

# **Magic, explanations, and evil**

## On the origins and design of witches and sorcerers

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### **Abstract**

In nearly every documented society, people believe that some misfortunes are caused by malicious group mates using magic or supernatural powers. Here I report cross-cultural patterns in these beliefs and propose a theory to explain them. Using the newly-created Mystical Harm Survey, I show that several conceptions of malicious mystical practitioners recur around the world, including sorcerers (who use learned spells), possessors of the evil eye (who transmit injury through their stares and words), and witches (who possess superpowers, pose existential threats, and engage in morally abhorrent acts). I argue that these beliefs develop from three cultural selective processes: a selection for intuitive magic, a selection for plausible explanations of impactful misfortune, and a selection for demonizing myths that justify mistreatment. Separately, these selective schemes produce traditions as diverse as shamanism, conspiracy theories, and campaigns against heretics – but around the world, they jointly give rise to the odious and feared witch. I use the tripartite theory to explain the forms of beliefs in mystical harm and outline ten predictions for how shifting conditions should affect those conceptions. Societally-corrosive beliefs can persist when they are intuitively appealing or they serve some believers' agendas.

“I fear them more than anything else,” said Don Talayesva<sup>1</sup> about witches. By then, the Hopi man suspected his grandmother, grandfather, and in-laws of using dark magic against him.

## 1. Introduction

Beliefs in witches and sorcerers are disturbing and calamitous. Sterility, illness, death, rainstorms, burnt-down houses, bald spots, attacks from wild animals, lost foot races, lost reindeer races, the puzzling behavior of a friend or spouse – the enigmatic, the impactful, the bothersome – all can spark suspicions of neighbors using magic and dark powers; all can precipitate violence. The suspects are sometimes normal humans, learned in dark magic, but other times, rumored to be odious and other. They devour babies, fornicate with their menstruating mothers, and use human skulls for sports. They become bats and black panthers, house pythons in their stomachs, and direct menageries of attendant nightbirds. They plot the destruction of families and then dance in orgiastic night-fests.<sup>2</sup>

Humans in nearly every documented believe that some illnesses and hardships are the work of envious or malignant group mates. Hutton (2004; 2017) reviewed ethnographies from three hundred non-European societies and documented pervasive beliefs in sorcerers, witches, the evil eye, and aggressive shamans. Of the 60 societies in the Probability Sample File of the Human Relations Area Files – a pseudo-random sample of well-documented human societies – 59 believed in some form of human-induced mystical harm, the only exception being the Kogi of Colombia<sup>3</sup> (sect. 2). European societies have historically held similar beliefs, embodied in the Roman *strix* (Oliphant 1913; Oliphant 1914), the Saxon *striga* (Cohn 1976), and most famously, the witches of the Great European Witch Hunt (Cohn 1976), and colonial New England (Karlsen 1987).

Beliefs about harmful practitioners are profoundly similar across vastly distant societies (Needham 1978; Kluckhohn 1959). The European witches of the late modern period were said to eat human flesh, engage in obscene activities, and assemble in conspiratorial, orgiastic

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<sup>1</sup> The quotation comes from autobiography of Don Talayesva (Talayesva and Simmons 1942:379).

<sup>2</sup> The quotes by Don Talayesva (opening) and the Santal guru Kolean Haram (section 3) demonstrate that these beliefs are disturbing. The destruction mentioned in section 3 demonstrates that they're calamitous. Table 2 and section 6.2.1 describe the events that trigger suspicions of mystical harm. Table 3 features examples of animal transformations and attendants. Yamba witches were said to devour children (Gufler 1999), Apache witches had sex with menstruating family members (Basso 1969), Akan witches used human skulls for soccer (Debrunner 1961), and Santal witches met naked in nighttime assemblies, danced, and copulated with their spirit familiars (Archer 1974). Nyakyusa witches had pythons in their bellies (Wilson 1951).

<sup>3</sup> The ethnographic texts included in eHRAF did not describe mystical harm beliefs in two PSF societies: the Koreans and the Kogi. But researchers elsewhere have reported sorcery beliefs in Korea (Walraven 1980), so their omission seems due to ethnographers underreporting the topic. Meanwhile, Reichel-Dolmatoff (1997:141; 1976:286) explicitly stressed the absence of beliefs in mystical harm among the Kogi. Nevertheless, in describing Kogi lineages, he made a vague comment suggesting that people do in fact believe in mean-spirited, uncanny harm: “Both groups, the Hukúkui as well as the Mitamdú, are further regarded as vaguely dangerous and endowed with rather evil powers” (Reichel-Dolmatoff 1997:250).

nighttime gatherings (Cohn 1976). Similar behaviors were suspected of witches among the Yamba of Cameroon (Gufler 1999), the Santal of South Asia (Archer 1984), and the Navajo of the American Southwest (Kluckhohn 1944), among many other societies (Hutton 2017; Mair 1969; see sect. 2). And just as people worldwide believe in sensational and atrocious witches, they also often suspect that sickness and death are the work of ordinary people secretly practicing dark magic (e.g., Trobriand Islanders: Malinowski 1922; Tswana: Schapera 1952; Niimípuu: Walker, Jr. 1967).

In this paper, I refer to people believed to use magic or supernatural powers to injure others as *practitioners of mystical harm*<sup>4</sup>. This term is broad, including, for example, beliefs about werewolves, abhorrent witches, people whose stares transmit illness, and neighbors who use voodoo dolls in secret. *Magic* refers to occult methods with instrumental ends, such as spells, curses, rites, manipulated objects, and everyday superstitions. Magic can be used<sup>5</sup> to produce socially-justified ends, such as healing people or succeeding in gambling, as well as less acceptable objectives, such as inducing illness. I use refer to harmful magic as *sorcery*. Methods of sorcery include cursing, stabbing voodoo dolls, and placing charmed poisons in people's paths.

*Sorcerers* are people who use magic for malicious ends – that is, people who use sorcery. *Witches*, on the other hand, exhibit up to three sets of characteristics: (1) They are existentially threatening, (2) they have supernatural powers, and (3) they are morally repugnant. Some practitioners qualify as both sorcerers and witches, such as those believed to both use magic and engage in activities like graveyard conspiracies and cannibalism. I justify these definitions in section 2.

The ubiquity of mystical harm beliefs and their striking similarities raise two basic questions:

1. Why do humans believe in mystical harm?
2. Why do those beliefs take the form that they do?

This paper advances a tripartite theory to answer those questions. I propose that beliefs in mystical harm, and beliefs about who orchestrates it, are the result of three cultural selective processes:

1. *Selection for intuitive magic*. As people try to influence others' misfortune, they selectively retain intuitive magic, producing compelling spells and charms for harming others. This produces intuitive harmful magic, but more relevantly, it convinces people that sorcery works and that other group members practice it.
2. *Selection for plausible explanations of misfortune*. People look for explanations for why things go wrong. When they feel threatened, they suspect distrusted group mates; when they believe in sorcery, it provides a straightforward explanation for how a

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<sup>4</sup> I choose the term *mystical* to refer to harm that is transmitted either through magical means (e.g., spells, buried poisons, voodoo dolls) or supernatural powers (e.g., transforming into an animal and attacking someone, inflicting misfortune through an inadvertent envious stare). This usage follows Evans-Pritchard (1937), who contrasted *mystical causation* with *natural causation*, and Needham (1978:26), who defined a *witch* as "someone who causes harm to others by mystical means", corresponding closely with my term *practitioner of mystical harm*.

<sup>5</sup> Whenever I refer to the effects of magic (e.g., producing illness) or the features of a malicious practitioner (e.g., flying and eating corpses), I refer to *beliefs* about those traditions rather than actual consequences or traits.

distrusted rival harmed them from afar. Over time, iteratively searching for plausible explanations shapes beliefs about sorcerers to become increasingly compelling, although the same process can produce explanations that do not include sorcery, including beliefs about werewolves, the evil eye, and conspiratorial governments.

3. *Selection for demonizing narratives.* Actors bent on eliminating rivals devise demonizing myths to justify their rivals' mistreatment. These campaigns often target and transform malicious practitioners, both because people suspect that malicious practitioners transmit harm and because individuals accused of mystical harm are easily demonized and abused.

On their own, these three processes produce beliefs and practices as varied as gambling superstitions, conspiracy theories, and vitriolic campaigns against heretics, but in societies around the world, they combine to produce the archetypal, odious image of the witch.

## 2. Cross-cultural patterns

Researchers struggle over whether beliefs about harmful practitioners are similar across cultures. Many have emphasized commonalities (e.g., Mair 1969; Kluckhohn 1959), but others have criticized drawing these comparisons, one scholar concluding that “anthropologists have committed a possibly grave error in using the same term [*witchcraft*] for other cultures” (Crick 1973:18).

The most important effort in documenting cross-cultural patterns in these beliefs was conducted by Hutton (2017; see also Hutton 2004). Hutton reviewed ethnographies in three hundred extra-European societies and identified five characteristics that malicious magicians around the world share with the early modern European conception of the witch. Namely, they tend to (1) cause harm using non-physical, “uncanny” methods, (2) represent internal threats to their communities, (3) gain their abilities through training or inheritance, (4) have qualities that incite horror and loathing, and (5) give rise to strategies of resistance, including counterspells and murderous campaigns. Hutton also reviewed, among other things, similarities in witches' heinous activities and the social conditions that inspire violence towards suspected malicious practitioners.

Hutton's project was ambitious, but he sampled societies opportunistically, risking the overrepresentation of peculiar beliefs. He also chose not to systematically code traits, such as how frequently practitioners are believed to kill people or associate with animals. These limitations prevented him from drawing strong inferences about how these beliefs compare around the world.

I designed the Mystical Harm Survey (MHS) to systematically capture beliefs about mystical harm in a representative sample of the world's societies. The dataset covers the 60 societies of the Probability Sample File of the Human Relations Area Files, a pseudo-random sample of well-documented cultures that were selected to make inferences about humanity more generally (see the Supplementary Materials for more details). The full dataset is available at [osf.io/492mj](https://osf.io/492mj) and includes beliefs about 103 malicious practitioners (or practices) from 58 societies. The analyses reported here exclude leaders (e.g., elders, chiefs, senior lineages) and public magicians (e.g., shamans, priests), because these practitioners are public, institutionalized classes who advertise and perform their powers rather than simply being conceptions of group

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mates causing misfortune (including leaders and magicians produces nearly identical results; compare Supplementary Table 2 with Supplementary Table 4).<sup>6</sup>

I used Principal Components Analysis to reduce the 49 raw variables in the Mystical Harm Survey (e.g., does a practitioner consume flesh? do they cause economic harm?) to two derived variables (or principal components)<sup>7</sup>, shown in Figure 1 (see Supplementary Materials for details). This method exposes the axes along which practitioners vary the most and, thus, the cross-cultural structure of these beliefs. Both of the derived variables are interpretable: The first dimension represents how witchy malefactors are; the second distinguishes sorcerers, as classically understood, from the evil eye.



**Figure 1.** Results of logistic PCA showing practitioners of mystical harm. A single point represents a belief about a practitioner in a society (such as the Trobriand flying witch or the Amhara evil eye); the accompany numbers refer to the unique practitioner ID numbers (see Supplementary Table 1). The points are colored according to the terms used by the ethnographer(s) who described them. They are scaled according to the number of paragraphs coded in that society, ranging from 1 paragraph (practitioner 63) to 1,976 (practitioners 1 and 2). The images refer to the features that characterize a given quadrant: eye = evil eye (unintentional harm through stares or words); effigy = sorcery (learned magic); owl = witchiness (superhuman abilities, moral abhorrence, threat).

<sup>6</sup> Hereafter, I refer to this restricted dataset as the MHS and to the dataset including leaders and public magicians as the expanded MHS.

<sup>7</sup> There are two reasons to report a two-factor solution. First, a scree plot (Supplementary Figure 1) shows a dramatic change in slope (or elbow) at the third component; after the second component, the additional dimensions explain equivalent and smaller proportions of variance. Second, the third component is uninterpretable (see Supplementary Table 3). The first and second components explain 23.1% and 16.8% of the total variance, respectively (39.9% in total).

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Practitioners high on the first variable (PC1) are witches.<sup>8</sup> They are believed to kill people, cause illness, eat human flesh, desecrate corpses, use magic, fly, turn invisible, commit atrocities at night and in the nude, congregate in secretive meetings, transform into animals or use them as familiars, and engage in obscenities like incest and nymphomania; shamans and other magicians are often suspected of being witches (see Supplementary Table 2 for loadings). Practitioners low on this dimension lack these qualities. Contrary to many writers' impressions (e.g., Chaudhuri 2012; Mace et al. 2018; Sanders 1995), I did not find strong evidence that witches are more frequently women than men.

The second derived variable (PC2) separates everyday sorcerers from the evil eye. Practitioners low on PC2 use harmful magic, including spells, voodoo dolls, and magical poisons. They attack their neighbors and family members but sometimes target out-group individuals as well. Ethnographers often state that anyone can qualify as one of these practitioners, although men and public magicians are suspected more often. Practitioners high on PC2, in contrast, tend to possess the evil eye or blasting word: They harm people through their stares and comments, often inadvertently. Their powers derive from physiological differences, such as special eyes, rather than from learning specific methods or rites.

A surprising finding is that practitioners high on PC2 also tend to fly and eat human flesh. But this is less characteristic of the evil eye and more a feature of cannibals, ghouls, and lycanthropes (humans who transform into animals). In fact, no practitioner labeled "evil eye" by an ethnographer was said to fly or consume human flesh. Cannibals, ghouls, and lycanthropes likely appear with the evil eye in Figure 1, because they all tend not to use sorcery (shifting them high on PC2) and they lack most other witchy qualities (shifting them low on PC1).

In Figure 1, I colored the points according to the ethnographer's name for that practitioner. These colors cluster, showing that terms like "sorcerer" or "witch" in fact capture cross-culturally recurrent beliefs. Sorcerers (blue) are normal humans who use effigies, curses, and other spells to harm their rivals. Descriptions of sorcerers are very similar to descriptions of people generally knowing and using dark magic (purple). Possessors of the evil eye (yellow) harm people with their stares and words, often unintentionally. They do not employ spells, and their powers tend to be inborn rather than actively procured. Witches (pink) are much more variable across societies, but they share up to three sets of traits: (1) They are threatening (e.g., they kill and conspire in secret, nighttime meetings), (2) they are supernaturally powerful (e.g., they fly and transform into animals), and (3) they are abhorrent (e.g., they consume human flesh and desecrate corpses) (see Figure 2). This results of the PCA suggest that witchiness is a dimension rather than a discrete trait – that is, some societies describe practitioners who are more threatening, supernaturally powerful, and abhorrent than the practitioners described in other societies.

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<sup>8</sup> Several variables, all of which appeared very infrequently in the MHS, had unstable loadings that collapsed when the data from a single region were excluded from the PCA (see Supplementary Materials, section 2.2 and Supplementary Tables 5 and 6). I have not reported these unstable loadings here, but see Supplementary Table 2 for the full factor matrix.





**Figure 2.** (A) *Witches' Sabbath* (Goya, 1798) and (B) *Witches' Flight* (Goya, 1798) depict the conceptions of witches held by many medieval Europeans. The witches are shown to be nocturnal, partly nude, and associated with nighttime animals like bats. They fly, kill babies, devour human flesh, and conspire in groups with evil spirits. But beliefs such as these were not restricted to Europe. Similar actions were suspected of witches around the world, from societies as far-ranging as the Tlingit of the Pacific Northwest to the Akan of West Africa to the Trobriand Islanders of the South Pacific.

The analysis helps reconcile a historic debate about the difference between witches and sorcerers. Evans-Pritchard (1937) drew a strict boundary between the two, specifying that malicious practitioners are *either* normal humans who use magic (sorcerers) *or* different entities who do not use magic, instead attacking with supernatural powers (witches). He used the dichotomous scheme to describe Azande beliefs in particular, but other anthropologists applied the same typology to different ethnographic contexts (e.g., Reynolds 1963; but see Turner 1964).

Figure 1 reveals that Evans-Pritchard's witch-sorcerer binary does not generalize. Some heinous, supernaturally powerful practitioners (witches) only attack with supernatural stares and thoughts, such as those of the Azande (9) and Akan (1), but many are believed to also employ spells, charms, and other material magic. Some witches, for example, stuffed effigies into the carcasses of dead puppies (Tlingit: De Laguna 1972:730); others recited spells to fly (Trobriand Islanders: Malinowski 1922:241) or used horseshoes and keys to conjure evil spirits (Colonial New England: Karlsen 1987:9). Thus, witches resemble other malicious practitioners, such as

sorcerers or possessors of the evil eye, except transformed along a dimension of witchiness, made more threatening, more abhorrent, and more supernaturally powerful.

## 3. Existing theories of mystical harm

The most influential theories of mystical harm ascribe a function to these beliefs, often regarding them as group-level adaptations. Most popular is the theory that these beliefs discourage socially unacceptable behavior. According to this theory, *if* people suspect that their irate neighbors will attack them with evil spells and powers, *then* people will refrain from upsetting each other, both to avoid being attacked by mystical harm and to avoid being accused (Whiting 1950; Beattie 1963; Walker, Jr. 1967).

Faulkingham (1971:112) summarized this theory in observations of the Hausa (Niger): “Sorcery beliefs in Tudù provide people with strong motivations to be gregarious and to avoid quarrels. One is hesitant to be silent, alone, or bickering, lest he be accused of being a sorcerer. Further, people are reticent to exacerbate quarrels, for they may become ensorcelled.” But he also recognized that these beliefs entail major costs: “While sorcery beliefs have these social control functions, I believe that the villagers pay a high psychological price, since hostile emotions are relentlessly proscribed” (Faulkingham 1971:112).

Other researchers have echoed Faulkingham’s second point, disputing cooperation theories by noting how sorcery and witchcraft beliefs sow distrust and provoke quarreling (Gershman 2016; see Hutton 2017:35 and works cited therein). Among the Kapauku Papuans, most wars in one region (Mapia) started because of presumed sorcery; in another (Kamu), sorcery accounted “for about thirty per cent of the conflicts” (Pospisil 1958:154). Other examples of contexts in which sorcery and witchcraft accusations bred violence abound (e.g., Gebusi: Knauft 2010; Rajputana: Skaria 1997; Yolngu: Warner 1958; Zulus: Bryant 1929). Suspicions of magical harm can even inspire vitriol among family members, such as when a Klamath woman slayed “her own mother for the fatal bewitchment of her child” (Stern 1965:21). An ethnographer quoted the Santal (South Asia) guru Kolean Haram, who summarized the sociological and psychological stresses of witchcraft beliefs: “The greatest trouble for Santals is witches. Because of them we are enemies of each other. If there were no witches, how happy we might have been” (Archer 1984:482).

Other scholars argue that beliefs in mystical harm explain misfortune. Evans-Pritchard (1937) famously proposed this hypothesis in his report on Azande witchcraft. But the claim that witchcraft beliefs explain misfortune cannot account for many features of those beliefs. Most notably, why should people suspect that *group mates* engineer misfortune through *magic or supernatural powers* when they can already blame gods, water demons, and other purported, invisible harmful forces? Addressing this gap, Boyer (2001) pointed out that we are predisposed to think about other people harming us. Humans are social animals, he observed, constantly engaged in reciprocal favors. Thus, he hypothesized, we have evolved psychological mechanisms that often interpret misfortune either as someone cheating us or as punishment for apparently cheating others. As people adopt or develop explanations that conform to these expectations, they produce beliefs in mystically powerful cheaters and cheater-detectors: “People who give others the evil eye are overreacting cheater-detectors and witches are genuine cheaters” (Boyer 2001:200).



I borrow elements of the explanation hypothesis, but Boyer's formulation suffers from some of the same flaws as Evans-Pritchard's: Both leave the content of witchcraft beliefs largely unexplained, including why people use spells or charms or why witches transform into animals and mutilate corpses. Boyer's account also confronts a problematic inconsistency: If people with the evil eye are "overreacting cheater-detectors", then why is the evil eye linked so often to envy (Dundes 1992), rather than feelings of being cheated?

Finally, many researchers connect mystical harm beliefs to sociological events, such as the envy, inequality, and redistribution associated with social change (Comaroff and Comaroff 1999; Bohannan 1958), the control of women (Hester 1992; Natrella 2014), and scapegoating (Oster 2004). But these accounts remain atomized and disconnected. They focus on single determinants (such as rising inequality), most of which only apply in some circumstances, while failing to describe many of the features of mystical harm beliefs.

I have left out many other explanations for these beliefs, including ones that invoke repressed sexual impulses (Cohn 1976), distorted perceptions of existing or historic cults (Murray 1921), the inadvertent consumption of ergot fungi (Caporael 1976; Alm 2003), and delusions resulting from psychiatric illness (Field 1970). These accounts suffer from many of the same criticisms as those reviewed above. Not only do they fail to explain the content of mystical harm beliefs, they also leave open the question of how shifting conditions should elicit some beliefs but not others.

### 4. Introducing the tripartite theory: Cultural selection

I propose that mystical harm beliefs develop from the interaction of three cultural selective processes. *Cultural selection* occurs when people preferentially retain particular practices or beliefs, such as because they appear to more effectively produce a desired outcome (Blackmore 1999; Boyd and Richerson 1985; Campbell 1965; Sperber 1996). For example, the cultural selection of effective killing technology occurs as people adopt and maintain tools that kill animals or enemies. As people modify their tools and keep the effective versions, they iteratively fashion technology well-designed for killing, like sleek spears or bows-and-arrows. Notably, cultural selection occurs whenever people use culturally-transmitted practices for some desired end and they apply regular criteria to evaluate the effectiveness of those practices. Thus, selection can produce sleek killing technology, but it can also produce chairs, cheesecake, Disney movies, and other delights that satisfy desires humans want.

Cultural selective processes are significant for two reasons. First, they produce complex traditions that no single individual could have devised in a single moment (Henrich 2015). But just as importantly (although less frequently appreciated), these processes *retain* those traditions. A spear, for example, may be used frequently yet remain unchanged for centuries. Although it does not evolve, people selectively retain it for assassinating game and enemies.

Many scholars assume that cultural selective processes are protracted, involving generations and many individuals, but they don't have to be. Yes, selective processes can occur over many generations: Myths demonizing Jews, for example, evolved over decades as people throughout Europe borrowed and modified each other's existing productions (Cohn 1967). But cultural selection can also produce complex beliefs on very short time-scales with many fewer

participants, such as if several people concoct, maintain, and revise heinous myths about a feared sub-group in the hours or days following a catastrophe.

I propose that mystical harm beliefs develop from three cultural selective schemes that produce and maintain (1) intuitive techniques of harmful magic, (2) plausible explanations of misfortune, and (3) myths that demonize a subgroup. The three proposed schemes occur under different circumstances and frequently act independently of each other, separately producing superstitions, conspiracy theories, and propaganda. But they also interact and develop each other's products, giving rise to beliefs in sorcerers, lycanthropes, evil eye possessors, and abhorrent witches. In the following sections, I elaborate on each of these selective processes.

### 5. Magic

Figure 1 shows that people in many societies suspect that their misfortunes are caused by others using sorcery. Why do people accept that sorcery works and presume that others practice it? Here, I argue that these convictions develop from a *selection for intuitive magic*. People adopt superstitions because of a predisposition to note spurious correlations between cheap actions (such as wearing special underwear) and important, unpredictable outcomes (such as winning a football game). As they then select among superstitions, they choose the most compelling ones, driving the development and maintenance of intuitive magic (see Singh 2018 for an expanded version of this argument). As a consequence, people accept the efficacy of magic, including harmful sorcery, and understand that other group mates know it and might practice it.

#### 5.1. The selective retention of intuitive magic

##### *5.1.1. People adopt superstitions (magic) to influence significant outcomes that are important and unpredictable*

Rubbing rocks before giving speeches, wearing special underwear during football matches, blowing on dice before letting them roll – we regularly use superstitions to nudge uncertainty in our favor. Humans adopt *magic* or *superstitions*, which I define as interventions that have no causal bearing on their intended outcome, when those outcomes are important (roughly, fitness-relevant) and occur randomly (Ono 1987; Keinan 2002; Malinowski 1948). Such outcomes include victory in war, the arrival of rain, recovery from illness, and rivals becoming sick, dying, or suffering economic losses. That we adopt superstitions to control these outcomes seems a result of a kind of bet-hedging psychology. When the costs of an intervention are sufficiently small relative to the potential benefits (like wearing special underwear to win a football match), and when the outcome seems to occur sometimes after the intervention, individuals benefit on average from adopting those interventions (McKay and Efferson 2010; Johnson et al. 2013). The predisposition to adopt superstitions to control uncertainty provides the basis for magical practices across human societies (Vyse 2014), including, I propose, magic for harming others.

##### *5.1.2. People selectively retain magical interventions that seem the most effective*

Magic should culturally evolve to become more apparently effective. Humans have intuitions predisposing us to regard some magical techniques, such as those with more steps and repetition (Legare and Souza 2012), as more potent than others. As magic-users iteratively innovate and select these more effective-seeming techniques, they produce intuitive magic. People around the world share biases about how causality and efficacy work, so this selective process should produce cross-cultural similarities in magical techniques (e.g., Nemeroff and Rozin 2000; Rozin et al. 1986), discussed below.

### 5.2. Ethnographic evidence for intuitive magic

At its basis, a selection for intuitive magic demands that people actually attempt to harm each other using magical means. It also predicts that magic will be effective-seeming and that common intuitive principles will characterize both harmful magic and other superstitions. Both claims are supported by the ethnographic record.

#### 5.2.1. *People attempt harmful magic*

People are notoriously reticent about discussing harmful magic with ethnographers, let alone admitting to using it (e.g., Ames 1959:264; Nadel 1954:164). Nevertheless, researchers have successfully documented direct and indirect evidence of people using private sorcery. During his time with the Azande, Evans-Pritchard discovered two bundles of bad medicine in one of his huts. One was engineered “to destroy the popularity of the settlement where I lived by killing some people and making the rest afraid to remain there” (Evans-Pritchard 1937:402). The other was planted to kill the anthropologist. Richards (1935) examined the magical horns collected in a Bemba village during a witch-hunting movement in what-is-now Zambia. Although the vast majority were harmless medicine containers, “11 out 135 horns were admitted by every one to be undeniably bad destructive magic, that is to say, prepared for the injury of others” (Richards 1935:453). Researchers report other examples such as these (e.g., Anglo-Saxon England: Crawford 1963; Wogeo: Hogbin 1938:231; Tlingit: Emmons and De Laguna 1991:410), although people’s admissions of using sorcery and even accounts of other people discovering evidence are difficult to interpret because of the possibility of deception.

Less contestable evidence of people using sorcery is the frequency with which specialists sell harmful services and magicians or laypeople performing evil magic to harm out-group enemies. Specialists sold harmful services in 26 of the 58 societies coded in the expanded MHS, while in at least 10 of those societies, practitioners used magic and supernatural powers to attack enemies of rival groups.

#### 5.2.2. *Malicious magic is governed by the same intuitive principles as other kinds of magic*

The strongest evidence that magic, both harmful and otherwise, develops from a selection for effective-seeming practices is that all kinds of magic are governed by the deeply intuitive principles of sympathetic magic.

*Sympathetic magic* refers to two causal principles – *the law of contagion* and *the law of similarity* (or *homeopathy*) – which guide magic around the world (Frazer 1920). The law of

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contagion refers to the implicit belief that “physical contact between [a source object] and [a target object] results in the transfer of some effect or quality (essence) from the source to the target” (Nemeroff and Rozin 2000:3). This principle covers contamination or pollution, in which a negative substance qualitatively changes a target object, as well as notions that acting on a part (for example, on a lock of hair) can have an effect on the whole (for example, the person who once owned it). That we wrongly but frequently believe in contagious magic seems in part a misfiring of psychological mechanisms evolved for noting contamination and illness transmission and perhaps overinterpreting the lingering effects of objects on each other (Rozin and Nemeroff 2002; Apicella et al. 2018).

In contrast to contagion, the law of similarity or homeopathy refers to the impression that “things that resemble each other at a superficial level” – like a voodoo doll that resembles a person – “also share deeper properties” (Nemeroff and Rozin 2000:3) – for example, that acting on the doll produces effects on the imitated target. It remains unclear why people so habitually make this association, but as with the law of contagion, it likely reflects misfiring biases in causal reasoning.

Frazer (1920, Ch. III) famously documented examples of both contagious and similarity-based magic around the world. Among his many cases of contagious magic, he noted that people often believe that one can affect a target by magically treating the impressions it leaves, such as footprints. Footprints feature in malicious magic, like when people tamper with a target’s prints to induce illness or pain, and in hunting magic, like when pursuers locate the tracks of animals and doctor them to slow the target (see Table 1). Among his many examples of similarity-based magic, Frazer (1920) documented the frequent belief that one can influence a target by creating and manipulating an effigy of it. Table 1 reviews examples of both malicious and non-malicious magic that uses effigies.

**Table 1.** Malicious magic is governed by the same intuitive principles of sympathetic causality that structure other kinds of magic. \*Examples documented by Frazer (1920).

| MAGICAL METHOD  | EXAMPLES OF MALICIOUS MAGIC (societies with references)  | EXAMPLES OF OTHER MAGIC (societies with references)   |
|---|--|---|
| Treating the footprints of a target, such as to harm a person (malicious magic) or aid in the capture or warding off of animals (other magic) | *Chero<br>*Maori<br>Natinixwe (Wallace and Taylor 1950, pp. 189-90)<br>Niimíípu (Walker, Jr. 1967, p. 74)<br>Siwai (Oliver 1955, p. 87)<br>Tswana (Schapera 1952, p. 45) | Ainu (Munro 1963, p. 113)<br>Azande (Lagae 1999, pp. 146-47)<br>Fox (Jones 1939, pp. 23-24)<br>*Khoikhoi<br>*Nlaka’pamux<br>Persians (Massé and Messner 1954, p. 282) |
| Manufacturing and treating an effigy, such as to injure a target (malicious magic) or induce birth or drive away neighbors (other magic)      | Ancient Egyptians (Budge 1901, p. 75)<br>Colonial New England (Karlsen 1987, p. 8)<br>*Kenyah<br>*Malay<br>*Ojibwe<br>Sami (Karsten 1955, pp. 43-44)                     | *Basotho<br>Egyptians (Ammār 1954, p. 89)<br>*Inuit<br>*Japanese<br>*Nisenan<br>Pomo (Aginsky 1939, pp. 212-13)   |

## 6. Explanations

The selection of intuitive magic convinces people that malevolent magic is effective and that others practice it. How does this then transform into beliefs about sorcerers and witches who cause harm?

In this section, I propose that, under certain circumstances, people's hypervigilant tendencies lead them to suspect that group mates engineer inexplicable misfortunes. As they iteratively consider how those group mates harmed them, people maintain a *selection for plausible explanations of misfortune*. When they believe that sorcery is effective, people may suspect and develop beliefs about sorcerers, although they may consider other means of transmitting harm, such as animal transformation, the evil eye, and even governmental conspiracies.

### 6.1. Selection for plausible explanations of misfortune

#### 6.1.1. *People suspect distrusted group members in the wake of impactful, negative outcomes*

Whether we lose a wallet or observe an epidemic sweeping through our community, we commonly attribute impactful, hard-to-explain events, especially negative ones, to the wicked intentions of other humans (Tennen and Affleck 1990). These tendencies seem to have evolved to vigilantly recognize threat (Raihani and Bell 2018). Our social lives are marked by conflict, so we benefit from tracing and anticipating when spiteful others harm us, even if it means making occasional mistaken attributions (see error management: Johnson et al. 2013; McKay and Efferson 2010).

A growing body of literature, most of it in the psychological sciences, shows that a person is most likely to suspect other people for causing some misfortune under four conditions:

- (1) The person feels threatened (Abalakina-paap et al. 1999; Mirowsky and Ross 1983; Saalfeld et al. 2018; Mashuri and Zaduqisti 2015);
- (2) They are distrustful of others (Abalakina-paap et al. 1999; van Prooijen and Jostmann 2013; Raihani and Bell 2017);
- (3) They confront an event that is hard to explain (Rothschild et al. 2012; van Prooijen and Douglas 2017; van Prooijen and Jostmann 2013);
- (4) That event is impactful (van Prooijen and Douglas 2017; van Prooijen and van Dijk 2014; McCauley and Jacques 1979).

These conditions are enlightening for two reasons. First, they provide evidence for adaptive hypotheses of paranoid thinking. People benefit from identifying mean-spirited rivals who conspire to harm them, so it's reasonable that our psychology has evolved to seek out these individuals when they are most likely to harm us. Second, identifying these conditions generates predictions for the contexts under which people are most likely to develop beliefs in mystical harm. If some adaptive psychological machinery provides a psychological foundation for sorcery and witchcraft, then the conditions that trigger that psychology should in turn breed suspicions of mystical harm. I discuss these predictions in section 6.2.

#### 6.1.2. *People selectively retain plausible explanations for how group mates harmed them*

Humans constantly seek explanations (Frazier, Gelman, and Wellman 2009; Lombrozo 2006). When your money-purse goes momentarily missing in a coffee shop and you suspect the wait staff or your fellow patrons, you automatically consider the various ways by which they might have accomplished their misdeed. You deem some explanations likelier than others – for example, that it was stolen once rather than stolen and returned and then stolen again, or that it was stolen by the grungy crust-punk rather than by the well-to-do suburban family to his left. The process of inferring an explanation by comparing hypotheses against each other and selecting the best among them is known as “inference to the best explanation” (Harman 1965).

People suffer many hard-to-explain misfortunes, such as illness, the death of a loved one, and a burnt-down house. I propose that as they search for explanations for how suspected rivals engineered those harms, they retain the most plausible explanations. A distrustful person whose livestock dies, for example, will search for an explanation for how a rival committed the act. They will consider explanations that they have learned, concoct other stories, and ask knowledgeable group mates. As other people suffer similar, inexplicable injuries, and as people share their conclusions and suspicions with each other, communities spin more and more conceivable tales for how heinous group members abused them from afar. When people believe in the efficacy of malicious magic (following section 5), it provides a sufficient and parsimonious answer, easily accounting for invisible, distant harm.

In societies without strong beliefs in magic, this selective process still occurs, although it converges on different explanations. One explanation is that powerful governments mastermind misfortune. In his analysis on paranoia in US politics, Hofstadter (1964) noted that people often attribute their troubles to distrusted governments or the puppeteers controlling them, such as the Catholics, Free-Masons, and Illuminati. Barkun (2013) showed that these theories evolve. Milton Cooper, for example, tweaked and synthesized existing theories about the Illuminati, the CIA, the Kennedy assassination, observations of cattle mutilations, and the AIDs epidemic. His super-conspiracy theories comprehensively explained both the momentous and the puzzling, producing an unparalleled appeal. As I am write this, his 1991 book *Behold a Pale Horse* (Cooper 1991) ranks 2,998<sup>th</sup> among all books on Amazon.com, besting the highest-selling editions of *The Iliad*, *War and Peace*, and *Uncle Tom's Cabin*.

Beliefs about mystical practitioners should evolve like contemporary conspiracy theories. Over time, they should become more internally consistent and plausible while encompassing a wider set of inscrutable events.

### **6.2. Ethnographic evidence for plausible explanations of misfortune**

I have argued that beliefs in mystical harm develop to explain how distrusted group mates attacked a person from afar. At least two basic predictions follow: (1) Beliefs in mystical harm should track distrust and suspicions of harmful intent, and (2) malicious practitioners should be suspected of causing calamitous, negative events, especially ones for which people lack alternative explanations. Meanwhile, that these beliefs develop from a selection for the most plausible explanations clarifies why malicious practitioners often associate with, and transform into, animals.

#### *6.2.1. Accusations of mystical harm track distrust and suspicions of harmful intent*



People who suffer calamity overwhelmingly suspect individuals with a presumed interest in harming them. When several girls fell into possessed fits in Salem Village in 1692, many of the girls' families' political rivals were suspected of attacking the girls and their allies (Boyer and Nissenbaum 1974). Among the Azande, "A witch attacks a man when motivated by hatred, envy, jealousy, and greed... Therefore a Zande in misfortune at once considers who is likely to hate him" (Evans-Pritchard 1937:100). For the Trobriand Islanders, "the passions of hatred, envy, and jealousy" are expressed "in the all powerful sorcery of the *bwaga'u* [sorcerer] and *mulukwausi* [witch]" (Malinowski 1922:395). Many ethnographers studying other societies have made similar comments (e.g., Tlingit: De Laguna 1972:730; Tikopia: Firth 1954:114; Ona: Gusinde 1971:1102; Tukano: Reichel-Dolmatoff 1971:156-157; Pawnee: Weltfish 1965:337).

People regard envy in particular as a potent, malicious emotion. They not only suspect that envious individuals want to harm them, but in societies everywhere, people believe that the emotion itself transmits mystical harm, such as through covetous stares (the evil eye) or jealous compliments (the blasting word) (Dundes 1992). Beliefs in the harmful effects of envy likely exist because envy drives malice. Individuals who experience envy are more likely to injure better-positioned targets (Smith and Kim 2007; Miceli and Castelfranchi 2007) and even derive pleasure when envied persons suffer (van de Ven et al. 2015; Smith et al. 1996). Thus, a person who expresses envy betrays a desire to harm, making them a key suspect after things go wrong.

The theory proposed here also predicts that beliefs about witches, sorcerers, and evil eye possessors should prosper in communities with lower levels of trust compared to those with higher levels. This explains why mystical harm beliefs increase with conditions that exacerbate distrust, such as growing inequality and the resulting rise in envy (e.g., Lederman 1981).<sup>9</sup>

## 6.2.2. *Mystical harm explains impactful and unexplainable misfortunes*

I argued that paranoid tendencies intensify when the impact of a misfortune is high and it is unexplainable. If beliefs in mystical harm develop from these tendencies, people should fault malicious practitioners for high-impact and inexplicable injuries.

People overwhelmingly accuse malicious practitioners of causing impactful hardship. Of the 83 practitioners or practices in the MHS, at least 78% were said to cause illness, 77% death, 30% economic trouble, and 16% catastrophes (such as hailstorms or epidemics). In total, 94% were reported as producing at least one of those outcomes.

Ethnographic descriptions often focus on the inexplicability of these hardships (e.g., Nsenga: Reynolds 1963:19; Kerala Brahmins: Parpola 2000:221). The Navajo attributed illnesses to witchcraft when they were "mysterious from the Navaho point of view" or "persistent, stubbornly refusing to yield to usual Navaho treatment" (Kluckhohn 1944:54). Other strange circumstances, such as the appearance of unexplained tracks, were taken as further evidence.

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<sup>9</sup> Analyzing Pew survey data in nineteen sub-Saharan African, Gershman (2016) reported a robust, negative correlation between the prevalence of mystical harm beliefs and several measures of trust. He acknowledged that the evidence was correlational yet preferred the interpretation that mystical harm beliefs erode trust. This is reasonable – people who understand illness and death to be the handiwork of evil group members should grow more distrustful of them – but the proposed theory also predicts the opposite direction of causality. As I discussed, people who distrust others should suspect them of causing unexplainable misfortunes, and sorcery provides a parsimonious explanation.

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When the Tiwi experienced a decrease in mortality from fighting, raids, and neglected wounds, they attributed the resulting increase in natural deaths to a rise in poison sorcery (Pilling 1958:123).

People attribute random calamities aside from death, disaster, illness, and material loss to mystical malice. Ten of the 83 practitioners in the MHS were said to produce sterility; 12 influenced love and attraction. Witches in colonial New England were rumored to cause clumsiness, falling, fires, forgetfulness, barrenness, deformed children, spoiled beer, storms, sleep paralysis, and unusual behavior in animals (such as a cow wandering off or a sow knocking its head against a fence) (Karlsen 1987). Table 2 includes every example of harm or misfortune recorded in the MHS that does not qualify as death, injury, love, sterility, catastrophe, or economic trouble. Nearly early all are inexplicable and bothersome.

**Table 2.** Every example of harm or misfortune recorded in the MHS that does not relate to death, injury, sickness, love, sterility, catastrophe, or economic trouble. Citations appear in the MHS dataset.

| SOCIETY<br>(with practitioner* and MHS practitioner ID) | HARM OR MISFORTUNE  |
|---|---|
| Akan, <i>obayifo</i> /witch [1]                         | Accidents (including lorry accidents); bad behavior of wife; becoming a drunkard; burnt-down house; cracks in buildings; ill luck; poor performance on school exams; pregnant men |
| Amhara, <i>buda</i> /evil eye [3]                       | Croaking or worsening of singer's voice   |
| Aymara, <i>laiqa</i> /sorcerer [8]                      | Accidents; failure in fishing   |
| Azande, <i>aboro mangu</i> /witch [9]                   | Burnt-down hut; coldness of prince towards subject; failed magic; ruined performance of witch-doctor; sulkiness or unresponsiveness of wife                                       |
| Azande, <i>aira kele ngwa</i> /sorcerer [10]            | Outcome of divination (poison oracle)   |
| Azande, <i>irakörindel</i> /possessor of teeth [11]     | Broken items, including stools, pots, and bowls   |
| Azande, women's sexual magic [12]                       | Bad luck  |
| Chukchee, sorcery [22]                                  | Losing strength while wrestling; slowing down in a foot- or reindeer-race   |
| Chuuk, <i>souboud</i> /sorcerer [23]                    | Disturbed growth; falling or tripping during competition (basketball)   |
| Dogon, <i>yadugonu</i> /witch [27]                      | Temporary muteness  |
| Highland Scot, <i>buidseachd</i> /witchcraft [40]       | Stuck or overturned truck   |
| Hopi, <i>bowaka</i> /witch [42]                         | Malicious gossip; misbehavior of children   |
| Iroquois, witch [47]                                    | Confusion in sports competitions  |

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|  |  |
|--|--|
| Lau Fijians, raw eyes [61]                   | Skin discoloration (i.e., becoming tan)  |
| Lozi, <i>muloi</i> /witch [64]               | Inability to perform acrobatics; inability to score during football  |
| Ojibwa, <i>windigo</i> /cannibal spirit [71] | Overtaken canoes   |
| Pawnee, witch [74]                           | Stopped rain   |
| Santal, sorcery [77]                         | Deception  |
| Saramaka, sorcery [78]                       | Boat accidents   |
| Tarahumara, <i>sukurúame</i> /sorcerer [89]  | Outcomes of competitions (e.g., races); twins  |
| Tiv, <i>mbatsav</i> /witch [91]              | Appearance of baldspots; bad dreams; burnt clothes; “whatever goes wrong if there is no more convenient explanation” |
| Tlingit, land otter sorcery [93]             | Disappearance  |

\*The indigenous term for the practitioner or practice with the ethnographer’s term or translation

### 6.2.3. Animals associated with mystical harm explain impactful misfortune and invisible harm

Those animals associated with malevolent supernatural practitioners provide further evidence that these beliefs serve as compelling explanations of misfortune. Table 3 displays all of the animals associated with harmful practitioners recorded in the MHS, separated into those animals believed to be transformed practitioners and those animals that act as their servants, steeds, or helpers.

**Table 3.** Every example in the MHS of practitioners either transforming into animals (including the practitioner’s soul entering or becoming an animal) or working with animals (including spirit familiars taking animal form). Citations appear in the MHS dataset.

#### ANIMALS INTO WHICH PRACTITIONERS TRANSFORM

| SOCIETY<br>(with practitioner* and MHS practitioner ID) | ANIMAL   |
|---|--|
| Akan, <i>obayifo</i> /witch [1]                         | Antelopes, bulls, bushpigs, centipedes, cows, crop worms, crocodiles, dogs, hyenas, leopards, lions, lizards, owls, rats, red deer, snakes (including poisonous ones), squirrels, tsetse fly |
| Amhara, <i>buda</i> /evil eye [3]                       | Hyenas   |
| Azande, <i>aboro mangw</i> /witch [9]                   | Bats   |
| Bahia Brazilians, <i>lobishomem</i> /werewolf [15]      | Wolves   |
| Dogon, lycanthrope [28]                                 | Eagles, panthers   |
| Eastern Toraja, <i>topokantoe</i> /sorcerer [29]        | Snakes   |

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|   |  |
|---|--|
| Eastern Toraja, <i>taoe mepongko</i> /werewolf [30]     | Buffalo, cats, deer, dogs, pigs, white ants  |
| Garó, lycanthropy [36]                                  | Any beast or reptile, including crocodiles, snakes, and tigers   |
| Hopi, <i>bowaka</i> /witch [42]                         | Animals, including coyotes, foxes, lizards, and wolves   |
| Iroquois, witch [47]                                    | Any animal, including dogs, pigs, turkeys, and owls  |
| Kapauku, <i>meenoo</i> /cannibal [53]                   | Dogs, hawks  |
| Lozi, <i>muloi</i> /witch [64]                          | Hyenas, lions  |
| Mataco, <i>ayieu</i> /sorcerer [68]                     | Horses, jaguars, venomous reptiles (including rattlesnakes)  |
| Santal, <i>tonhi</i> /witch [76]                        | Bears  |
| Serbs, <i>vještice</i> /witch [79]                      | Insects, reptiles, sparrows  |
| Tiv, <i>mbatsav</i> /witch [91]                         | Chicken leopards (?), crocodiles, foxes, leopards, lions, monkeys, owls, witch cats (?), other birds ( <i>akiki</i> , <i>kpire</i> ) |
| Tlingit, <i>nukwsati</i> /witch [92]                    | Cranes, geese, owls, porpoises, sea lions  |
| Trobriand Islanders, <i>yoyova</i> /flying witches [94] | Fireflies, flying foxes, nightbirds  |
| Wolof, <i>doma</i> /witch [101]                         | Ants, cats, donkeys, hyenas, monkeys, owls, snakes, vultures   |

### ANIMALS ASSOCIATED WITH PRACTITIONERS (e.g., familiars, mounts)

| SOCIETY<br>(with practitioner* and MHS practitioner ID) | ANIMAL  |
|---|---|
| Akan, <i>obayifo</i> /witch [1]                         | Antelopes, bats, chameleons, cocks, crabs, dogs, eagles, electric fish, goats, horses, house flies, leopards, lions, lizards, lice, owls, rats, smart hawks (?), snakes (including black mambas, black snakes, green mambas, puff adders, pythons, spitting cobras, thrush striped snakes), soldier ants, tsetse flies, wasps, weaver birds, wolves |
| Amhara, <i>buda</i> /evil eye [3]                       | Hyenas  |
| Aymara, <i>laiga</i> /sorcerer [8]                      | Nighthawks, owls  |
| Azande, <i>aboro mangu</i> /witch [9]                   | Nocturnal birds and animals, including bats, jackals, and owls  |
| Bahia Brazilians, <i>lobishomem</i> /werewolf [15]      | Dogs  |
| Bemba, <i>muloshi</i> /witch [17]                       | Magical birds, owl-like birds   |
| Blackfoot, medicine [18]                                | Spiders   |
| Chukchee, sorcery [22]                                  | Dogs, reindeer  |
| Eastern Toraja, <i>taoe mepongko</i> /werewolf [30]     | Black cats, snakes  |

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|   |   |
|---|---|
| Eastern Toraja, <i>taoe meboetoe</i> /werewolf [31] | Black cats  |
| Garo, lycanthropy [36]                              | Animals that live in the forest, including elephants, crocodiles, snakes and other reptiles, and tigers |
| Hopi, <i>bowaka</i> /witch [42]                     | Lizards   |
| Lozi, <i>muloi</i> /witch [64]                      | Jackals, lizards, nightjars, owls, rats, water-snakes   |
| Ojibwa, witchcraft [72]                             | Snakes, wolverines  |
| Pawnee, witch [74]                                  | Owls  |
| Santal, <i>tonhi</i> /witch [76]                    | Dogs, tigers  |
| Serbs, <i>vještice</i> /witch [79]                  | Birds, insects, small reptiles, snakes  |
| Tarahumara, <i>sukurúame</i> /sorcerer [89]         | Invisible birds   |
| Tiv, <i>mbatsav</i> /witch [91]                     | Cats, nightjars, owls, snakes   |
| Tzeltal, witch [100]                                | Snakes  |

\*The indigenous term for the practitioner or practice with the ethnographer's term or translation

A cursory glance reveals that many of the animals fall into one of two categories. First are those creatures responsible for calamities, such as man-killers and crop-destroyers. Snakes, bears, tigers, wolves, and crocodiles all attack humans, leaving wounded individuals searching for explanations. Hypervigilant people should immediately suspect their enemies, and ethnographic descriptions show that this frequently occurs. To the Akan, snakes bring “sudden and most unpleasant death”, so “anyone who has a narrow escape from a snake comes to ask who sent it and why” (Field 1970:130). Archer (1984:486) recorded an incident among the Santal of South Asia when a man was mauled by two bears. He soon consulted a witch finder to learn who was behind the attack.

Another class of ruinous misfortune is the destruction of crops. The Akan accused witches of becoming squirrels, rats, crop worms, antelopes, bush pigs, cows, bulls, dogs, and red deer – but all of those suspicions followed incidents when those animals consumed or destroyed a person's harvest (Debrunner 1961).

The second major category includes those animals whose alliance or transformation explains how dark practitioners commit their wickedness unseen, such as owls, nightjars, flying foxes, and fireflies. In all of these instances, people seem confident that a group mate harmed them and, noticing these animals flitting about, find their appearance the missing explanatory piece for how a distrusted rival harmed them.

Several animals do not fall into the above categories, but their associations with malicious practitioners still seem to parsimoniously explain puzzling events. The Tlingit believed that witches could become porpoises and sea lions, but these suspicions occurred when those animals behaved enigmatically, lacking “the normal fear of human beings displayed by ordinary wild animals” (de Laguna 1972:731). Thus, an ailing sea lion that remained near people's houses and porpoises that swam too close to shore were suspected of being metamorphosed witches.

Hyenas were associated with malicious magicians among the Wolof, Amhara, and Lozi, as well as many cultures not included in the MHS, such as the Kaguru of Tanzania (Beidelman 1975) and Persians in medieval India (Ivanow 1926). This association seems the result of

demonizing narratives feeding back on plausible explanations. If people believe that certain individuals have superpowers and feast on human flesh (as shown in Figure 1 and discussed in the next section), they should start to suspect transformation when they witness nocturnal hyenas digging up corpses.

### 7. Evil

The above two processes fail to explain the extreme heinousness of witches, such as their cannibalism and graveyard conspiracies. Here, I propose that these features develop from a *selection for demonizing narratives* – specifically, from a selection for those traits that justify the mistreatment of accused practitioners and even spur other group mates to remove them.

#### 7.1. Selection for demonizing narratives

##### *7.1.1. People promote demonizing narratives when they want to justify mistreatment of a group*

The cannibalism, conspiratorial meetings, and existential threat posed by witches are peculiar commonalities, but they are not unique. Sociologists studying moral panics and elimination campaigns in Western contexts have documented similar “folk devils”, with target groups ranging from youth sub-cultures (Cohen 1972) to Jews (Cohn 1967; Cohn 1966). Their analyses, together with insights from psychological research, reveal why these narratives recur with such consistency around the world.

Folk demonization usually occurs because one group – hereafter, the Campaigners – wants to justify the mistreatment of another – hereafter, the Targets (Goode and Ben-Yehuda 2009). Targets can be social groups, such as Jews or heretics, but they can also be those people who do some behavior, like people who use LSD (Goode 2008).

Campaigners demonize Targets for several, non-exclusive reasons, including (a) competition, such as when removing Targets opens up resources, (b) existential fear, such as when Targets are believed to threaten Campaigners, and (c) moral campaigns, such as when Campaigners want to curb some behavior. The foundations of these motivations can be legitimate, like if removing victims frees up benefits that the Campaigners can enjoy (e.g., Philip IV’s motivation to arrest the Knights Templar: Barber 2006), or mistaken, such as when Campaigners wrongly understand Targets to be threatening (e.g., panics about satanic groups: Victor 1989).

To mistreat Targets, Campaigners must often gain the approval of other group mates – hereafter, the Condoners. They can secure this approval by promoting sensational myths that justify abusing the Targets. People might craft these myths deliberately, as in many propaganda campaigns (e.g., Desforges 1999), but they can also do so unconsciously. People reflexively attend to and exaggerate evidence that supports their goals and their claims (Nickerson 1998; Kunda 1990), a tendency arguably designed to sway others (Mercier and Sperber 2011).

As Campaigners refine portrayals of Targets that justify and urge violence, they selectively retain demonizing narratives. The iterative crafting of heinous myths about Jews illustrates this process. For example, Cohn (1967) tracked the history of *The Rabbi’s Speech*, a fabricated speech by a chief rabbi describing the Jews’ plot to control finance and undermine



Christianity. The speech started as a fictional chapter in an 1868 novel recounting a conspiratorial meeting between representatives of the twelve tribes of Israel and the Devil. In the years afterwards, the chapter was borrowed, modified, distributed in pamphlets, and reprinted as purported fact. In an 1881 version from France, the many speeches had been consolidated into a single address, the satanic element was absent, and a note was included explaining that the document came from a forthcoming book by an English diplomat, vouching for its authenticity.

### *7.1.2. Demonizing narratives develop and are maintained during stressful uncertainty*

For demonizing narratives to flourish, Condoners need to believe them. But this is often not the case because people are armed with cognitive adaptations that recognize and protect against deception (Sperber et al. 2010). In fact, ethnographers occasionally report people's skepticism about the existence or portrayals of evil magicians (e.g., Tswana: Schapera 1952:44).

Condoners should be gullible or credulous in at least two conditions. First, they should accept information when it comes from influential or trusted sources, such as religious authorities or the media. Second, and more relevantly, people should become receptive when they need valuable information, especially during times of unexplainable stress. Research on social learning and gossip show that uncertainty, especially about important events, motivates individuals to pursue social information (Boyd and Richerson 1988; Laland 2004; Morgan et al. 2012; Rosnow 1991).

In conclusion, times of unexplainable disaster breed paranoid suspicion while leaving injured parties intensely credulous. This combination of mistrust and gullibility allows fearful or exploitative campaigners to invent abominable witches.

## **7.2. Ethnographic evidence for demonization**

### *7.2.1. Witches are well-designed to induce punitive outrage*

In section 2, I showed that witches exhibit many common features, two of the most striking being (1) their threatening nature and (2) their moral abhorrence, especially their cannibalism and defilement of human bodies. These behaviors ignite severe punitive ire, encouraging violence towards those actors.

Depicting a group as an existential threat – organized and secretive yet powerful and conspiratorial – is effective, because, in short, people want to remove threats. A vast literature shows that people are more willing to invest in collective action when they feel existentially threatened (e.g., Johnson and Frickel 2011; Berry 2015; Maher 2010). Meanwhile, researchers note that people use past harms committed by a group to justify violence and mistreatment towards it (Sullivan et al. 2012) and people forgive aggressors when reminded of these wrongs (Wohl and Branscombe 2009). If narratives develop to maximally support and provoke violence towards demonized Targets, Targets should be portrayed as representing as large a threat as is believable.

Aside from conspiratorially plotting destruction, witches engage in atrocious behaviors, most frequently cannibalism and corpse desecration, but also acts such as necrophilia (e.g., Navajo: Kluckhohn 1944) and incest (e.g., Apache: Basso 1969; Kaguru: Beidelman 1963).

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What accounts for their pervasiveness? As readers can attest, these acts trigger an intense, visceral moral outrage (Haidt, Björklund, and Murphy 2000). For the !Kung, “the two worst sins, the unthinkable, unspeakable sins, are cannibalism and incest” (Marshall 1962:229), while among the Comanche, “the very idea that one of them might under stress eat another person was vigorously repulsed” (Wallace and Hoebel 1952:70). In fact, the repugnance at cannibalism is so intense that some societies even claim to forbid the consumption of animals that resemble humans, exemplified in taboos on the Amazon river dolphin and nutria (a large semiaquatic rodent) among the Warao (Wilbert 1972:69).

One possible reason for our revulsion at acts like cannibalism and necrophilia is that they indicate that an actor is dangerous and not to be trusted. People may have evolved psychological mechanisms to select social partners who are predictable and safe. Any individual who even *considers* an atrocious behavior, like consuming flesh, having sex with dead bodies, or mutilating corpses, reveals an underlying preference that makes them perilous social partners (Tetlock 2003; Hoffman, Yoeli, and Nowak 2015). Our revulsion at these acts may be enhanced by feelings of disgust, which have been shown to heighten moral judgment (Schnall et al. 2008).

Regardless of why we abhor cannibalism and other obscenities, the broader point is that those acts invite severe punitive outrage, making them potent for justifying and urging elimination. Should some other set of behaviors provoke greater outrage, the proposed theory predicts that witches will do those instead (assuming that people will believe the accusations).

### *7.2.2. Witches resemble the demonized targets of other moral panics and eradication campaigns*

The traits of witches are sensational and atrocious, but they are not unique. Other panics and campaigns of mistreatment – such as attacks on heretics and dissidents, moral panics during times of stress, and conspiracy scares – similarly transform targets into witch-like demons. Table 4 lists some examples. Note how frequently these groups supposedly pose existential threats and violate sacred values.

**Table 4.** The targets of moral panics and elimination campaigns resemble witches, especially by posing existential threats and violating sacred values.

| SELECTED GROUPS  | TRAITS ASCRIBED<br>(with references)  |
|--|---|
| Christians, 100s, Roman Empire                                 | Worship a donkey-god or genitals of priest; engage in secretive meetings, infanticide, child-cannibalism, and nighttime, incestuous orgies; “threaten the whole world and the universe and its stars with destruction by fire” (Felix and Rendall 1972:337-41)                                |
| Knights Templar, early 1300s, France                           | Deny Christ; spit, trample, and urinate on the cross; engage in homosexual practices, including disrobing newcomers and kissing them; collect in secret meetings at night; are bound by oaths enforced by death; swear to advance the Order at all costs, lawful or not (Barber 2006:202-203) |
| Fratricelli “de opinione” (radical Christian sect), 1466, Rome | Enjoy nighttime orgies in crypts; sacrifice a small boy, make powder from his body, and consume it communally in wine during mass (Cohn 1976:46)  |

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|                                     |  |
|-------------------------------------|--|
| Catholics, mid-1800s, United States | “The anti-Catholics invented an immense lore about libertine priests, the confessional as an opportunity for seduction, licentious convents and monasteries... Infants born of convent liaisons were baptized and then killed” (Hofstadter 1964:80-81).                    |
| Mau Mau rebels, 1950s, Kenya        | Mutilate victims’ corpses; take secretive oaths at night that involve obscenities like public masturbation and drinking menstrual blood (Lonsdale 1990:398-400)  |
| Communists, 1965, Indonesia         | Murder, torture, and castrate generals; woman’s Communist group dances naked at night; plot nation-wide purge of anti-Communists (Wieringa 2011; Henry 2014)   |
| Tutsis, early 1990s, Rwanda         | Send women to seduce Hutu and infiltrate positions of power; plot a war to reestablish control, massacre Hutu, and establish Nilotic empire across Africa; admire Nazis and engage in cannibalism; elders kill and pillage and rape girls and women (Desforges 1999:72-83) |

## 8. Discussion

### 8.1. The origins of sorcerers, lycanthropes, the evil eye, and witches

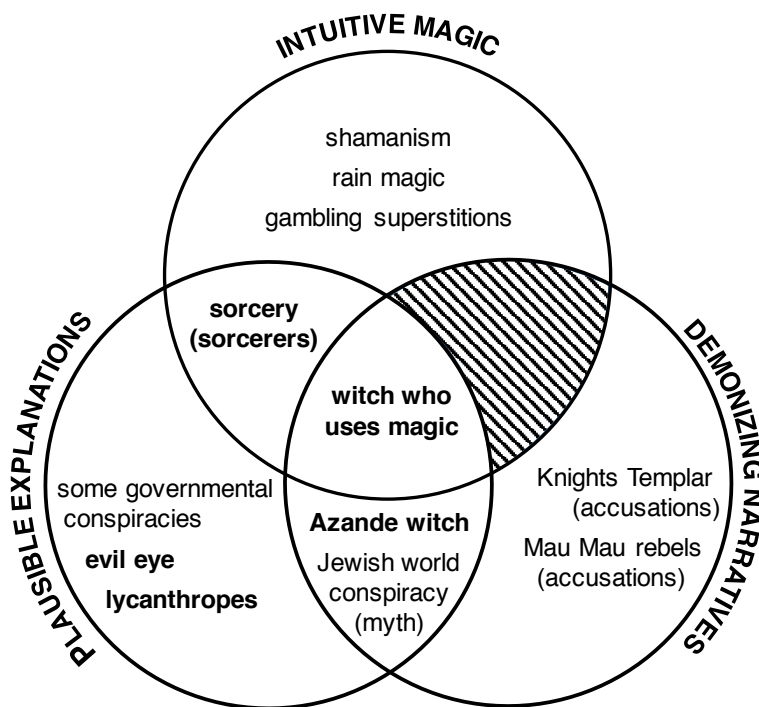
Table 5 displays the three cultural selective processes hypothesized to be responsible for shaping beliefs in practitioners of mystical harm. Figure 3 shows how those processes interact to produce some of the malicious practitioners identified in Figure 1 (sorcerers, the evil eye, lycanthropes, and witches).

**Table 5.** The three cultural selective schemes responsible for beliefs in practitioners of mystical harm.

| CULTURAL SELECTIVE SCHEME:<br>What is being selectively retained?                                    | CONTEXTS:<br>When should we expect it to occur?   | FEATURES OF BELIEFS IN MYSTICAL HARM:<br>Which features of mystical harm beliefs does this process produce?  |
|--|---|--|
| <b>Intuitive magic (section 5):</b><br>Effective-seeming interventions for harming or killing others | When people want to harm rivals   | That harm can be transmitted through sympathetic means (contagion, similarity); that harmful magic is effective and that others do it  |
| <b>Plausible explanations (section 6):</b><br>Explanations for impactful misfortune                  | Following unexplainable, harmful misfortune, especially when people are distrustful or persecuted | That impactful and unexplainable harm is caused by magic and supernatural powers; that malicious practitioners are envious or offended; that they associate with animals, especially |

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|  |  |  |
|--|--|--|
|  |  | man-killers and nighttime or tiny animals  |
| <b>Demonizing narratives (section 7):</b><br>Narratives that justify and urge mistreatment of a target group | When influential individuals aim to remove a sub-group; during stressful uncertainty | That malicious practitioners are threatening (e.g., conspire, kill); that they violate sacred values (e.g., eat corpses) |



**Figure 3.** The three selective schemes responsible for beliefs in practitioners of mystical harm. Practitioners of mystical harm are bolded; examples of other practices and beliefs are unbolded. The intersection of demonizing narratives and intuitive magic is filled because no beliefs should exist there – any demonizing narrative in which the target uses magic should also blame the target for terrible events, shifting them to the center.

According to the theory outlined here, sorcerers are the result of both a selection for intuitive magic and a selection for plausible explanations. The selection for intuitive magic produces compelling techniques for controlling uncertain outcomes, including rain magic, gambling superstitions, and magic aimed at harming others, or sorcery. Once people accept that this magic is effective and that other people practice it, it becomes a plausible explanation for misfortune. A person who feels threatened and who confronts unexplainable tragedy will easily suspect that a rival has ensorcelled them. As people regularly consider how others harm them, they build plausible portrayals of sorcerers.

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Beliefs about werewolves, werebears, weresnakes, and other lycanthropes also develop from a selection for plausible explanations. Baffled as to why an animal attacked them, a person suspects a rival of becoming or possessing an animal and stalking them at night. This explanation becomes more conceivable as the lycanthrope explains other strange events and as conceptions of the lycanthrope become more plausible. Many societies ascribe transformative powers to other malicious practitioners (see Table 3), showing that people also suspect existing practitioners after attacks by wild animals.

Beliefs in the malignant power of stares and words likewise develop to explain misfortune. As reviewed earlier, people around the world connect jealousy and envy to a desire to induce harm. Thus, people who stare with envy or express a compliment are suspected of harboring malice and an intention to harm. A person who suffers a misfortune remembers these stares and suspects those people of somehow injuring them. In regularly inferring how envious individuals attacked them, people craft a compelling notion of the evil eye.

Why suspect the evil eye rather than sorcery? There are at least two possibilities. First, an accused individual may ardently vow not to know sorcery or to have attacked the target (see these claims among the Azande, both described in text: Evans-Pritchard 1937:119-125; and shown in film: Singer 1981, minute 21). Alternatively, given beliefs that effective sorcery requires powers that develop with age, special knowledge, or certain experiences, it may seem unreasonable that a young or unexperienced group mate effectively ensorcelled the target. In these instances, the idea that the stare itself harmed the target may provide a more plausible mechanism.

The famous odious, powerful witch, I propose, arises when blamed malicious practitioners become demonized. People who fear an invisible threat or who have an interest in mistreating competitors benefit from demonizing the target, transforming them into a heinous, threatening menace. Thus, witches represent a confluence of two and sometimes all three cultural selective processes.

In Figure 1, I showed that beliefs about malicious practitioners exist along two dimensions. The tripartite theory accounts for this structure. All of the practitioners displayed are plausible explanations of how group mates inflict harm. One dimension (SORCERY-EVIL EYE) distinguishes those explanations of misfortune that include magic (sorcerers) from those that do not (evil eye, lycanthrope). The other dimension shows the extent to which different practitioners have been demonized. In short, all beliefs about harmful practitioners are explanations; sometimes they use magic, sometimes they're made evil.

### 8.2. Ten predictions

The proposed theory generates many predictions for how shifting conditions should drive changes in beliefs about malicious practitioners. I referred to several of these throughout the paper. Here are ten (the section of the paper is noted when a prediction is discussed in the paper):

1. People are more likely to believe in sorcerers as sorcery techniques become more effective-seeming.
2. People are more likely to ascribe injury to mystical harm when they are distrustful of others, persecuted, or otherwise convinced of harmful intent. (sect. 6.2.1)

3. The emotions attributed to malicious practitioners will be those that most intensely and frequently motivate aggression. (sect. 6.2.1)
4. People are more likely to attribute injury to mystical harm when they lack alternative explanations. (sect. 6.2.2)
5. The greater the impact of the misfortune, the more likely people are to attribute it to mystical harm. (sect. 6.2.2)
6. Practitioners of mystical harm are more likely to become demonized during times of stressful uncertainty.
7. The traits ascribed to malicious practitioners will become more heinous or sensational as Condoners become more trustful or reliant on information from Campaigners.
8. Malicious practitioners will become less demonized when there is less disagreement or resistance about their removal.
9. The traits that constitute demonization will be those that elicit the most punitive outrage, controlling for believability. (sect. 7.2.1)
10. Malicious practitioners whose actions can more easily explain catastrophe, such as those who employ killing magic compared to love magic, will be easier to demonize.

### 8.3. The cultural evolution of harmful beliefs

Social scientists, and especially those who study the origins of religion and belief, debate over whether cultural traditions evolve to provide group-level benefits (Baumard and Boyer 2013; Norenzayan et al. 2016). Reviving the analogy of society as an organism, some scholars maintain that cultural traits develop to ensure the survival and reproduction of the group (Wilson 2002). These writers argue that traditions that undermine societal success should normally be culled away, while traditions that enhance group-level success should spread (Boyd and Richerson 2010).

In this paper, I have examined cultural traits with clear social costs: mystical harm beliefs. As sources of paranoia, distrust, and bloodshed, these beliefs divide societies, breeding contempt even among close family members. But I have explained them without invoking group-level benefits. Focusing on people's (usually automatic) decisions to adopt cultural traditions, I have shown that beliefs in witches and sorcerers are maximally appealing, providing the most plausible explanations and justifying hostile aims. Corrosive customs recur as long as they are useful and cognitively appealing.

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# Magic, explanations and evil: The origins and design of witches and sorcerers

## SUPPLEMENTARY MATERIALS

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### 1. The Mystical Harm Survey (MHS)

#### 1.1. Background

The Mystical Harm Survey (MHS) is designed to characterize patterns in beliefs about practitioners of mystical harm across societies. The Survey samples ethnographic texts from the 60 societies comprising the Probability Sample File of the electronic Human Relations Area Files, a pseudo-random sample of well-documented human societies designed to make inferences about humanity more generally (Human Relations Area Files 1967; Naroll 1967). For each society, I selected the two ethnographic texts containing the most paragraphs tagged for the code SORCERY (USE code 754)<sup>1</sup>. Whenever the documents included a total of less than twenty paragraphs, I included all ethnographic texts with paragraphs tagged for SORCERY until at least twenty paragraphs were covered or, if that was not possible, until all of the ethnographic texts tagged for SORCERY in a given culture were included.

Two independent coders read through the tagged paragraphs for each society, identified the different practitioners of mystical harm discussed, and coded each practitioner for 58 features. Discrepancies between the two resulting datasets were identified and resolved through discussion to produce a final, merged dataset, available at [osf.io/492mj](https://osf.io/492mj). Supplementary Table 1 displays the societies, ethnographic documents, and practitioner IDs.

#### 1.2. Inclusion criteria

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<sup>1</sup> According to the electronic Human Area Files, code 754 (SORCERY) includes any reference to the following: “Ideas of the causation of disease and death through witchcraft and sorcery; actual and reputed prevalence of sorcery; motives for practicing sorcery; methods (e.g., bone pointing, manipulation of effigies, exuvial magic, invocation of spirit aids); employment of sorcerers; witches, wizards, and sorcerers; physical, social and mental characteristics; sources of power; training; organization; special types of sorcerers (e.g., werewolves and other were-animals, vampires, individuals with the evil eye); evidence as to the efficacy of sorcery; reactions to sorcerers (e.g., witch hunts); etc.”

Each row of the dataset corresponds with a conception of a practitioner (or practice) of mystical harm. The inclusion criteria for a practitioner of mystical harm were as follows:

*People who are believed to use magical or supernatural powers to attack non-strangers: Individuals, either in-group or people with whom individuals otherwise frequently interact, believed to harm people they know through magic (e.g., recited spells, magical poisons, charms) or supernatural powers (e.g., becoming a spirit and eating people; transforming into animals and attacking people; harming people with thoughts or stares). This excludes beliefs about supernatural attackers who are strangers (e.g., beliefs that individuals from far-away lands transform into bears and hassle travelers). This also excludes people who only attack out-group members (e.g., shamans who only attack members of other groups).*

*Each row of the dataset refers to a different practitioner of mystical harm. Some societies have several such practitioners – for example, an ethnographer might describe one kind of person who can become an animal at night and a different kind of person who transmits harm through stares. In these cases, each practitioner is coded as a separate entry in the dataset. In another instance, an ethnographer may only describe one practitioner in a society, although that practitioner may have many abilities – for example, they may report that people believe that some individuals can become animals, fly, and attack with magical spells. In these instances, a single practitioner will appear in the dataset for that society.*

*In some instances, ethnographers describe a technique or practice – for example, “black magic” — but they don’t present it in connection with certain practitioner. In these instances, rows in the dataset correspond only to the practice (when appropriate, variables CLASS01 and CLASS02 will add clarifying information).*

*Public magicians (e.g., shamans, priests, other magicians) are often said to have malignant, mystical powers. Whenever this is the case, coding is as follows:*

- *Whenever an ethnographer reports that a practitioner class includes, but is not restricted to, public magicians, then public magicians are not coded separately. For example, shamans would not be coded separately if an ethnographer states that people believe that individuals in their group are witches and that shamans are sometimes accused as witches.*
- *Whenever an ethnographer describes public magicians as attacking non-strangers with mystical powers and they differ from other practitioner types on the basis of one or more variables, then they are coded separately. For example, shamans would be coded separately if an ethnographer states that all witches harm people, but shaman-witches alone can fly and transform into animals.*

Two additional exclusion criteria were added while resolving discrepancies:

*Exclude: Spells and curses that are used to enforce contracts or promises*

*Exclude: Mystical harm that is considered to be “good magic”, such as judiciary magic*

### 1.3. Citations

Any coding decision that reports the presence of some trait includes a citation in the format *refX:Y*, where X refers to the number of the document (for example, reference 1, reference 2, and

so on; the title and author of the document appear in the same row) and Y refers to the page number.

## 2. Analyses

### 2.1. Logistic PCA

All statistical analyses were conducted in R (R Core Team 2015). Because the data are binary, I conducted a logistic PCA, using the `logisticPCA` function of the `logisticPCA` package (Landgraf and Lee 2015). Following Landgraf (2016), I used the `cv.lpca` function to choose  $m$ , an argument in the `logisticPCA` function denoting the natural parameters from the saturated model.

I ran the model 10 times, varying  $k$  from 1 to 10, and produced a scree plot (see Supplementary Figure 1). The scree plot showed a break between the second and third components, justifying a cutoff either at two or three dimensions.

For the reported analyses, I excluded practitioner classes that are exclusively leaders (e.g., sheikhs, elders) and public magicians (e.g., shamans, priests) – that is, any practitioners coded 1 for the variable BEHA18. Note that the principal components are very similar regardless of whether these practitioner classes are included (compare the factor loadings in Supplementary Table 2 with those in Supplementary Table 4). I removed all free-response variables and transformed the following categorical variables into binary variables:

TECH10: 1 & 2 --> 1

*["always unintentional" and "sometimes unintentional" coded as "unintentional"]*

PROC01: 1 & 2 --> 1

*["biological heredity" and "non-biological heredity" coded as "heredity"]*

BEHA01: 1 & 2 --> 1

*["devour flesh" and "devour souls" coded as "cannibalism"]*

BEHA14: 1, 2, & 3 --> 1; 4 --> 0

*["harm family members for enjoyment", "harm family members as obligation", and "harm family members as consequence of harm" coded as "harm family members"; "harm family members for other reasons" coded as absence]*

BEHA20: 1 & 2 --> 1

*["political leaders" and "household heads, elder lineages, generation leaders" coded as "leaders"]*

I also created two new variables from the categorical variable SEX coding whether the given practitioner class is mostly or exclusively female (SEX1) or mostly or exclusively male (SEX2). I binned each practice or practitioner class into a superordinate category (e.g., "evil eye", "witch") based on the ethnographer's translation (NAME02) and term (NAME03). The binning decisions are recorded under the variable NAME04 in the dataset.

The first two dimensions are interpretable; the third dimension is not (see Supplementary Tables 2 and 3). I thus reported the first two dimensions and their corresponding loadings, specifying  $k = 2$ . I did not report loadings for any factor whose loading was driven entirely by a

single geographic region (see next section and Supplementary Tables 5 and 6). Figure 1 in the main text shows the 83 practitioners plotted on the two principal components.

## 2.2. Testing for geographic dependencies

Some human societies are more similar to others, such as because they share a cultural history or because beliefs and practices have diffused from one to the other. Comparative analyses that investigate cross-cultural patterns must ensure that these non-independencies do not influence results and bias interpretations.

As I mentioned, I tried to minimize dependencies in the dataset by coding the Probability Sample File of the electronic Human Relations Area Files, a body of high-quality ethnography covering sixty societies that were chosen to represent human diversity and minimize similarities that might result from cultural diffusion or shared cultural history. But dependencies persist in the PSF, so I conducted two additional analyses to test whether geographic patterns in particular biased the results. First, I conducted an omnibus F-test to evaluate whether regions as defined by HRAF (e.g., Africa, Asia) have different PC scores on average. I found no evidence that they do ( $F_{14,150} = 1.66$ ,  $p = 0.070$ ). Second, I re-ran the logistic PCA eight times, in each instance removing all of the data-points in a single region, and compared the resulting factor matrices. I found that the eight PCAs produced very similar components, despite using a substantially reduced dataset in some instances (removing Africa, for example, reduced the sample from 83 to 54 observations) (Supplementary Tables 5 and 6). Still, this analysis revealed that several variables, especially those with very few observations, were unstable across analyses, often with a factor loading collapsing when the observations for a single region were removed (e.g., Necrophilia, Incest, and Opposite Actions). I have shaded those loadings in Supplementary Tables 2 and 4 and refrained from reporting them in my description of the components in the main text.

## 2.3. Testing for the stability of the principal components

There is substantial disagreement about the appropriate sample size for principal component analysis, but I conducted several analyses to test whether the reported components are stable:

1. I produced jackknife estimates of the proportion of variance explained by the first two dimensions. The resampling procedure produced means nearly identical to the values reported above with very low variation ( $k = 1$ : mean = 0.231, sd = 0.0026;  $k = 2$ : mean = 0.400, sd = 0.0030), suggesting that, at the least, small deviations in sampling produce very similar components.
2. I re-ran the logistic PCA with the full MHS dataset, including leaders and public magicians. The factor matrix (Supplementary Table 4) is very similar to the factor matrix for the PCA with the reduced MHS dataset (Supplementary Table 2), suggesting not only that the sample size of 83 is sufficient to produce stable components but also that excluding institutionalized classes did not substantially bias the results of the PCA.
3. As I just described, I re-ran the logistic PCA eight times, in each instance removing all of the data-points in a single region. With the exception of several unstable loadings, which have been flagged, the resulting dimensions are highly stable and similar to those produced in the main analysis.

## Supplementary Tables

**Supplementary Table 1.** The sixty societies coded for the Mystical Harm Survey (MHS). The IDs denote the practices or practitioners coded and refer to the points in Figure 1 in the main article. Asterisks refer to leaders or public magicians believed to inflict mystical harm.

| SOCIETY<br>(with references)   | PRACTITIONER<br>IDs |
|--|---------------------|
| Akan (Debrunner 1961; Field 1970)  | 1, 2                |
| Amhara (Messing 1985; Reminick 1974)   | 3                   |
| Andaman Islanders (Cipriani 1961; Man 1932)  | 4*                  |
| Aranda (Basedow 1925; Spencer and Gillen 1927)   | 5*, 6, 7            |
| Aymara (Tschopik 1946, 1951)   | 8                   |
| Azande (Evans-Pritchard 1937; Lagae 1999)  | 9, 10, 11, 12, 13   |
| Bahia Brazilians (Beierle 1999; Hutchinson 1957; Pierson 1967)   | 14, 15, 16          |
| Bemba (Maxwell 1983; Richards 1935)  | 17                  |
| Blackfoot (Goldfrank 1966; Schultz 1930)   | 18                  |
| Bororo (Baldus and Lillios 1974; Colbacchini and Albisetti 1996)   | 19*, 20             |
| Central Thai (Hanks 1963; Textor 1973)   | 21*                 |
| Chukchee (Bogoras 1907)  | 22                  |
| Chuuk (Bollig 1967; Mahony 1971)   | 23, 24*             |
| Copper Inuit (Damas 1996; Jenness 1922; Pryde 1972; Stefánsson 1913)                                     | 25*                 |
| Dogon (Griaule and Winchell 1986; van Beek 1994)   | 26, 27, 28          |
| Eastern Toraja (Adriani and Kruijt 1968, 1969)   | 29, 30, 31          |
| Ganda (Mair 1934; Orley 1970)  | 32, 33              |
| Garó (Burling 1963; Goswami and Majudmar 1968; Majudmar 1978; Marak 1997; Playfair 1909; Rongmuthu 1960) | 34*, 35, 36         |
| Guaraní (Ganson 1994; Schaden and Lewinsóhn 1969)  | 37                  |
| Hausa (Besmer 1983; Cohen 1969; Faulkingham 1971; Greenberg 1946)  | 38, 39              |
| Highland Scots (Ducey 1956; Geddes 1955; Parman 1990)  | 40, 41              |
| Hopi (Aberle 1951; Talayesva and Simmons 1942)   | 42                  |
| Iban (Graham 1987; Pilz 1988; Sandin 1967, 1980; Sutlive 1992)   | 43                  |
| Ifugao (Barton 1919; Lambrecht 1955, 1957)   | 44, 45, 46          |
| Iroquois (Parker 1913; Selden 1966; Wallace 1972)  | 47, 48*             |
| Kanuri (Cohen 1967; Peshkin 1972)  | 49, 50, 51*         |
| Kapauku (Pospisil 1958, 1978)  | 52, 53              |
| Khasi (Godwin-Austen 1872; McCormack 1964; Stegmiller and Knight 1956)                                   | 54, 55*             |

|  |                        |
|--|------------------------|
| <b>Klamath</b> (Gatschet 1890; Stern 1965)   | 56*                    |
| <b>Kogi</b>  | No practitioners coded |
| <b>Korea</b>   | No practitioners coded |
| <b>Kuna</b> (Howe 1986; Marshall 1950; McKim 1947; Nordenskiöld 1930, 1966; Nordenskiöld and Kantule 1938; Wafer 1934)         | 57*, 58*, 59           |
| <b>Kurds</b> (Masters 1953)  | 60                     |
| <b>Lau Fijians</b> (Hocart 1929; St. Johnston 1918)  | 61, 62                 |
| <b>Libyan Bedouins</b> (Abu-Lughod 1986)   | 63                     |
| <b>Lozi</b> (Gluckman 1955; Reynolds 1963)   | 64                     |
| <b>Maasai</b> (Merker 1971; Spencer 1988)  | 65, 66*, 67            |
| <b>Mataco</b> (Alvarsson 1988; Karsten 1932; Métraux 1943, 1959)   | 68                     |
| <b>Mbuti</b> (Turnbull 1965a, 1965b)   | 69, 70                 |
| <b>Ojibwa</b> (Landes 1937; Rogers 1962)   | 71, 72                 |
| <b>Ona</b> (Chapman 1982; Gusinde 1971)  | 73*                    |
| <b>Pawnee</b> (Murie 1914; Weltfish 1965)  | 74                     |
| <b>Saami</b> (Itkonen 1984; Scheffer 1704)   | 75*                    |
| <b>Santal</b> (Archer 1974, 1984)  | 76, 77                 |
| <b>Saramaka</b> (Herskovits 1934; Price 1990)  | 78                     |
| <b>Serbs</b> (Kemp 1935; Pavlovic 1973)  | 79, 80, 81             |
| <b>Shlulh</b> (Berque 1973; Hatt 1974; Hoffman 1967; Montagne 1973)  | 82                     |
| <b>Sinhalese</b> (Leach 1961; MacDougall 1971)   | 83, 84                 |
| <b>Somali</b> (Cerulli 1959; Helander 1988; Lewis 1961, 1963)  | 85*, 86, 87            |
| <b>Taiwan Hokkien</b> (Ahern 1973, 1978; Diamond 1969; Gallin 1966; Harrell 1974; Saso 1974; Seaman 1981; Wolf and Huang 1980) | 88                     |
| <b>Tarahumara</b> (Bennett 1935; Kennedy 1978; Merrill 1988)   | 89                     |
| <b>Tikopia</b> (Firth 1939, 1954, 1970)  | 90                     |
| <b>Tiv</b> (Akiga and East 1939; Bohannon and Bohannon 1969)   | 91                     |
| <b>Tlingit</b> (De Laguna 1972; Emmons and De Laguna 1991)   | 92, 93                 |
| <b>Trobriand Islanders</b> (Malinowski 1922; Tambiah 1983)   | 94, 95*                |
| <b>Tukano</b> (Goldman 1963; Reichel-Dolmatoff 1971)   | 96*, 97, 98            |
| <b>Tzeltal</b> (Hunt 1962; Nash 1970)  | 99, 100                |
| <b>Wolof</b> (Ames 1959; Irvine 1973)  | 101                    |
| <b>Yakut</b> (Sieroszewski 1993)   | 102*                   |
| <b>Yanoama</b> (Barker 1967; Chagnon 1968; Early and Peters 1990; Wilbert 1995)  | 103                    |

**Supplementary Table 2.** Factor matrix for main PCA; k=2. Loading values that exceed 0.1 are shaded in blue; those less than -0.1 are shaded in red. Lighter shades of blue or red are used whenever a loading is unstable (i.e., the loading approaches 0 when re-running the PCA without data-points in one of the eight world regions; see Supplementary Tables 5 and 6). See section 2 in the main text and Supplementary Materials, section 2.1. for details.

| VARIABLE | DESCRIPTION                           | LOADINGS<br>(PC1) | LOADINGS<br>(PC2) |
|----------|---------------------------------------|-------------------|-------------------|
| ABIL01   | Fly                                   | 0.32516907        | 0.14302452        |
| ABIL02   | Invisibility                          | 0.205909888       | -0.009169168      |
| ABIL03   | Soul travel                           | 0.056690138       | 0.033021234       |
| ABIL04   | Animal transformation                 | 0.122242946       | 0.068753986       |
| BEHA01   | Cannibalism                           | 0.103315857       | 0.128334064       |
| BEHA02   | Corpse desecration                    | 0.121359352       | -0.082833927      |
| BEHA03   | Opposite actions                      | 0.281345231       | 0.265918042       |
| BEHA05   | Incest                                | 0.147052238       | -0.264364818      |
| BEHA06   | Necrophilia                           | 0.33462192        | -0.176723353      |
| BEHA07   | Nymphomania                           | 0.34353687        | 0.006144635       |
| BEHA08   | Sexual obscenities for transformation | 0.086421939       | -0.291125273      |
| BEHA09   | Nudity                                | 0.102146631       | 0.08326658        |
| BEHA10   | Bad hygiene                           | 0.034940439       | 0.026754025       |
| BEHA11   | Association with excretion            | 0.039858256       | 0.017601684       |
| BEHA12   | Conspiracy, league, organization      | 0.138475056       | 0.019830117       |
| BEHA13   | Meet in secret                        | 0.154627629       | 0.052992401       |
| BEHA14   | Harm family members                   | 0.078032123       | 0.0011897         |
| BEHA15   | Nighttime activity                    | 0.249260101       | 0.08622003        |
| BEHA16   | Animal familiars                      | 0.118117498       | -0.000942145      |
| BEHA19   | Magicians                             | 0.1592915         | -0.319589474      |
| BEHA20   | Political leaders                     | 0.055161044       | -0.064466745      |
| CLASS01  | All people capable                    | -0.146136104      | -0.244239998      |
| CLASS02  | Unspecified who does harm             | -0.250167558      | -0.146828521      |
| PHYS01   | Physiological differences             | 0.052933539       | 0.232937982       |
| PHYS03   | Phys. differences enable powers       | 0.009980626       | 0.2803895         |
| PHYS04   | Possession                            | 0.060299393       | 0.004828253       |
| PHYS05   | Other differences                     | 0.036192844       | 0.074111038       |
| PROC01   | Hereditary                            | 0.07217096        | 0.071607907       |
| PROC02   | Inborn powers                         | -0.018598541      | 0.195605675       |
| PROC03   | Learn powers                          | 0.105701039       | -0.079974362      |
| PROC04   | Consume substance to gain powers      | 0.068185729       | 0.115230135       |
| PROC05   | Kill someone to gain powers           | 0.083552187       | -0.049751624      |
| PROC06   | Work with spirit                      | 0.031419489       | -0.062361694      |

|        |                                |              |              |
|--------|--------------------------------|--------------|--------------|
| PROC07 | Self-denial                    | -0.050628603 | -0.162398126 |
| SEX1   | Females                        | 0.02358944   | 0.05692325   |
| SEX2   | Males                          | -0.006154369 | -0.130694118 |
| TECH01 | Kill                           | 0.270335279  | 0.001278266  |
| TECH02 | Injure/cause illness           | 0.177113799  | -0.018420366 |
| TECH03 | Cause sterility                | 0.051593471  | 0.013879334  |
| TECH04 | Influence love                 | 0.038732201  | -0.030082982 |
| TECH05 | Cause economic harm            | 0.027404997  | 0.00280285   |
| TECH06 | Cause catastrophe              | 0.085194669  | -0.01350542  |
| TECH07 | Attack out-group members       | 0.023585796  | -0.260215976 |
| TECH08 | Cause other harm               | 0.036128341  | 0.006527775  |
| TECH10 | Unintentional harm             | -0.028071652 | 0.183714785  |
| TECH11 | Evil eye/blasting word         | -0.049015075 | 0.116455603  |
| TECH12 | Spells, charms, material magic | 0.211641972  | -0.335998449 |
| TECH13 | People pay practitioner        | 0.08803222   | -0.054815857 |
| TECH14 | Attack with thoughts           | 0.068173884  | 0.021752934  |



**Supplementary Table 3.** Factor matrix for main PCA; k=3. Note that the logistic PCA produces different principal components depending on the value of k. Loading values that exceed 0.1 are shaded in blue; those less than -0.1 are shaded in red. Variables with unstable loadings (see Supplementary Materials, section 2.2) are shaded in gray.

| VARIABLE | DESCRIPTION                           | LOADINGS<br>(PC1) | LOADINGS<br>(PC2) | LOADINGS<br>(PC3) |
|----------|---------------------------------------|-------------------|-------------------|-------------------|
| ABIL01   | Fly                                   | 0.261310321       | 0.101815617       | -0.201846378      |
| ABIL02   | Invisibility                          | 0.409703525       | -0.09070882       | 0.180670872       |
| ABIL03   | Soul travel                           | 0.071268067       | 0.030519718       | 0.04431291        |
| ABIL04   | Animal transformation                 | 0.119487455       | 0.056538577       | -0.026263067      |
| BEHA01   | Cannibalism                           | 0.153564276       | 0.152742408       | 0.051352952       |
| BEHA02   | Corpse desecration                    | 0.12080023        | -0.1122753        | -0.052821421      |
| BEHA03   | Opposite actions                      | 0.310724617       | 0.252884327       | 0.046453642       |
| BEHA05   | Incest                                | 0.080762048       | -0.241630038      | -0.091354863      |
| BEHA06   | Necrophilia                           | 0.181585866       | -0.23391196       | -0.210422819      |
| BEHA07   | Nymphomania                           | 0.115152046       | 0.024315248       | -0.23114178       |
| BEHA08   | Sexual obscenities for transformation | 0.108406361       | -0.195815521      | 0.116101125       |
| BEHA09   | Nudity                                | 0.091572631       | 0.0873964         | -0.096798347      |
| BEHA10   | Bad hygiene                           | 0.044302125       | 0.022824908       | 0.10176039        |
| BEHA11   | Association with excretion            | 0.044741576       | 0.001787086       | -0.002544706      |
| BEHA12   | Conspiracy, league, organization      | 0.17365596        | -0.008798663      | -0.204633806      |
| BEHA13   | Meet in secret                        | 0.162595738       | 0.034531167       | -0.052372707      |
| BEHA14   | Harm family members                   | 0.071465612       | -0.00815942       | -0.047999928      |
| BEHA15   | Nighttime activity                    | 0.281045093       | 0.080658594       | 0.109445833       |
| BEHA16   | Animal familiars                      | 0.124565927       | -0.007817369      | 0.025785961       |
| BEHA19   | Magicians                             | 0.121134907       | -0.31346491       | -0.043594339      |
| BEHA20   | Political leaders                     | 0.052265438       | -0.07190035       | 0.005977858       |
| CLASS01  | All people capable                    | -0.223463755      | -0.237884005      | 0.285994857       |
| CLASS02  | Unspecified who does harm             | -0.231406022      | -0.114906425      | -0.155647345      |
| PHYS01   | Physiological differences             | 0.04683958        | 0.218749501       | -0.058742026      |
| PHYS03   | Phys. differences enable powers       | 0.036536654       | 0.273892194       | 0.015797165       |
| PHYS04   | Possession                            | 0.051172622       | 0.00496581        | -0.053254519      |
| PHYS05   | Other differences                     | 0.04498602        | 0.072057847       | 0.009876187       |
| PROC01   | Hereditary                            | 0.089410421       | 0.065727736       | 0.034238935       |
| PROC02   | Inborn powers                         | 0.019420081       | 0.185572523       | 0.12565599        |
| PROC03   | Learn powers                          | 0.228821394       | -0.153137777      | 0.261224069       |
| PROC04   | Consume substance to gain powers      | 0.083781038       | 0.127130635       | -0.023132067      |
| PROC05   | Kill someone to gain powers           | 0.081128883       | -0.062608431      | -0.001528838      |
| PROC06   | Work with spirit                      | 0.021399866       | -0.056104371      | 0.020183767       |
| PROC07   | Self-denial                           | -0.026746541      | -0.019501283      | 0.29936995        |

|        |                                |              |              |              |
|--------|--------------------------------|--------------|--------------|--------------|
| SEX1   | Females                        | -0.050390224 | 0.202456316  | -0.370954747 |
| SEX2   | Males                          | -0.016977207 | -0.122842641 | 0.047912838  |
| TECH01 | Kill                           | 0.272269589  | -0.035747559 | 0.017591199  |
| TECH02 | Injure/cause illness           | 0.177790256  | -0.018873235 | -0.07701598  |
| TECH03 | Cause sterility                | 0.045053583  | 0.015378214  | -0.062798915 |
| TECH04 | Influence love                 | 0.034943364  | -0.035515646 | -0.019888074 |
| TECH05 | Cause economic harm            | 0.094707008  | -0.020996145 | 0.453659122  |
| TECH06 | Cause catastrophe              | 0.080095645  | -0.019836153 | 0.001666995  |
| TECH07 | Attack out-group members       | -0.022017348 | -0.319410645 | -0.097703912 |
| TECH08 | Cause other harm               | 0.038735278  | 0.00038124   | 0.02299223   |
| TECH10 | Unintentional harm             | 0.008195979  | 0.174330917  | 0.156955982  |
| TECH11 | Evil eye/blasting word         | -0.028592515 | 0.10382641   | 0.072824517  |
| TECH12 | Spells, charms, material magic | 0.169514626  | -0.339638019 | -0.175331041 |
| TECH13 | People pay practitioner        | 0.082383068  | -0.059466278 | 0.012172597  |
| TECH14 | Attack with thoughts           | 0.080965544  | 0.005891889  | -0.000470779 |

**Supplementary Table 4.** Factor matrix for PCA when including leaders and public magicians;  $k = 2$ . The first PC was flipped (factor loadings were multiplied by -1) to make it comparable to the PCs shown in Supplementary Tables 2 and 3. Loading values that exceed 0.1 are shaded in blue; those less than -0.1 are shaded in red. Lighter shades of blue or red are used whenever a loading is *likely* to be unstable (see Supplementary Materials, section 2.2 and Supplementary Tables 5 and 6).

| VARIABLE | DESCRIPTION                           | LOADINGS<br>(PC1) | LOADINGS<br>(PC2) |
|----------|---------------------------------------|-------------------|-------------------|
| ABIL01   | Fly                                   | 0.312932832       | 0.150452661       |
| ABIL02   | Invisibility                          | 0.139671194       | -0.061132521      |
| ABIL03   | Soul travel                           | 0.059654541       | 0.034065482       |
| ABIL04   | Animal transformation                 | 0.112058867       | 0.060849166       |
| BEHA01   | Cannibalism                           | 0.094850787       | 0.147224247       |
| BEHA02   | Corpse desecration                    | 0.131118907       | -0.089953239      |
| BEHA03   | Opposite actions                      | 0.219594662       | 0.373463208       |
| BEHA05   | Incest                                | 0.167292836       | -0.307183159      |
| BEHA06   | Necrophilia                           | 0.368757815       | -0.211129435      |
| BEHA07   | Nymphomania                           | 0.384224961       | 0.005063995       |
| BEHA08   | Sexual obscenities for transformation | 0.092059453       | -0.356128452      |
| BEHA09   | Nudity                                | 0.11628465        | 0.105273768       |
| BEHA10   | Bad hygiene                           | 0.034889771       | 0.034530096       |
| BEHA11   | Association with excretion            | 0.041458222       | 0.025661462       |
| BEHA12   | Conspiracy, league, organization      | 0.115818639       | 0.016503716       |
| BEHA13   | Meet in secret                        | 0.134499522       | 0.059533441       |
| BEHA14   | Harm family members                   | 0.082464792       | 0.001235027       |
| BEHA15   | Nighttime activity                    | 0.28572701        | 0.119801377       |
| BEHA16   | Animal familiars                      | 0.125248313       | 0.003053012       |
| BEHA19   | Magicians                             | 0.131307225       | -0.271205732      |
| BEHA20   | Political leaders                     | 0.040163542       | -0.059802318      |
| CLASS01  | All people capable                    | -0.113314878      | -0.24511333       |
| CLASS02  | Unspecified who does harm             | -0.265927537      | -0.177547625      |
| PHYS01   | Physiological differences             | 0.046404197       | 0.139929013       |
| PHYS03   | Phys. differences enable powers       | 0.030134315       | 0.117287614       |
| PHYS04   | Possession                            | 0.053450375       | 0.011953868       |
| PHYS05   | Other differences                     | 0.044383839       | 0.036624372       |
| PROC01   | Hereditary                            | 0.073866425       | 0.077017831       |
| PROC02   | Inborn powers                         | -0.010528638      | 0.203671599       |
| PROC03   | Learn powers                          | 0.115663249       | -0.096759625      |
| PROC04   | Consume substance to gain powers      | 0.073834959       | 0.133829938       |
| PROC05   | Kill someone to gain powers           | 0.091385668       | -0.05587827       |

|        |                                |              |              |
|--------|--------------------------------|--------------|--------------|
| PROC06 | Work with spirit               | 0.031828357  | -0.043670455 |
| PROC07 | Self-denial                    | 0.039799114  | -0.176563109 |
| SEX1   | Females                        | 0.020079901  | 0.074343695  |
| SEX2   | Males                          | 0.017071117  | -0.159396295 |
| TECH01 | Kill                           | 0.273974326  | 0.017403458  |
| TECH02 | Injure/cause illness           | 0.191232124  | -0.026061077 |
| TECH03 | Cause sterility                | 0.046118629  | 0.021921333  |
| TECH04 | Influence love                 | 0.03533839   | -0.038463531 |
| TECH05 | Cause economic harm            | 0.027617601  | 0.018021146  |
| TECH06 | Cause catastrophe              | 0.086925475  | -0.000474426 |
| TECH07 | Attack out-group members       | 0.021582662  | -0.156680262 |
| TECH08 | Cause other harm               | 0.037868411  | 0.013103683  |
| TECH10 | Unintentional harm             | -0.034699648 | 0.202230195  |
| TECH11 | Evil eye/blastng word          | -0.048879509 | 0.123233424  |
| TECH12 | Spells, charms, material magic | 0.176774225  | -0.254119465 |
| TECH13 | People pay practitioner        | 0.103091852  | -0.08334272  |
| TECH14 | Attack with thoughts           | 0.05328259   | 0.040583132  |

**Supplementary Table 5.** Factor loadings for PC1 for eight PCAs; all analyses excluded leaders and public magicians. For each PCA, all of the data for a single region were removed (e.g., the AFRICA column includes factors loadings for the PCA when excluding all of the data-points in Africa). Whenever necessary, PCs were flipped (factor loadings were multiplied by -1) to make them comparable to each other and to those shown in Supplementary Tables 2, 3, and 4. Loading values that exceed 0.1 are shaded in blue; those less than -0.1 are shaded in red. The coloring of the standard deviations corresponds with their values, ranging from white (sd = 0) to green (sd = 0.15). Factor loadings for PC2 appear in Supplementary Table 6.

| VAR    | DESCRIPTION                           | AFRICA | ASIA  | EUROPE | MIDDLE AMER. | MIDDLE EAST | NORTH AMER. | OCEAN. | SOUTH AMER. | MEAN  | STD DEV |
|--------|---------------------------------------|--------|-------|--------|--------------|-------------|-------------|--------|-------------|-------|---------|
| ABIL01 | Fly                                   | 0.277  | 0.457 | 0.290  | 0.325        | 0.344       | 0.209       | 0.296  | 0.298       | 0.312 | 0.071   |
| ABIL02 | Invisibility                          | 0.150  | 0.083 | 0.391  | 0.203        | 0.166       | 0.092       | 0.119  | 0.182       | 0.173 | 0.098   |
| ABIL03 | Soul travel                           | 0.056  | 0.051 | 0.075  | 0.057        | 0.051       | 0.058       | 0.067  | 0.050       | 0.058 | 0.009   |
| ABIL04 | Animal transformation                 | 0.123  | 0.112 | 0.109  | 0.122        | 0.130       | 0.117       | 0.142  | 0.158       | 0.127 | 0.017   |
| BEHA01 | Cannibalism                           | 0.089  | 0.108 | 0.184  | 0.104        | 0.103       | 0.113       | 0.082  | 0.095       | 0.110 | 0.032   |
| BEHA02 | Corpse desecration                    | 0.125  | 0.107 | 0.109  | 0.121        | 0.117       | 0.138       | 0.213  | 0.055       | 0.123 | 0.044   |
| BEHA03 | Opposite actions                      | 0.302  | 0.329 | 0.291  | 0.287        | 0.282       | 0.345       | 0.323  | 0.000       | 0.270 | 0.111   |
| BEHA05 | Incest                                | 0.167  | 0.104 | 0.160  | 0.144        | 0.140       | 0.120       | 0.139  | 0.090       | 0.133 | 0.026   |
| BEHA06 | Necrophilia                           | 0.359  | 0.277 | 0.001  | 0.332        | 0.332       | 0.298       | 0.365  | 0.267       | 0.279 | 0.118   |
| BEHA07 | Nymphomania                           | 0.343  | 0.273 | 0.304  | 0.346        | 0.356       | 0.136       | 0.302  | 0.269       | 0.291 | 0.071   |
| BEHA08 | Sexual obscenities for transformation | 0.111  | 0.045 | 0.160  | 0.084        | 0.089       | 0.088       | 0.122  | 0.000       | 0.088 | 0.048   |
| BEHA09 | Nudity                                | 0.095  | 0.098 | 0.085  | 0.103        | 0.102       | 0.094       | 0.084  | 0.269       | 0.116 | 0.062   |
| BEHA10 | Bad hygiene                           | 0.043  | 0.026 | 0.048  | 0.035        | 0.034       | 0.041       | 0.033  | 0.011       | 0.034 | 0.012   |
| BEHA11 | Association with excretion            | 0.036  | 0.046 | 0.089  | 0.039        | 0.041       | 0.037       | 0.034  | 0.000       | 0.040 | 0.024   |
| BEHA12 | Conspiracy, league, organization      | 0.136  | 0.129 | 0.109  | 0.139        | 0.143       | 0.129       | 0.126  | 0.343       | 0.157 | 0.076   |
| BEHA13 | Meet in secret                        | 0.144  | 0.136 | 0.152  | 0.155        | 0.159       | 0.139       | 0.139  | 0.276       | 0.162 | 0.047   |
| BEHA14 | Harm family members                   | 0.077  | 0.085 | 0.084  | 0.078        | 0.080       | 0.083       | 0.082  | 0.042       | 0.076 | 0.014   |
| BEHA15 | Nighttime activity                    | 0.234  | 0.253 | 0.301  | 0.251        | 0.232       | 0.225       | 0.226  | 0.260       | 0.248 | 0.025   |
| BEHA16 | Animal familiars                      | 0.113  | 0.151 | 0.128  | 0.118        | 0.109       | 0.119       | 0.127  | 0.097       | 0.120 | 0.016   |
| BEHA19 | Magicians                             | 0.170  | 0.151 | 0.115  | 0.155        | 0.153       | 0.177       | 0.162  | 0.091       | 0.147 | 0.029   |
| BEHA20 | Political leaders                     | 0.058  | 0.050 | 0.047  | 0.054        | 0.053       | 0.061       | 0.048  | 0.066       | 0.054 | 0.007   |

|         |                                  |        |        |        |        |        |        |        |        |        |       |
|---------|----------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| CLASS01 | All people capable               | -0.118 | -0.146 | -0.148 | -0.154 | -0.170 | -0.188 | -0.160 | -0.121 | -0.150 | 0.024 |
| CLASS02 | Unspecified who does harm        | -0.243 | -0.260 | -0.224 | -0.254 | -0.235 | -0.217 | -0.260 | -0.301 | -0.249 | 0.027 |
| PHYS01  | Physiological differences        | 0.033  | 0.052  | 0.028  | 0.055  | 0.058  | 0.056  | 0.083  | 0.105  | 0.059  | 0.025 |
| PHYS03  | Phys. differences enable powers  | -0.013 | -0.014 | 0.016  | 0.013  | 0.023  | 0.010  | 0.032  | 0.041  | 0.014  | 0.020 |
| PHYS04  | Possession                       | 0.057  | 0.067  | 0.065  | 0.060  | 0.061  | 0.054  | 0.056  | 0.058  | 0.060  | 0.005 |
| PHYS05  | Other differences                | 0.019  | 0.051  | 0.052  | 0.036  | 0.035  | 0.041  | 0.049  | 0.014  | 0.037  | 0.014 |
| PROC01  | Hereditary                       | 0.065  | 0.072  | 0.078  | 0.073  | 0.070  | 0.086  | 0.075  | 0.074  | 0.074  | 0.006 |
| PROC02  | Inborn powers                    | -0.040 | 0.010  | -0.011 | -0.012 | -0.048 | -0.008 | 0.003  | -0.015 | -0.015 | 0.020 |
| PROC03  | Learn powers                     | 0.113  | 0.090  | 0.174  | 0.104  | 0.106  | 0.097  | 0.106  | 0.055  | 0.106  | 0.033 |
| PROC04  | Consume substance to gain powers | 0.061  | 0.073  | 0.071  | 0.069  | 0.071  | 0.076  | 0.076  | 0.085  | 0.073  | 0.007 |
| PROC05  | Kill someone to gain powers      | 0.085  | 0.077  | 0.090  | 0.084  | 0.085  | 0.084  | 0.072  | 0.161  | 0.092  | 0.028 |
| PROC06  | Work with spirit                 | 0.038  | 0.030  | 0.042  | 0.030  | 0.024  | 0.025  | 0.031  | 0.027  | 0.031  | 0.006 |
| PROC07  | Self-denial                      | -0.040 | 0.001  | -0.020 | -0.053 | -0.049 | -0.069 | -0.059 | -0.060 | -0.044 | 0.023 |
| SEX1    | Females                          | 0.017  | 0.022  | 0.020  | 0.024  | 0.035  | 0.022  | 0.015  | 0.035  | 0.024  | 0.007 |
| SEX2    | Males                            | -0.003 | -0.005 | -0.004 | -0.008 | -0.008 | 0.000  | -0.004 | -0.051 | -0.010 | 0.017 |
| TECH01  | Kill                             | 0.304  | 0.275  | 0.245  | 0.268  | 0.268  | 0.273  | 0.270  | 0.273  | 0.272  | 0.016 |
| TECH02  | Injure/cause illness             | 0.162  | 0.163  | 0.186  | 0.176  | 0.198  | 0.208  | 0.149  | 0.221  | 0.183  | 0.025 |
| TECH03  | Cause sterility                  | 0.052  | 0.066  | 0.053  | 0.052  | 0.054  | 0.058  | 0.045  | 0.026  | 0.051  | 0.011 |
| TECH04  | Influence love                   | 0.042  | 0.042  | 0.017  | 0.038  | 0.040  | 0.048  | 0.036  | 0.035  | 0.037  | 0.009 |
| TECH05  | Cause economic harm              | 0.025  | 0.034  | 0.037  | 0.027  | 0.023  | 0.029  | 0.041  | -0.007 | 0.026  | 0.015 |
| TECH06  | Cause catastrophe                | 0.086  | 0.096  | 0.088  | 0.085  | 0.087  | 0.103  | 0.074  | 0.065  | 0.086  | 0.012 |
| TECH07  | Attack out-group members         | 0.060  | 0.016  | -0.015 | 0.021  | -0.003 | 0.069  | 0.025  | -0.046 | 0.016  | 0.038 |
| TECH08  | Cause other harm                 | 0.033  | 0.044  | 0.037  | 0.036  | 0.033  | 0.048  | 0.043  | -0.008 | 0.033  | 0.017 |
| TECH10  | Unintentional harm               | -0.035 | -0.011 | -0.024 | -0.021 | -0.017 | -0.052 | -0.006 | -0.049 | -0.027 | 0.017 |
| TECH11  | Evil eye/blasting word           | -0.051 | -0.041 | -0.037 | -0.044 | -0.043 | -0.042 | -0.054 | -0.051 | -0.046 | 0.006 |
| TECH12  | Spells, charms, material magic   | 0.247  | 0.219  | 0.187  | 0.208  | 0.208  | 0.198  | 0.224  | 0.119  | 0.201  | 0.038 |
| TECH13  | People pay practitioner          | 0.092  | 0.078  | 0.083  | 0.087  | 0.085  | 0.085  | 0.080  | 0.076  | 0.083  | 0.005 |
| TECH14  | Attack with thoughts             | 0.064  | 0.073  | 0.077  | 0.068  | 0.066  | 0.421  | 0.068  | 0.011  | 0.106  | 0.129 |

**Supplementary Table 6.** Factor loadings for PC2 for eight PCAs; all analyses excluded leaders and public magicians. For each PCA, all of the data for a single region were removed (e.g., the AFRICA column includes factors loadings for the PCA when excluding all of the data-points in Africa). Whenever necessary, PCs were flipped (factor loadings were multiplied by -1) to make them comparable to each other and to those shown in Supplementary Tables 2, 3, and 4. Loading values that exceed 0.1 are shaded in blue; those less than -0.1 are shaded in red. The coloring of the standard deviations corresponds with their values, ranging from white (sd = 0) to green (sd = 0.15). Factor loadings for PC1 appear in Supplementary Table 6.

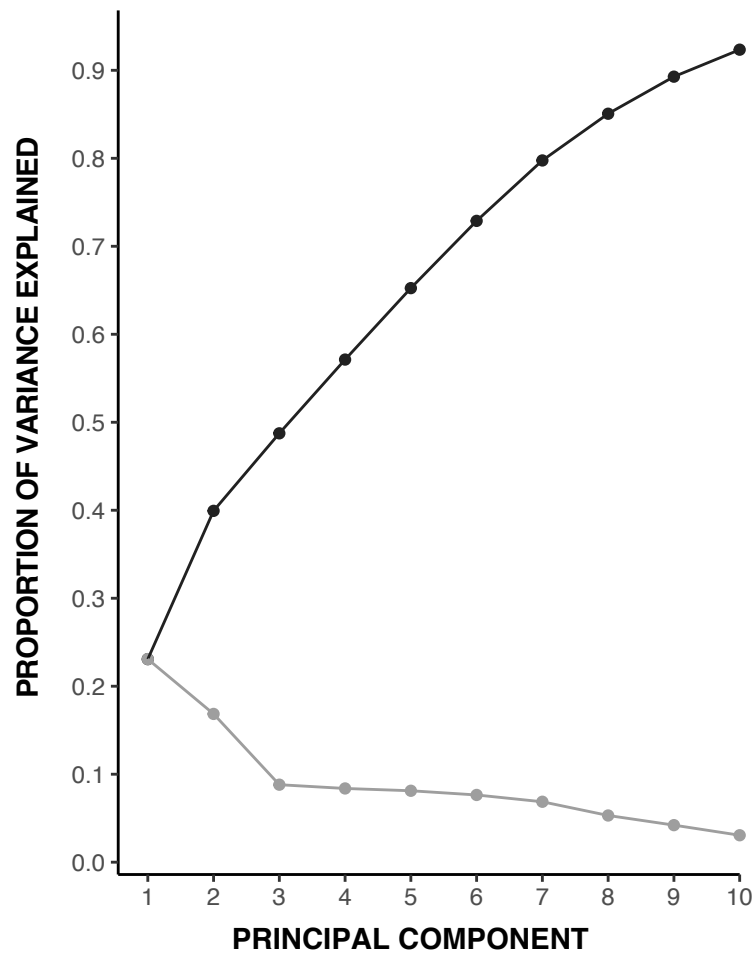
| VAR    | DESCRIPTION                           | AFRICA | ASIA   | EUROPE | MIDDLE AMER. | MIDDLE EAST | NORTH AMER. | OCEAN. | SOUTH AMER. | MEAN   | STD DEV |
|--------|---------------------------------------|--------|--------|--------|--------------|-------------|-------------|--------|-------------|--------|---------|
| ABIL01 | Fly                                   | 0.158  | 0.139  | 0.201  | 0.138        | 0.123       | 0.117       | 0.169  | 0.084       | 0.141  | 0.036   |
| ABIL02 | Invisibility                          | 0.002  | -0.027 | -0.117 | -0.013       | -0.012      | -0.002      | -0.011 | 0.141       | -0.005 | 0.070   |
| ABIL03 | Soul travel                           | 0.043  | 0.029  | 0.006  | 0.033        | 0.052       | 0.031       | 0.028  | 0.015       | 0.030  | 0.014   |
| ABIL04 | Animal transformation                 | 0.079  | 0.049  | 0.057  | 0.067        | 0.063       | 0.072       | 0.087  | 0.074       | 0.069  | 0.012   |
| BEHA01 | Cannibalism                           | 0.127  | 0.132  | 0.130  | 0.129        | 0.169       | 0.137       | 0.095  | 0.084       | 0.125  | 0.026   |
| BEHA02 | Corpse desecration                    | -0.065 | -0.076 | -0.088 | -0.085       | -0.081      | -0.088      | -0.135 | -0.089      | -0.088 | 0.020   |
| BEHA03 | Opposite actions                      | 0.272  | 0.238  | 0.238  | 0.264        | 0.262       | 0.218       | 0.251  | 0.000       | 0.218  | 0.090   |
| BEHA05 | Incest                                | -0.257 | -0.339 | -0.287 | -0.262       | -0.258      | -0.166      | -0.197 | -0.045      | -0.226 | 0.090   |
| BEHA06 | Necrophilia                           | -0.157 | -0.221 | 0.000  | -0.178       | -0.161      | -0.141      | -0.151 | -0.121      | -0.141 | 0.064   |
| BEHA07 | Nymphomania                           | 0.020  | -0.055 | -0.012 | 0.000        | -0.006      | -0.009      | -0.021 | 0.130       | 0.006  | 0.054   |
| BEHA08 | Sexual obscenities for transformation | -0.307 | -0.300 | -0.287 | -0.294       | -0.276      | -0.314      | -0.316 | 0.000       | -0.262 | 0.106   |
| BEHA09 | Nudity                                | 0.092  | 0.064  | 0.081  | 0.083        | 0.076       | 0.080       | 0.082  | 0.130       | 0.086  | 0.020   |
| BEHA10 | Bad hygiene                           | 0.014  | 0.079  | 0.005  | 0.027        | 0.025       | 0.022       | 0.022  | -0.015      | 0.022  | 0.027   |
| BEHA11 | Association with excretion            | 0.015  | 0.012  | -0.028 | 0.018        | 0.012       | 0.024       | 0.015  | 0.000       | 0.008  | 0.016   |
| BEHA12 | Conspiracy, league, organization      | 0.030  | 0.005  | 0.040  | 0.018        | 0.012       | 0.026       | 0.039  | -0.102      | 0.008  | 0.046   |
| BEHA13 | Meet in secret                        | 0.059  | 0.037  | 0.066  | 0.051        | 0.043       | 0.063       | 0.074  | -0.079      | 0.039  | 0.049   |
| BEHA14 | Harm family members                   | 0.005  | 0.000  | 0.013  | 0.000        | -0.004      | 0.006       | 0.004  | -0.030      | -0.001 | 0.013   |
| BEHA15 | Nighttime activity                    | 0.097  | 0.103  | 0.080  | 0.084        | 0.077       | 0.082       | 0.069  | 0.006       | 0.075  | 0.030   |
| BEHA16 | Animal familiars                      | -0.001 | -0.003 | -0.006 | -0.002       | 0.006       | 0.006       | -0.024 | 0.000       | -0.003 | 0.009   |
| BEHA19 | Magicians                             | -0.266 | -0.341 | -0.260 | -0.323       | -0.336      | -0.320      | -0.254 | -0.448      | -0.319 | 0.063   |
| BEHA20 | Political leaders                     | -0.057 | -0.049 | -0.051 | -0.065       | -0.068      | -0.059      | -0.060 | -0.379      | -0.099 | 0.114   |

|         |                                  |        |        |        |        |        |        |        |        |        |       |
|---------|----------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| CLASS01 | All people capable               | -0.278 | -0.157 | -0.263 | -0.246 | -0.238 | -0.282 | -0.262 | -0.160 | -0.236 | 0.050 |
| CLASS02 | Unspecified who does harm        | -0.178 | -0.176 | -0.114 | -0.140 | -0.125 | -0.131 | -0.131 | -0.095 | -0.136 | 0.029 |
| PHYS01  | Physiological differences        | 0.238  | 0.201  | 0.298  | 0.235  | 0.209  | 0.221  | 0.261  | 0.245  | 0.239  | 0.031 |
| PHYS03  | Phys. differences enable powers  | 0.272  | 0.297  | 0.303  | 0.280  | 0.221  | 0.289  | 0.323  | 0.188  | 0.272  | 0.045 |
| PHYS04  | Possession                       | 0.010  | -0.014 | 0.000  | 0.005  | 0.001  | 0.006  | 0.011  | 0.020  | 0.005  | 0.010 |
| PHYS05  | Other differences                | 0.129  | 0.074  | 0.051  | 0.075  | 0.082  | 0.072  | 0.047  | 0.069  | 0.075  | 0.025 |
| PROC01  | Hereditary                       | 0.075  | 0.065  | 0.050  | 0.072  | 0.084  | 0.081  | 0.062  | 0.066  | 0.069  | 0.011 |
| PROC02  | Inborn powers                    | 0.195  | 0.225  | 0.175  | 0.188  | 0.296  | 0.178  | 0.150  | 0.164  | 0.196  | 0.046 |
| PROC03  | Learn powers                     | -0.068 | -0.078 | -0.155 | -0.081 | -0.080 | -0.073 | -0.076 | -0.076 | -0.086 | 0.028 |
| PROC04  | Consume substance to gain powers | 0.127  | 0.111  | 0.085  | 0.115  | 0.123  | 0.115  | 0.082  | 0.211  | 0.121  | 0.040 |
| PROC05  | Kill someone to gain powers      | -0.048 | -0.052 | -0.062 | -0.052 | -0.056 | -0.047 | -0.061 | -0.116 | -0.062 | 0.023 |
| PROC06  | Work with spirit                 | -0.073 | -0.052 | -0.083 | -0.062 | -0.059 | -0.061 | -0.061 | -0.050 | -0.063 | 0.011 |
| PROC07  | Self-denial                      | -0.220 | 0.000  | -0.163 | -0.163 | -0.154 | -0.165 | -0.166 | -0.112 | -0.143 | 0.065 |
| SEX1    | Females                          | 0.057  | 0.047  | 0.087  | 0.057  | 0.036  | 0.055  | 0.067  | 0.050  | 0.057  | 0.015 |
| SEX2    | Males                            | -0.188 | -0.113 | -0.125 | -0.128 | -0.122 | -0.115 | -0.133 | -0.122 | -0.131 | 0.024 |
| TECH01  | Kill                             | 0.012  | -0.007 | -0.017 | -0.011 | 0.003  | 0.002  | 0.001  | -0.031 | -0.006 | 0.014 |
| TECH02  | Injure/cause illness             | 0.013  | -0.021 | -0.016 | -0.028 | -0.029 | -0.015 | -0.076 | 0.007  | -0.021 | 0.027 |
| TECH03  | Cause sterility                  | 0.025  | 0.013  | 0.010  | 0.013  | 0.009  | 0.014  | 0.020  | -0.009 | 0.012  | 0.010 |
| TECH04  | Influence love                   | -0.024 | -0.043 | -0.015 | -0.030 | -0.031 | -0.032 | -0.017 | -0.031 | -0.028 | 0.009 |
| TECH05  | Cause economic harm              | 0.003  | 0.022  | -0.013 | 0.004  | 0.006  | 0.003  | 0.003  | -0.035 | -0.001 | 0.017 |
| TECH06  | Cause catastrophe                | -0.010 | 0.013  | -0.024 | -0.015 | -0.017 | -0.026 | -0.013 | -0.058 | -0.019 | 0.020 |
| TECH07  | Attack out-group members         | -0.180 | -0.179 | -0.256 | -0.263 | -0.302 | -0.332 | -0.268 | -0.216 | -0.250 | 0.055 |
| TECH08  | Cause other harm                 | 0.011  | 0.011  | 0.008  | 0.008  | 0.009  | 0.009  | 0.021  | -0.056 | 0.003  | 0.024 |
| TECH10  | Unintentional harm               | 0.174  | 0.177  | 0.179  | 0.175  | 0.154  | 0.238  | 0.215  | 0.144  | 0.182  | 0.031 |
| TECH11  | Evil eye/blasting word           | 0.099  | 0.118  | 0.102  | 0.112  | 0.106  | 0.112  | 0.104  | 0.183  | 0.117  | 0.027 |
| TECH12  | Spells, charms, material magic   | -0.312 | -0.361 | -0.322 | -0.343 | -0.328 | -0.333 | -0.357 | -0.397 | -0.344 | 0.027 |
| TECH13  | People pay practitioner          | -0.045 | -0.062 | -0.051 | -0.056 | -0.053 | -0.054 | -0.053 | -0.081 | -0.057 | 0.011 |
| TECH14  | Attack with thoughts             | 0.030  | 0.028  | 0.014  | 0.021  | 0.036  | -0.003 | 0.023  | -0.045 | 0.013  | 0.026 |



## Supplementary Figure

**Supplementary Figure 1.** Scree plot for main logistic PCA. Gray points show the additional variance explained by each principal component. Black points show the cumulative variance explained.



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