

**Title:** Ghost, Divination, and Magic among the Nuosu: An Ethnographic Examination from Cognitive and Cultural Evolutionary Perspectives

**Author:** Ze Hong<sup>ab1</sup> (ORCID: 0000-0002-5343-3008)

**Author Affiliations:**

<sup>a</sup> Department of Human Evolutionary Biology, Harvard University, 11 Divinity Avenue, 02138, Cambridge, MA, United States

<sup>b</sup> Department of Sociology, Zhejiang University, Hangzhou, Zhejiang Province, 310058, P. R. China

**Keywords:** Magic; Divination; Nuosu; Cultural Evolution; Cognition

<sup>1</sup> To whom correspondence should be addressed: [ze\\_hong@g.harvard.edu](mailto:ze_hong@g.harvard.edu)

## Abstract

I present a detailed ethnographic study of magic and divination of the Nuosu people in southwest China, and offer a cognitive account of the surprising prevalence of these objectively ineffective practices in a society that has ample access to modern technology and mainstream Han culture. I argue that in the belief system of the Nuosu, ghosts, divination, and magical healing rituals form a closely interconnected web that gives sense and meaning to otherwise puzzling practices, and such belief system is importantly supported and reinforced by individuals' everyday experiences. Contemporary Nuosu people overwhelmingly treat these practices as instruments for achieving specific ends and often entertain considerable uncertainty regarding their efficacy, which may be over-estimated for a number of reasons, e.g., 1) the intuitive plausibility of divination for ghost identification and exorcist rituals is enhanced by the belief in the existence of ghosts as a result of abductive reasoning, 2) negative instances (divinatory or healing ritual failures) are under-reported, and 3) people's mis-perception of the probability of uncertain events' occurrence often prevents them from realizing that the efficacies of magical/divinatory practices do not outperform chance. I conclude with some suggestive comments on the generality of the psychological and social mechanisms discussed.

## 1. Introduction

In anthropology, magic (divination is usually classified as a subtype of magic) have always been prominent themes since the time of Tylor (1871) and Frazer (1890). What is the nature of magic, and why do humans perform these seemingly ineffective actions? Some early theorists treated magic as having the same goal as modern science: to explain, predict, and control worldly events (Horton, 1967), while later anthropologists largely reject such intellectualist interpretations and shift their focus towards either the symbolic and conventional aspects of magic (Keita, 2007; Tambiah, 1990; Tedlock, 2006) or its social functions (Whitehouse, 2022), such as reducing anxiety (Kracke, 1992), enhancing social cohesion (Jagiello et al., forthcoming), and justifying political legitimacy (Flad, 2008).

Elsewhere, we have strongly argued for the instrumentality of divination practices drawing from a wide range of ethnographic and historical sources (Hong & Henrich, 2021). Here, I provide a detailed ethnographic analysis of magic and divination practices as well as the belief systems that these practices are embedded in among the Nuosu people in Southwest China. As will be shown, traditional Nuosu magic and divination have an unmistakable instrumental component, and people emphatically care about whether or not magic/divination works. This is not to say that the magic and divination do not serve psychological, social, and political functions; they clearly do. However, anthropological studies of magic and divination have largely ignored the cognitive aspect<sup>1</sup>, i.e. why do people perceive magic/divination as effective means for achieving specific ends (Boyer, 2020)? This is important because the various psychological, social, and political functions typically depend on some level of confidence in the efficacy of these practices (Horton, 1968). As such, a cognitive approach can meaningfully contribute to our understanding of the nature and consequences of supernatural beliefs and practices in traditional societies.

The rest of the paper is organized as follows. After introducing the ethnographic background of the population and laying out some existing explanations in the literature (section 2), I first describe the Nuosu concept of the ghost which serves as the theoretical basis for many Nuosu divinatory and magical rituals (section 3), and then analyze and explain why these rituals are seen as effective and practiced in everyday life (section 4). Briefly, I argue that people's belief in ghosts is supported by both intuition and abductive reasoning (interpreting ambiguous events as involving ghosts), and people's confidence in the efficacy of divination and magic is a result of both their theoretical plausibility and under-reporting of failures. Finally, I point out a cognitive bias where individuals misperceive the probability of uncertain events happening by chance using fetal sex prognostication through dreams as an example. These cognitive and social factors, among others, collectively contribute to the persistence of ineffective technologies such as divination and magic in human societies.

## 2. Ethnographic background and existing literature on Nuosu magic

The Nuosu people traditionally live in the Liangshan Prefecture of Sichuan province in China, and is officially classified as the Yi people, the 6<sup>th</sup> largest ethnic group in the People's Republic of China with a population of more than 8 million (Mullaney, 2010). Despite much external influence from the

---

<sup>1</sup> There have been some recent efforts to examine the nature of magic from cognitive perspectives, such as Sørensen (2007) and Hong (2022a) which point to our cognitive intuitions about magical efficacy, and a series of the studies on the psychological principles of sympathetic magic by psychologists Paul Rozin and Carol Nemeroff.

dominant Han culture and the availability of modern technology, the Nuosu in Liangshan retain a substantial amount of their traditional cultural practices, in particular magic and divination. Although superstition beliefs and practices are far from extinct in the modern world, they are usually marginalized by the mainstream culture (Hong & Henrich, 2021). Among the Nuosu, however, it plays a prominent role in everyday life, especially when it comes to diagnosing and treating illnesses, and to a lesser extent ensuring general good luck and avoiding bad fortune.

There has been a vast amount of literature on magic in Nuosu populations in Mandarin Chinese (For a start, see Bamo 1994). In Nuosu language, to perform a magic ritual (which typically involves interaction with supernatural<sup>2</sup> entities) is called “*bi*”, and the individuals performing these rituals are called “*bimo*”<sup>3</sup> (“*mo*” means masters of some craft). In contemporary China, studies of Nuosu magic are often referred to as “*Bimo* (毕摩) culture studies” due to the official categorization of most Nuosu magical practices as “ethnic traditions” to be preserved. Most of these studies, however, treat Nuosu magic as a kind of art possessed by a class of elite practitioners, with a heavy focus on its manifested form. As a result, in most published work we often see a detailed description of *how* these rituals are performed but not *why* they are performed. When explanations are offered, they are usually formulated as a casual combination of Malinowskian accounts of magic and Marxist theory of labor and productivity: magic rituals are attributed to a gap between people’s subjective desires/abilities and the objective reality, and the reason for such gap is due to a lack in productive forces (See Liao (2010); Zhang (1994); Zhang (2015)). For example, Zhu (2005) outlines such an explanation in the beginning of his extensive analysis of Nuosu magic:

In situations where there is a huge difference between the forces of nature and the productive forces of the society, the Yi enhance their self-confidence through the visible activities of magic, and believe that they could control nature by means of magic. Such belief in magic and ritual reflects the primitive<sup>4</sup> psyche of the early Yi and their desire to control the objective world.

Admittedly there is truth in this type of explanation, yet it is woefully incomplete and often presented in a way as if no further explanation is necessary. The truth in such an explanation, I suggest, is that a large expected benefit of achieving some ends (e.g. healing illness) will naturally produce an incentive for people to perform some action (e.g. healing ritual). However, for individuals to actually perform this action, this incentive has to be combined with some confidence that the action will likely work. The idea is that individuals’ decision-making process likely involve a crude cost-benefit analysis: an instrumental action is performed only when the expected return (the product of belief in the efficacy of the instrumental action and the benefit that would be obtained if the action is successful) is larger than the cost of performing the action. Note that here the “belief in efficacy” is probabilistic in nature, meaning that individuals are aware that these actions do not achieve successful outcomes 100% of the time (Hong & Henrich, 2021). Additionally, it is not a guarantee that an increase in productive forces (or

---

<sup>2</sup> The concept of “supernatural” is a difficult one in both anthropology (Dein, 2016) and psychology (Lindeman & Svedholm, 2012). With the caveats of conceptual difficulties, in this paper “supernatural” is used from the western intellectual perspective and refers to entities/causal relationship that violates natural laws or known physical principles.

<sup>3</sup> Also “Pi-mu” or “Bi muo” in earlier works of Nuosu magic.

<sup>4</sup> In the West, the “primitive” has largely been abandoned due to its derogative connotations. Here I am using it to translate the Mandarin word 原始 as in the original text.

technological capability) will lead to a decrease in magic and ritual practices. In his seminal work *Religion and the Decline of Magic*, Keith Thomas (1971/2003) emphatically points out that the decline of various magical beliefs and practices occurred *before* the technologies at the time were able to solve the practical problem that people faced. Conversely, in certain societies that are by any measure technologically advanced such as Taiwan and Hong Kong, superstitious beliefs such as geomancy (*feng shui*), auspicious date selection and various kinds of deity worships are widely popular (Emmons, 1992; Katz, 2003; R. Y. M. Li et al., 2016). A recent, astonishing example is that the Taiwanese government organized a public rainmaking ritual where officials and local people alike prayed to the sea goddess Mazu for rainfall during a severe drought in the spring of 2021 (BBC News, 2021).

In the English-language literature, systematic examination of Nuosu magic typically occurs from a historical perspective that investigates the evolution of Nuosu religious rituals in the unique political setting of the past few decades (Kraef, 2014) or within an functionalist framework that emphasizes either the rituals' psychic benefits or societal level effects, which can take various different forms. For example, Mueggler (2001, p. 66) suggests that Nuosu divination and healing rituals may be thought of "as methods for creating an ethics to deal with the violence of state power in daily life"; Swancutt (2021) argues that Nuosu divination and other predictive methods are used to push back against adversities caused by ghosts, presumably through the psychic comfort that these activities confer. Instrumentality is rarely mentioned: whether magic/divination rituals "work" and why they are perceived to "work" is typically not part of the research agenda.

### 3. A Cognitive and Cultural Evolutionary Account of Ghost beliefs among the Nuosu

#### 3.1. Ghost in Nuosu culture: ever-present ancestral spirits

Like many traditional societies in the world, the Nuosu have a polytheistic worldview and believe in life after death (Bamo, 2003). Specifically, the Nuosu believe that deceased individuals become ghosts (*nuci*) and may exert very real impacts on the world of the living by causing certain forms of illness or misfortune. Notably, in the Nuosu belief system *nuci* primarily affect individuals of their own clan; that is to say, *nuci*-related illnesses are most often attributed to dead relatives of the patient. One reason for this may be that in Nuosu culture, descendants have a strong responsibility to their elderly generations, alive or dead. This responsibility is in an important sense material; for example, during festivals married sons (and to a lesser extent daughters) would visit their parents with a non-trivial amount of gifts. Similarly, after the death of one's elderly relatives, it is the later generations' responsibility to offer sacrifices to make sure that their deceased relatives are happy in the afterworld (See SM video 1 for a funeral march). As a result, the Nuosu would perform regular safety-keeping rituals called *xiaobu* to satisfy their deceased relatives as well as *ad hoc* exorcist rituals to appease and send away *nuci* that already haunts the patient (Zheng, 2003).

For the Nuosu, *nuci* can be either good or bad just like living people. Bad *nuci*, often described as having insatiable appetites, bothers the living and causes illness (Vermander, 1999). Good *nuci*, on the other hand, can attach itself to certain individuals and grant them super-human powers. These good *nuci* are called *rasa* and may decide to attach themselves to their living relatives at any moment in life. Such attachment initially causes physical discomfort and/or illness, and the host of such *rasa* needs to go

through a ritual to officially become a *sunī*<sup>5</sup>, after which not only the illness goes away but the host also obtains extra-ordinary powers (Yueqi, 2021). The *sunī* can then communicate with his/her *rasa* for both informational purposes and exorcism, as will be elaborated in later sections.

Those who experienced violent or unexpected deaths are believed to turn to an extremely malicious kind of *nuci* called *ze*. Unlike regular *nuci*, *ze* is described as having a definitive physical form and can directly communicate (e.g. having a conversation) with the living. Occasionally, these *ze* would “visit” living people who may then decide whether to accept it and thus become its “host”. If a *ze* is accepted, it will benefit its host primarily in the form of stealing things (usually food) from other households and give it to its host<sup>6</sup>. The host, however, needs to treat *ze* very carefully as it may decide to harm the host if it is not satisfied for whatever reason. Readers familiar with the anthropology of witchcraft may notice that the underlying logic of *ze* is very similar to that of the practice of keeping the ghost/spirit of infants with unexpected death as a tool to ensure wealth and good fortune in Southeast Asia (Watson & Ellen, 1993).

In addition to the above types of *nuci*, there are numerous other types of ghosts and spirits of natural objects (mountain spirits, water spirits, etc.) in the Nuosu belief system, characteristic of a polytheistic worldview (Bamo, 2003). The exhaustive elaboration of all supernatural entities of the Nuosu people is neither possible nor necessary, as this paper primarily concerns with the general psychological and social mechanisms that sustain ghost beliefs, a subject that has become the focal topic in the cognitive science of religion (Barrett, 2007; Boyer, 2001) yet largely ignored by traditional anthropological studies.

### 3.2. Ghost beliefs sustained by cultural transmission and abductive reasoning

Why do people believe in the existence of ghosts? One explanation that has been repeatedly invoked by cognitive scientists is that they are intuitively believable. The literature in cognitive science of religion has pointed out a few psychological tendencies that contribute to ghost beliefs: first, our mentalizing ability leads us to project human-like mental states to non-human objects (Barrett, 2004; Guthrie, 1995), possibly conferring adaptive advantages (Bering et al., 2005); second, mind-body dualism, which refers to the intuitions that minds and bodies are separate entities, makes plausible the belief that human soul or soul-like entities may survive death and exert influence on the living (Bloom, 2007). Relatedly, evolutionary theorists have proposed that humans have a “Hypersensitive Agency Detection Device”, making us more likely to sense the presence of agents in ambiguous situations (J. L. Barrett, 2000). The idea here is that these psychological tendencies make us more likely to attribute our experiences as the result of agent-like entities (e.g., ghosts and spirits).

The amount of theoretical and empirical research that focuses on innate intuitions is very large and I shall not further belabor this point. What I would like to point out is that cultural transmission often works alongside innate intuitions about ghosts and spirits and reinforces such beliefs, particularly

---

<sup>5</sup> In the standard literature on the Nuosu, *sunī* and *bimo* are categorized as two different types of professionals where *sunī* resembles a typical shaman that would enter into an altered state of consciousness, whereas *bimo* are usually literate and are deemed the possessors of transmitted knowledge. One can “learn” to be a *bimo* whereas to become a *sunī* divine inspiration is always required.

<sup>6</sup> In a sense, *ze* is a powerful “helper” of the household, in the field I also collected stories of *ze* helping his host family catching fish and finding lost cattle, for example.

through abductive reasoning (Coltheart et al., 2010). In short, innate intuitions about ghosts make people more likely to interpret ambiguous situations as ghost encounters<sup>7</sup> (inference to the best explanation) which may then be transmitted to naïve<sup>8</sup> individuals as factual testimonies. That is, during the transmission process the uncertainty involved in the interpretation of the situation may get lost and the “fill in the blank” memory reconstruction process (Manning & Loftus, 1996; Schacter et al., 2011) may cause the “ghostness” of the story to be exaggerated. Below I briefly describe how the cultural transmission process contribute to ghost beliefs among the Nuosu people.

For the Nuosu, cultural information contributes to ghost beliefs primarily in two ways. First, many public, social activities either implicitly or explicitly assume or “demonstrate” *nuci*’s existence. In addition to the aforementioned regular “safety-keeping” and *ad hoc* healing rituals, there are ample social gatherings such as funerals and the spectacular *cubi* ceremony<sup>9</sup> which lasts for three days/nights nonstop to appease the dead when entire generations of individuals have passed away. A more dramatic ritual that explicitly portrays the existence of *nuci* is called *nucituo* (literally, to chase *nuci* away). This ritual is performed when the *nuci* involved is deemed especially malicious (such as *ze*) and needs to be chased away in a quite literal manner. It is conducted by the *sun*i who would enter a trance-like state and allegedly summons his/her *rasa* in order to see the *nuci*. The *sun*i then walks towards the presumed direction of the *nuci* and chases it back to its grave (*chi’he*, where the former body of the *nuci* was burned, see SM Figure 2), followed by a group of local people cursing and spitting in the presumed direction of the *nuci* during the chase. There are variations of this ritual: a simpler version is called *nuciguo* where the *nuci* is only chased out of the house and not all the way back to its grave (see SM video 3). A more spectacular form of this ghost-chasing ritual is called *sijiezi* where the *sun*i picks two (usually young) individuals from the audience to act as a temporary host of her *rasa* to “chase away” the *nuci* (see SM video 16 for a demonstration). The procedure starts with the to-be-possessed people holding a Y-shaped tree branch with both of their hands. Then, as the *sun*i chants, one of the possessed people begins to shake his hands (which is said to be caused by the shaking of the tree branch induced by the *rasa*). The *sun*i then verbally commands the possessed to chase the *nuci*; if the ritual is successful, the possessed person would jump or run (which is interpreted as “the *rasa* is controlling the person to chase the *nuci*”) towards the *nuci*’s grave. When the presumed grave location is reached, the possessed would stick the Y-shaped tree branch into the ground which symbolizes the end of the ritual as the *nuci* is believed to be sent back to its grave. Occasionally, objects deemed unclean such as dead dogs or chickens would be dumped onto the *nuci*’s grave to ensure that it does not come back to the living.

For a naïve person (in the cultural evolutionary sense), the most straightforward explanation for the above cultural practices and phenomena is that ghosts indeed exist and that certain individuals in the community possess the ability to interact with them (in practice, almost always sending/chasing them away). In reality, however, these practices and phenomena may be observed for a variety of other (naturalistic) reasons. For example, people may perform healing rituals when standard medical treatment

---

<sup>7</sup> Of course, there is great individual level variation regarding the propensity to interpret sensory experience as spiritual. See Luhrmann et al. (2021) for a recent large scale study.

<sup>8</sup> Throughout this paper, “naïve” will be used in a cultural evolutionary sense, referring to the cognitive mental state before receiving any cultural information.

<sup>9</sup> For the Nuosu, to properly send deceased individuals to the afterword (so that they don’t bother living individuals in the form of illness anymore). Before *cubi*, dead people wander around in the world of the living as spirits that cause illness and misfortune.

fails due to a simple cost-benefit analysis: the expected benefit of a successful ritual is very large and people are willing to “give it a try” even if they are quite skeptical of the efficacy of these rituals (Hong & Henrich, 2021). Social factors such as norm adherence and peer pressure could also lead individuals to perform these exorbitant rituals such as *cubi*. On the practices that allegedly “demonstrates” the existence of ghost and the extraordinary powers of *bimo* and *sun*i, a modern reader could easily come up with naturalistic reasons for them: the *sun*i that correctly identifies the grave of the presumed *nuci* may have done so due to chance and selective reporting of successful predictions; it is also quite possible that he/she uses social cues during the ghost-hunting march to infer the correct location of the *nuci* grave. One of my informants told me that he has noticed that certain *sun*i pay close attention to where the crowd (largely consists of local people who know the grave location) look, and these *sun*i walk towards the direction of the people’s gaze. We do not know the extent to which these deceptive tricks happen among the Nuosu, but from classic ethnography we know that deception happens quite a bit and certain people are aware of such possibility (Evans-Pritchard, 1937). What about the most spectacular and hard-to-explain phenomenon, *sijiezi*, where a *sun*i allegedly uses his/her *rasa* to control other people? Many of my informants have personally experienced the ritual (holding the Y-shaped branch, shaking and jumping/running), and report a not fully conscious mental state (e.g. “I don’t quite remember what I was doing”/ “I saw see a dim light in front of me”) that resembles symptoms of hypnosis<sup>10</sup> (Kihlstrom, 2016). Ethnographically, hypnosis is also observed being used in traditional societies to induce altered state of consciousness either in oneself or others (Bullock, 1950; Lancy, 1996). Therefore, it is highly likely that the “mind-control” type of magic is in fact a form of hypnotism, a psychological concept that is almost certainly absent for the Nuosu people. Indeed, a few of my most skeptical informants who generally deny the existence of ghosts and the efficacy of magic rituals admit that *sijiezi* is very hard to explain with naturalistic means. For the Nuosu people who witness it, it must have been an overwhelming experience which they have no explanation other than that of some supernatural power attaching itself to a host human to chase the ghost. Table 1 provides a more comprehensive list of the phenomena that purportedly “demonstrate” the extra-ordinary power of the *bimo/sun*i and the potential scientific explanations.

<i>Description</i>	<i>reference</i>	<i>Potential scientific explanation</i>
<i>Bimo/sun</i> i correctly identifies the location of <i>nuci</i> ’s grave	(Bamo, 2003)	<i>Chance/under-reporting of failures, intentional cheating (following the gaze of local people)</i>
<i>Bimo/sun</i> i makes people chase alleged <i>nuci</i> via chanting	<i>Field observation</i>	<i>Chance/under-reporting, hypnotism</i>

<sup>10</sup> Mose Cihuo, a pioneering researcher in documenting Nuosu magic told me another practice that resembles hypnotism even more: the *bimo/sun*i would induce people into a sleep-like state and use extensive verbal suggestion during their sleep; when they wake up, the *bimo/sun*i would ask them to describe where they have been to and what they saw in their dreams. (interview conducted on 07/2021 at Southwest Minzu University)



<i>Bimo/suni rubbing their bare feet against/licking hot iron without being burnt</i>	(Zheng, 2003)	<i>Training; the physics of thermal conduction and heat transfer (see Coe (1957) and Leikind &amp; McCarthy (1988) for the science of firewalking, and (Zeuner et al., 2019) for Leidenfrost effect)</i>
<i>Bimo/suni biting a rope attached to a goat and swinging it in circles</i>	Field observation	Training
<i>Bimo/suni correctly reveals information that he/she has no direct access to in divination sessions</i>	(Zhu, 2005)	Chance/under-reporting of failures
<i>Bimo/suni makes boiling water not as hot when whipping the water onto a patient's body in healing rituals using spells</i>	(Zheng, 2004)	Placebo effect; the water does not feel very hot anyways after being transferred from the wok onto the body.
<i>Bimo/suni uses chicken as a diagnostic device that correctly identifies the location of illness of the patient</i>	(Du, 2016)	Chance/under-reporting of failures

Table 1. A list of phenomena that purportedly demonstrate the extra-ordinary power conferred by *rasa*.

The second way in which cultural information contributes to ghost beliefs is that *nuci* is talked about very often in casual settings. People would share their “ghost stories” with each other either in the form of their own experiences or second or third-hand hearsays. These stories often include vivid details of the occasion in which *nuci* are encountered, what *nuci* looks like, and sometimes what happened after the protagonists had seen *nuci*. Unsurprisingly, *nuci* are almost always seen during night-time. Regarding *nuci*'s appearance, although the exact descriptions from different individuals vary, there are some general features to be noted. First, a *nuci*'s face cannot be seen which is interpreted by the local people as either the *nuci* not showing its face or that all those who have seen *nuci*'s face have died. Second, *nuci*'s figure is often portrayed as vague and blurry. Outcomes of *nuci* encounters, when mentioned, are almost exclusively unfortunate events happening to the protagonist. In fact, these unfortunate events are sometimes used as *evidence* that the protagonist has indeed seen a *nuci*. For example, a man in Meigu County told the following story when prompted to share his *nuci* experience:

A long time ago I worked as a schoolteacher in a village. I was sitting outside [of the classroom] eating lunch and saw two people coming towards me. I thought they were neighbors coming to play around; when they came close, however, they gave me a scare and walked away. It did not bother me very much, but later I was told that there was an old woman down the road (that the two people were going towards) who fainted after seeing them, and then I realized that they were *nuci*.

This is a slightly atypical ghost story as the protagonist did see the *nuci* quite clearly. Here, though the person telling the story did not suffer an unfortunate fate himself, another person did (the old woman who fainted) and this was used as evidence that he met *nuci* that day. Here we observe abductive reasoning at play: for the protagonist, among all possible explanations of why the woman fainted, the theory that she met *nuci* is the most likely one (from a Bayesian perspective, this would be a natural outcome if the prior belief of ghosts existing and can cause harm is sufficiently high (Powers et al., (2017), also see Andersen (2019) for a similar interpretation in the framework of predictive coding), and therefore he reasons that the strangers that he met were *nuci* when in fact they could have been two naughty villagers joking around.

What is perhaps more interesting, however, is when individual level abductive reasoning combines with population level information transmission dynamics. When an explanation is attributed to the story which is then told to another individual, it is quite possible that the listener does not view the transmitted information (e.g., I saw ghosts) as an inference obtained through abduction but as a factual observation, thus mistakenly increases the receiver's belief that ghosts exist. In other words, a probabilistic assessment of the actual situation in the story teller's mind (I'm 60% percent confident that I saw ghosts) often turns into a factual statement (I saw ghosts) and may be interpreted by the listener as such. Of course, the extent to which such mis-inference exists in actual human populations is an open empirical question, but the many extraordinary ghost stories among the Nuosu strongly suggest some exaggeration of the original story is happening. Unfortunately, we don't have systematic data regarding the extent to which these stories are believed. Much work in epistemic vigilance suggest that humans likely have evolved cognitive mechanisms that prevent us from believing false information during the process of communication (Sperber et al., 2010), yet it should be kept in mind that our vigilance towards communicated information is not foolproof and there are circumstances under which these vigilance mechanisms fail. For example, it is true that people will check the plausibility of messages against their background beliefs (Mercier, 2017), but in societies where the prevailing background belief is already false (e.g., ghosts exist), transmitted information that confirms the existing belief (e.g., I saw a ghost) is likely to further boost people's confidence in the background assumption.

## 4. Magic and divination in everyday context: an instrumental practice

### 4.1. General description of Nuosu magic and divination

With a basic understanding of the Nuosu concept of ghost, *nuci*, we are now in a good position to understand the form and logic of magic and divination rituals. Today, traditional magic and divination practices are collectively referred to as *mixin* by the Nuosu themselves, a term that literally translates as "superstition" in Mandarin Chinese (Ha, 2009) but no longer carries negative connotations among the locals. In everyday situations, *mixin* is primarily used to refer to traditional healing rituals which for the Nuosu are usually various forms of exorcism. Numerous ethnographic studies of the Nuosu have pointed out that the indigenous theory of illness among the Nuosu is *almost exclusively* ghost/spirit aggression or soul loss<sup>11</sup> (Bamo, 2003; Zhu, 2005), a phenomenon not uncommon in traditional, small scale societies

---

<sup>11</sup> Even in soul loss (to which children are particularly vulnerable) some malicious spirit is believed to be responsible for either kidnapping the soul or leading the soul astray.

around the world<sup>12</sup> (Murdock, 1980). Nowadays, *mixin* in the form of exorcism provided by *bimo* and *sun*i coexists with modern medical care provided by doctors in hospitals, and the two ways of treating illness are strictly viewed as alternatives despite having fundamentally different theories of illness and corresponding treatment methods (Zheng, 2004).

Given the common goal of curing illness yet different theoretical foundations regarding what *causes* illness, one might expect the Nuosu to conceptually divide illnesses into those to be treated by doctors and those to be treated by *bimo*. In an important sense this is true: local Nuosu people often stress that the patient needs the right kind of treatment to regain health. If the illness is caused by *nuci* then it is useless to go to the hospital, and if the illness is not caused by *nuci* then *bimo* cannot do anything about it (Tang, 2017). In practice, however, it is not at all clear that the manifested symptoms neatly categorize the underlying illnesses into the two groups, and many individuals will adopt a “try one, if not work, then another” strategy or simply employ both traditional exorcism and modern medicine simultaneously (Wang, 2018). Occasionally, divination methods will be used to decide the nature of the illness and whether the patient should consult a *bimo* or visit a doctor (see SM video 2).

When the patient (or his family members) decides that the illness is caused by *nuci*, there are generally three steps to take. First, the *bimo* or *sun*i needs to determine what *nuci* is involved. Bamo (2003) lists more than a dozen methods for doing this including the use of eggs, various chicken body parts, natural signs, and astrological tables<sup>13</sup>. My own fieldwork indicates that the most common method of identifying causative *nuci* is egg divination (*vaqihe*) (Figure 1. SM video 9-15). According to Bamo (2003):

The *bimo* rubs a raw egg over the patient’s body, and then pierces a small hole on top of the egg and lets the patient blow his/her breath into the egg from the hole. Then, the *bimo* brushes the egg with water using an Artemisia twig and starts chanting. He then breaks the egg and drops its yolk into a bowl of water and observes the shape, color as well as the distribution of egg bubbles in order to decide the nature and seriousness of the illness as well as the specific *nuci* involved. After such observation, he stirs the egg-water mix and places the broken egg shell onto the swirling water. When the eggshell stops moving, the *bimo* can tell whether the soul of the patient is still with him/her by the orientation of the egg shell. If the soul is lost, then a soul-recall ritual should be performed... (my translation)

---

<sup>12</sup> Although recent scholars have emphasized the importance of herbal medicine in addition to exorcism rituals (Y. Li et al., 2017; Sha, 2016), during my own fieldwork among the Nuosu in Meigu county most of my elderly informants told me that herbal medicine was rarely used and only for minor wounds, including professional Nuosu scholars at the Bimo Culture Research Center of Meigu County (美姑县毕摩文化研究所). In fact, many of them emphasize that *mixin* was the *only* healing method for any serious illness when hospitals were not accessible.

<sup>13</sup> The Nuosu astrological tables use a combination of the patient’s age and their zodiac signs to deduce the *nuci* involved.



Figure 1. A *bimo* performing an egg divination ritual (*vaqihe*) for a local woman on the street of Hongxi town.

What Bamo describes here is likely the complete, ideal procedure of egg divination (cf. Swancutt (2021)'s more detailed description of an egg divination ritual). In practice, the brushing of the egg is often omitted, and the body rubbing using the egg is not done by the *bimo* but by the patient him/herself or a friend/family member. Occasionally, the identification of *nuci* is not sufficient to determine the treatment, as the *nuci* can be potentially satisfied by a number of offerings (i.e. chicken, pig, sheep, goat, cow). Thus a second step is sometimes performed with either sheep shoulder blade bone (*yopiqi*; see SM video 2) or artemisia twigs<sup>14</sup> (*saiyomo*; see SM video 4-5) to determine whether sacrificing certain animals would satisfy the *nuci*. In the context of exorcism rituals, both methods require the *bimo* to ask a question in the form of “will sacrificing X work?” and then to generate signs by burning the bone to produce cracks or cutting marks on the twig with a knife and counting the parity of the number of marks (see supplemental material for a detailed description of the two divining methods). If the sign is favorable, then the domesticate animal of question will be sacrificed. Finally, the exorcism ritual is held; depending on the type of *nuci* identified the ritual may contain slightly different procedures. Generally, the *bimo* (occasionally *sun*i) would make effigies using dry grass, plastic ropes and mud which represents the *nuci* that will be expelled away (Figure 2), and then the *bimo/sun*i would perform a number of symbolic/sympathetic actions (See Mueggler (2001, p. 40) for an elaborate discussion of magic principles involved in Nuosu magic) where the *nuci* is offered sacrificial meat, induced out of the patient's body and sent away (full description of the healing ritual is available in the SM; see SM video 6-8 for how it's used). Notably, these ritual procedures make a lot of sense from the locals' perspectives:

---

<sup>14</sup> Note that this type of divination does not require the practitioner to be a *bimo* or *sun*i; lay people may also learn to perform such illness diagnosis.

anyone who spends some non-trivial amount of time with the Nuosu would get the basic idea of their traditional healing ritual (illness caused by ghosts → identification of causative ghosts → exorcism), and although the audience of the ritual often do not fully understand the meaning of every single action, they nonetheless believe that these actions are instrumental to the eventual success of the ritual. The practitioners of the ritual (i.e., the *bimo* and *sun*i themselves), on the other hand, almost always know what they are doing. If we consider the ability to perform an exorcist ritual as a type of specialized knowledge, then the differential understanding of ritual actions may be viewed as a division of cognitive labor that has been discussed extensively in philosophy of science (Kitcher, 1990; Weisberg & Muldoon, 2009) and cognitive psychology (Kominsky et al., 2018; Lutz & Keil, 2002).



Figure 2. Effigies made of grass and mud that represents ghosts (nuci) made by a *sun*i during a exorcist ritual.

On divination, a few more notable types deserve mentioning in addition to the illness-causing ghost identification methods. First, recall that the *sun*i is believed to possess superhuman powers conferred by his/her *rasa*. The *sun*i can then quite literally perform divination using his/her *rasa*; in a market setting, the *sun*i may be appropriately called a diviner. The fees that they charge their clients vary, and very famous *sun*i may charge an exorbitant amount of money. Typically, for a 20-30 minute session the client pays 20-150 RMB (3-20 USD) in either cash and/or cigarette/alcohol to inquire about

health, career, marriage, or luck in general, though most inquiries are illness related. Although in theory the *suni* can just summons his/her *rasa* for answers, in practice additional information-generating methods like palm reading or egg divination is often used in combination with invoking *rasa*.

Other informational methods may also fall under the umbrella term divination, broadly defined. The aforementioned Artemisia twig divination (*saiyomo*), for example, may be used as a general epistemic device for individuals who need to make decisions in situations of uncertainty. One of its common usages is to indicate directions to search for lost items. Similar to sheep shoulder blade divination, one first needs to ask a question in the form of “will X (lost item, e.g., cattle) be found in direction Y (e.g. north, south, west, east)?” If the sign is favorable, then the same question is repeated, and in cases of a second favorable sign, one may be assured of the answer<sup>15</sup>. I have also encountered instances where it is used to help determine whether one should go to the hospital or perform a traditional healing ritual for specific illnesses.

The Nuosu also use dreams for informational purposes, a very common phenomenon ethnographically (Grunebaum et al., 1966; Lincoln, 1935). However, there is no professional diviner who relies on dreams partly because of the idiosyncratic features of dream divination (Hong, 2022b). At the folk level, though, people often use dream signs to predict the sex of fetus in casual settings. In a highly patriarchal society like the Nuosu, knowing the sex of the yet-to-be-born is not only a matter of curiosity but also of practical significance. As the Nuosu family line is carried by the males and daughters are essentially considered “outsiders” from an inheritance perspective, a Nuosu couple would not stop reproduction until they have at least one boy. Because of the great interest on this subject, there are many folk methods to predict fetal sex, including 1) shape of the pregnant women’s belly, 2) timing of the pregnancy based on some horoscopic calendar, 3) words of young children who just learn to talk, 4) esoteric techniques of individual diviners, etc. Dreams, however, remain the most talked-about methods for fetal sex prognostication, and will be later used as an important case study to illustrate the psychological and social mechanisms that contribute to the persistence of magic and divination in later sections.

#### 4.2. The maintenance of magic and divination from an empirical perspective: under-reporting of failures

From the cognitive perspective, a central question around magic and divination rituals is whether they “work”. This is a crucial question not only for early anthropologists and ethnographers<sup>16</sup> trying to understand exotic cultural practices but also local people themselves who rely on these technologies for important, sometimes life-and-death situations. In the summer of 2019, a *bimo* performed egg divination for me in the town of Hongxi to see if I have health problems and potential sacrificial rituals to perform. He ended up offering rather specific predictions about my health and family events. For instance, he predicted that my father had a sister who died and turned into *nuci*, which is causing me health issues (this is unfortunately wrong; my father does have a sister but she is alive and well). Whenever I told my divining experience to local people, they *always* asked me “so did your father indeed have a sister who died?” Of course, the locals may be particularly interested the accuracy of divination in my case because

---

<sup>15</sup> See Hong & Henrich (2021) for a list of divination methods that require auspicious signs to appear multiple times to ensure that the sign is not a result of “noise”.

<sup>16</sup> As alluded to, most contemporary cultural anthropologists no longer view this question as crucial or even relevant.

they want to know whether traditional Nuosu divining procedures work on outsiders as well. Nonetheless, this anecdote illustrates that people do care about the outcomes of divination, and also provides a plausible mechanism for why certain diviners are able to charge significantly more money than others for their alleged accurate predictions. Exactly why certain diviners are perceived to have better success record than others remains to be investigated, and it is likely the result of a multitude of factors including luck, prediction precision, familiarity with the client, etc. The same is true for traditional exorcist rituals: *bimo* and *sun*i are famous almost always because they have established a good reputation for their healing success, and stories of their miraculous healing achievements circulate widely in the community. There are reasons to think that the emphasis on empirical success is quite general: Lightner et al., (2021)'s cross-cultural study on ethnomedical specialists, for example, shows that these specialists frequently obtain good reputation for healing success and are able to receive material payments as a consequence.

Regarding the efficacy of divination and magic in general, we have previously shown that many Nuosu individuals are able to give a subjective estimate in the form of percentages (Hong & Henrich, 2021). Figure 3 shows the combined data collected during five months of fieldwork among the Nuosu in Meigu county between 2019 and 2021. We can see that most subjects believe that magic and divination rituals are quite efficacious, with a mean of reported success rate of 66%. While we cannot take these numbers too literally, they do show that local Nuosu people have some rudimentary understanding of percentages/proportions, as high reported percentages are almost always associated with positive attitude towards the use of traditional rituals, and low reported percentages associated with negative attitudes.

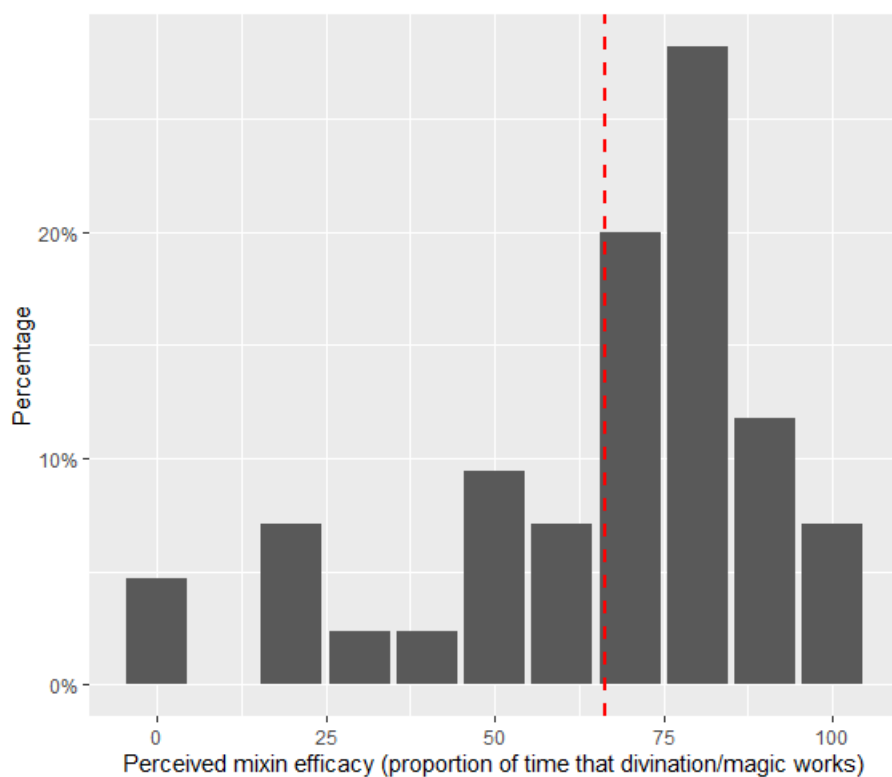


Figure 3. Distribution of subjectively perceived *mixin* efficacy. N=85. Red dashed line ( $\bar{x}$ =66.24) represents the mean of the distribution.

How do we account for the apparent empirical success of various divination and magic practices<sup>17</sup>? There are two possibilities. First, certain traditional healers indeed have extra-ordinary powers and can cure their patients either by successfully exorcising the ghost that bothers them or by some other means, and diviners have the ability to correctly foretell future events due to their *rasa*. In fact, some anthropologists implicitly hold this view by invoking some mysterious forces that humans do not yet fully understand<sup>18</sup>. Second, there may be some general social and psychological mechanisms that make magic and divination practices appear more effective/accurate than they actually are. Importantly, these two possibilities are not mutually exclusive: magic and divination may be genuinely effective and at the same time their effectiveness can be over-estimated. For psychologists and cognitive scientists, the first possibility is usually not seriously entertained, and I will similarly focus on the second possibility and examine the extent to which there exists factors that bias people's assessment of the efficacy of magic and divination.

In the literature, psychological factors such as placebo effect for traditional healing rituals (Hong, 2021; Humphrey, 2018) and regression to the mean (i.e. illness recovers regardless of any treatment applied) (Linden, 2013; Morton & Torgerson, 2003) have been well-studied and they certainly contributes to the perceived efficacy of *healing* rituals due the mind's suggestive power and the fact that illnesses frequently recover on their own without interventions (Zheng, 2004). However, these factors do not explain the perceived success of divination practices where the generation of accurate information is typically not affected by suggestion or regression to the mean (e.g. whether one will find his lost cattle by going north). Therefore, some more general mechanisms may be needed to account for the high perceived success of these traditional practices.

In Hong & Henrich (2021), we have formally modeled the process of individuals updating their belief regarding the efficacy of some technology and the parameters that could bias individuals' efficacy estimate during the information transmission dynamics at the population level. One key parameter that leads individuals to over-estimate the efficacy of some technology is the extent to which negative instances (ritual failure) is under-reported. In subsequent empirical evaluation of the model, we have identified substantial reporting bias in both traditional rainmaking and dream divination using historical data (Hong, Slingerland & Henrich, forthcoming; Hong, 2022), and conclude that under-reporting of negative evidence of some socially-approved technology is likely a common, recurring feature in human societies that contributes to the persistence of magic and divination in general. Among the Nuosu, I primarily examine such reporting bias in the most prevalent kind of magic practice, traditional exorcist healing rituals (roughly accounts for 80% of *mixin* rituals, see Mose, 1996) and a particular form of divination (loosely defined), fetal sex prognostication through the use of dreams.

---

<sup>17</sup> One suggestion from some Han people who run business in Nuosu villages is that most people suffer from malnutrition in the past, and because the meat of the animals sacrificed in exorcist rituals was cooked and shared by the ritual participants, the patient would feel better after consuming the much-needed calory input. This is unlikely to be the whole story because in many exorcist rituals the meat is considered to be sacrificed to the ghost, and although it is cooked and shared, the patient suffer from the illness is forbidden from consuming the meat for fear of the ghost attaching itself back to the patient.

<sup>18</sup> This position is especially prevalent among Chinese anthropologists and ethnographers (see Du (2016)). Though not always appear in formal writing, genuine, extraordinary powers of healers and diviners are often invoked and attributed to some mysterious forces that science cannot account for in casual conversations.



Between summer 2019 and summer 2021, I opportunistically interviewed 72 Nuosu participants and asked the following questions in the form of vignettes:

Q1: “If a friend of yours feels ill, and after a *mixin* ritual is performed he does not recover and still feels ill, to what extent are you willing to tell this (incident) to others?”

Q2: “If a friend of yours feels ill, and after a *mixin* ritual is performed he recovers and doesn’t feel ill anymore, to what extent are you willing to tell this (incident) to others?”

Participants were instructed to answer this question on a 5-point Likert scale (very willing – willing – don’t care– unwilling – very unwilling) and to provide verbal justifications for their choice when possible. Figure 4 shows the distribution of participants’ answers to the two questions. Note that the only difference between the two questions is the outcome of the illness recovery: the protagonist recovers in Q2 and does not recover in Q1.

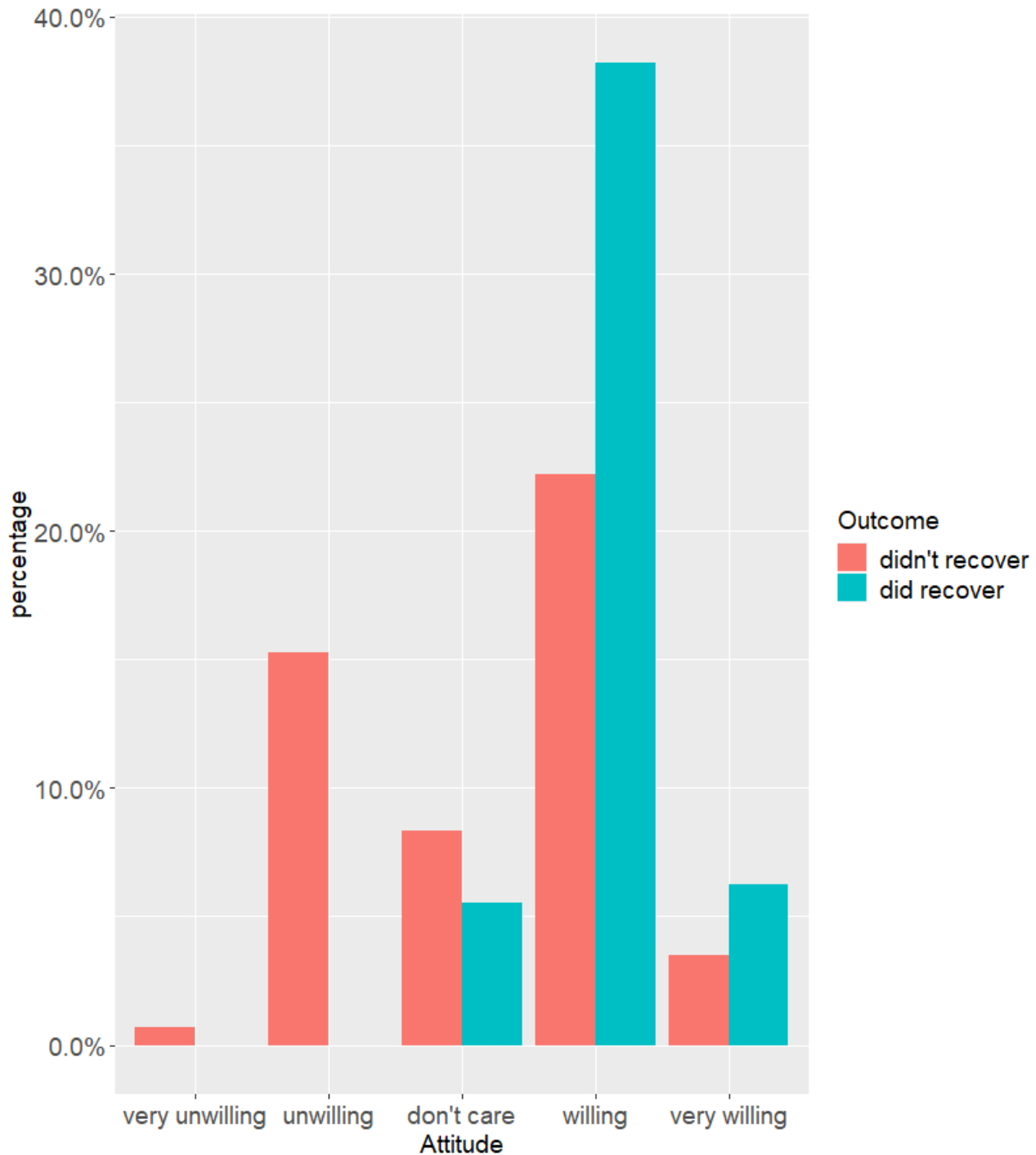


Figure 4. The frequency plot of willingness of Nuosu participants to tell the traditional healing experience to others, broken down by the outcome of the healing ritual. Mean (did recover)=4.01, SD (did recover)=0.49; mean (didn't recover) = 3.25, SD (didn't recover) = 1.02.

From Figure 4 we can see that while a substantial proportion of individuals (~15%) are unwilling to share their stories of ritual failures, in the case of ritual success most participants choose to share the story with others. Relatedly, the proportion of participants who choose “very willing” and “willing” is significantly higher in the vignette scenario of recovery than in that of non-recovery, meaning that

individuals are more likely to share a story with a good ending (illness recovered) than one with a bad ending (illness not recover/death). Formal statistical test shows that the difference in score of the two vignette scenarios are highly significant (t-test,  $p < 10^{-7}$ ).

There are some general patterns in participants' responses regarding why they are unwilling to reveal a healing failure to others. First, people are quite explicit in making the point that in the case of recovery, of course one is willing to share the good news whereas if the patient doesn't recover, people do not wish to talk about it because of the negative emotions it may incur. Indeed, the underlying psychology of preferentially thinking and talking about positive experience has been extensively studied in social psychology (Gable et al., 2004; Langston, 1994). Second, since people know that these rituals are not meant to work 100% of the time, failures can be easily explained away by invoking technical issues or fate (the patient is destined to become ill/die), and as such the *bimo* (occasionally *sun*) who perform the ritual is not responsible for the ritual failures. In a sense, the *bimo* is helping the host family to negotiate with the *nuci* by offering it meat, etc., and the audience of the ritual can clearly see this<sup>19</sup>. Because the *bimo* are often friends or relatives of the host family who invite them to perform the healing ritual, people are generally concerned that spreading these failures to others may negatively affect their reputation. Even if the incompetence of *bimo* is suspected, there is the more serious worry that since *bimo* are believed to have super-human powers, if they come to know that whoever has said bad things about them (e.g. attributing healing failures to their incompetence), they may curse these people and cause material harm. Therefore, a common response among the Nuosu is that "if a *bimo* fails to cure the illness, just don't ask him to perform the ritual again; no need to tell this to others."

To check the robustness and generality of the under-reporting pattern, we asked the same two questions in an online survey in three nearby colleges. Because subjects in the survey are largely Han individual who may not know about *mixin*, we changed the wording "after a *mixin* ritual is performed" into "after going to a hospital". The same pattern is observed (Figure 5): people are more willing to report their experience to others when the outcome is positive, though the reporting bias is not as pronounced as in the *mixin* case among the Nuosu (but still statistically significant; t-test,  $p = 0.0004$ ).

---

<sup>19</sup> The voluntary nature of inviting *bimo* to perform healing ritual is often emphasized, that is, nobody forces the host family to invite any particular *bimo* and there is an implicit agreement that the *bimo*'s effort to trying to cure the illness should be acknowledged and appreciated regardless of the therapeutic outcome.

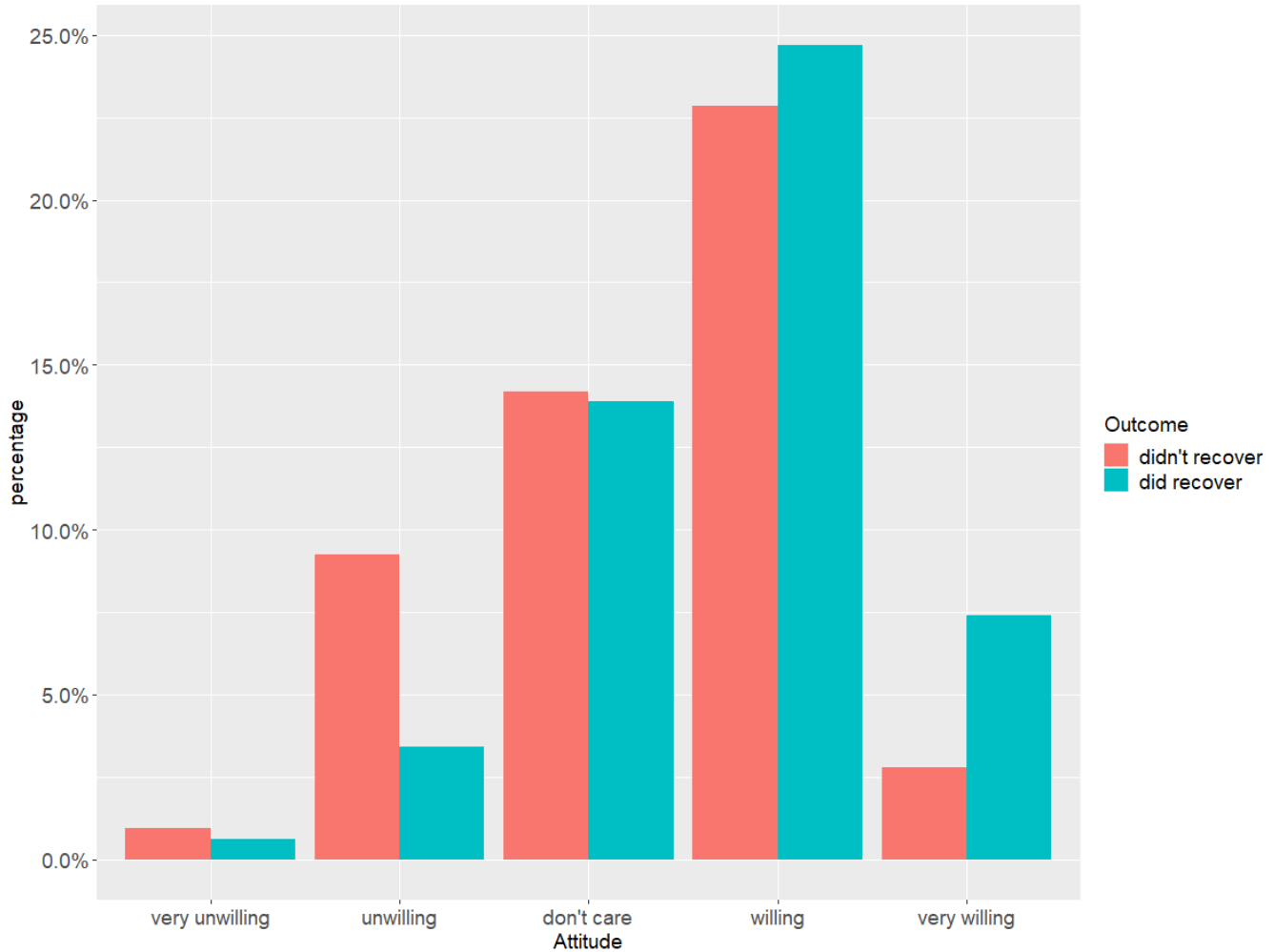


Figure 5. The frequency plot of willingness of college subjects to tell the hospital experience to others, broken down by the outcome of hospital treatment. Mean (did recover) = 3.70, SD (did recover) = 0.85; mean (didn't recover) = 3.34, SD (didn't recover) = 0.91.

Now let us turn to the divinatory practice of fetal sex prognostication to better observe the potential reporting bias in action. Because we know that the probability of a pregnant women giving birth to a boy or a girl is roughly the same (50%) (Orzack et al., 2015), the chance efficacy of fetal sex prognostication is 50%; that is, if one only randomly guesses the sex of fetus he/she will achieve a long term success rate of 50%. If we assume that common folk methods for fetal sex prognostication do not outperform chance (See Hong & Zinin (submitted) for why this should be a reasonable assumption), then any significant deviation from 50% in people's reports of predictive success and failures would be evidence for a reporting bias.

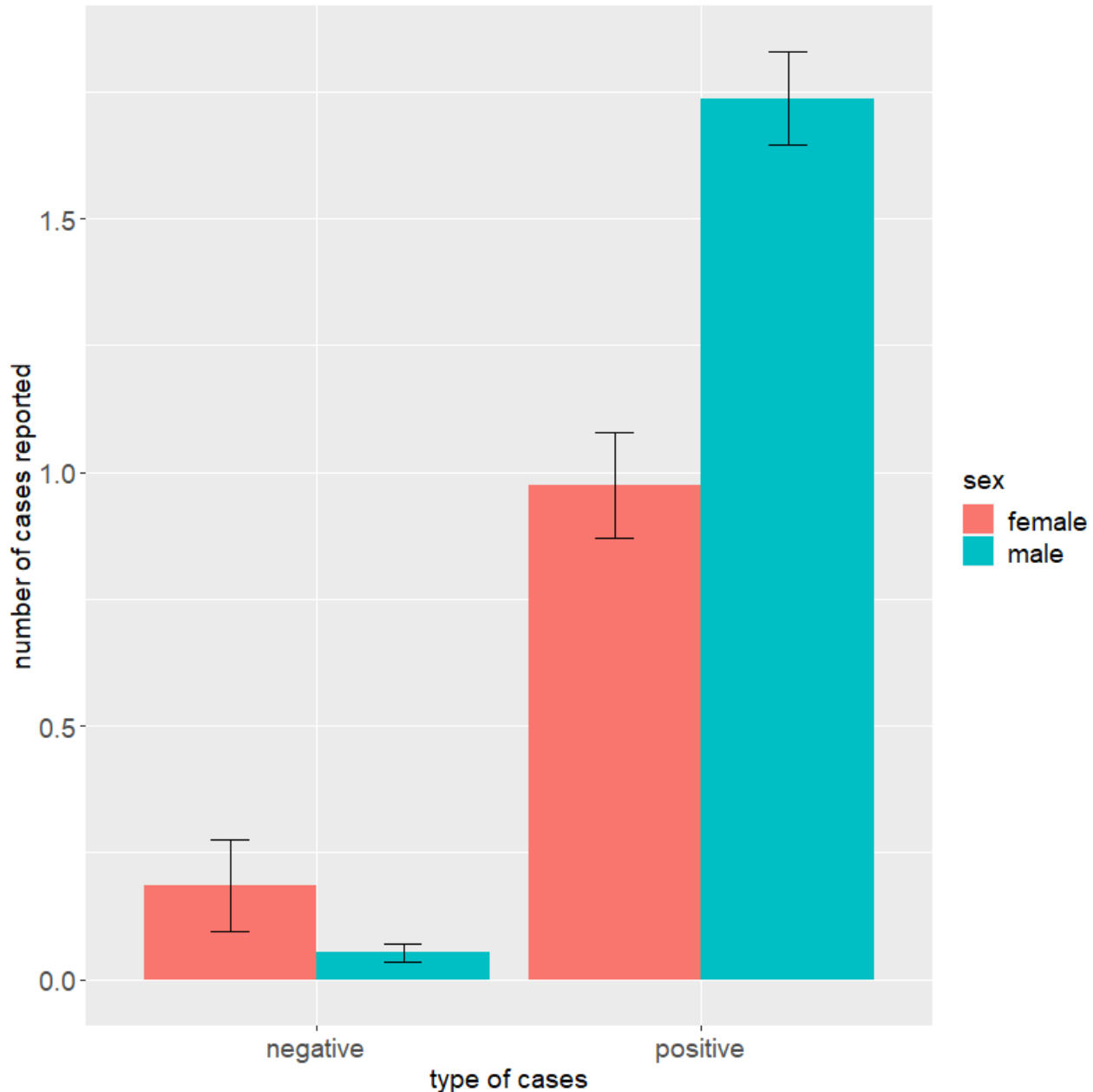


Figure 6. The number of predictive success and failures (broken down by sex) from participants' reports (N=39). Error bars represent 95% confidence interval.

We first asked participants if they know of any folk methods of predicting fetal sex, and then specifically inquired whether they have either personally experienced or heard about predictive successes or failures. Importantly, we emphasized predictive failures by repeating the question “have you heard of any predictive failures?” Figure 6 shows the average number of predictive success and failures by sex for participants who reported at least one incidence of fetal sex prognostication. We immediately observe the overwhelming pattern that reported predictive successes vastly outnumber failures. In fact, out of all 39 subjects only two participant (one has received formal medical training and is very skeptical about folk methods of fetal sex prognostication, the other dreamt of girl-related items 7

times yet every time gave birth to a boy; she concluded that her pregnancy dreams were “opposite” to others) reported predictive failures. Of course, we cannot definitively rule out the possibility that some folk methods are indeed effective; for example, telling the sex of fetus by the shape of the pregnant women’s belly. In our sample, most individuals reported the use of dreams as a predictive device (if the pregnant woman or her close relatives dream of boy-related items such as gun or knife then she’ll give birth to a boy, and girl-related items such as earrings or bracelet then she’ll give birth to a girl), and to my knowledge there is no scientific evidence showing that pregnant women’s dream content correlates with the sex of their baby. Moreover, if we take participants’ subjective report at face value, the “success rate” of fetal sex prognostication is 94%!

The results above thus suggest a very large reporting bias. In fact, it is so large that what we observe in Figure 6 is likely more than just under-reporting of failures; other factor such as retrospective inference (e.g. inferring/misremembering that one must have dreamed of boy-related items after a boy is born, see Hong 2022b). It is possible, however, that individuals are aware of the existence of such bias and take it into consideration when evaluating the efficacy of fetal sex prognostication. My fieldwork indicate that this is not the case; during focus group discussions many individuals expressed strong confidence in the correlation between dream contents and fetal sex. Indeed, from the perspective of cultural transmission, the learner must find the evidence for various types of fetal sex prognostication overwhelming. Additional psychological mechanisms such as confirmation bias and norm adherence<sup>20</sup> that give rise to under-reporting have been suggested in Hong & Henrich (2021): people have a tendency to selectively attend to and remember information that confirms their existing beliefs (Nickerson, 1998) and there may be normative pressure against revealing failures which would challenge the validity of culturally prevailing beliefs (people may nonetheless hold private doubts; see Boyer 2020). The bottom line is that the resulting under-reporting of negative instance will recursively maintain individuals’ confidence in fetal sex prognostication over generations at the population level.

### 4.3. misperception of chance in evaluating the efficacy of magic and divination: evidence from fetal sex prognostication

For scientists, the *empirical* reason that we deem some technology with uncertain outcomes as ineffective is almost always that it does not outperform chance. However, as Hacking (2006) points out, the modern understanding of probability did not emerge until rather recently in human history, and we do not have a very good understanding of whether and how ancient people without formal statistical training compare the efficacy of some technology with chance. Here, we use fetal sex prognostication as a case example to examine this important question in the field. Crucially, we want to explore the extent to which Nuosu individuals realize that the empirical requirement for some technology to be effective is that it needs to outperform chance. Fetal sex prognostication again is an ideal case here because we know that its “chance efficacy” is roughly 50%, and with this knowledge we can examine individuals’ understanding of technological efficacy and chance in a straightforward setup.

In particular, we have asked the two following questions:

---

<sup>20</sup> See Zheng (2003) for a description of the normative pressure on performing *xiaobu* ritual in rural communities.

Q1) If a diviner correctly predicts the fetal sex 50 out of 100 pregnant women, what do you think of his/her divining ability? (5-point Likert scale from very low to very high)

Q2) If someone without any divining ability only randomly guess fetal sex, how many out of 100 do you think he'll guess correctly?

On the surface, the answers to these questions should be very obvious to anyone with basic knowledge of statistics and probability. However, these are far from trivial questions for Nuosu participants. Firth & Cole (1975) have long pointed out that individuals in illiterate, traditional societies often have trouble answering questions that involve hypothetical scenarios. For the above questions, Nuosu participants often find 2) particularly difficult, partly because this is a very unfamiliar situation.

In total, we collected 159 responses for Q1) and 114 response for Q2), and Figure 7 visualizes the distribution of individual responses. There are a couple notable patterns. First, the majority of participants think that a diviner that performs exactly at chance level has some divining ability after all. While over half of the participants think diviner with 50% success record is merely “mediocre” (note that even “mediocre” here is a somewhat positive evaluation and can also be translated in English as “fair”), a substantial amount (over a quarter) of the participants rate the diviner’s ability as either “high” or “very high”. Correspondingly, few participants (less than 15%) think that a random guesser would achieve a 50% success rate (which from a statistical perspective is the most likely outcome), and the majority think that he/she would have a success rate much smaller than 50%.

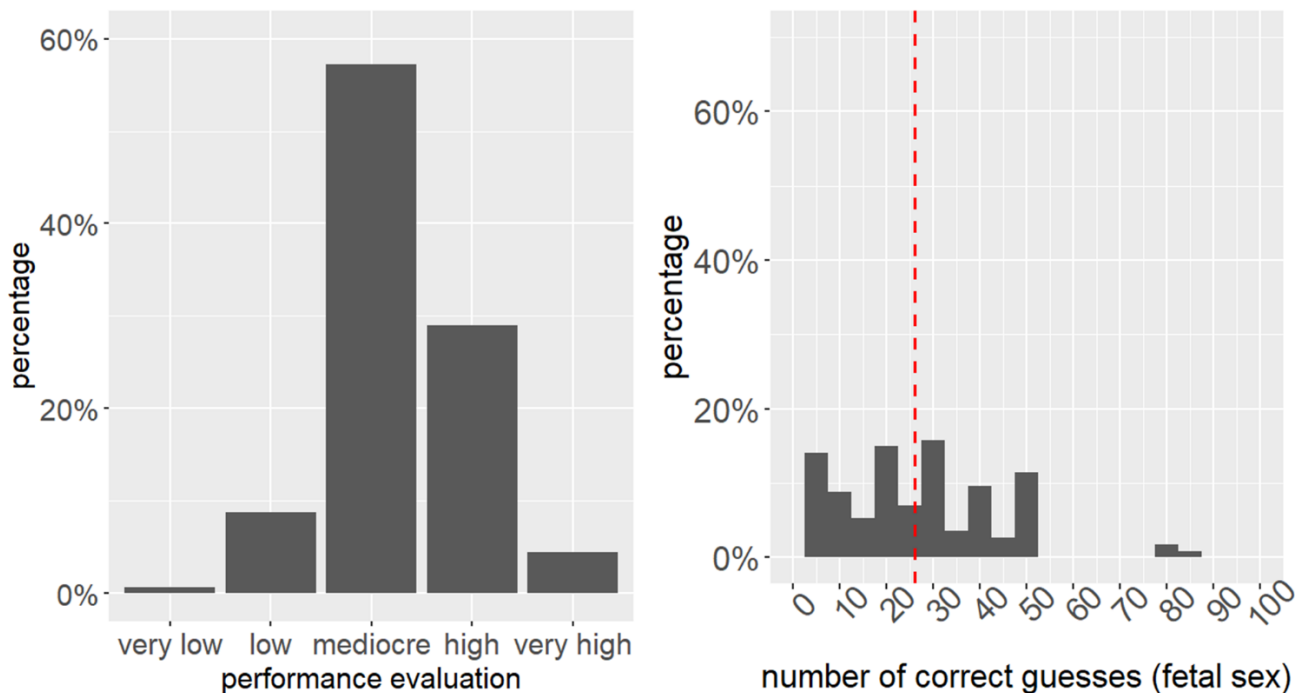


Figure 7. The distribution of participants’ response to questions on chance and uncertainty of fetal sex prognostication. Red dashed line represents the mean of the distribution (25.96).

These results may appear striking (in particular nearly 15% of the participants report that random guessing would achieve 0-5 success out of 100 times), and one may worry that participants in the field

simply lack the numeracy required to understand the questions correctly. While this is certainly a possibility, there are reasons to think that the above patterns meaningfully represent how individuals reason and think about these scenarios. First, lack of numeracy alone does not explain the substantial skew in distribution of people's estimation of a random guesser's number of correct guesses, where individuals systematically report numbers smaller than 50. Second, as mentioned earlier in the paper, many individuals in this population have a rudimentary understanding of percentages and would spontaneously re-phrase the questions as "so his success rate is 50%..." and certainly know that a good diviner should have a high success rate. Additionally, these response patterns are not unique to the Nuosu; I have collected survey and interview data showing that even college educated individuals respond to these questions in the same pattern (Hong, unpublished), suggesting a potentially very robust psychological bias when people think about chance and uncertainty.

During interviews and focus group discussions, participants often express that the 50% feels like a substantial percentage and that someone who achieves that success rate is, although not "very good", certainly possesses some mediocre predictive ability. Moreover, the idea of "randomly guessing" is a very unfamiliar one, and in the field we often needed to "act out" someone who mindlessly points finger at imaginary pregnant women with his eyes closed, murmuring "boy, girl, boy, boy, girl..." for the participants to get a basic understanding of "random guessing". Indeed, who would do such a thing except for professional statisticians! For the Nuosu, it is quite sensible that someone tries to perform fetal sex prognostication, but such prognostication must be based on some technique or knowledge, be it the belly shape checking, dream interpreting, palm reading, or something else. In reality, because one is trying to offer accurate predictions, presumably based on all available information, "random guessing" is something that makes very little sense.

Yet this creates a problem: although individuals can easily tell a good diviner from a bad one based on their empirical success record, it is rather difficult to realize that a diviner's fetal sex prognostication is no better than a coin flip, and as such various types of fetal sex prognostication may never be definitively rejected. In a different paper, we have analyzed fetal sex prognostication in China using extensive historical record and show that it very much persisted till the late Qing dynasty (1644-1912 CE) and to some extent the present day (Hong & Zinin, submitted).

In many evolutionary accounts of magic and divination, the key puzzle is posed as "why would people perform these objectively ineffective yet often costly rituals?" (Rossano, 2015; Ruffle & Sosis, 2007; Soler, 2012). This puzzle can be rephrased without loss of much information as "why would people not 'do nothing' when normally some ritual is expected (thus avoid the cost)?" Here, the implicit assumption is that in so far as individuals treat these ritual practices as instruments for achieving specific ends, they should compare the efficacy of these rituals with chance. I have shown, based on data on fetal sex prognostication in the field, that individuals may not possess the statistical capability to compute chance efficacy, and therefore fail to recognize that these prognostication methods do not outperform chance. From a strict probability perspective, the number of correct fetal sex predictions follows a binomial distribution with parameter  $n$  and  $p$ , where  $n$  denotes the number of independent "trials" and  $p$  denotes the probability of success for each "trial". Mathematically, the probability of obtaining  $k$  out of  $n$  successes is given by:



$$Pr(X = k) = \binom{n}{k} \cdot p^k \cdot (1 - p)^{(n-k)}$$

The inferential problem, then, is to determine the most likely number of successes (chance) given certain  $n$  and  $p$ . The brute-force way to do this would be to compute the probability of occurrence for each number of success (i.e., from  $X = 1$  to  $X = n$ ), compare them, and pick the one with the largest value. Needless to say, this is a very computationally intensive process. The smart way would be to realize that the shape of the distribution is unimodal and to obtain the most likely number of success one can simply compute the mean or mode of this distribution<sup>21</sup>, which is  $np$ . It is unlikely that the Nuosu people in the field know either mathematical fact. In fact, many of the participants who answered correctly (a random guesser would guess 50/100 correct) did so probably due to the well-known “equiprobability bias”, a tendency to believe that any process that involve some randomness would result in a fair distribution where all possible outcomes have equal probability (Gauvrit & Morsanyi, 2014; Morsanyi et al., 2009).

Like under-reporting of negative evidence, the biases in thinking about chance and uncertainty may contribute to the recurrence and persistence of ineffective technologies quite generally. As long as the promised result can appear by chance, people may fail to recognize that technologies do not perform any better than “doing nothing”. The key here is that people are not consciously comparing the efficacy of some technology with the natural frequency of positive outcomes, which, when sufficiently large, may create the illusion that technologies aiming at producing these outcomes have a fairly high success rate and are thus worth using. Note that this phenomenon occurs even when individuals have full access to the empirical data needed for such comparison such as fetal sex prognostication. In everyday life, such information is often not readily available in most other domains, creating an additional layer of difficulty for definitively rejecting certain technologies as ineffective.

## 5. Discussion

In this paper, I have presented detailed ethnographic descriptions of Nuosu divination and magic and provided cognitive and cultural evolutionary explanations for the persistence of these cultural practices. For a cultural category as rich and complex as divination/magic, a full understanding of it necessarily requires multifaceted explanations. I agree with cognitive and psychological researchers that people’s intuitive theories about the world plays a large role in maintaining various kinds of supernatural beliefs, but would like to emphasize the synergistic interaction between intuition and the unique information transmission dynamics in human societies. From a developmental perspective, although children may be said to be “predisposed” to believe in ghosts and spirits as a result of dualism and agency detection (Bloom, 2007), cultural inputs are nonetheless indispensable for the eventual formation of theistic beliefs (Harris, 2012). In fact, I argue that in times of significant social change vis-à-vis people’s supernatural beliefs (e.g., the booming research on religious beliefs as a natural, cognitive phenomenon (J. L. Barrett, 2007) and the prominent rise of New Atheism (Schröder, 2017; Schulzke, 2013)) in the West, it is more pressing than ever to understand the sociological and cultural dynamics for belief formation, both on the existence of spiritual entities and the effectiveness of cultural practices (e.g. magic and divination rituals) that aim to achieve specific ends via interaction with these spiritual entities.

---

<sup>21</sup> When  $np$  is an integer, the mean median and mode are the same and equal  $np$ .

The Nuosu in southwest China thus provides an ideal opportunity for a detailed case study. Arguably one of the most superstitious ethnic groups in contemporary China, the Nuosu have ample access to mainstream cultural information and technology, yet they have managed to maintain much of their traditional belief in ghosts, magic, and divination. In this paper, building on existing research in cognitive science and cultural evolution, I have provided empirical evidence for the psychological biases that powerfully reinforce the existing beliefs in ghosts/spirits and the efficacy of technologies based on such beliefs. Below, I offer some additional comments on these biases in the Nuosu context, as well as the possibility of having a general, unified theory of divination and magic.

### 5.1. On ghost beliefs and abductive reasoning

I am not the first to point out the relationship between abductive reasoning and supernatural beliefs (Boyer, 1994; Coltheart et al., 2010), I have, however, broadened the ways in which abductive reasoning contribute to these beliefs and emphasized its importance in the process of cultural transmission. Specifically, abductive reasoning not only plays a role in situations where individuals misinterpret sensory data but also in situations where one attempts to make sense of other people's behavior. For example, during the spectacular exorcist rituals, it is quite natural for observers to arrive at the conclusion that ghosts indeed exist (the "best" explanation given people's background beliefs) via abduction. Regarding cultural transmission, as long as the uncertainty involved in abductive reasoning gets somewhat lost via transmission channels such as testimony (e.g., inferred ghost stories presented as facts), the naïve listener may mis-process the data and end up over-estimating the probability that ghosts exist or the efficacy of some technology, and these ghost beliefs in turn serve as the theoretical basis for divination and magic practices.

### 5.2. The cultural consequences of under-reporting of negative evidence

As mentioned, under-reporting of negative evidence is likely to be a very common bias in human societies when people evaluate the efficacy and report success/failures of some technology. Note that in addition to the obvious effect of up-biasing people's estimate of technological efficacy, under-reporting of failures can have some interesting, indirect consequences. The vast majority of my participants, for example, believe that *bimo/suni* in the past were more powerful than those now, and some even go as extreme as "all practicing *bimo* and *suni* today are charlatans." This may be a natural consequence of under-reporting of failures: because although failures are generally under-reported, most individuals can still personally experience failures to some extent which will no doubt affect their evaluations of the specific *mixin* practitioners and perhaps the efficacy of *mixin* in general. However, people cannot directly experience the *mixin* rituals of past *bimo/suni* and thus all their information regarding these past *bimo/suni* is obtained through testimony which is subject to biased reporting. Note that this does not mean that people think *bimo/suni* of their time are worthless; it's simply that they are relatively less powerful compared to their ancient counterparts. Additionally, the fundamental validity of traditional magic and divination practices is rarely challenged. In fact, the belief that contemporary shamans are less powerful may serve as an easy excuse that explains away their failures.

It is possible that the psychological tendency to under-report failures also contributes to the common cultural myth that technologies (e.g., magic and divination) and practitioners of these technologies were very powerful in ancient times, and gradually became worse and worse over time (which stands in sharp contrast to modern science which is getting increasingly powerful) (Eliade, 1963;

Malinowski, 1926/2014). In fact, some of my informants would explicitly mention this and provide reasons for such presumed power/ability decline, such as cumulative ability deterioration (a student cannot be as good as his master, and his student is even worse) and recent human interference with the environment that disrupted the man-nature relationship (e.g., use of explosives to build roads and railways in the mountain). Of course, these are likely post-hoc rationalizations to justify the impression that *bimo/suni* today were less powerful than those in the past.

### 5.3. On the persistence of magic and divination: general cognitive and social factors

Although the present paper primarily used the Nuosu as an example to illustrate how individuals may misperceived the efficacy of magic/divination and chance, such psychological and social factors may be quite general in sustaining ghost beliefs and ineffective technologies in traditional human societies. This is because the psychological biases do not depend on the specificities of the society's belief systems, and the de-centralized information transmission dynamics is largely similar in small scale, traditional societies. In fact, even in contemporary, modern societies reporting bias has been shown to inflate people's assessment of efficacy of medical products (de Barra, 2017; de Barra et al., 2014). In traditional societies where there is no epistemic authority to regulate the production of knowledge, individuals' beliefs are subject to many kinds of biases and inferential mistakes (Hong & Henrich, 2021).

The fact that many problems frequently solve themselves and many technologies achieve their desired ends probabilistically means that we often need to decide whether some technology performs better than chance, and the difficulty in computing "chance efficacy" may thus present a large barrier for the rejection of some technology in societies where statistical knowledge is lacking, especially when it is the only method for dealing with some practical problem. Significance-testing, randomized controlled trials and other advanced statistical methods for determining whether something is due to chance is a very recent cultural achievement in human history, and there are good reasons to suspect that before the advent of these tools identifying technologies as having no better than chance performance was genuinely hard.

It is my hope that this work could inspire more efforts to explore general cognitive and social factors that affect our understanding of technologies which we rely upon on a daily basis. Although a complete theory of magic may not be possible (Hong, 2022b), our understanding of technological practices, ineffective and effective, past and present, could still be greatly enhanced by focusing on both individual psychology and the social contexts in which they are embedded.

### Conflict of interest

None.

### Acknowledgement

I thank Dr. Joseph Henrich for his continued support for this project, Mona Xue for carefully proofreading and commenting on an earlier draft of the manuscript, and all my Nuosu informants and participants for making this research possible.

### Funding

This research is funded by the John Templeton Foundation and the Issachar Fund.

## References

- BBC News. (2021). *Why the world should pay attention to Taiwan's drought*. Retrieved from <https://www.bbc.com/news/world-asia-56798308>
- Andersen, M. (2019). Predictive coding in agency detection. *Religion, Brain and Behavior*, 9(1), 65–84. <https://doi.org/10.1080/2153599X.2017.1387170>
- Bamo, A. (1994). *彝族祖灵信仰研究: 彝文古籍探讨与彝族宗教仪式考察*. 四川民族出版社.
- Bamo, A. (2003). 凉山彝族的疾病信仰与仪式医疗 (下). *宗教学研究*, 2.
- Barrett, J. (2004). *Why would anyone believe in God*. AltaMira Press.
- Barrett, J. L. (2000). Exploring the natural foundations of religion. In *Trends in Cognitive Sciences* (Vol. 4, Issue 1). [https://doi.org/10.1016/S1364-6613\(99\)01419-9](https://doi.org/10.1016/S1364-6613(99)01419-9)
- Barrett, J. L. (2007). Cognitive Science of Religion: What Is It and Why Is It? *Religion Compass*. <https://doi.org/10.1111/j.1749-8171.2007.00042.x>
- Bering, J. M., McLeod, K., & Shackelford, T. K. (2005). Reasoning about dead agents reveals possible adaptive trends. *Human Nature*. <https://doi.org/10.1007/s12110-005-1015-2>
- Bloom, P. (2007). Religion is natural. In *Developmental Science*. <https://doi.org/10.1111/j.1467-7687.2007.00577.x>
- Boyer, P. (1994). *The naturalness of religious ideas: A cognitive theory of religion*. Univ of California Press.
- Boyer, P. (2001). *Religion explained: the evolutionary origins of religious thought*. Basic Books.
- Boyer, P. (2020). Why divination? Evolved psychology and strategic interaction in the production of truth. *Current Anthropology*. <https://doi.org/10.1086/706879>
- Bullock, C. (1950). *Mashona and the Matabele*. Juta & Co. <https://ehrafworldcultures.yale.edu/document?id=fs05-007>
- Coe, M. R. (1957). Fire-walking and related behaviors. *The Psychological Record*. <https://doi.org/10.1007/bf03393294>
- Coltheart, M., Menzies, P., & Sutton, J. (2010). Abductive inference and delusional belief. In *Cognitive Neuropsychiatry*. <https://doi.org/10.1080/13546800903439120>
- de Barra, M. (2017). Reporting bias inflates the reputation of medical treatments: A comparison of outcomes in clinical trials and online product reviews. *Social Science and Medicine*. <https://doi.org/10.1016/j.socscimed.2017.01.033>
- De Barra, M., Eriksson, K., & Strimling, P. (2014). How feedback biases give ineffective medical treatments a good reputation. *Journal of Medical Internet Research*. <https://doi.org/10.2196/jmir.3214>
- Dein, S. (2016). The Category of the Supernatural: A Valid Anthropological Term? *Religion Compass*.

<https://doi.org/10.1111/rec3.12194>

- Du, M. (2016). 四川彝族原始宗教之毕摩仪式实录. 收藏, 1.
- Eliade, M. (1963). *Myth and reality*. Harper & Row.
- Emmons, C. F. (1992). Hong Kong's *Feng Shui*: Popular Magic in a Modern Urban Setting. *The Journal of Popular Culture*, 26(1), 39–50. <https://doi.org/10.1111/j.0022-3840.1992.00039.x>
- Evans-Pritchard, E. (1937). *Witchcraft, oracles and magic among the Azande*. Clarendon Press.
- Firth, R., & Cole, M. (1975). The Cultural Context of Learning and Thinking: An Exploration in Experimental Anthropology. *Man*. <https://doi.org/10.2307/2801238>
- Flad, R. K. (2008). Divination and Power. *Current Anthropology*. <https://doi.org/10.1086/588495>
- Frazer, J. G. (1890). *The Golden Bough: A Study in Comparative Religion, Volume 2 (Vol. 2)*. Macmillan.
- Gable, S. L., Impett, E. A., Reis, H. T., & Asher, E. R. (2004). What do you do when things go right? The intrapersonal and interpersonal benefits of sharing positive events. *Journal of Personality and Social Psychology*. <https://doi.org/10.1037/0022-3514.87.2.228>
- Gauvrit, N., & Morsanyi, K. (2014). The equiprobability bias from a mathematical and psychological perspective. *Advances in Cognitive Psychology*. <https://doi.org/10.5709/acp-0163-9>
- Grunebaum, G. E., Caillois, R., & others. (1966). *The dream and human societies*. Univ of California Press.
- Guthrie, S. E. (1995). *Faces in the clouds: A new theory of religion*. Oxford University Press on Demand.
- Ha, Z. (2009). 当代中国少数民族宗教政策简评. 中共济南市委党校学报, 2.
- Hacking, I. (2006). *The emergence of probability: A philosophical study of early ideas about probability, induction and statistical inference*. Cambridge University Press.
- Harris, P. L. (2012). Trusting What You're Told. In *Trusting What You're Told*. <https://doi.org/10.4159/harvard.9780674065192>
- Hong, Z. (2021). The Population Dynamics of the Placebo Effect and Its Role in the Evolution of Medical Technology. *Human Ecology*, 1–12.
- Hong, Z. (2022a). A cognitive account of manipulative sympathetic magic. *Religion, Brain & Behavior*, 0(0), 1–17. <https://doi.org/10.1080/2153599X.2021.2006294>
- Hong, Z. (2022b). Dream Interpretation from a Cognitive and Cultural Evolutionary Perspective: The Case of Oneiromancy in Traditional China. *Cognitive Science*, 46(1), e13088. <https://doi.org/https://doi.org/10.1111/cogs.13088>
- Hong, Z., & Henrich, J. (2021). The Cultural Evolution of Epistemic Practices. *Human Nature*, 1–30.
- Horton, R. (1967). African Traditional Thought and Western Science. *Africa*. <https://doi.org/10.2307/1158253>

- Horton, R. (1968). Neo-Tylorism: Sound Sense or Sinister Prejudice? *Man*, 3(4), 625.  
<https://doi.org/10.2307/2798583>
- Humphrey, N. (2018). Shamans as healers: When magical structure becomes practical function. In *The Behavioral and brain sciences*. <https://doi.org/10.1017/S0140525X17002084>
- Katz, P. R. (2003). Religion and the state in post-war Taiwan. *China Quarterly*.  
<https://doi.org/10.1017/s000944390300024x>
- Keita, L. (2007). Horton revisited: African traditional thought and Western science. In *Africa Development*. <https://doi.org/10.4314/ad.v32i4.57326>
- Kihlstrom, J. F. (2016). Hypnosis. In *Encyclopedia of Mental Health: Second Edition*.  
<https://doi.org/10.1016/B978-0-12-397045-9.00180-4>
- Kitcher, P. (1990). The Division of Cognitive Labor. *The Journal of Philosophy*.  
<https://doi.org/10.2307/2026796>
- Kominsky, J. F., Zamm, A. P., & Keil, F. C. (2018). Knowing When Help Is Needed: A Developing Sense of Causal Complexity. *Cognitive Science*. <https://doi.org/10.1111/cogs.12509>
- Kracke, W. (1992). *Cultural aspects of dreaming*. Encyclopedia of Dreams. Internationale Institute for Dream Research.
- Kraef, O. (2014). Of Canons and commodities: The cultural predicaments of Nuosu-Yi “Bimo culture.” *Journal of Current Chinese Affairs*, 43(2), 145–179.
- Lancy, D. F. (1996). Playing on the mother-ground: cultural routines for children’s development. In *Culture and human development* (pp. xii, 240). Guilford press.  
<https://ehrafworldcultures.yale.edu/document?id=fd06-031>
- Langston, C. A. (1994). Capitalizing On and Coping With Daily-Life Events: Expressive Responses to Positive Events. *Journal of Personality and Social Psychology*. <https://doi.org/10.1037/0022-3514.67.6.1112>
- Leikind, B. J., & McCarthy, W. J. (1988). Firewalking. In *Experientia*.  
<https://doi.org/10.1007/BF01961268>
- Li, R. Y. M., Chau, K. W., Law, C. Y., & Leung, T. H. (2016). Superstition and Hong Kong housing prices: A hedonic pricing approach. In *Econometric Analyses of International Housing Markets*.  
<https://doi.org/10.4324/9781315743035>
- Li, Y., Wang, J., Yu, M., Liu, Y., & others. (2017). 彝药剂型的起源与发展. *中成药*, 2017 年 02, 377–380.
- Liao, L. (2010). 论彝族民间诅咒巫术. *和田师范专科学校学报*, 6.
- Lightner, A. D., Heckelsmiller, C., & Hagen, E. H. (2021). Ethnoscience expertise and knowledge specialisation in 55 traditional cultures. *Evolutionary Human Sciences*.  
<https://doi.org/10.1017/ehs.2021.31>
- Lincoln, J. S. (1935). *The dream in primitive cultures*.

- Lindeman, M., & Svedholm, A. M. (2012). What's in a term? Paranormal, superstitious, magical and supernatural beliefs by any other name would mean the same. *Review of General Psychology*. <https://doi.org/10.1037/a0027158>
- Linden, A. (2013). Assessing regression to the mean effects in health care initiatives. *BMC Medical Research Methodology*. <https://doi.org/10.1186/1471-2288-13-119>
- Luhrmann, T. M., Weisman, K., Aulino, F., Brahinsky, J. D., Dulin, J. C., Dzokoto, V. A., Legare, C. H., Lifshitz, M., Ng, E., Ross-Zehnder, N., & Smith, R. E. (2021). Sensing the presence of gods and spirits across cultures and faiths. *Proceedings of the National Academy of Sciences of the United States of America*. <https://doi.org/10.1073/pnas.2016649118>
- Lutz, D. J., & Keil, F. C. (2002). Early understanding of the division of cognitive labor. *Child Development*. <https://doi.org/10.1111/1467-8624.00458>
- Malinowski, B. (2014). *Myth in primitive psychology*. Read Books Ltd.
- Manning, C. G., & Loftus, E. F. (1996). Eyewitness testimony and memory distortion. *Japanese Psychological Research*. <https://doi.org/10.1111/j.1468-5884.1996.tb00003.x>
- Mercier, H. (2017). How gullible are we? A review of the evidence from psychology and social science. *Review of General Psychology*. <https://doi.org/10.1037/gpr0000111>
- Morsanyi, K., Primi, C., Chiesi, F., & Handley, S. (2009). The effects and side-effects of statistics education: Psychology students' (mis-)conceptions of probability. *Contemporary Educational Psychology*. <https://doi.org/10.1016/j.cedpsych.2009.05.001>
- Morton, V., & Torgerson, D. J. (2003). Effect of regression to the mean on decision making in health care. In *British Medical Journal*. <https://doi.org/10.1136/bmj.326.7398.1083>
- Mose, C. (1996). 美姑毕摩宗教活动简介. 美姑彝族毕摩调查研究.
- Mueggler, E. (2001). *The age of wild ghosts: memory, violence, and place in Southwest China*. Univ of California Press.
- Mullaney, T. (2010). *Coming to Terms with the Nation*. University of California Press.
- Murdock, G. P. (1980). *Theories of Illness a World Survey*. University of Pittsburgh Press. <https://philpapers.org/rec/MURTOI>
- Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of General Psychology*. <https://doi.org/10.1037/1089-2680.2.2.175>
- Orzack, S. H., Stubblefield, J. W., Akmaev, V. R., Colls, P., Munné, S., Scholl, T., Steinsaltz, D., & Zuckerman, J. E. (2015). The human sex ratio from conception to birth. *Proceedings of the National Academy of Sciences of the United States of America*. <https://doi.org/10.1073/pnas.1416546112>
- Powers, A. R., Mathys, C., & Corlett, P. R. (2017). Pavlovian conditioning—induced hallucinations result from overweighting of perceptual priors. *Science*. <https://doi.org/10.1126/science.aan3458>
- Rossano, M. (2015). The evolutionary emergence of costly rituals. *PaleoAnthropology*.

- Ruffle, B. J., & Sosis, R. (2007). Does It Pay To Pray? Costly Ritual and Cooperation. *The B.E. Journal of Economic Analysis & Policy*. <https://doi.org/10.2202/1935-1682.1629>
- Schacter, D. L., Guerin, S. A., & St. Jacques, P. L. (2011). Memory distortion: An adaptive perspective. *Trends in Cognitive Sciences*. <https://doi.org/10.1016/j.tics.2011.08.004>
- Schröder, S. (2017). Organized New Atheism in Germany? *Journal of Contemporary Religion*. <https://doi.org/10.1080/13537903.2016.1256646>
- Schulzke, M. (2013). The politics of New Atheism. *Politics and Religion*. <https://doi.org/10.1017/S1755048313000217>
- Sha, X. (2016). 彝族毕摩医药的研究现状. *中国民族医药杂志*, 6.
- Soler, M. (2012). Costly signaling, ritual and cooperation: Evidence from Candomblé, an Afro-Brazilian religion. *Evolution and Human Behavior*. <https://doi.org/10.1016/j.evolhumbehav.2011.11.004>
- Sørensen, J. (2007). *A cognitive theory of magic*. Rowman Altamira.
- Sperber, D., Clément, F., Heintz, C., Mascaro, O., Mercier, H., Origgi, G., & Wilson, D. (2010). Epistemic vigilance. *Mind and Language*. <https://doi.org/10.1111/j.1468-0017.2010.01394.x>
- Swancutt, K. (2021). The Chicken and the Egg: Cracking the Ontology of Divination in Southwest China. *Social Analysis*, 65(2), 19–40.
- Tambiah, S. J. (1990). *Magic, science, religion, and the scope of rationality*. Cambridge University Press.
- Tang, Q. (2017). 疾病诊疗的地方性经验与民族医学价值的探讨——以凉山彝族“斯色那”治疗为案例. *北方民族大学学报 (哲学社会科学版)*.
- Tedlock, B. (2006). Toward a Theory of Divinatory Practice. *Anthropology of Consciousness*, 17(2), 62–77. <https://doi.org/10.1525/ac.2006.17.2.62>
- Thomas, K. (2003). *Religion and the decline of magic: studies in popular beliefs in sixteenth and seventeenth-century England*. Penguin UK.
- Tylor, E. B. (1871). *Primitive culture: researches into the development of mythology, philosophy, religion, art, and custom* (Vol. 2). J. Murray.
- Vermander, B. (1999). The Religious System of the Yi of Liangshan. *China Perspectives*, 21, 3–12.
- Wang, Zi. (2018). 一位彝族乡民的“神药两解”治疗史. 云南大学.
- Watson, C. W., & Ellen, R. F. (1993). *Understanding witchcraft and sorcery in Southeast Asia*. University of Hawaii Press.
- Weisberg, M., & Muldoon, R. (2009). Epistemic landscapes and the division of cognitive labor. *Philosophy of Science*. <https://doi.org/10.1086/644786>
- Whitehouse, H. (2022). *The ritual animal: Imitation and cohesion in the evolution of social complexity*. Oxford University Press.
- Zeuner, M., Schwark, K., Hanisch, C., & Ziese, M. (2019). Leidenfrost effect studied by video analysis.



*European Journal of Physics*. <https://doi.org/10.1088/1361-6404/ab37d6>

- Zhang, C. (1994). 彝族的占卜术. 云南民族学院学报 (哲学社会科学版), 4.
- Zhang, D. (2015). 凉山彝族的祭祖与占卜. 西南民族大学学报》(人文社会科学版), 3.
- Zheng, L. (2003). 凉山彝族信仰的表达与嬗变——对毕摩仪式的经验研究. 四川大学.
- Zheng, L. (2004). 畢摩信仰與凉山彝族的健康觀. 臺北利氏學社年刊, 7(93.02), 71–84.
- Zhu, F. (2005). 彝族地区的巫文化探析. 四川大学.