; patients strive to convince others in the community that they have a legitimate need for care.

The social environment of sick or injured humans is fundamentally different from the social environment of sick individuals of other species. In non-human animals, being recognized as sick or injured can lead to a loss of attractiveness as a mate or cooperation partner, to a challenge of social rank, to avoidance or exclusion from the group, or to preferential targeting by predators (Tiokhin 2016). Although all of this also could happen to sick or injured humans, a different response from the social environment is rare in other species and highly common in humans: social support and treatment (Steinkopf 2015). Ethnographic and archeological research has demonstrated that this kind of social support is essential for convalescence; disease and injury mortality would be markedly higher in its absence (Gurven et al. 2012; Navarrete & Fessler 2006; Tilley 2015). Thus, patients must convincingly communicate their need for care to others in their communities. This has a number of implications for the evolution of health and healing: The prosocial environment of humans should favor symptoms that signal suffering convincingly and motivate others to acknowledge the sick state and grant help and treatment (Steinkopf 2015; 2017; Tiokhin 2016). Marked displays of pain in humans might be selected for their effectiveness in mobilizing others' support (Finlay & Syal 2014; Steinkopf 2016; Williams 2002). Self-injury and suicidal behavior (Hagen et al. 2008; Nock 2008) and the use of invasive and harmful treatments (de Barra & Cownden 2016) have been hypothesized to serve as highly costly signals to convince others of the victim's neediness. Somatization can be regarded as a mechanism of changing the channel from psychological to somatic symptoms in an environment in which psychological symptoms would not be acknowledged (Brüne 2015; Kleinman 1986).

Thus, the community at large has an important role in the healing encounter. This group has to acknowledge the sick state to absolve the sick individual from tasks and responsibilities and to legitimize provision of food and care. An additional function of the shamanic intervention, therefore, may be to point to – and to convince others of – the fact that the focal individual needs care. In this context of cooperative caregiving, rituals that are dramatic or striking may be more effective in convincing others (de Barra & Cownden 2016): Who but someone in true need of care would undergo such a treatment? The cultural selection pressures acting on the shaman thus may favor performances that inspire fear and trepidation. Formidable dress, contact with powerful forces, and simulated surgical interventions are culturally effective displays because they signal to others that the sick individual has a legitimate problem and need for care. In a sense, the role of the shaman may be *diagnostic* (reliably informing others of the patient's illness and care) as much as *curative*. Remarkably, both the sick individual and the shaman should have a shared interest in a convincing healing performance; a successful illusion of treatment effect and patient response supports both the shaman's claim of expertise and the patient's adoption of the sick role.

The aforementioned mechanisms of reciprocal communication and persuasion are not restricted to the environment of small-scale societies and shamans; they can still be observed in modern medical environments (Moerman 2002). Today, as before, sick individuals have to convince others of their need for

care, and doctors (especially when self-employed) have to convince people of their competence and care (Steinkopf 2012; 2017). Further, the rituals and structure of contemporary medicine still play an important role in highlighting and legitimizing patients' need for care. Although health belief systems have largely changed from spiritual to biological, parallels between contemporary medicine and shamanism are evident. Although medical training no longer requires celibacy, the arduous and prolonged training can be considered a similarly transformative event. Interestingly, the duration of medical training in Western medicine has remained at six or seven years since medieval times at least, despite great differences in availability of useful biomedical knowledge (French 2003). Further, patients usually go to doctors with the expectation of receiving acknowledgment of their sick states by being prescribed treatments, often leading to the prescription of pure or impure placebos or even overtreatment (e.g., Faessler et al. 2010; Howick et al. 2013; Meissner et al. 2012). Although the prescribed treatment is ineffective or even harmful, it contributes to the legitimization of the patient's suffering as well as to the doctor's reputation. On the one hand, the doctor's acknowledgement of the patient's sick state manifested in diagnosis and prescription is a signal to the community for a legitimate need for relief and care. On the other hand, a doctor generously prescribing treatment and thus acknowledging the patient's needs may develop a better reputation (and more economic success) than a medical miser who treats only when treatment is indicated (Fabrega 1997; Steinkopf 2017).

In sum, the shaman has to persuade patients and onlookers through a healing spectacle, *and* the sick individual has to convince others of a sick state, incapacity, and a need for care. Both may have a shared interest in making the healing encounter appear effective, because it supports the shaman's claim of expertise *and* the patient's adoption of the sick role. Modern doctors also act and compete in terms of satisfying expectations and building community consensus around the sick person's need for care.

Toward a neurophysiological foundation for altered states of consciousness

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Abstract: Singh's cultural evolutionary theory posits that methods of inducing shamanic altered states of consciousness differ, resulting in profoundly different cognitive states. We argue that, despite different methods of induction, altered states of consciousness share neurophysiological features and cause shared cognitive and behavioral effects. This common foundation enables further cross-cultural comparison of shamanic activities that is currently left out of Singh's theory.

Singh's cultural evolutionary theory successfully accounts for multiple aspects of shamanism as a recurrent phenomenon. When addressing the evolution of shamanism, however, Singh rejects altered states of consciousness (ASC) as a crucial element, considering these less important than other elements, such as behavioral adaptations. He further claims that different methods of inducing ASC have "profoundly different physiological and psychological effects" (sect. 4.2, para. 1). One of Singh's reasons for setting aside ASC as explanatory is that he thinks the ASC used by shamans do not have a common neurophysiological basis. Yet, this claim is unsubstantiated. Here, we suggest that ASC both share certain neurophysiological features and give rise to shared cognitive and behavioral effects.

Altered states of consciousness induced by methods as varied as sensory deprivation, shamanic drumming, trance, meditation, endurance running, hallucinogen consumption, and even epileptic seizures produce shared cognitive and behavioral effects, including hallucinations, out-of-body experiences, ego dissolution, enhanced imagery, and a distorted sense of time (see Castillo 1990; Danielson et al. 2011; Dietrich 2003; Forgas & Forgas 1992; Hayashi et al. 1992; Kjellgren et al. 2003; 2008; Mason & Brady 2009; Speth et al. 2016; Suedfeld 1980; Suedfeld & Eich 1995; Vaitl et al. 2005; Zuckerman & Cohen 1964). These shared effects are not likely to be coincidental; rather, it is likely that ASC share certain neurophysiological features that correspond to these cognitive and behavioral effects. Although there is as of yet no consensus as to what these shared neurophysiological features are, it is worth reviewing some evidence supporting the view.

One line of evidence comes from using electroencephalography (EEG) to compare ASC with non-altered states. EEG results indicate that ASC, regardless of induction method, correspond to greater activity in the low-frequency bands—delta, theta, and slow alpha (see Takahashi et al. [2005], Batty et al. [2006], Cahn & Polich [2006], and Fox et al. [2013] for meditation and relaxation states; Neher [1962], Oohashi et al. [2002], and Gingras et al. [2014] for trance and shamanic drumming; Hayashi et al. [1992] and Iwata et al. [2001] for sensory deprivation; Muthukumarasamy et al. [2013], Tagliazucchi et al. [2016], and Carhart-Harris et al. [2016] for hallucinogens; and Danielson et al. [2011] for epileptic seizures). These frequency bands, in turn, are associated with internally directed attention and attenuated interaction with the external environment (e.g., Benedek et al. 2014). These results suggest that internally directed attention might be a common element of ASC. Supporting this view, practices such as drumming, trance, endurance running, and focused meditation simulate sensory deprivation to varying degrees and cause highly focused internal attention, such that engagement with external stimuli is highly attenuated (Castillo 1990; Dahl et al. 2015; Dietrich 2003; Gingras et al. 2014; Hove et al. 2016; Lutz et al. 2008). This disengagement of attention from external stimuli, known as perceptual decoupling, helps to sustain internally directed tasks (Hove et al. 2016; Smallwood et al. 2007; Smallwood et al. 2011; Spreng et al. 2010). Similarly, hallucinogens that induce ASC impair reactions to external stimuli, but this occurs because of the failure of sensory gating in filtering out extraneous stimuli, causing a failure to process incoming information adequately (Carter et al. 2005; Geyer & Vollenweider 2008).

The second line of evidence comes from studies using neuroimaging techniques such as functional magnetic resonance imaging (fMRI). Such studies suggest that one of the most common effects of ASC, known as ego dissolution (the loss of a sense of self), corresponds to disruptions to the default mode network (DMN). The DMN is activated during self-referential processes, such as autobiographical memory retrieval (Boly et al. 2008; Buckner et al. 2008; Raichle et al. 2001). Studies using fMRI have indicated that, during ASC induced by various methods—including focused meditation (Brewer et al. 2011), hallucinogen consumption (Carhart-Harris et al. 2012; 2016; Palhano-Fontes et al. 2015; Tagliazucchi et al. 2016; Speth et al. 2016), and epileptic seizures (Danielson et al. 2011)—the activation of the DMN decreases, giving rise to ego dissolution. These studies also reveal that, during ASC, regardless of induction method, high functional connectivity is exhibited between three interacting brain networks: default mode, frontoparietal control, and salience (see Brewer et al. 2011; Carhart-Harris et al. 2016; Hasenkamp et al. 2012; Hove et al. 2016; Tagliazucchi et al. 2016). The frontoparietal control network is responsible for cognitive control and attention (Cole & Schneider 2007; Cole et al. 2014; Vincent et al. 2008). The salience network is responsible for detecting salient events (internal or external) and for directing resources to the relevant neural areas (Christoff et al. 2009; Menon & Uddin 2010; Seeley et al. 2007). Enhanced connectivity among these three

large-scale brain networks could explain some of the effects experienced by individuals during ASC, including the perceptual decoupling discussed above.

This evidence supports the idea of a common neurophysiological foundation to ASC. We further claim that a common neurophysiological foundation to ASC can be of significant explanatory value for a cultural evolutionary theory of shamanism. For example, Singh's theory notes but does not currently explain the shaman's insensitivity to pain, which, in our view, would be explained by perceptual decoupling in ASC. Similarly, Singh's theory does not account for the shaman's ritualistic practice of using dark times of the day or dark spaces, such as caves; in our view, this is explained by the relationship between sensory deprivation and ASC. Finally, Singh's theory notes but does not currently explain why shamans believe they are not in control of their experience, which, in our view, is explained by the experience of ego dissolution common to ASC. Although ASC and their underlying mechanisms require further investigation, we argue that it is too soon to reject the idea of a common neurophysiological foundation to ASC. Our argument is consistent with the primary objectives of Singh's cultural evolutionary theory and can be considered an extension to that theory, because it can help explain the universality, ubiquity, and endurance of shamanic activities around the world.

The social functions of shamanism

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Abstract: Cultural evolutionary accounts of shamanism must explain the cross-cultural recurrence and variation in associated practices. We suggest that Singh's account of shamanism would be strengthened by considering the social functions of shamanism in groups. Shamanism increases social group cohesion, making it distinct from other magico-religious practices.

The term *shamanism* can be applied broadly to a wide set of magico-religious practices that occur across cultures. Historical, social, economic, and ecological factors contribute to how shamanistic practices are organized within cultural groups. Singh's account of the cultural evolution of shamanism provides a framework for explaining cross-cultural variation and recurrence of related practices. As the author notes, however, the current "theory is agnostic as to whether shamans provide benefits to clients or groups" (sect. 3.4, para. 3). We argue that understanding social functions is central to a cultural evolutionary account of shamanism. We discuss how the social nature of shamanism differentiates it from practices related to other magico-religious practices such as witchcraft. We also explain that the rituals associated with shamanism provide a means of social cohesion that does not always necessarily involve signaling cooperative intent (Watson-Jones & Legare 2016).

Shamanism and traditional healing are distinct from practices related to witchcraft. Winkelman's (1986b) analysis of Standard Cross-Cultural Sample (Murdock & White 1969) data provided evidence that magico-religious practices are related to political and economic complexity. This analysis revealed that there are four major practitioner types related to socioeconomic conditions:

1. The Healer Complex that includes shamans, shaman/healers, and healers – the major distinction among these being that the shamans and shaman/healers engage in trance states,

whereas the healers do not. Shamans were most associated with hunter/gatherer societies, shaman/healers with all societies that had agriculture, and healers with almost all societies that were politically integrated.

2. Mediums who were characterized as engaging in possession-like trance states and were found in agricultural and pastoralist societies

3. Priests who were often leaders in societies with political integration and a hierarchical social structure that relied heavily on agriculture

4. Malevolent practitioners who engaged in harmful activities against others in societies with political integration. Across many cultures, witchcraft practitioners are considered malevolent actors. For example, in South Africa, witchcraft is a common attribution for the ultimate cause of AIDS transmission (Legare & Gelman 2008). Witchcraft practitioners are accused of using their supernatural knowledge for individual gain and are not regarded as working in the interests of all members of the community. In many cases, once communities with shamans are integrated into more complex socioeconomic systems, practitioners associated with the predominant religion call out or label shamans as witches to delegitimize their role within the community (Winkelman 1986b).

Shamanism is communal. Many anthropologists have argued that shamanism has social functions; it increases social cohesion and cooperation. Shamans act as a conduit to the supernatural realm, where they act on group members' behalf and enable rituals (often dramatic) that bind group members together for a common goal. This is not to say that shamans act selflessly. As the author notes, shamans often are prestigious members of their communities. An account of the cross-cultural recurrence and variation of magico-religious practices must take into account the perceived, or actual, motivations of the practitioners. The shaman reduces uncertainty surrounding important fitness-related events, such as illness, childbirth, hunting, and protection from enemies. Healers are almost exclusively responsible for dealing with illness-related issues, and witches are perceived as focused on causing harm to others, most often surreptitiously. It would be interesting to consider whether shamanism is ever practiced in secret – if shamanistic practices are done in isolation from other community members, are they ever done without request or knowledge of the community?

The importance of shamanism and similar practices for group functioning is not necessarily related to signaling cooperative intent, and the author provides a cogent argument against costly signaling accounts of shamanism. Cooperative intent doesn't get off the ground without a preexisting, regularly maintained core of social cohesion. The rituals associated with shamanism provide a means of reaffirming social solidarity through shared experience and providing an indication of commitment to group norms.

Does shamanism professionalize because of its contribution to group functioning? Singh argues that shamanism professionalizes "because individuals typically must invest in transformative practices to be considered capable of influencing uncertain outcomes" (sect. 5.1, para. 4). In this way, the professionalization differs from that of practices related to technical knowledge. Both expertise and group consensus increase perceptions of ritual efficacy (Souza & Legare 2011). We argue that the professionalization of shamanism also is related to the function it serves for groups. As the earliest ritual practitioners, shamans provided a means of group cohesion that was, and is, essential for small-scale societies.

The defining characteristics of shamanism come partly from its relationship to social group dynamics and the benefits its practices provide for social cohesion. Singh's framework of the cultural evolution of shamanism neglects an essential explanatory feature of shamanism: the social benefits it provides to human groups.

The evolution of the shaman's cultural toolkit

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Abstract: A complete picture of shamanism's cultural evolution requires an understanding of how the professionalization of shamanism affects the distribution of knowledge within societies. We suggest that limiting knowledge to fewer people could impede the accumulation of functional knowledge within shamanism. On this basis, we make further predictions about how the domain of shamanism could change and collapse.

The complexity of a cultural toolkit is highly dependent on the size and interconnectedness of the group that holds that toolkit (Derex et al. 2013; Kline & Boyd 2010; Powell et al. 2009). If a society shrinks, it can experience loss of cultural knowledge because of low-fidelity transmission (Henrich 2004). Even at its best, social learning is imperfect, and details of tools, practices, and beliefs can be lost from one generation to the next. For example, if a society has a highly effective but complex fish hook design, it is unlikely that everyone in that society will master its construction. Given more minds, the probability that at least one learner will learn everything necessary to recreate this technology increases; furthermore, given a larger number of people to learn from, the greater is the probability that any specific learner will learn all of the key pieces of knowledge (Muthukrishna et al. 2013). Small variations in transmission can lead to innovation on a tool or piece of knowledge, rendering something like a fishhook more effective than the previous version (Aoki et al. 2011; Eerkens & Lipo 2005). These innovations will be passed on to the next generation through the preferential learning from these experts (e.g., Chudek et al. 2012; Henrich & Gil-White 2001).

Singh discusses this in the context of a whole society losing shamanism, but not in the context of how these mechanisms affect the shaman's toolkit itself. Professionalization of shamanism reduces the number of teachers and learners capable of transmitting the shaman's knowledge. If only a few shamans and a few apprentices hold a specific type of knowledge, then we should expect lossy transmission. Even if we assume that the fidelity of transmission is extremely high at an individual level—each apprentice might train for years to perfectly learn the entire toolkit—the limited number of minds this knowledge iterates through will decrease the likelihood of new innovations accumulating. This type of high-fidelity vertical transmission is conservative and is unlikely to produce much variation (Cavalli-Sforza & Feldman 1981). Even under conditions of perfect fidelity, the best we can hope for is that the shaman's toolkit remains static and simple. Under conditions of low fidelity, it will need to be largely reinvented in each generation.

In many of the domains in which a shaman works, this is unimportant. If the shaman's primary role is to control the weather, then a lack of fidelity and innovation will do no harm. There is no real causal connection between the details of the toolkit and its alleged effects. Therefore, the probability of this knowledge ever becoming functional is infinitesimal. For other domains, this possibility could pose real problems. Medicine and food acquisition can have tangible impacts on a society's ability to survive and prosper. Small innovations in these domains can accumulate over time to create effective tools that far surpass anything individuals could come up with on their own (cf. Cavalli-Sforza & Feldman 1981; Henrich & Henrich 2010). Conversely, the failure to innovate could make a society less likely to thrive in its environment and less able to compete with other groups.

For shamanism to avoid becoming maladaptive in these cases, other mechanisms need to be used to increase the probability of transmission and innovation. Competition among multiple shamans could increase the probability that functional practices arise, but if we follow Singh's claim, the selection pressures here are for more elaborate displays rather than functional skill sets. Even if this is not the case, the number of shamans is likely to remain too low for effective innovation in many societies. Domains such as medicine can be maintained by dispersed parallel traditions outside of shamanism. As effective innovations accumulate in an area such as medicine, the shaman's purview should become increasingly restricted to only the perceived spiritual aspects of the illness (Hultkrantz 1985).

Paying attention to these dynamics allows us to make more specific predictions about how shamanism might change or disappear as societies become more complex. The role of shamans in domains where functional knowledge is possible should become more restricted as these more effectual practices develop. In addition to the suggestions in Singh's article, shamanism may disappear because the early professionalization of shamanism reduces the chances a shaman's toolkit can compete with the increasingly complex technology of a growing society.

Further, given imperfect fidelity, the pieces of a shaman's toolkit that are maintained should become simpler and easier to transmit. Traits like redundancy through repetition of steps can increase the probability of this transmission (Acerbi & Tennie 2016). This type of routinization would make supernatural practices more ritualized over time (cf. Humphrey & Laidlaw 1994). In some cases, shamanism's ecstatic trance states may thus be replaced with more easily transmitted ritualized action. If easy-to-transmit mechanisms such as repetition and ritualization become part of what is passed on, they will begin to look increasingly like what we expect from religions (Whitehouse 2004). Thus, another way shamanism may disappear is by changing into something that looks increasingly like religion. This has been the case with the religious traditions that followed many of prophets and religious founders Singh offers as examples of shamanism.

When we compare the roles of shamans with the roles of religious professionals as a broad category, the likelihood of this transition becomes more plausible. Priests and pundits are also privileged communicators with the supernatural world in domains of uncertainty (Weber 1969), but these religious professionals are more likely to work in routinized ritual practices than the elaborate trance states of shamans (cf. Whitehouse 2004). Even in our increasingly technological world, the problem of uncertainty remains. Increases in safety and security have led to some decline in religious belief in some parts of the world (Norris & Inglehart 2004), yet religion worldwide has shown little decline (Stark 1999; Stark & Bainbridge 1985). The problem of coping with uncertainty remains, and managing this uncertainty frequently stays in the hands of religious professionals.

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NOTE

1. Correspondence concerning this article should be addressed to Aiyana K. Willard.

Identifying the nature of shamanism

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Abstract: Singh conflates diverse religious statuses into a single category that includes practitioners with roles that differ significantly from empirical characteristics of shamans. The rejection of biological models of trance and conspicuous display models misses the evolutionary roots of shamanism involving the social functions of ritual in producing psychological and social integration and ritual healing.

Conceptual problems undermine Singh's approach, which misrepresents the empirical research on shamans he cites (Winkelman 1990; 1992). Instead of using the empirical distinctions discovered between shamans and other magico-religious practitioners, he combines witch doctors, mediums, healers, priests, prophets, and others into a category he calls shamans on the basis that they all have trances. He does not provide a cogent view of trance; however, nor does he justify using the word *shaman* to refer to the actual object of his investigation: people who are good at deceiving others into thinking they can control uncontrollable events. His conclusion that shamans are "cheese-cake" illustrates a loose metaphoric approach to a phenomenon that he ambiguates rather than clarifies.

To explain shamanism – a premodern worldwide phenomenon – we must account for the independent derivation of a complex of specific characteristics found cross-culturally in foraging societies (Winkelman 1992), including the following:

- Shamans' charismatic roles as preeminent social leaders
- The unification of the community in an overnight ceremony
- Community engagement in dancing, drumming, and singing
- The alteration of consciousness and self-reference in out-of-body and death/rebirth experiences
- Effective divination and healing abilities
- Experiences of animal powers and transformation into an animal
- The use of supernatural power to harm
- Spirit beliefs about nature that provide a comprehensive animistic cosmology

Singh proposes that shamanism represents traditions developed through cultural evolution to convince people that a practitioner can influence unpredictable events. Singh's effort to use data to show that shamanism involves addressing uncontrollable events is based on an arbitrary classification of events as certain or uncontrollable and random. This illustrates the specious nature of his arguments. Since when is childbirth a controllable event in premodern societies, where it was a major source of mother and infant mortality? Why presume that political or economic activity is certain? Furthermore, the primary focus of shamanism involves using ritual to elicit endogenous healing responses (Winkelman 2010a). These are not uncontrollable, but they are reliably elicited in hypnotic susceptibility and placebo responses and their health-enhancing physiological effects.

In defining shamans in terms of trance, Singh appears to attempt to explain what Winkelman (1992) called *shamanistic healers*: a universal social phenomenon of ritual specialists who ritually alter consciousness to enter into spirit relations for purposes of divination and healing. This concept of shamanistic healers underlying Singh's concept of shamanism is compromised by defining them in terms of trance, but discounting the analytic usefulness of trance with reference to biological (neurotheological) theories of altered states of consciousness (ASC). Biological theories are necessary because shamanistic healers deliberately use ASC for their functional roles in divination and healing (Winkelman 2010a).

Explaining the human universals of trance – ritual ASC and shamanistic healing – requires an account of how and why these states occur and their nature and effects (i.e., Winkelman 2011a; 2011b), not merely considering them to be contrived displays to impress gullible people. Although Singh asserts that shamans use trance to violate intuitions of humanness, just what is human or non-human about trance is not critically addressed. Why should something virtually universal – institutionalized trance rituals –

be considered a violation of humanness? What evidence is there that claims of non-normal powers and professional competition select for displays of trance and death/rebirth reports? Why should this subterfuge be proposed instead of recognizing the widespread natural occurrence of these experiences as consequences of extreme suffering, trauma, drug use, and other organic and psychological factors?

The notion that a similar complex of ritual behavior is the consequence of selection presumes that the behaviors facilitate adaptations. Singh undermines his own argument by first stating that his theory is agnostic regarding whether shamans provide benefits. Later, however, he claims that shamans control events with "fitness-relevant" outcomes. Adopting explanations based on cultural selection, how did more gullible people believing in people who appear to control uncontrollable mechanisms enable their groups to outcompete other cultures? How do these presumptive delusions make cultures more adaptive and able to outcompete others? How did susceptibility to superstitions regarding people who claim they can control unseen causal agents or uncontrollable events affect survival-relevant outcomes? Why should people prefer "successful-appearing practices" (sect 3.4, para. 2) rather than actually successful practices? Singh fails to address how these superstitions about powerful others can select for more competitive cultures or the complex of behaviors associated with shamanism. If Singh wants to attribute shamanism to a susceptibility to suggestion by powerful others, the co-evolution of shamanism, the hypnotic capacity, and ASC are very relevant (Cardeña 1996; Rossano 2009; Winkelman 2010a).

There is no need to presume that some need for superstition about special human powers leads to claims of invisible entities who control unpredictable events. There are well-recognized innate modules that underlie the assumptions of spirits – agency detection and interpersonal intelligence – that have established evolutionary bases (i.e., detection of predators and inferring the thoughts of others).

Singh's rejection of the hypothesis that shamanism exploits costly signals misses the point. Such displays function to signal one's commitment because their energetic cost provides credible display of commitment (Rossano 2015), regardless of when the benefits are received. Shamanic performance not only is a commitment manifested in extensive energy expenditure, but also produces positive effects on intragroup relations, intergroup signaling, and interspecies communication (Winkelman 2010a).

Shamanism involved the evolution of the dynamics of a charismatic social leader who exploited ritual mechanisms to alter consciousness during a nighttime public dancing performance with the community joining in, singing and clapping. We see similar ritualization in chimpanzees' maximal display, which has integrative social and psychological functions that reveal the hominid basis from which shamanism evolved among our hominid ancestors (Winkelman 2009; 2010b; 2015). The adaptive nature of this complex as a conspicuous display affecting humans and other species was the domain of behaviors in which cultural evolution acted to select for shamanic potentials. Shamanism evolved in the context of this ritual of empowerment that enhanced well-being, augmented consciousness through ASC, and enhanced susceptibility to ritually elicited placebo effects.

Complexity and possession: Gender and social structure in the variability of shamanic traits

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Abstract: Singh deploys cultural evolution to explain recurrent features of shamanistic trance forms, but fails to substantively address important distinctions between these forms. Possession trance (vs. trance without possession) is disproportionately female-dominated and found in complex societies. The effects of cultural conditions on shamanism thus extend beyond its presence or absence and are vital for modeling its professionalization and spread.

Singh's article attempts to explain the cross-cultural persistence and similarity of professionalized shamanic roles as a function of cultural evolution acting within the constraints of evolved cognitive biases. At the same time, Singh purports to account for variation in the specific forms of shamanism. His choice, however, to reduce the operational definition of shamans to "practitioners who enter trance to provide services" (sect. 1, para. 1) substantially weakens the potential for true comparison among discrete forms of shamanism. And there *are* discrete forms of shamanism: Shamanic or trance practice takes predictably different forms in distinct societies in relation to several crucial axes of variation, particularly gender roles, social structure, and type of trance (Bourguignon 1973; Winkelman 1986a).

Moreover, ecstatic states such as trance are not limited to professional shamans. Hayden (2003) distinguishes shamans from mystics who enter trances but do not function as helpers or healers and, conversely, shamans from magicians who effectively harness spiritual power but do not use trance states. Therefore, focusing on competitive advertising as the function of trance within shamanic cultural forms misses something about both shamanism and trance.

Using a sample from Murdock's original Ethnographic Atlas, Bourguignon (1968) found that societies with higher levels of structural complexity were more likely to exhibit possession trance, whereas less complex societies were more likely to have trance without possession (see also Bourguignon & Evascu 1977; Winkelman 1986a). Greenbaum (1973) found that, within sub-Saharan African societies, structural rigidity, that is, highly prescribed, hierarchical social roles, predicted the existence of possession trance above and beyond social complexity. Similarly, using Murdock and Provost's (1973) societal complexity variables, Winkelman (1986a) found that the training process for shamanic healers was more likely to involve spirit possession in more complex societies, especially those with high political integration, high population density, and high levels of social stratification.

Another crucial layer of variability not acknowledged in Singh's article is that trance cults focused on spirit possession are disproportionately headed by female priests or shamans or attract a predominately female following (Lewis 1971; Sered 1994). This is no trivial detail, even if the sole focus remains on professionalization and credibility displays. A new aggregated database that one of us (Stockly) has collaborated in constructing and validating may be especially well suited for investigating both the variability between types of trance (spirit possession trance and trance without possession) and the distribution of such techniques along gender and sex lines (Stockly et al. 2017). The Sex Differences in Religion Dataset (SDRD) compiles data from existing databases and original variables coded from several ethnographic accounts into a single dataset, enabling statistical analyses using data that previously had existed only in isolation. The SDRD focuses especially on data relevant for women and gender roles within spiritual and religious traditions, including variables regarding the status of women, non-binary gender roles, marriage residence patterns, religious and cultural rituals, domestic violence, and social development for a representative worldwide sample of 215 different cultures. The sample encompasses both the Standard Cross-Cultural Sample (Murdock & White 1969) and the HRAF Probability Sample (Naroll 1967). For the present analysis, in conjunction with new SDRD codes for spirit possession, we recoded and supplemented Snarey's (1996) codes on high gods and used data originally coded by Justinger (1978), Lagacé (1977), and Huber et al. (2004).

Using the SDRP database, we conducted new analyses focused on the relationships among social structure, trance type, and gender and sex roles. Here, we report preliminary findings. For these analyses, skewness and kurtosis of all variables were within acceptable limits (± 2.00) for parametric tests. Sample sizes differ as a function of variable overlap between source datasets.

Corroborating Bourguignon's earlier findings, the presence of female-dominated possession cults exhibited a significant positive Pearson product-moment correlation with larger societal population ($r = .383$, $n = 35$, $p = .023$); more layers of institutional hierarchy within stateless societies ($r = .366$; $n = 34$, $p = .033$); and belief in moral high gods ($r = .284$, $n = 102$, $p = .004$). The latter association bears on recent findings in cultural evolution indicating that, as societies grow in population size and complexity, religious systems may converge toward veneration of moral high gods and monotheism (Norenzayan et al. 2016; Purzycki et al. 2016). The fact that possession cults not only thrive in such contexts but are typically dominated by women's participation calls for explanation (Lewis 1971). Perhaps shedding some light on this question, we found that female-dominated possession cults are also positively associated with relative economic deprivation ($r = .343$, $n = 34$, $p = .047$) and low frequency of premarital sex ($r = .411$, $n = 35$, $p = .014$).

Each of the above variables indexes one or more important features of what Douglas (1970; 1999) characterized as "high-grid, high-group" societies – cultures that exert high levels of hierarchical social control over strictly bounded populations. Meanwhile, female-dominated possession cults were inversely correlated with the overall social status of those who enter possession trances ($r = -.365$, $n = 105$, $p < .001$). This is unsurprising, given that they are women, but it further emphasizes the complex and intriguing association between strict social control and possession trance, as in Korean shamanism (Kendall 1987).

We agree with Singh that trance states are not *anthropological esoterica* (Bourguignon 1973, p. 11). Fertile opportunities for theoretical progress are missed, however, when researchers neglect the interactions among social structure and religious forms (Douglas 1970). The questions of whether a shaman in a given society is a man or woman (or a third gender; e.g., Callender & Kochems 1986) and whether that shaman's trance is characterized by the bodily intrusion of culturally posited supernatural agents or the retention of personal agency are directly relevant for Singh's agenda of mapping the strategic affordances that influence the spread of shamanic practices. Clearly, something about complex, hierarchical societies bends cultural selective pressures toward female-dominated possession trance. Why? Singh's preference for collapsing these varied distinctions is, unfortunately, a step away from, rather than toward, greater knowledge. If shamanism is nothing but "cheesecake," then it comes in far more than one flavor.

Author's Response

Why is there shamanism? Developing the cultural evolutionary theory and addressing alternative accounts

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Abstract: The commentators endorse the conceptual and ethnographic synthesis presented in the target article, suggest extensions and elaborations of the theory, and generalize its logic to explain apparently similar specializations. They also demand clarity about psychological mechanisms, argue against conclusions drawn about empirical phenomena, and propose alternative accounts for why shamanism develops. Here, I respond.

If intrepid travelers stumbled onto some hitherto unknown island hosting the most remote, untouched peoples, separated from the rest of humankind by tens of thousands of years and subject to their own unique cultural evolutionary histories, we would expect shamans. That peculiar constellation of trance, dance, otherness, and superpowers, shamanism occurs with such reliable consistency that several writers have branded it “universal” (Bužeková 2010). Technically, it’s not, but the recurrence of shamanism suggests that it develops from shared human psychological capacities, generalizable cultural evolutionary processes, and convergent social dynamics. In the target article, I proposed an account rooted in these foundations. In their 25 commentaries, leading thinkers and constructive colleagues replied.

I greatly appreciate that such a diversity of thoughtful researchers, each with a distinct expertise in some facet of human nature, have engaged with shamanism in general and this theory in particular. In this response, I summarize and reply to their insights, queries, and criticisms. In section R1, I review the proposed theory and clarify its core concepts. I then consider elaborations and generalizations of the theory (sect. R2) and further address why shamanism collapses or transforms with shifting circumstances (sect. R3). I evaluate alternative cultural evolutionary accounts, such as those proposing shamanism to be an effective division of labor or a mechanism for social bonding (sect. R4) and conclude by suggesting directions for future research (sect. R5).

R1. Reviewing and clarifying the proposed theory

In this first section, I review the cultural evolutionary theory of shamanism and clarify the central concepts. In response to commentators’ questions and suggestions, I also use this space to develop components of the theory, such as outlining how shamans deviate from notions of humanness and how dramas of strangeness promote perceptions of supernatural engagement.

R1.1. On shamans

I defined *shamans* as “practitioners who enter trance to provide services” (sect. 1, para. 1). **Winkelman** rightly observes that I have combined “witch doctors, mediums, healers, priests, prophets, and others ... on the basis that they all have trances” (para. 1). **Boyer** commends this avoidance of “otiose terminological quibbles” (para. 1); still, several commentators object. **Winkelman** points out that, according to a typology he developed, shamans are a subclass of trance practitioners restricted to foraging societies who, among other activities, transform into animals and lead ceremonies accompanied by community dancing, drumming, and singing. **Cardena & Krippner** endorse a definition of shamanism in which practitioners fulfill the needs of the community, engage in magical flight or mediumship/possession, and possess expertise in altering one’s

and sometimes others’ consciousness. As with others (e.g., Hultkrantz 1993; Lewis 2003), I prefer a broader definition because it captures a puzzling assemblage of traits that co-occur across time and space. This usage also encompasses practitioners who are commonly described as shamans but are sometimes left out of more selective definitions, like Japanese and Korean shamans (Blacker 1975; Kendall 1985). Nevertheless, using more restrictive criteria is valuable for carving up cultural variation and investigating the determinants of a wider array of characteristics in a more specific set of contexts.

R1.2. On superstition and invisible agents

The term *superstition* seemed to have introduced some confusion, especially in its relation to invisible agents (**Beit-Hallahmi; Winkelman**). By *superstitions*, I mean false beliefs in the effectiveness of interventions, following a similar usage by psychologists and evolutionary biologists (Abbott & Sherratt 2011; Foster & Kokko 2009; Ono 1987; Skinner 1948; Vyse 2014). Superstitions include blowing on dice, dancing to call rain, and visiting a shaman to heal incurable illness. Building on theoretical and empirical insights from these researchers, I argued that people adopt these false beliefs because of a bet-hedging psychology: When the costs of an intervention are sufficiently small relative to the potential benefits, and when the outcome seems to occur sometimes after the intervention, individuals benefit on average from adopting those interventions (Beck & Forstmeier 2007; Foster & Kokko 2009; McKay & Efferson 2010). For example, if I am desperate for rain and, upon dancing, find that it rains the next day, I will be predisposed to note an illusory correlation and dance during the next drought.

I agree with **Beit-Hallahmi** and **Winkelman** that the invisible agents believed to populate the world and intervene in important events represent a separate phenomenon with a distinct psychological basis, likely involving capacities that evolved for detecting agents. I also agree with **Boyer** that invoking sociocognitive biases, including agent detection, is insufficient to explain why we believe invisible forces determine random, important events and that these beliefs largely remain important, unsolved mysteries.

Both superstitions and invisible agents surround important, random, uncontrollable events, such as illness healing and the arrival of rain. People develop superstitions to control these outcomes; they also tend to believe that invisible agents oversee them. According to the proposed theory, a selection for efficacious-seeming superstitions drives the development of practitioners who supposedly interact with these invisible forces.

R1.3. On the cultural evolutionary story

I argued that shamanism develops because of a cultural selection for superstitions that seem to best control uncertain outcomes. As people choose superstitions to summon the rain, heal disease, and so forth, they drive selection for magic that exploits our psychological biases, producing practitioners who engage with invisible agents to control events of uncertainty.

Boyer notes that there is no precise connection to models of cultural transmission and that the account is most consistent with the cognitive attractor framework. I

connected the theory to cultural transmission models in note 5, including the cognitive attractor framework (referred to as “approaches by SC”). I agree that the proposed cultural evolutionary story resembles cognitive attractors insofar as it explains the prevalence of various cultural variants by examining how shared cognitive biases predispose us to find some beliefs more compelling. However, it differs from at least some cognitive attractor models in how it hypothesizes cultural design to emerge: Rather than design developing from minds consistently reconstructing variants, design is hypothesized to result mostly from clients preferentially selecting or patronizing practices that seem effective.

Boyer questions my allusion to prestige and conformity biases, and **Winkelman** asks for clarification on how “these presumptive delusions [of controlling events of uncertainty] make cultures more adaptive and outcompete others” (para. 6). To clarify, the proposed cultural evolutionary story incorporated neither prestige biases, conformity biases, nor cultural group selection. In fact, note 5 explicitly rejects several of these mechanisms; it reads, “[The proposed account] diverges from models by [Boyd and Richerson] in ignoring or downplaying the involvement of cultural group selection ... and stressing that functional technologies emerge from individuals adopting what *seems* to work (rather than from, for example, purely copying the variants of the successful or prestigious).”

R1.4. On humanness

A major premise of my argument is that shamans encourage perceptions of their supernatural abilities by violating conceptions of humanness, allegedly becoming entities distinct from normal humans. **Haslam** critiques this claim, focusing especially on the opposing examples of shamans being more animal-like in some ways and less animal-like in others. He states that defining humanness (and deviations from it) on an axis running from most animal-like to least human-like is not useful, because supernatural agents differ in ways orthogonal to that distinction.

Haslam interprets violations of humanness to mean that a person becomes more or less animal-like. But I intended those deviations to encompass many forms of foreignness, including the following:

1. A person is more animal-like, such as sharing affinities with jaguars or birds.
2. A person has specially developed cognitive abilities, such as self-control.
3. A person has different body parts, such as new eyes, ears, or head.
4. A person's biological constitution differs, such as having special blood, organs, or magical substances within the body.
5. A person is believed to have undergone a fundamental transformation, such as from long bouts of fasting, death and resurrection, or debilitating illness.
6. A person is subject to inexplicable or rare circumstances, such as lightning strikes or an auspicious birth.
7. A person exhibits inexplicable or rare behavior or morphology, such as psychosis (see sect. R2.2) or anatomical abnormalities.

I agree with **Haslam** that shamans violate behavioral norms in many ways that convey strangeness rather than

differing from one particular dimension of humanness. But I respectfully disagree that those differences can take any form and lack patterns. The ethnographic examples presented in **Table 2**, which include categories 3, 4, and 5, illustrate that the transformative events presumably undertaken by shamans often correspond directly with their supposed powers. For example, shamans claim new eyes or ears to justify exceptional sensory abilities, while they declare similarity to certain animals to claim those beasts' powers.

The differences delineated above reveal that many factors contribute to people's notions of superpowers, aside from a perception of supernatural beings having higher or disembodied cognition. Moreover, these intuitions of difference extend beyond the religious lore of small-scale societies, even characterizing the mythologies of contemporary Western media. The target article referred to the origin stories of superhero narratives, but other modern-day examples of supernaturalizing otherness exist. For example, Jedi have a high concentration of intelligent life forms (*midi-chlorians*) in their blood, endowing them with the power to use “the Force” (*Star Wars*: Lucas 1999), while the superhuman of Besson's (1997) *The Fifth Element* has DNA with “infinite genetic knowledge” and 200,000 (fictional) memo groups rather than the supposedly normal 40 memo groups. Importantly, these differences are not random; they reflect local conceptions of what constitutes a human and its abilities.

R1.5. On trance

As a defining feature of shamanistic practice, trance invited considerable attention among the commentators (**Cardeña & Krippner**; **Hove & Stelzer**; **Kapitany & Kavanagh**; **Linguist**; **Tabatabaeian & Jennings**; **Winkelman**). Summarizing their common points, I use this section to address four questions: (1) What is trance (as used in the target article)? (2) How might trance performances promote perceptions of supernatural contact or powers? (3) Do trance states share neurophysiological underpinnings? (4) Do trance states provide psychological benefits?

R1.5.1. What is trance? By *trance*, I mean “a temporary state that appears psychologically and behaviorally distinct from normal human functioning” (sect. 1, para. 2). In response to **Cardeña & Krippner**'s comments about distinctions in the literature, this usage is very broad. It encompasses both “ecstasy” and “trance” as used by Rouget (1985) and incorporates any cultural understanding of that temporary, dissimilar state. Cultural interpretations of trance include soul journeying, possession, mediumship, and the perception that a person's healing energy is boiling (e.g., Katz 1982). This definition also applies to most if not all altered states of consciousness—because they are defined as states of consciousness that are radically different from ordinary functioning (Tart 1972)—including the 20 outlined by Vaitl et al. (2005).

R1.5.2. How might trance performances promote perceptions of supernatural contact or powers? I argued that trance is a performance of strangeness that promotes perceptions of supernatural power. Several commentators ask for precision on how this should occur or what

strangeness entails (Kapitany & Kavanagh; Winkelman). I agree that explicitly outlining these social and psychological pathways is fundamental for a complete theory of shamanism, so I review and propose some explanations here.

Kapitany & Kavanagh offer a helpful account for how trance should presumably demonstrate supernatural powers or contact. They state that people are quick to detect teleology, entertain dualism, and attribute agency to the ambiguous. Thus, when they witness individuals with “unusual mental abilities” (trance), people are inclined to accept that some outside agency, probably in the form of invisible agents, is the instigator.

Kapitany & Kavanagh’s hypothesis is useful, but as currently formulated, it predicts only that people will infer outside, agentic, spiritual involvement, or possession. Therefore, it cannot explain other common trance states, such as soul journeying and the medicine-induced, special sight of the Azande (Evans-Pritchard 1937). I suggest including it as one of three complementary mechanisms to describe trance:

1. *Intuitive possession.* When confronted with hard-to-explain behavior, people’s belief in spirits and their tendency to attribute ambiguity to agentic forces predispose them to explain the behavior as possession (an outside spirit intervening in and causing it) (Kapitany & Kavanagh).

2. *Performative transformation.* People are impulsively skeptical of declarations of superhuman acts (e.g., claims of one’s soul leaving one’s body, seeing signs of witchcraft in others’ bodies, or one’s healing energy boiling to the point of special sight). But by acting in ways very foreign to normal human behavior, people more credibly appear to be entities distinct from normal humans with different kinds of abilities. For example, a person normally shouldn’t foam at the mouth and lose touch with the sensory world; someone doing so presumably has become a different kind of entity, making declarations of special abilities more conceivable.

3. *Performances of claims.* Observers have notions of what should be involved in, for example, being possessed by a deity or leaving one’s body. For example, if a possessing spirit is known to be animal-like, the practitioner should be animal-like. If the possessing deity is angry and masculine, the practitioner should manfully fume.

Note that for all of the above-suggested mechanisms, trance becomes more convincing as the person’s behavior becomes more dissimilar from ordinary human conduct. Alternative explanations become more plausible as trance departs from the expected.

Boyer emphasizes the value of examining ethnographic accounts – of connecting “attention to cultural variants” to “a rich psychology” (last para.). I agree. In that vein, I interpret the above explanations in the context of two ethnographic films that interested readers can view: *N/um Tchai* (Marshall 1969), which shows trance dancing among the !Kung, and *Magical Death* (Chagnon & Asch 1973), which shows shamanic healing and killing magic among the Yanomamö.

N/um Tchai illustrates the second mechanism. The most advanced healers of the !Kung can see illness or fetuses inside the body, tell of lions that may be lurking far away from camp, and leave their bodies to converse with the spirits of dead ancestors (Katz 1982). These abilities

develop only in the deepest form of trance, full *kia*, during which they “die” (referred to as “half-death” in the film). In ascending to *kia*, healers “go into a formalized frenzy, gurgling and shrieking. In this state they may get up and run about, they fall on the fire, throwing burning coals on their hair” (Marshall 1969, minute 4). The film shows them gasping and shrieking, apparently unaware of the outside environment, until they enter the deepest trance; here, their powers are the strongest but they also demand close attention and care from the other healers. In sum, to develop the abilities necessary for curing and divining, !Kung healers must enter a very different state of being that is characterized by formalized yet strange and dissociated behaviors.

Magical Death provides an example of the third mechanism presented above: Shamans act according to observers’ expectations of supernatural agents; the foreignness of this behavior adds credibility to their performance. Chagnon narrates that the shamans, intoxicated from snorting hallucinogenic powder, “gradually transformed from mortal men to spirits. The faces, gestures, and sounds were the expressions of *hekura* [spirits], not of men” (Chagnon & Asch 1973, minutes 13–14). The shamans extended and contracted their necks, erectly squatted, crawled on all fours, stretched their faces, and spoke in unintelligible languages. In behaving as the spirits they had supposedly become, the shamans more credibly engaged with the supernatural.

R1.5.3. Do trance states share neurophysiological correlates? Several researchers have previously argued that trance states recur because they produce cross-culturally consistent cognitive states (Harner 1990; Winkelman 2000). Concluding that divergent methods of trance induce contrasting states, I rejected these accounts. The varied responses expose an ongoing disagreement about this apparently simple question: Kapitany & Kavanagh agree with my criticism, Cardena & Krippner argue for two main states (“ecstasy” and “trance”), and Tabatabaiean & Jennings insist on the shared cognitive and behavioral effects of vastly different altered states of consciousness. Hove & Stelzer accept that different techniques produce different states, although they emphasize that shifting one’s mental state frequently delivers benefits (addressed in the next section).

Do different trance states, such as those induced by hallucinogens, drumming, and meditation, share neurophysiological or psychological effects? In the target article, I examined ethnographic evidence and a review of 20 altered states (Vaitl et al. 2005) suggesting otherwise. Cardena & Krippner discuss patterns of variation in hypnotic states, as well as Rouget’s (1985) distinction between immobile, silent states and those that are kinetic, loud, and social. Yet Tabatabaiean & Jennings maintain that altered states of consciousness “both share neurophysiological features and give rise to shared cognitive and behavioral effects” (para. 1). It is an exciting claim, but the literature they cite emphasizes variability. For instance, they assert that “regardless of induction method” (para 3), altered states produce greater activity in alpha, theta, and delta waves. But the cited research reports the opposite pattern with hallucinogen use (Carhart-Harris et al. 2016; Muthukumaraswamy et al. 2013; Tagliazucchi et al. 2016). Cahn and Polich’s (2006) review of meditation

generally finds support for increased alpha activity, but they too highlight how different techniques and situational factors drive variation. For example, studies that controlled for relaxation reported “a lack of alpha power increases or even decreases” for transcendental meditation and yogic meditation (Cahn & Polich 2006, p. 186). Meanwhile, differences in participant expectation, test environment, participant-experimenter interactions, and experience with a tradition all potentially mediate whether and to what extent changes in neural oscillations occur.

In short, research supports the claim that distinct trance states produce various neurophysiological effects. Differences result not only from different general methods (e.g., hallucinogens versus meditation) or different practices within methods (e.g., distinct meditative practices), but also from variation in a person’s psychology while entering those states.

R1.5.4. Do trance states produce psychological benefits for the practitioner? Hove & Stelzer conclude that different trance states produce different beneficial effects for the practitioner. They summarize research connecting psychoactive substances to psychiatric treatment, rhythmic drumming to internal processing and creativity, and altered states more generally to self-curative capacities. All of these claims are plausible. Nevertheless, the existence of benefits does not mean that shamanism culturally evolved to exploit them. Instead, we must consider unique and divergent predictions that a beneficial trance hypothesis makes about shamanism and trance. Specifically, this account’s central prediction is that people will use different methods of trance induction to solve different problems contingent on the hypothesized advantage of that state. For example, people should use rhythmic drumming to foster creative thinking more generally, not only when trying to control uncertain outcomes. They should also consume hallucinogens to treat psychiatric illnesses and especially those diseases that respond best to psychoactive substances, such as “depression, anxiety, posttraumatic stress disorder, and drug addiction” (Hove & Stelzer, para. 7). Developing such an account and testing it against the proposed theory will forward our understanding of trance’s place in society.

The target article largely overlooked the biological correlates of altered states, but I agree with **Hove & Stelzer**, **Tabatabaeian & Jennings**, and **Winkelman** that a full understanding of shamanism requires integrating these topics, especially by examining how cultural practices induce those states. I devoted little discussion to music and dance in shamanism, but these widespread practices seem closely linked to altered states, especially given recent research suggesting that healing songs around the world exhibit recurrent, perceptible musical features (Mehr et al. 2018).

R2. Elaborating the cultural evolutionary theory of shamanism

Many commentators accept the basic logic of the proposed theory, using their response to extend, nuance, generalize, or explore various implications of the account (**Boudry**; **Fiala & Coolidge**; **Glowacki**; **Johnson**; **Polimeni**; **Powers & Corlett**; **Ross & McKay**; **Steinkopf & de**

Barra). In this section, I summarize these responses into three topics: (1) extensions of the basic logic to explain related features (in particular failure-resilient beliefs and dramas of illness); (2) considerations of how individual differences, especially surrounding psychosis-like experiences, may sculpt or be maintained by shamanistic practice; and (3) generalizing the theory to explain the emergence of shaman-like figures in other domains of uncertainty.

R2.1. The selective retention of failure resilience and dramatized illness

Boudry and Steinkopf & de Barra extend the basic logic of the cultural evolutionary theory to explain aspects of magic and shamanism overlooked in the target article. In particular, Boudry considers how failure selects for techniques and beliefs that are robust to falsification, and Steinkopf & de Barra examine how the cultural evolution of shamanism should lead to the dramatization of the client’s illness.

Boudry notes that magic frequently fails. Patients die, stolen items remain unfound, the gray storm clouds recede and the drought persists. Confronted with failure, people lose faith in some practices and beliefs more than others, selecting for cultural variants that are resilient to failure. He applies the logic to both magical interventions and the capricious nature of supernatural agents. For magical interventions, he points out that upon failure, we lose more faith in some interventions (e.g., those that involve a single step) than we do in others (e.g., those that involve many steps). Consequently, we drive a cultural selection for failure-resilient magic. Meanwhile, gods and ancestor spirits only sometimes seem to respond to supplications. People in turn preferentially accept depictions of agents as fickle or prone to dissatisfaction.

Boudry’s hypotheses are plausible and should be tested in future investigations of magic. They are also valuable because they emphasize the complex psychological landscape shaping beliefs in magic. In the target article, I stressed how beliefs in spirits sculpt which superstitions seem most effective, but as research on the cultural evolution of magic moves forward, we profit from considering those patterns of magical design that remain unexplained, as well as from investigating the involvement of other psychological biases (e.g., those relating to sympathetic magic: Nemeroff & Rozin 2000).

Steinkopf & de Barra recognize that the account proposed in the target article left the role of the client largely undiscussed. Addressing this gap, they deduce that shamans and patients both share an interest in playing up the patient’s illness.

That shamans should dramatize their clients’ illness is consistent with the proposed cultural evolutionary theory. By theatrically playing out otherwise invisible struggles, these performances support perceptions of practitioner success. When a client finally recovers, observers will more confidently accredit the shaman because they witnessed the practitioner battle the illness, remove it, or otherwise contend with it. Ethnographies frequently document the dramatization of illness removal: Shamans around the world incarnate disease and act out their struggle or success in purging it from the patient. The opening anecdote, adapted from descriptions by Balıkcı (1963) and

Rasmussen (1929), depicts an Inuit *angakok* battling with illness-causing ghouls. Meanwhile, the most common and oft-discussed performance of illness involves removing some tiny, pathogenic invader, such as a rock or bone, usually implanted there by some malicious force (e.g., Shuar: Harner 1968; Nepal: Hitchcock 1973; Navajo: Kluckhohn 1944).

I also agree that clients enact (and exaggerate) their illnesses to attract support and attention, but the elaboration of these performances seems driven by a separate process. Rather than developing from a selective retention of effective-seeming practices, these may evolve as individuals imitate and refine the behaviors of other people who successfully attracted care. I refer to this idea in section R3.3.2 in the discussion of possession trance.

R2.2. Psychosis

Several commentators (Fiala & Coolidge; Polimeni; Powers & Corlett; Ross & McKay) focused on psychological variation among individuals and specifically on a topic that has long attracted attention in the academic study of shamanism: psychosis (Czaplicka 1914; Devereux 1961b; Radin 1937; Silverman 1967). These authors suggest four ways by which psychosis might interact with shamanism:

1. Individuals with psychotic tendencies more easily or more successfully become shamans (Fiala & Coolidge), because, for example, they sincerely believe their own powers (and will therefore better convince others) (Powers & Corlett), others interpret their singular experiences as “special gifts” (Ross & McKay), or they find the religious world view or themes more appealing or familiar (Polimeni; Powers & Corlett).
2. Shamanic training helps individuals with psychotic tendencies control their experiences (Ross & McKay).
3. Hallucinations produce magic-religious content (Polimeni).
4. The benefits of shamanism help maintain genetic variants supporting psychosis-like and antisocial behavior (Fiala & Coolidge; Polimeni).

The first suggestion seems plausible. Communities likely regard individuals with some psychosis-like tendencies as more genuinely engaging with supernatural forces, exemplified in how frequently people attribute supernatural connection to individuals with bizarre or unexplainable behavior (see sect. 3.3.2 of the target article). The second suggestion, that training allows some individuals to control their psychotic experiences, is an intriguing speculation and worthy of investigation, especially given the potential parallels between shamans and clairaudient psychics capable of regulating their voice-hearing (Powers & Corlett; Ross & McKay). Meanwhile, hallucinations and religious beliefs both stem in part from promiscuous pattern recognition (Whitson & Galinsky 2008), so we should expect some convergent content, as posited by the third suggestion. The similarity between beliefs in malicious witchcraft by group mates and paranoid ideation presents an illustrative example of this convergence (Bentall et al. 2001; Mair 1969).

The fourth suggestion is also conceivable: If the additional benefits of being a shaman sufficiently compensate for the costs associated with psychotic-like behavior or antisociality,

shamanism may have contributed to the maintenance of otherwise maladaptive genetic variants. However, evaluating this final proposition demands not only examining whether and to what extent shamanic practice carries fitness benefits for individuals with psychotic-like experiences, but also testing such an account against competing evolutionary theories of psychosis (Crespi & Badcock 2008; Del Giudice & Ellis 2016; Power et al. 2015).

Despite the plausibility of these proposed interactions between shamanism and psychosis, none of them appear necessary for the existence of shamanism. Individuals with psychotic tendencies might be more successful shamans, but as many anthropologists have shown, shamans are frequently psychologically normal individuals (see sect. 2 of the target article for examples). Meanwhile, the content of hallucinations might resemble religious world views, but given that most people subscribe to these cosmologies in most societies, invoking psychosis seems unnecessary. Returning to the example of witchcraft, in many societies, the majority of people believe that embittered group mates attempt to harm them through invisible means. Although these resemble paranoid hallucinations, this similarity means neither that psychosis-like experiences produce witchcraft narratives nor that individuals must possess psychotic tendencies to entertain those beliefs.

In summary, people with psychosis-like experiences may pay lower costs to become shamans, and they may develop the ability to control these experiences, engaging them during supposed supernatural contact. Moreover, their ideation resembles religious cosmologies, and in articulating them, they may help develop mystical world views. Nevertheless, that humans experience psychosis seems unnecessary to explain the existence and features of shamanism.

R2.3. Generalizing the cultural evolutionary theory of shamanism

As two commentators recognize, shaman-like authorities, such as war ritual specialists (Glowacki) and professional money managers (Johnson), help individuals influence and predict uncertain outcomes, although they differ from shamans in, for example, not using trance. How can we generalize the cultural evolutionary theory to (1) explain the emergence of these other uncertainty specialists, while (2) accounting for differences between them and magical trance practitioners?

Here I generalize the cultural evolutionary theory to explain the development of uncertainty specialists more broadly:

1. People are especially prone to adopting superstitions to influence or learn about important, random, uncontrollable outcomes.
2. People have models of what determines when those outcomes occur. People often believe that invisible agents control those outcomes, but these models can take other forms as well. For example, people may believe that markets behave according to very complicated, statistical trends or that they reflect the momentum and attitudes of the business world.
3. People consider practices or practitioners that supposedly interact with these forces to be more effective. In many cases, this entails influencing or learning about the behavior of invisible agents, but this varies according to the conception. If, for example, people believe that

uncertain outcomes are determined by complicated, statistical trends, then the most effective-seeming divinatory intervention may be one that uses complicated statistical methods to prophesy the outcome.

4. Competition among practitioners should (a) accelerate the cultural selection for practices that bolster the practitioner's credibility and (b) mediate the extent to which practitioners invest in these credibility-building practices.

5. Because clients consider practitioners who invest in credibility practices to be more effective, institutionalized specialization occurs. Clients prefer to patronize the subset of individuals who have invested and who have become, in the community's eyes, capable of reading and influencing the determining forces.

This generalization describes why we should expect practitioners specialized in the application of ineffective tools to influence and learn about events of uncertainty. It also predicts how those uncertainty specialists vary. Depending on their clients' model of why some uncertain outcome occurs, different practitioners will draw on distinct techniques and invest in unique credibility-building practices. For example, shamans see or communicate with spirits, ancestors, deities, and witches; to be considered capable of doing so, they deviate from notions of humanness that encourage perceptions of special powers. Meanwhile, financial asset managers might claim to use complicated mathematical models to track and predict the behavior of markets; accordingly, they should observe practices that encourage perceptions of their special ability, such as procuring advanced degrees in math or physics.

Johnson lists hedonism, psychopathy, and grueling early work schedules as potential mechanisms by which financial professionals foster a perception of "superhuman powers of market divination" (para. 4). His proposition is compelling, but do these deviations promote a perception of specific special powers? In the same way that shamans claim new eyes for superhuman sight or animal affinities for animal-like abilities, do the ways in which money managers differ and perform their specialness correspond to the special aptitudes they profess? Answering these questions will help uncover why credulous clients patronize inert money managers.

Glowacki reports that war ritual specialists typically do not undergo transformative initiations or become entities distinct from normal humans. As currently formulated, the generalized account predicts that these war ritual specialists should differ in *some* way, however. For example, if ritual specialists allege to divine the future or influence the outcomes of war, the proposed account would predict some narrative or performance of difference to encourage an acceptance of these skills. Without one, their hold over their jurisdiction should be weak, and competitors hoping to entice their clientele should invade and use more compelling techniques (such as claiming to have died and come back to life). Studying how war ritual specialists and other uncertainty specialists defend their jurisdiction will advance our understanding of the origins of specialization while also challenging or developing accounts to explain it.

R3. The collapse and transformation of shamanism

The target article aimed to explain general features of shamanism while outlining how variation in social or

intellectual conditions should mediate the intensity of certain practices or the existence of shamanism. Several commentators offer additional or more nuanced explanations of why shamanism should collapse (**Baumard; Blackwell & Purzycki; Willard, Nakawake, & Jong [Willard et al.]**), while others ask why shamanism transforms with shifts in social complexity and religious organization (Willard et al.; **Wood & Stockly**). Incorporating these topics, especially the transformation of shamanism with growing social complexity, was outside of the scope of the investigation. Nevertheless, I agree that explaining them is necessary for a complete understanding of shamanism and the evolution of religion, so I consider them here.

R3.1. Collapse from prosperity

I listed several conditions under which shamanism should decline, such as when people stop believing that invisible agents intervene in their lives or when they accept that other individuals are unable to interact with these forces. **Baumard** agrees but asks what drives this disenchantment of the world. Drawing on life history theory, he argues that behavioral changes driven by affluence are pivotal. As people become wealthier, their behavioral strategies shift from risk-averse conservatism to being more future-oriented, risk-prone, and open-minded. This new way of thinking, being more optimistic, progressive, and experimental, facilitates the development of scientific thinking and results in a naturalizing of people's world views.

Baumard's hypothesis seems reasonable, but it raises a basic question. According to his argument, scientific thinking and experimentation revealed the natural origins of supposedly supernatural phenomena and the impossibility of human magic. Is this true? Was science crucial in demystifying the world? Integrated with historical analyses, **Baumard's** approach has promising potential in elucidating the decline of magic and contemporary variation in enchanted world views.

R3.2. Collapse from invaded jurisdictions

Blackwell & Purzycki and **Willard et al.** argue that shamanism should transform or collapse when competing parties more effectively provide shamans' services. They both offered medicine as an example, and I agree. Because they more reliably produce desired outcomes, alternate healing traditions with observable results should invade and consume swaths of the shaman's jurisdiction.

These commentators focused on competition with effective practices, but shamans also lose clients to traditions that are comparably ineffective. Among the Mentawai of Siberut Island (Indonesia) with whom I work, healing practices that claim origins in Europe or in Abrahamic religions increasingly find support because of their cultural roots. These off-island healing traditions hail from the same cultures as guns, motorcycles, and cell phones, so people ascribe them a legitimacy normally denied indigenous competitors.

R3.3. Transformation and shifts in social complexity

Observers of religion have long noted associations between the form of religious practice and various dimensions of social structure and religious institutionalization. **Willard et al.** and **Wood & Stockly** ask about the origins of two

important patterns often said to characterize the religious practices of complex societies: the disappearance of trance among priests and the emergence of possessed, female shamans. Here, I discuss competing hypotheses and identify open questions with the aim of shedding a preliminary light on these trends.

R3.3.1. Why do priests in organized religions less frequently employ trance? Willard et al. remark that religious authorities in organized religions use trance less frequently than their small-scale counterparts. In fact, as they point out, traditions born from shamanic prophets seem to sanitize themselves of ecstatic performances over their institutional lifetimes. To explain the shift, Willard et al. point to fidelity. Their argument is as follows: *If* (1) easily transmitted rituals outcompete harder-to-transmit ones (because easily transmitted rituals have greater fidelity, especially when there are few learners), *and* (2) routinized rituals are more easily transmitted than trance performances, *then* cultural evolution should favor routinized rituals over trance. Despite the elegance of their logic, there are reasons that this hypothesis seems unable to explain the decline of trance in organized religion, foremost among them the difference in fidelity between unorganized and organized religion. Organized religions transmit beliefs and practices with much higher fidelity than unorganized religions, not only because they have many more learners and teachers, but also because they benefit from such technologies as liturgy, specialized training, and writing. Consequently, by the logic of Willard et al.'s hypothesis, we should predict that rather than contributing to its decline, institutionalized religions would be *more likely* to retain trance than unorganized religions.

If not fidelity, then what? An alternate hypothesis postulates that trance disappears because it threatens institutionalization (O'Dea 1961). Specifically, as long as trance indicates supernatural contact or power, religious organizations must contend with charismatic startups claiming divinity and threatening its control over the mystical (Keitt 2005a; Lewis 2003). To check these plastic prophets, officials condemn trance or at least delegitimize it among laypeople. I referred to such campaigns in sections 4.3.2 and 6.2 but did not extend them to explain the more common absence of trance in organized religions.

Anecdotal accounts of young religions reveal the destabilizing nature of trance and others' attempts to thwart it. Bell (2005) documented this tension in her study of the young Korean religion Ch'öndogyo. Describing a conversation with an informant, she wrote, "When I ask him why the centre does not like *taegangnyöng* ["great descent of the spirit"] he responds, '*Taegangnyöng* changes the people's minds'... He says that officials do not like it because then 'they don't control the man'" (Bell 2005, p. 11). Even religious traditions that retain trance contrive schemes to regulate these "charismatic fires" (Poloma 1997), such as by authorizing or publicizing only some people's divine contact or instituting additional criteria for religious authority (Lewis 2003; Shepherd & Shepherd 2006; White & White 1996). Research surveying the histories of major organized religions (e.g., Keitt 2004; 2005b) can test to what extent this hypothesis explains the scarcity of trance among religious traditions in complex societies.

R3.3.2. Why the prevalence of possessed female shamans? Wood & Stockly review previous anthropological work and new results showing that, in complex societies, trance performances involve a belief of possession (a spirit entering the host's body) more frequently than in less complex societies. Moreover, these possession trances are more commonly employed by female shamans. As they ask (last para.), what "about complex, hierarchical societies bends cultural selective pressures toward female-dominated possession trance"?

The puzzling preponderance of possessed female shamans has attracted anthropological inquiry for more than half a century (e.g., Boddy 1994; Carneiro 1940; Cohen 2007; Kehoe & Gileiti 1981; Lerch 1982). Lewis (2003) proposed a widely supported account, focusing on how hierarchical societies breed oppression. I reformulate his hypothesis in three steps:

1. Hierarchical societies constrain shamanism in local environments and intensify experiences of subjugation.
2. Possession represents a strategy by which subjugated people, including women and low-status men, gain attention and care, air their grievances, and make demands. This elaborates on Steinkopf & de Barra's argument that people should dramatize their illness to attract care, except that in this case, illness manifests as the bodily intrusion of invisible, malevolent beings.
3. People believe that those individuals who have been possessed can train themselves and use their proximity to the supernatural for healing, divining, controlling the weather, and so on.

In other words, the repressive environment of these hierarchical societies pushes people (and women in particular) to perform intrusive possession. Because the institutionalized religions condemn trance outside of their religious authority, they create vacant jurisdictions for local shamans. These possessed individuals fill those jurisdictions.

Critically evaluating Lewis's hypothesis is beyond the scope of this response. Nevertheless, it confronts two important questions. First, what prevents religious authorities from controlling or delegitimizing the trance of possessed female shamans? Second, shamans are frequently exclusively or predominantly men in many small-scale societies. Which forces constrain women from becoming practitioners in those contexts, and why do those forces diminish in importance in hierarchical societies?

R4. Alternate cultural selective schemes

I argued that shamanism is a product of a cultural selection for the most intuitive magic or a selection for the most effective-seeming services to influence outcomes of uncertainty. Competition among practitioners to provide these services further drives this selection while regulating the intensity of the practices that develop.

Many commentators (Blackwell & Purzycki; Humphrey; Linquist; Nielsen, Fischer, & Kashima [Nielsen et al.]; Schindler, Greenberg, & Pfattheicher [Schindler et al.]; Watson-Jones & Legare) contend that other cultural selective schemes—selecting, for example, practices that improve group competitiveness or

assuage an ever-present fear and awareness of mortality – have sculpted and thus explain the features of shamanism. Some commentators propose that these alternate selective schemes act in conjunction with a selection for intuitive magic, whereas others described them as mutually exclusive hypotheses. In this section, I address these various alternate selective schemes and examine to what extent they can explain the features of shamanism.

I agree with many of the commentators (**Blackwell & Purzycki; Humphrey; Linquist; Polimeni; Nielsen et al.; Watson-Jones & Legare**) that shamans likely provide benefits to clients or the group, such as by delivering herbs or reinforcing beliefs in moralistic, supernatural punishment. But in my response below, I echo the sentiment of the target article that these benefits cannot explain the recurrence of the practice or the design features discussed (trance, jurisdiction, transformative practices, professionalization).

Whether or not readers find my responses below to be compelling, I urge researchers moving forward to outline the cultural evolutionary process presumed to be responsible for the proposed design. Showing that shamanism – or any cultural practice for that matter – has some design (e.g., group-level benefits) does not establish that a cultural evolutionary process selectively retained those design features. Not only do alternate cultural selective schemes often produce convergent features (Singh et al. 2016; 2017), but as these commentaries illustrate, practices have many effects across many domains. Specifying how cultural evolutionary or social processes produce patterns of features justifies why some set of effects, rather than a practice's myriad other consequences, contribute to its appearance and stability.

R4.1. Has shamanism culturally evolved to promote cohesion or enforce cooperation?

Linquist, Nielsen et al., and Watson-Jones & Legare propose that shamanism is selectively retained because it provides group-level benefits, either through rituals that promote social cohesion or by enforcing social commitments in which the threat of being attacked by a shaman ensures cooperative behavior.

Is shamanism the most culturally fit mechanism for cementing trust and solidarity among members of a group? It seems not. By my understanding, a much more effective technology – and one that should presumably out-compete shamanism on this metric – would involve those individuals who need to bond exchanging resources (Molm et al. 2000; 2007; Uehara 1990), participating in joint, risky endeavors (Cook et al. 2005), touching each other (Gallace & Spence 2010; Morhenn et al. 2008), and, assuming that these are indeed effective means of binding groups, *all* dancing in synchrony (Hove & Risen 2009; Reddish et al. 2013; Tarr et al. 2015) and *all* sharing traumatic, painful experiences (Bastian et al. 2014; Whitehouse & Lanman 2014; Whitehouse et al. 2017) rather than practitioners acting alone. Moreover, (1) unlike shamans, people shouldn't claim that they do not experience pain (see Table 1 of the target article); and (2) these intense bonding events should occur when cooperation and trust are most necessary, such as before collective action or when growing distrust threatens group survival (e.g., following conflict that drives group

fission: Hurd 1983; Walker & Hill 2014). Last, given that shamans engage in some of the aforementioned activities with the patient alone (e.g., touching), a potentially more fruitful line of investigation might test whether performances cultivate trust between the practitioner and the client.

Aside from predicting divergent features of ceremonies, a group-bonding hypothesis leaves unexplained many of the specific features that define shamanism – for example, why a single individual should run off to the woods, return with a bloody face, and then later be summoned to declare whether it will rain in the coming days, during which he dances alone or with other prophets, violently shakes, and, delivering his divination in a thunder voice, claims to channel a rain goddess.

I have concluded that shamanism likely does not culturally evolve to foster social solidarity. What about the hypothesis that shamanism culturally evolves to promote cooperation, specifically by establishing a fear of mystical, moralistic retribution? Observers do report shamans and other religious practitioners exercising their supposed supernatural connection to enforce rules and curb predation. For example, in many societies, people visit shamans to kill individuals who have wronged them (e.g., Shuar: Harner 1972; Shilluk: Oyler 1920), potentially discouraging conflict, while medieval monks used threats of cursing to protect their property in the absence of more effective enforcement mechanisms (Leeson 2012).

Despite observations of shamans and religious clerics leveraging their supernatural connection to enforce cooperative rules, there are several lines of evidence that undermine what **Linquist** named “the commitment hypothesis.” Here I review two.

First, anthropologists frequently observe shamans manipulating their supernatural authority for self-serving objectives. Inuit shamans used their supernatural authority to demand sexual favors from their clients (D'Anglure & Philibert 1993), while among the Shuar, men sometimes “gave their daughters in marriage to shamans without the customary bride-service, or even the less common bride-price, because the girls' fathers feared the bewitching power of the shamans” (Harner 1972, p. 118). This predation seems even more pronounced in complex societies. The *Ibede Goda*, a shamanic spiritual leader of the Kaffa people of Ethiopia, was fabulously rich and enjoyed the sexual company of many virgins. Orent (1969, p. 308) explained the shaman's obscene wealth, describing not only his two-story mansion of iron and glass, but his singular physique: “The *Ibede Goda* is obese. His hugeness represents the opposite of the constant quest for food in which every [Kaffa] must engage most of the year.” Relatedly, rather than considering shamans to be prosocial enforcers of the common good, people often fear them as morally ambiguous agents, subject to envy and malice (Whitehead & Wright 2004). Handelman (1972, p. 92) captured this in his summary of the perceived morality of the Washoe (Great Basin) shaman: “The shaman had the capacity for both the greatest good and the greatest evil, and the figures of healer and witch were both embodied in the person of the shaman.”

Second, the commitment hypothesis predicts that shamanism should be absent in those societies with strong and effective enforcement institutions. This prediction is violated by the work on neo-shamanic practices, much of

which has focused on Scandinavia (Kraft et al. 2015; Lindquist 1997), a region with enforcement mechanisms that are among the most effective in the world (Fisman & Miguel 2007). That shamanism develops in these contexts suggests a function distinct from maintaining cooperation.

R4.2. Has shamanism culturally evolved to effectively provide services?

Two commentators suggest that shamanism effectively provides services, which in turn contributes to its maintenance and explains its constituent features. **Blackwell & Purzycki** defend the hypothesis that shamanism culturally evolves to organize and signal specialized abilities, whereas **Humphrey** suggests that shamanism recurs because it elicits self-curative capacities or the placebo effect.

Blackwell & Purzycki propose that shamanism develops partly to effectively organize expertise. Focusing on herbal knowledge and cognitive insight, they go on to suggest that performances of strangeness function as honest signals of these special abilities.

There are at least two reasons to question the claim that shamanism develops to effectively organize herbal knowledge. First, many shamans do not treat with herbs: According to coding by Winkelman and White (1987), shamans in 15 of the 43 societies coded did not use herbs extensively. Moreover, when shamans do possess herbal expertise, this knowledge is typically distributed among many other minds, including with other herbalists recognized specifically for their know-how (e.g., Piaroa: Heckler 2007; Warao: Wilbert 1987b). Second, even if we accept the claim that shamans represent specialized repositories of herbal knowledge, is this more efficient than distributing knowledge among many minds? Existing research suggests not: As **Willard et al.** point out, restricting expertise to a few people, especially in small populations, risks losing knowledge and impedes accumulation.

What of the hypothesis that shamanism culturally evolves to effectively organize insight? First, and most importantly, why should shamans be more insightful than their group mates? As I have argued at various points, trance likely fails to provide insight because different methods induce dissimilar and sometimes opposing effects (although see **Hove & Stelzer's** evidence for rhythmic drumming in particular). Second, if efficacy indeed is being maximized and societies have devised some mechanism for fostering insight (e.g., rhythmic drumming), why constrain it to one or a couple of individuals? One would expect that an advantageous technology facilitating, for example, intuiting animal behavior would be more widely shared.

Finally, do “performances of strangeness” function to signal shamans’ “specialized, effective skills and abilities” (**Blackwell & Purzycki**, para. 5)? Theatrical enactments of soul loss or possession seem uninformative signs of one’s herbal knowledge or cognitive specialties. Why not recite herbal remedies or demonstrate herbal treatments? If signaling cognitive insight, why not display it more directly, such as by breaking up disputes (social insight) or competing in the tracking of animals (intuiting animal behavior)? Trance performances seem deficiently designed as indications of shamans’ supposed special abilities, especially in comparison to hypothetical alternatives.

The second argument of efficacy centers on the placebo effect. **Winkelman** and **Powers & Corlett** refer to placebo-driven healing effects, although **Humphrey** formulates the argument most rigorously. I interpret his hypothesis in four parts:

1. The shaman is well designed to convince the patient of genuine and effective care.
2. This performance of care elicits a placebo effect.
3. This placebo effect produces beneficial self-care.
4. This benefit sustains shamanism, which otherwise could not be maintained and would constitute “a flimsy house of cards” (Humphrey, para. 4).

I agree with points 1 and 2, but I remain skeptical of 3 and 4. Here’s why. First, is the shaman’s activation of placebo effect beneficial? In his commentary and elsewhere (e.g., Humphrey 2002b; Humphrey & Skoyles 2012), **Humphrey** persuasively proposes that organisms have evolved regulatory systems designed to invest in self-care under optimal conditions. This involves, for example, running a temperature or producing antibodies when the likelihood of recovery is highest, as well as (I add) turning off symptoms that would normally restrain or protect the organism, such as nausea, exhaustion, and pain. Humphrey contends that narratives and performances of supernaturalness activate the patients’ “innate capacities for self-cure” (the placebo effect), thus providing genuine care. But a basic question remains: Is the triggering of these curative or alleviative capacities beneficial? As long as the shaman represents a false signal of care, the patient will initiate self-cure and turn off protective symptoms under the wrong conditions (see note 7 in the target article). For example, imagine that the patient benefits most from activating self-cure while ingesting herbs on day 1, but, expecting a shaman’s treatment, holds off until a healing ceremony on day 2. By waiting, the patient has suboptimally expended resources toward recovery. The logic of adaptation warns that shaman-triggered self-healing may be to the patient’s detriment.

Second, can shamanism persist solely from a *perception* of efficacy, rather than actual fitness benefits? The evidence suggests that it can. Many related traditions persist without delivering benefits, most notably the countless mantras, spells, and talismans used to sway the weather, harm envied group mates, ensure success in school exams, protect oneself from illness, multiply crop productivity, discourage one’s spouse’s from adultery, and so on (Evans-Pritchard 1929; Mauss 2001; Vyse 2014). Similarly, many ineffective, non-healing practitioner classes, some of them shamanic, flourish around the world; these include rainmakers (Cooke & Beaton 1939), malicious magicians for hire (Lieban 1967; Todd 1936), crystal gazers (Lang 1911), war ritual specialists (**Glowacki**), and even asset managers (**Johnson**). Their ubiquity illustrates that these practices thrive solely because of perceived efficacy.

R4.3. Has shamanism culturally evolved to assuage a fear and awareness of death’s inevitability?

Schindler et al. propose that shamanism culturally evolves in part to alleviate anxieties about death; therefore, we should analyze it within a terror management theory (TMT) framework. Shamans assuage death anxieties, they contend, not

only by “providing hope of averting lethal outcomes,” but also by validating belief systems about a life beyond this one.

I agree with **Schindler et al.** that shamans help control events closely tied to mortality, including illness and drought. The theory proposed in the target article explains this by examining the psychology of superstition: People adopt causally innocuous interventions to control important (roughly, fitness-relevant) events. Any event that is closely tied to mortality will be important, so TMT and the proposed theory make overlapping predictions here. But shamans also assist with achieving success in business (e.g., Korea: Kendall 1985), divining guilt (e.g., Tlingit: Emmons & De Laguna 1991), and locating lost objects (e.g., Canela: Crocker 1990), among other activities. Individuals attribute importance to these and want to control or understand them, but their relationship to death is more indirect. TMT explains a subset of the shamans’ jurisdiction without providing further explanatory power.

What of the idea that people patronize or support shamans because they reinforce beliefs in an afterlife? The same criticism applies here as well: TMT predicts that shamans will behave as if these beliefs are real, paralleling the proposed cultural evolutionary theory, but as currently formulated, it cannot explain features beyond this. Furthermore, its most basic prediction – that shamanic performances acknowledge that human souls survive separately from their bodies (mind-body dualism) – fails to hold up in many contexts. Shamanic ceremonies do frequently reinforce the notion of a human soul, such as when practitioners summon the client’s spirit or when their own souls leave their bodies (e.g., Desjarlais 1989; Eliade 1964; Lindquist 2004). Such portrayals are frequently absent though, such as when shamans summon and contain an illness-causing water deity (Schefold 1988), or when they eat medicines and dance to “see spirital emanations of witchcraft floating about as lights” (Evans-Pritchard 1937, p. 178).

R5. Some suggested future directions

R5.1. Testing among competing accounts

Most, if not all, commentators support an approach to explain shamanism that jointly considers how psychology, social dynamics, and cultural evolutionary processes shape and aggregate these practices. Many commentators endorse the idea that shamanism results from a cultural selection for effective-seeming magic, but some suggest that other cultural evolutionary schemes better explain its design and dynamics. I argued against them, but I invite those researchers and others to develop these competing accounts and test them against the proposed theory. As I stressed, alternate hypotheses should specify not only the predicted design features of shamanism, but how within-group social dynamics and cultural selective schemes interact to produce this design.

A promising route for testing among competing theories is to investigate the extent to which different accounts describe and predict the features composing shamanism. The theory I proposed generated the following hypotheses for some basic constituent practices:

1. Trance is a performance of foreignness that bolsters the practitioner’s claims of supernatural contact or abilities.

2. Initiating events and practices, including debilitating illness, asceticism, and theatrical performances and narratives of change, convince observers that the practitioner has changed in some fundamental way, supporting their claims of non-normal powers.

3. Shamanism professionalizes because individuals typically must “transform” to be considered capable of influencing or foreseeing events of uncertainty. Competition partly determines the degree of investment in these transformative, credibility-building practices.

Researchers developing competing accounts should present alternate hypotheses to explain these features (as many of the commentators did), allowing us to directly test the extent to which contrasting theories describe ethnographic realities.

R5.2. Unexamined questions about the design and dynamics of shamanism

I applied the proposed theory to explain trance, transformative practices, the peculiarity of the shaman, professionalization, variation in the intensity of certain practices, the conditions for collapse, and why shamanism changes with shifting social complexity and religious centralization. Still, I did not address many basic questions about the design and dynamics of shamanism, including the following:

1. Why are shamans so frequently men?
2. Why do shamanic ceremonies often involve music and dance?
3. What explains the clothing and adornment of shamans?
4. Why do shamans sometimes lose their jurisdictions to mantras, spells, and other magical techniques?
5. Why don’t some magical practitioners use trance?

I devoted some attention to several of these, but the explanations offered were more preliminary than defensible. Ongoing work should use the proposed theory (or competing accounts) to examine these and other patterns of shamanism.

R5.3. The predictable development of sociocultural near-universals

Ethnographers aiming to comprehensively describe the social and cultural worlds of particular societies typically organized their reports into sections that were loosely reused across authors and cultures – for example, magic and religion, social control, family life, art. These sections were further subdivided into topics that were more specific but nevertheless familiar and common – for example, shamanism, gods, origin myths, witchcraft, property rights, marriage. The frequency of these divisions may expose the shared frames through which Western anthropologists interpreted the cultures of the world. But they also likely reflect the behavioral reality of sociocultural patterns. In the same way that gas molecules released into some room will eventually come to fill it uniformly, a hypothetical human society placed in some novel environment and devoid of complex cultural practices seems to exhibit a tendency toward developing a swath of sociocultural near-universals, including shamanism, laws

against killing (Hoebel 1954), and lullabies (Mehr & Krasnow 2017).

In the target article, I theorized how fundamental aspects of humans – such as our superstitious psychology, our biases to detect agents, and the incentive to monopolize services – interact in predictable ways to assemble shamanism. Whether or not this theory holds up, this project represents a small contribution toward characterizing why humans share such peculiar clusters of practices across time and space. Our growing understanding of psychology, sociality, and cultural evolution, combined with fresh access to large databases of ethnographic data (e.g., Ember 1997; Kirby et al. 2016; Watts et al. 2015), provides researchers with sophisticated frameworks and new empirical insights to outline how cultural variants are created and maintained. Now is a promising time to investigate why human societies reliably produce these sociocultural near-universals.

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[The letters “a” and “r” before author’s initials stand for target article and response references, respectively]

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