

Cooperation, Reputation and Supernatural Belief

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I, Sarah Peacey, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm this has been indicated in the thesis.

Abstract

Belief in supernatural agents, such as gods and witches, has been prevalent in societies throughout history. These beliefs may be adaptive, in helping the individuals who adhere to them survive and reproduce in certain social and ecological conditions. This thesis furthers understanding of why certain patterns of accusations and witchcraft beliefs occur. Supernatural beliefs are associated with reputation, thought to be a mechanism for cooperation. Fear of punishment by gods may promote prosocial behaviour. Accusing an individual of witchcraft may be a negative tag, used to inflict sanctions on competitors, norm violators, or those it is otherwise not profitable to cooperate with.

The major part of this thesis analyses witchcraft using a dataset compiled from ethnographic accounts of Bantu cultures from sub-Saharan Africa. This contains society-level variables and individual case studies. I also use pre-existing, cross-cultural datasets.

Results suggest that prevalence of witchcraft belief in societies does not co-evolve with societal traits that might predict competition. In witchcraft accusations, including why the sex typically accused differs between societies, individual-level variables correlated more with the characteristics of accusations than society-level traits. While it remains unclear why some accusations have more severe outcomes than others, the study finds a higher number of accusers is more likely to be associated with a lasting reputation as a witch.

I conducted a lab-in-field experiment in Northern Ireland, comparing two possible mechanisms for cooperation: 1) the reputational effects of being observed by others and 2) fear of supernatural punishment from high gods. Possible reasons for inconclusive results are discussed.

Supernatural beliefs are probably adaptive under particular circumstances relating to human cooperation and conflict. However, as others have found, complex beliefs and patterns mean that conclusions are somewhat ambiguous.

Impact Statement

Witchcraft beliefs are still prevalent in many areas of the world, including India, Melanesia, large parts of Africa and a substantial number of other countries.

Violence in relation to witchcraft beliefs still occurs, although the exact extent of this is unknown. Accusations can have a range of outcomes for individuals, from relatively little effect to the accused being killed or maimed.

This thesis contributes to the understanding of why such harmful beliefs may arise in societies, and why particular individuals may be targeted by accusations. Little previous research has examined witchcraft belief from the perspective of evolutionary anthropology. The approach taken here is also relatively novel in that it seeks to examine how society-level patterns may influence individual-level accusations using quantitative methods. It has demonstrated how particular competitive relationships between individuals may lead to witchcraft accusations.

I created a dataset for the purpose of this study, using information on historic witchcraft beliefs and accusations in the Bantu societies of sub-Saharan Africa. Using an evolutionary framework serves to de-mystify what can otherwise appear to be irrational or random patterns of harmful behaviour. As such thinking is increasingly integrated into the study of witchcraft it could in due course have beneficial effects on public discourse and policy design.

This thesis also examines religious beliefs from an evolutionary perspective. There has been substantial research on how religious belief may influence cooperation, and particularly how the presence of moralising high gods may promote cooperation in large-scale societies. Here I present new data from field research using economic games in Northern Ireland, which is novel in comparing two proposed mechanisms for cooperation: fear of supernatural punishment and concern for being monitored by other people.

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Chapter 1 Introduction

This introduction, through an exploration of the relevant literature, explains the potential of a cross-cultural quantitative approach to the study of witchcraft. It takes a complementary approach to the previous studies on witchcraft undertaken by social anthropologists and historians, and also a few more recent cross-cultural studies. I also address the question of comparing two proposed mechanisms for cooperative behaviour: the fear of monitoring and punishment by moralising gods, and being observed and monitored by other humans. Through this I illustrate how the studies undertaken in this thesis contribute to our understanding of religious beliefs and witchcraft beliefs from an evolutionary perspective.

Belief in the supernatural

Throughout history, and extending into prehistory, human societies have believed in the supernatural (Hutton, 2017; Peoples, Duda, & Marlowe, 2016; Swanson, 1964). That is, in the existence of forces and beings which are invisible, and apparently cannot be explained by scientific understanding. These gods, ghosts, devils, witches, ancestors, sprites, and countless other beings are thought to influence human existence.

This thesis examines two forms of supernatural concept: witchcraft beliefs and the belief in moralising high gods. They are explored with the possibility that they are adaptive in an evolutionary sense: they may enable the individuals that adhere to them to survive and reproduce in particular ecological conditions.

Both forms of supernatural belief have been associated with how humans cooperate with each other (or do not) (e.g. Atkinson & Bourrat, 2011; Gershman, 2016; Geschiere, 2015; Kluckhohn, 1944; Mace et al., 2018; Norenzayan et al., 2016). Cooperation exists throughout nature but is particularly extensive in our species, and is thought to be a major driving force of human evolution (Bshary & Raihani, 2017; Nowak & Sigmund, 1998). Witchcraft belief and belief in moralising high gods are both associated with a proposed mechanism for cooperation and morality: reputation (e.g. Mace et al., 2018; Norenzayan et al., 2016; Purzycki et al., 2018;

Shariff & Norenzayan, 2011; Power 2017). There are of course systematic differences between these forms of belief, but reputation connects them in a number of ways.

Witchcraft belief is associated with reputation in that individuals accused of practising it are given what, in some evolutionary literature, has been classified as a negative reputational ‘tag’ (Antal, Ohtsuki, Wakeley, Taylor, & Nowak, 2009). Other individuals may then decide not to cooperate with that individual, to ostracise them or even kill them. While religious belief is associated with reputation in a number of ways, I focus on the belief that your behaviour (or reputation) is monitored by gods who will punish you for transgressions (e.g. Lang et al., 2019; Xygalatas et al., 2018).

In this study, I test predictions about how such beliefs may be adaptive, or increase the capacity of individuals to survive and reproduce. I use experimental economic games, pre-existing survey data, and also a new dataset of witchcraft beliefs and accusations from sub-Saharan Africa. I analyse why particular patterns of witchcraft beliefs and accusations occur, and how fear of monitoring and punishing high gods and being observed by others promote cooperation. The aim of this thesis is to further understanding of how these supernatural beliefs are shaped by evolutionary processes.

This chapter provides an introduction to various strands of literature this thesis is based on, including an outline of previous research on witchcraft belief and how it may be adaptive, and why belief in moralising gods is thought to be a mechanism promoting cooperation.

Why study witchcraft?

Witches ‘have haunted the human imagination with remarkable persistence’ (Briggs, 2002: 1). They have been identified as the antithesis of positive values, or an inversion of the normal values of a society. They are conceived of as having otherworldly abilities, such as being able to fly, transform into animals, magically inflict illness and death, and destroy crops and livestock (Behringer, 2004). Some

societies conceive of witchcraft as an actual substance in the body, which is revealed on autopsy (Evans-Pritchard, 1937; Price-Williams, 1962). In both Europe and Africa, witches were thought to be cannibals, who went to their victims' graves to feast on their flesh (Douglas, 1991; Winter, 1963).

Despite the more fantastical aspects of witchcraft beliefs, when accusations of practising black magic are directed at individuals, they are based in the reality of social relationships and socio-ecological conditions. Accusations have a range of consequences that can range from relatively minor, such as being made to perform a healing ceremony, to extremely violent outcomes. The 'witch craze' of early modern Europe, lasting from approximately 1450-1750, is estimated to have led to the trials of around 90,000 individuals and the executions of around 45,000 (Levack, 2016). In a modern context, violence related to belief in witchcraft is an area of human rights concern: individuals who are the subject of witch-hunts are often tortured, ostracised or murdered (Cimpric, 2010; Foxcroft, 2017; Thomas et al., 2017). It is unknown how many victims of violence related to witchcraft beliefs there are worldwide, as numbers are believed to be underreported, but cases appear on every continent. A number of United Nations agencies and officials have acknowledged the issue as a critical one and taken steps to monitor cases and formulate policies for prevention (Foxcroft, 2017). In the UK, Project Violet was set up by the Metropolitan Police to tackle cases of child abuse linked with witchcraft accusations ('Child abuse linked to faith belief'; Metropolitan Police website). Witchcraft beliefs can lead to forms other than through accusations: individuals, including albinos who are believed to have magical properties, are killed or mutilated for their body parts which are then trafficked (Foxcroft 2017).

Belief in witchcraft remains particularly strong in Melanesia (Foana'ota, 2017; Thomas et al., 2017), India (Chaudhuri, 2012; 'India 'witch hunters' 2019) and many parts of Africa (Chilimampungu & Thindwa, 2011; Foxcroft, 2017; Secker, 2013). Witchcraft accusations and related violence also occur in Saudi Arabia, Indonesia, Pakistan, Brazil, Guatemala, the United Kingdom, and numerous other countries (Foxcroft, 2017; Hanson et al., 2013). It is not uncommon for illness and premature deaths to be attributed to witchcraft in Africa (Fottrell, Tollman, Byass, Golooba-Mutebi, & Kahn, 2012). In Sukumaland, Tanzania, those who kill 'witches' are

thought to be performing a public good by ridding their communities of individuals who are as dangerous as thieves and murderers (Dickinson, 2002).

Many current accounts suggest that it is vulnerable individuals who are accused of witchcraft: the majority are women and children; the elderly and the disabled are also at risk (Chilimampunga & Thindwa, 2011; Cimpric, 2010; Foxcroft, 2017). Children are often identified as witches in Sub-Saharan Africa and Asia (Adinkrah, 2004; Foxcroft, 2017; Secker, 2013).

The similarity of core witchcraft beliefs in geographically and historically distant cultures is striking, despite regional variations (Geschiere, 2015). There are common beliefs that witches are likely to poison their victims' food in both China, (Mace et al., 2018) and Africa (Goody, 1970; Wilson, 1936), which result in people avoiding eating with those suspected of witchcraft. In such geographically distant locations as Scotland and India, witches were believed to dry up cow's udders and women's breast milk (Maloney, 1976). The methods used by witches are also similar in widely dispersed cultures: in Papua New Guinea, Africa and North America they were thought to acquire hair and nail clippings or other forms of bodily waste from their intended victims, on which they could cast spells, leading to injury or death (Forge, 1970; Kluckhohn, 1944; Turner, 1952).

Definitions of witchcraft

Witchcraft can be generally defined as the use of supernatural methods to harm others or to acquire wealth (Gershman, 2016). When witchcraft is thought to have been used to increase success or wealth, this is usually associated with harming someone else in order to do so (Gershman, 2016), for example some societies believed that witches became rich by killing a member of their own family (Ardener, 1970). This is distinct from the definition of witchcraft used in modern day Wicca and neo-paganism. Practitioners may refer to themselves as 'witches' and seek to conduct rituals based on 'magic' rites, but this is a different phenomenon from the more general understanding of witchcraft, and is not intended to cause harm in any way (Foxcroft, 2017).

In his seminal study on the witchcraft beliefs of the Azande of Sudan, Evans-Pritchard made a distinction between sorcerers, who require external means to practice harmful magic, and witches who possess an innate ability to commit supernatural harm (Evans-Pritchard 1937). Many subsequent anthropologists in their accounts of witchcraft followed this distinction, but it was later identified as inapplicable to many cultures (Hutton, 2017). Throughout this thesis the terms ‘witchcraft’ and ‘sorcery’ will be used interchangeably. In the cases examined within this thesis (although not in the Azande), the effects of being identified as a witch or a sorcerer are generally identical and equally detrimental to the individuals they were applied to.

Hutton (2017), in a large qualitative study of witchcraft across the globe, identified five characteristics shared in cross-cultural conceptions of witches. 1) They have the ability to cause harm by uncanny means, and so often provide an explanation for misfortune 2) they are an internal threat to communities and attack those within them 3) they work within a tradition 4) they are evil, and motivated by malevolence 5) they can be resisted by various means, which range from benevolent magic to physically attacking the witch.

Beliefs in magic and ‘good’ witchcraft are not a focus of this thesis. Good witchcraft often consists of ‘counter-magic,’ intended to prevent harm and misfortune, including that caused by witches. It features the use of charms and talismans to protect their bearers (Frazer, 1922; Richards, 1935). Although good magic, or at least non-harmful magic, is a key part of witchcraft belief systems, it is distinct from the form where particular individuals acquire a reputation as a practitioner of harmful magic, and which can lead to severe consequences for them. A belief in harmful witches is more intrinsically tied to the social relations of a community than the use of charms, spells and rituals to ward off bad luck, and usually has a pronounced effect on the behaviour of others towards the accused.

Previous research on witchcraft

Much of the work undertaken by more recent researchers, and the studies in this thesis would not have been possible without the previous thought and research of

social anthropologists and historians. Here I will outline some of the past research on witchcraft beliefs and accusations.

Social anthropology

Anthropologists conducted pioneering fieldwork, mostly in the nineteenth and twentieth centuries, in cultures across the globe. They conducted participant observation within societies, recording details of daily life, social organisation, values, economic systems and material culture, amongst other features. They often documented witchcraft beliefs extensively.

Social anthropologists also produced various theories about the function of witchcraft beliefs within societies. Evans-Pritchard (1937) concluded that a fundamental aspect of witchcraft belief among the Azande was its use as an explanation of misfortune. A famous example of this relates to the collapse of granaries, as occasionally happened in Zandeland. The people sitting beneath a granary when it fell might be injured. It was acknowledged by Evans-Pritchard's informants that this happened because termites had destroyed the supports, and the wood had decayed through age. But 'why should it have collapsed at the particular moment when these particular people were sitting beneath it?' The coincidence of the timing of the collapse and the fact that those particular people were sitting under it is explained by witchcraft (Evans-Pritchard 1937: 69-70). Other anthropologists noted similar explanatory schemata in the societies they studied: Monica Hunter recounted that the Pondo ask why a louse has bitten one individual rather than another? Who was responsible for sending the louse? (Hunter, 1936). This seems to be a universal aspect of witchcraft beliefs: an unfortunate event occurs, which is usually illness or a death, but can also be loss of a job, a poor harvest, livestock sickness or an accident, and a witch is sought as an explanation (Behringer, 2004).

Evans-Pritchard also highlighted just how omnipresent witchcraft beliefs were among the Azande, and how much they were inextricably linked into the patterns of thought and behaviour in everyday life (Evans-Pritchard, 1937; Behringer, 2004). Other anthropologists before and after him made similar observations, such as Malinowski (1953) in his study of the Trobriand Islanders, where beliefs in magic

and harmful sorcerers, who were thought to be the cause of most deaths and illnesses, were interwoven into everyday life.

Witchcraft beliefs were thought to support the prevailing social and moral systems, or to act as a form of 'homeostatic control' within societies (Douglas, 1970).

Witches and sorcerers were often characterised as antisocial or unwilling to adhere to the norms of societies, and so the fear of being accused encouraged conformity, and adherence to social norms, and generous behaviour towards others (Kluckhohn, 1944).

Somewhat conversely to the idea that witchcraft beliefs regulated social relationships, anthropologists have also explained witchcraft beliefs as a form of 'social-strain gauge' (Marwick, 1970), which reflected the forms of tension present in a community. Where patterns of hostility and competition arose, for example in relation to unequal power and wealth, or between neighbours who were rivals in some way, or between co-wives in polygynous marriages, witchcraft accusations occurred (Douglas 1970). Anthropologists noted that the way societies were organised, in terms of their social and political structures, produced patterns of conflict and competition, which were liable to produce related patterns of witchcraft accusations (e.g. Marwick, 1952; Turner, 1957; Wilson, 2002).

Accusations were therefore a result of unresolvable tensions in social relations, and a means of expressing otherwise unacceptable aggression (Kluckhohn 1944). Accusations enabled individuals to sever ties where they became onerous (Douglas, 1991).

These observations are obviously related to questions such as who was most likely to be accused and why. In many societies, accusations seemed to occur most often between individuals who interacted frequently, such as close kin and neighbours, leading Geschiere (2003) to famously describe witchcraft as 'the dark side of kinship'. But there were others, such as the Navaho, or societies in such as the Abelam in New Guinea, where witches were thought to be members of nearby hostile communities (Forge, 1970; Kluckhohn, 1944). Witches are characterized

across societies as having an antisocial disposition, and being motivated by spite, malice and envy (Sanders, 1995).

Historical investigations of witchcraft beliefs and accusations

Historians also conducted investigations into witchcraft beliefs and accusations. The objects of their studies were no longer alive for them to question, but they had access to many detailed written accounts of trials (Macfarlane, 1970; Thomas, 1970). Many of the questions they asked were similar to those of the anthropologists: who was accused and why? Which social conditions were associated with accusations? Why did some areas have an excess of witch-hunting while others were free from it? (Boyer & Nissenbaum, 1976; Levack, 2016; Macfarlane, 1999).

Similarly to anthropologists, historians identified accusations as arising in relationships where there was conflict and tension. Boyer and Nissenbaum (1976) conducted a detailed study of the famous witch trials in Salem, Massachusetts. They concluded that a number of factors had contributed to the flurry of executions in 1692. They were a result of a historic factionalism dividing the community, caused in part by differences of opinion over the village's economic relationship with the nearby Salem town, and exacerbated by a lack of authority that could have assisted in resolving the conflict. The factionalism described by Boyer and Nissenbaum is similar to the village antagonisms described by anthropologists such as Victor Turner (Turner, 1957) among the Ndembu in Zambia. They often resulted from arguments and grudges between neighbours, and those who knew each other well, but not necessarily between family members (Thomas, 1970; Boyer & Nissenbaum, 1976; Macfarlane, 1999).

Historians working on societies within Europe also noted that witchcraft was a common explanation for misfortunes, such as accidents, deaths and illnesses that befell humans and livestock (e.g. Macfarlane, 1999; Sharpe, 1997). In early modern Essex, causing the death of humans was the most common cause of accusations, followed by agricultural misfortunes, such as the loss of butter and beer, or

accidents to equipment (Macfarlane, 1999). As in African societies, European witches were thought to be motivated by envy (Briggs, 2002).

Many historical investigations have focused on the European ‘witch craze’ of the early modern period, which lasted from around 1520-1750 (Levack 2016). This lasted for longer and produced more victims than any similar outbreak of witch-hunting (Harris, 1974). The intensity of the search varied from country to country: the largest numbers of suspected witches, accounting for nearly half of all prosecutions, were in the German lands of what was at the time the Holy Roman Empire, whereas countries such as the Netherlands had relatively few trials (Levack, 2016).

Briggs (2002), who researched witch trials in north-east France, made an observation which could equally apply to Bantu villages in sub-Saharan Africa: that it is hard for us in larger and more amorphous modern communities to imagine the levels of direct competition that arose between neighbours in small-scale societies. Individuals lived in greater proximity to one another, and had much lower levels of mobility. It can be envisaged how this was likely to give rise to intense rivalries and conflicts, and where witchcraft accusations perhaps seemed like the only solutions.

How do witchcraft accusations happen?

Here I give a narrative outline of how witchcraft accusations tend to occur. This refers to the Bantu societies that the studies in chapters 4-7 are based on, but there are similarities between them and accounts of accusations in other cultures.

Witchcraft accusations within Bantu societies tend to follow certain prescribed patterns. In the majority of the Bantu societies examined here, there is no such thing as a natural death, except among the very elderly (e.g. Brown & Hutt, 1935). The supernatural agent responsible may be an ancestor, or perhaps the death will be attributed to the breaking of a taboo. Which supernatural force is responsible may be left to the adjudication of a diviner. Sometimes there is little hesitation over who the ‘witch’ is, in which case a diviner is not consulted, and accusations and ‘retribution’ follow immediately. Cagnolo (1933: 152) writing about the Kikuyu, illustrates a common sequence of events in a witchcraft accusation:

‘Two persons live on unfriendly terms. One of them, being a victim of some misfortune, will accuse his enemy of witchcraft. Although the latter may protest his innocence, no one will believe him unless he submits his will to the judgement of God.’ The judgement of God relates to an ordeal, intended to remove any doubt as to who is the witch responsible for the misfortune.

The most common form of ordeal, found throughout the Bantu societies, is the poison oracle. The suspected witch or witches are given a dose of a poisonous substance. The Tiv and the Kpe used a mixture of sasswood bark (Ardener, 1956; Bohannan & Bohannan, 1953), the mixture the Kamba used was made from datura (Penwill, 1951), and *Erythrophleum guineense* was used by the Bemba (Gouldsbury & Sheane, 1911). These mixtures were often fatal unless vomited after ingestion: therefore if the accused vomited the mixture they were innocent, and if they died then they were guilty (Gouldsbury & Sheane, 1911). The poison ordeal did not always kill the accused, but signs of intoxication were taken as proof of guilt, and they might be hanged, or buried alive, or stoned to death (La Fontaine, 1959; Torday & Joyce, 1905) or subjected to some other form of brutal execution. Some cultures, such as the non-Bantu Azande, might give poison to chickens representing the accused, rather than the accused themselves, but this could also be a precursor to determine whether the accused should undergo the ordeal (Evans-Pritchard, 1937; Stannus, 1922).

Other forms of ordeal also took place to determine whether an individual was guilty of using witchcraft, including holding hot iron or licking a red-hot knife: an absence of injury showed the accused was innocent (Lambert, 1956).

With divination, the person who believes they have been bewitched, or their friends and relatives if they have died or are very sick, visit a witch doctor to find out who the witch responsible is. Diviners can be pivotal in an accusation, and the main driver of the identification of a particular ‘witch’. But more commonly, the diviner either receives hints and suggestions from the interested parties as to who the witch might be, or already has an inkling from their knowledge of relationships in the community (Hunter, 1936). ‘Smelling out’ is another procedure used to detect

witches, such as in the Yao and the Tswana, where a diviner ostensibly identifies the witch by scent (Brown, 1926; Stannus, 1922). The process of divination and ordeals appear to be effective in tagging a particular individual as a witch:

‘One who has been found guilty has little chance, in spite of all denials, to convince and alter public opinion, whose implicit belief in the diviner’s power to detect a criminal, makes it impervious to claims of innocence. Some individuals when accused, go to another diviner and seek to get a reversal of the charge. In this they sometimes succeed. Others unable to face the expense, or to find sympathy among their friends whose company is desired for a new test, just take all that comes, not with stoical indifference, but in hopeless resignation.’
(Soga 1931: 87).

Not all accusations result in death. In some, the accused is given a warning, such as a branch or tendril being laid in front of the hut of the ‘sorcerer,’ intimating that he or she should leave the district. If the warning is not heeded, further, more drastic action may follow (Soga, 1931).

In other situations, the accused is asked to perform a ritual to heal the sickness that has led to the accusation. This is intended to be an expression of goodwill toward their ‘victim’, which will lift the witchcraft, and commonly involves spitting or blowing out water or beer, and making a wish for the sick person’s recovery (Heald, 1998; Wilson, 1969). In other cases, individuals are not subjected to any overt form of ‘punishment’ or action relating to their alleged witchcraft. Instead they remain living in their communities, but they may be gossiped about and ostracized, as in the Chinese Mosuo (Mace et al. 2018). And in yet other cases, consequences from being labelled as a sorcerer appear to be very subtle, even when they are thought to have practised harmful witchcraft. Gluckman (1967:101) writing about the Lozi, mentioned an individual who was thought to have recently killed others through magic: ‘S is feared as a powerful witch, though I should not have known it merely through my long observation of the neighbourhood. People behave normally to him, but with heightened politeness.’ In some societies, the belief that an individual is a witch who practices black magic does not necessarily lead to an accusation, or to any sanctions against that individual. Instead,

accusations will only be directed towards that person following sickness or death (LeVine, 1963).

On some occasions, such as the death of an important individual, accusations seem to occur regardless of social relations, where it is more important that someone is held accountable for the death than anything else (e.g. Johnson, 1922). There are also societies where following a death, accusations do not appear to relate to particular social relationships, but instead the *mwavi* ordeal is administered to a group of individuals, and those who die are considered guilty (e.g. Werner, 1906).

In her study of witchcraft accusations against women in western Bengal, Chaudhuri (2012) identifies a typical pattern of a witch-hunt:

- The first step involves some preceding conflict between the accuser and the accused, and the accuser typically stands to gain something after the hunt.
- The second step involves the manifestation of witchcraft that usually takes the form of illness in the family of the accuser.
- The third step consists of the identification of the witch and a whispering campaign against her.
- The fourth step involves a trial, either formal or informal.
- The final step involves the witch-hunt where the entire village attacks the accused witch.

Such steps are very comparable to cases in the Bantu, although the latter often include the role of diviners and ordeal tests to determine the guilt of the accused. Many ethnographers record acknowledgements by their informants that particular diviners can be fraudulent, but this does not prevent widespread belief that some are accurate (Bullock, 1950; Soga, 1931).

This quote, from Winter (1963: 283) writing about the Amba, suggests how witchcraft beliefs were experienced in some societies:

‘By the time a man has reached the age of thirty or so it is almost inevitable that at least one of those closest to him, his mother or his father, a wife or one of his

children, will have died, having been killed, he will believe, by the witches. The hatred which he must feel towards those fellow villagers whom he thinks responsible can well be imagined.’

Evolutionary theory of witchcraft beliefs

Social anthropologists and historians have carried out research, and published much valuable information on witchcraft beliefs and accusations. However although such research synthesizes and compares findings (e.g. Levack 2016, Briggs 2002; Behringer 2004), much of the focus has been on patterns within individual societies.

A very notable exception to this is Hutton (2017), who, working within a narrative perspective, produced a detailed cross-cultural comparison of over 300 cultures across the globe, to examine shared beliefs surrounding witchcraft. His study produced the information on the worldwide characterisations of witches described above. There are limitations to narrative and similar approaches however, in that they may not be as systematic or robust as quantitative methods in identifying patterns. Hutton did not systematically code traits which might have produced stronger inferences, for example about how often witches are believed to kill people (Singh 2019).

There are three main, broadly overlapping evolutionary approaches used to study human behaviour: human behavioural ecology, cultural evolution, and evolutionary psychology. There is more overlap between the former two, and they are more applicable to the content of this thesis; therefore here I will focus on human behavioural ecology and cultural evolution. I will then provide a more specific outline of how witchcraft beliefs and accusations may operate in an evolutionary framework.

Human behavioural ecology

The primary discipline of this thesis is human behavioural ecology (HBE), which is a sub-discipline of evolutionary anthropology. Behavioural ecology originally focused on the behaviour of non-human animals (Cronk, 1991; Davies, Krebs, &

West, 2012). It is concerned with how a behaviour adopted by an individual animal in a given environment influences its Darwinian fitness, or to promotes its ability to survive and produce mature offspring. Different behaviours maximise fitness in varied environments (Smith, Borgherhoff, Mulder & Hill, 2001). Behavioural ecology was extended to the study of humans (Cronk, 1991).

HBE is focused on the core principle that human psychology and behaviour have evolved to maximise reproductive success, or the passing of genes to the next generation. Traits will be selected for if they enable individuals to survive and reproduce more successfully in particular environments, and are adaptive if they increase an individual's fitness in relation to the mean population fitness. These traits can be cultural as well as biological (Richerson & Boyd, 2005).

Inclusive fitness is an important concept, and has relevance to this study.

Organisms have direct fitness, where they reproduce and pass their own genes on to the next generation. They also have indirect fitness: by assisting individuals whom they are likely to share genes with (i.e. relatives) to survive and reproduce, they are increasing the probability that their own genes are passed on to the next generation. Together, direct and indirect fitness comprise inclusive fitness (Hamilton, 1964a, 1964b). Therefore, individuals should preferentially assist close kin. This is not always the case, as I discuss at other points in this thesis.

Following Tinbergen (1963) and Mayr (1961), behavioural ecology distinguishes between different forms of explanation for behaviours, which are not mutually exclusive. Proximate explanations encompass the ontogeny of a behaviour, which often relates to the development of the trait over a lifetime, and includes both learning and genetic inheritance. Proximate explanations also deal with the mechanisms of a trait: what is the immediate motivation or cause of a behaviour? Proximate causes include physiological and psychological mechanisms, and culturally transmitted knowledge (Cronk, 1991). Ultimate causes of behaviour relate to 1) its phylogeny, or the evolutionary history of that behaviour; when it arose and why it has followed a particular evolutionary path, using comparisons with other species, and 2) its adaptive benefits, or how it contributes to passing genes to the next generation.

Religious beliefs may be a proximate solution to the problem of why humans cooperate with one another, in that they explain how cooperation might work (Scott-Phillips, Dickins, & West, 2011). Similarly witchcraft beliefs may be a proximate mechanism for obtaining resources or otherwise gaining an advantage over competitors.

At first glance, witchcraft beliefs appear unlikely to contribute to human survival and reproduction: they are harmful and destructive for those who are accused, and accusations also frequently occur between close family members (Geschiere, 2003). Other evidence also suggests they contribute to the decline of trust and cooperation within societies (Gershman, 2016; Golooba-Mutebi, 2005). But it can be seen how they may be adaptive for accusers in certain situations. Individuals benefit from the removal of others they are competing with, who are a threat to them, or are burdensome in some way. A successful accusation means an accuser may gain further resources or prestige: factors which are thought to provide benefits that may contribute to an individual's lifetime ability to reproduce, for example by enabling access to larger support networks (Lyle & Smith, 2014; Power, 2017).

The fact that accusers may benefit from accusations, or that allegations of witchcraft are a result of competition does not mean that fear of witchcraft is not genuine. In the same way that cooperative behaviour can be motivated by feelings such as emotional closeness or sympathy (Kurzban, Burton-Chellew, & West, 2015), the emotions involved in accusations may stem from genuine fear of bewitchment (Hutton, 2017).

Cultural evolution

Culture can also be an adaptation to environments. This is particularly true for humans, who have cumulative culture, where the acquired knowledge of past generations can be transmitted to individuals who do not have first hand experience of a particular problem. Therefore the sum of knowledge available to an individual is greater than they could acquire alone (Acerbi & Mesoudi, 2015; Mesoudi, 2011; Richerson & Boyd, 2005). The premise of cultural evolution is that cultural traits

(or information, knowledge and values that are acquired through instruction or imitation) are transmitted between generations in a similar manner to genes (Boyd & Richardson, 1985; Cavalli-Sforza, Feldman, Chen, & Dornbusch, 1982; Darwin, 1871). As with genes, traits can be adaptive: those that promote survival and reproduction will increase in frequency throughout the population, and can be subject to the forces of selection (Dawkins, 1989).

But cultural evolution is not wholly analogous to biological evolution. Culture can be transmitted horizontally, or from peer to peer, as well as vertically between generations. There are forms of biased transmission, where some cultural variants are preferentially adopted over others, such as conformity bias (where individuals conform to the behaviour of the majority) and prestige bias (where individuals copy the behaviour of high status individuals) (Richerson & Boyd 2005).

Culture produces far more variation between human societies than genetic variation, and the range of human variation is vast (Pagel & Mace, 2004; Richerson & Boyd, 2005). Culture is crucial to human societies. There is a range of opinion on how much cultural traits tend to be adapted to the environment they are in. Some researchers have suggested that nearly all 'irrational' or superstitious behaviours make sense in the light of the environment they develop in (Harris 1985). For example, in Fiji taboos against eating shellfish while pregnant are thought to target the most toxic species, decreasing the probability of women developing fish poisoning (Henrich & Henrich, 2010).

But cultural traits are not necessarily adaptive (Boyd & Richerson 1985; Cavalli-Sforza & Feldman 1982). The processes used in determining the adoption of traits by societies, such as conformity and prestige bias, are decision-making tools for rapid acquisition of new information in unstable environments that can be maladaptive (Richerson & Boyd 2005). Richerson & Boyd (2005) identify witchcraft beliefs as an example of a cultural maladaptation, which are maintained in societies because 'evidence' of their existence is thought to occur through selectively ignoring factors which do not support the beliefs, and finding spurious evidence that appears to support them. This is a plausible explanation for why belief in witchcraft is maintained within societies when there is no evidence that it

is being practised. However it is also the case that witchcraft beliefs may be adaptive, if they enable individuals to rid themselves of competitors or otherwise difficult individuals.

Supernatural beliefs, cooperation and reputation

Reputational concerns are linked with the supernatural beliefs. Witchcraft may be a mechanism to damage the reputation of competitors (Mace et al. 2018). Identifying an individual as a witch may act as a negative reputational ‘tag’ that allows other individuals to sever cooperative ties with the accused (Antal et al., 2009; Douglas, 1991). This aligns with aspects of the evolutionary literature on cooperation.

The study of cooperation has formed a major part of research into the evolutionary aspects of human behaviour. From the perspective of natural selection, cooperation has frequently been labelled as a ‘puzzle’: when individuals are selfishly competing to survive and reproduce, why cooperate (e.g. Nowak, 2006, 2012; Rand & Nowak, 2013 Axelrod & Hamilton;)? Cooperation here is defined as a behaviour that has evolved because it provides a benefit to another individual (the recipient), and is selected for because of its beneficial effect on the recipient (West, Griffin, & Gardner, 2007). This includes when an act is beneficial to both the actor and the recipient (mutual benefit) and when an act is costly to the actor and beneficial to the recipient (altruism) (West et al. 2007).

Cooperation exists where there are mechanisms to promote it. Kin selection is one such mechanism: where there is a possibility that individuals share genes, assisting kin to survive and reproduce (for example by sharing food or providing childcare) leads to a higher likelihood that one’s own genes are passed on to the next generation (Hamilton, 1964a, 1964b; Maynard Smith, 1964). Cooperation among kin is the main form in which nonhuman animals cooperate, and humans also tend to cooperate the most with individuals they are closely related to (Kurzban et al., 2015).

But humans also cooperate extensively with individuals they are not related to. Reputation is a universal feature of human social systems (Macfarlan & Lyle,

2015), and is thought to be a key mechanism in promoting cooperation with non-relatives (e.g. Barclay, 2004; Milinski et al., 2001; Milinski, Semmann, & Krambeck, 2002; Martin A Nowak, 2006; Trivers, 1971). Reputation refers to the opinion held by others about a particular actor, including information about their past behaviour, such as their adherence to social norms and willingness to cooperate, which can be used by others to estimate future behaviour (Roddie, 2019). Individuals who have a good reputation for prosocial behaviour (or a good reputation in other domains) will be viewed as more desirable partners, because of their willingness and ability to provide benefits to others. This means that the actor, as a more desirable partner, is likely to receive more benefits, such as cooperation and assistance, from others. Individuals therefore have an incentive to build and maintain a good reputation and avoid a bad one. A bad reputation from failure to cooperate can lead to punishment (Fehr & Gächter, 2002).

A large number of mechanisms can be grouped under the broad heading of reputation. Direct reciprocity, also known as reciprocal altruism, involves an actor performing an altruistic act for a recipient. A reciprocal altruistic act is undertaken by the recipient for the original actor at a later date, so that both participants gain a net benefit (Trivers, 1971). Indirect reciprocity refers to cooperative acts performed by one actor, which benefit a recipient, and other individuals then decide to cooperate with the original actor on the basis of that act (Nowak & Sigmund 2005; Alexander, 1987). Biological market theory refers to the competition for partners (both in relation to mating but also in terms of cooperative partnerships), and places an emphasis on individuals' 'market value' relative to others in the environment, or their ability and willingness to provide benefits to others (Barclay, 2013, 2016; Hammerstein & Noë, 2016; Noë & Hammerstein, 1994). One aspect of biological market theory is competitive altruism: individuals compete to be more helpful and generous in order to be selected as partners (McNamara, Barta, Fromhage, & Houston, 2008; Roberts, 1998; Sylwester & Roberts, 2013; Raihani & Smith, 2015).

Biological market theory emphasises that individuals may be sought as partners not just because of their cooperativeness, but also for their strengths in other domains such as knowledge and competence. For example, a study of agro-pastoralists in

Peru, and bay-oil producers in the Dominican Republic, found that a reputation for economic competence was more predictive of being sought as a cooperative partner than a reputation for prosociality (Macfarlan & Lyle 2015).

Signalling is a further aspect of reputational cooperation, where individuals perform costly prosocial acts, which are thought to convey underlying information about their quality as a partner (e.g. Bliege Bird & Power, 2015; Bliege Bird, Ready, & Power, 2018; Roberts, 1998; Smith, Bliege Bird, & Bird, 2003; Zahavi, 1995).

Because an individual's reputation may determine whether they are chosen as cooperative partners by others, and preferably by those who are most willing and able to provide them with benefits, humans engage in reputation management. People are more likely to behave cooperatively if they are aware they are being observed by others: they are more likely to donate blood (Lacetera & Macis, 2010), sign up to an energy-reduction scheme that is inconvenient for individuals but overall a public good (Yoeli, Hoffman, Rand, & Nowak, 2013), and to donate more in experimental economic games (Barclay & Willer, 2007; Sylwester & Roberts, 2010) when their decisions are made public.

Reputation, gossip and ostracism

Monitoring others' reputations and transmitting information about their past behaviour is therefore central to maintaining one's own social relations: gossip is a useful tool for this. Gossip is defined as the exchange of information between individuals about another person who is not present (Giardini, 2012). Gossip has been identified as a multi-purpose phenomenon, which among other factors may facilitate social bonding (Dunbar, 1996; Dunbar, 2004). Gossip can be used to exchange information about other peoples' cooperative behaviour even if it has not been witnessed directly (Dunbar, 2004; Feinberg, Willer, & Schultz, 2014).

Research suggests that information transmitted through gossip can be used to select whom to cooperate with, and leads to the ostracism of those who behave selfishly (Feinberg et al., 2014; Sommerfeld, Krambeck, Semmann, & Milinski, 2007; Wu, Balliet, & Van Lange, 2016b). Ostracism is defined as social exclusion (Lindström & Tobler, 2018), and it is an effective form of punishment: those who are ostracised

no longer have support from group members, do not have access to assistance or any other benefits that come from cooperative partnerships, and are generally at a significant disadvantage (Feinberg et al. 2014).

Gossip can also be used as a strategy to manipulate the reputation of others, to benefit oneself (Nowak & Sigmund, 2005). It can be used to provide negative information to others about competitors, or to withhold positive information, enabling the gossiper to enhance their own status. Gossip appears to be a significant factor in producing witchcraft accusations: information is shared among members of a community about who the witch or witches are thought to be, who are to be held responsible for a particular misfortune (Chaudhuri, 2012; Stewart & Strathern, 2004).

Witches are often seen as scapegoats for misfortune (see above). But one question that has rarely been addressed using quantitative research is how individuals' behaviour towards others may be associated with their reputation as a witch. Does uncooperative or antisocial behaviour mean that individuals receive a tag as a witch or a sorcerer (Jordan, 2018; Mace et al., 2018)? Being vigilant to potential threats from partners or others in the environment is probably an evolved tendency (Raihani & Bell, 2019), which may lead to the severance of cooperative ties, or removal of individuals who may have harmful intentions, through witchcraft accusations. If a sceptical approach is taken to the idea that people are performing black magic, can the fact that particular individuals are targeted be related to their behaviour? This is obviously an area where collecting data is problematic, as people are often reluctant discuss such issues (Secker, 2013).

Ostracism in terms of being socially excluded, but also in the more extreme aspect of being expelled from a community, is a common outcome of witchcraft accusations (Bleek, 1976; Gershman, 2016; Junod, 1912; Kluckhohn, 1944). Some research, using either experimental economic games or computer modelling, demonstrates that ostracising 'defecting' cooperative partners leads to assortment between more cooperative individuals, or to the evolution of cooperation (e.g. Feinberg et al., 2014; Nakamaru & Yokoyama, 2014). Once ostracised, individuals may cooperate more in future interactions. Mace et al. (2018) examined whether

individuals who were avoided by others as ‘zhu,’ or witches, among the Mosuo of China, were uncooperative. They found no evidence that individuals given this ‘tag’ were any less cooperative than others in the population, in either their real-world behaviour or in economic games.

Ostracism may also, like gossip, be motivated by competition on the part of the individuals doing the ostracising, rather than a lack of cooperation on the part of the individual who is ostracised. Abbink & Doğan (2019) formulated an economic game, which they dubbed ‘the mobbing game’ which has clear parallels with witchcraft accusations. This game examined how groups mob a particular individual. In one treatment there was some evidence that victims were selected because they were different (identified by another colour to the rest of the players so that they stood out), but the biggest predictor of how the mobbing victims were selected was related to wealth: the richest players were mobbed the most.

There has been less empirical testing of reputational theories in situations where individuals have bad reputations. Some research suggests that individuals who are viewed as uncooperative are less likely to receive benefits from others (Price, 2006). Theory predicts that negative reputational tags will lead to the withholding of cooperation from those individuals (Antal et al., 2009; García et al., 2014).

Cross-cultural quantitative studies of witchcraft beliefs

The first large-scale quantitative of witchcraft beliefs was undertaken by Gershman (2016). The study examined how belief in witchcraft was correlated with a decline in trust and social capital in 19 sub-Saharan African countries. Although the intention behind Gershman’s study was not to test evolutionary hypotheses, the correlation with a decline in trust suggests that it may be associated with competition between individuals.

A further quantitative cross-cultural examination, also using an economic approach, tested a number of hypotheses for the phenomenon of the European witchcraft trials (Leeson & Russ, 2018). In a very thorough analysis, the authors used data on 43,000 people tried for witchcraft in 21 countries. They examined a number of

hypotheses. Their results suggested the most important factor in explaining increases in witchcraft trials was intensifying competition between the Catholic and Protestant churches for members.

Singh (2019) conducted a cross-cultural investigation into how the development of beliefs in malicious magical practitioners, including witches and sorcerers, can be explained through cultural selective processes. He identified a selection for intuitive magic, a selection for plausible explanations of misfortune, and a selection for demonizing myths that justify mistreatment. Singh's objective was slightly different from that of this thesis, in that he sought to explain how cultural selective processes have produced particular beliefs in practitioners of malicious magic. It relates more to social conceptions of witches and sorcerers, rather than to patterns of accusation that target particular individuals, or to the ecological conditions they evolve in.

Topics of enquiry

The literature to date has suggested several topics for enquiry which could usefully contribute to the understanding of how witchcraft beliefs evolve in societies. These are set out below.

Witchcraft beliefs and ecology

In examining the evolution of witchcraft beliefs, it is pertinent to ask what types of society they occur in. Previous research has examined this, but there is little consensus on why such beliefs arise in some societies but not others (Evans-Pritchard, 1937; Kluckhohn, 1944; Douglas, 1970; Hutton 2017). There is an association between witchcraft beliefs and agricultural societies with weak legal systems and low state development, whereas they occur with far less frequency among hunter-gatherers. They also occur to an extent among pastoralists (Koning, 2013; Swanson, 1964). The general explanation for these differences is that witchcraft beliefs are exacerbated by social inequalities (Macfarlane 1999; Winter, 1956): in general agricultural societies have greater inequality in wealth and

inheritance. Hunter gatherer societies tend to have greater equality in how resources are distributed (Borgherhoff Mulder et al., 2009; von Rueden, 2019).

The difference in levels of witchcraft belief between these forms of society could also be explained by how mobile or sedentary they are. Where conflict and disputes arise between individuals, in more mobile societies such as pastoralists and hunter-gatherers, it is possible for individuals to separate more easily than in sedentary agricultural groups (Koning, 2013; Briggs, 2002).

Research has also examined how witchcraft beliefs relate to social organisation. Kinship structures, such as descent, or how individuals trace their ancestry and inheritance, and post-marital residence, or where couples live after marriage, can have a huge influence on patterns of competition and cooperation within societies (Opie et al., 2014; Stone, 2006). Murdock (1980) in a cross-cultural study, found witchcraft beliefs were associated with patrilineal descent, where descent and inheritance are traced through the male line. But witchcraft beliefs have also been documented among societies where descent is traced through the maternal line (Beidelman, 1967; Mace et al., 2018).

Murdock, Koning and Swanson's studies are, to my knowledge, the only cross-cultural quantitative examinations of whether witchcraft beliefs arise in relation to particular patterns of descent and post-marital residence. There have also been studies that examine the relationship between societal traits and the distribution of witchcraft-related concepts such as the evil eye, where individuals can cause harm to others through a simple glance (Gershman, 2015). The evil eye belief is discussed in greater detail in Chapter 6.

Witchcraft and sex

Despite the common perception that individuals accused of witchcraft are usually old and female, there are in fact a substantial number of societies where men are more likely to be accused of witchcraft than women, or where witches are equally likely to be of either sex (Geschiere, 2015; Levack, 2016; Briggs, 2002; Singh 2019).

Previous research has investigated how the targets of witchcraft accusations vary by sex in different locations (e.g. Levack 2016; Briggs 2002). During the early modern witch craze, women were the victims of the majority of accusations, making up around 75% (Briggs 2002). However, more men were accused in particular localities such as Iceland, Normandy and Russia (Kivelson, 2003; Levack, 2016).

Authors have also discussed why a particular sex might be accused in the society they are studying. Where those targeted are female, a common explanation is that witchcraft accusations are a means of enforcing the patriarchal oppression of women (Barstow, 1988; Nathan, Kelkar, & Xiaogang, 1998), and that as women are lower in status they are more likely to be used as scapegoats. Where witches are male, explanations more frequently suggest that sex is a secondary factor. For example in Russia, the greater number of male witches has been explained by the fact that men were more likely to fit into certain problematic categories, such as itinerant vagrants, or folk-healers, who were viewed as posing a threat to the established social order by the upper classes (Kivelson, 2003)

However, there have not been any quantitative examinations, or explanations, for why the sex most commonly thought to be witches varies cross-culturally, or how this may relate to society level-traits. Evolutionary explanations of witchcraft beliefs may offer a further level of insight into why a particular sex is targeted more than the other. If witchcraft accusations are frequently the result of competition between individuals, then the focus of competition may indicate where one sex is more likely to be accused than the other. The competition may be a result of broader patterns in a society, or between individuals. There have not been any quantitative studies, beyond descriptive statistics, examining why accusations at an individual level target one sex or the other.

Witchcraft, social inequality and reasons for accusations

Witchcraft beliefs are also frequently associated with economic factors, and particularly with inequality between individuals. Witches are thought to be motivated by envy, and to use nefarious means, such as killing their own relatives, in order to acquire worldly success. Poor environmental conditions which led to

resource scarcity have been correlated with rises in witchcraft accusations both in Tanzania and in Europe (Miguel, 2005; Oster, 2004).

As previously mentioned, witchcraft beliefs have been associated with societies in which there is greater inequality, or where there are clear differences between individuals in terms of wealth and status. Accusations can be targeted at the rich and successful, who must have achieved their wealth through witchcraft, by those who are less well off. Those with greater wealth may also accuse those who have less, following a refusal of help or resources (Macfarlane, 1999; Thomas, 1971).

The Kaguru seem to exemplify the former situation: ‘Affluent men are often considered witches... A prosperous man may be both dangerous to others and in danger himself on accounts of witchcraft. He may have secured wealth by bewitching others so that he could take advantage of them. But his wealth, especially if he does not share it properly with others, may make other witches jealous of him.’ (Beidelman, 1963: 93).

Why study religion?

Religion, like witchcraft beliefs, has been associated with upholding moral systems. Many religions provide their followers with explicit laws to follow: the religion is a source of moral guidance, when observers have rules such as ‘You must not kill,’ ‘You must not steal,’ ‘you must not commit adultery.’ Early scientific studies on the effects of religiosity found that religious believers tended to view themselves as more cooperative and moral than non-believers (Galen, 2012). The issue for this study is the extent to which this position can be sustained by research, particularly in relation to the belief in moralising high gods.

The relationship between religion, cooperation and prosocial behaviour is less clear-cut than might be expected, and is subject to differing interpretations (Oviedo, 2016). This is due to the complex nature of religious ideas and prosociality, which produces ‘interpretative subtleties’ (Oviedo, 2016: 170). For example, different religious denominations may produce different types or levels of prosocial behaviour.

Hypotheses about how religious belief is associated with prosocial behaviour can be divided into a number of separate mechanisms. These include costly signalling, whereby the costly acts performed by believers signal their commitment to the prosocial principles of the religion (e.g. Irons, 2001; Power, 2017; Schloss & Murray, 2011; Sosis, 2003). There is also the bonding and cohesive effects of ritual (e.g. discussed in Atran & Henrich, 2010; Bloom, 2012; Baumard & Boyer 2003) and, the mechanism this thesis explores, the fear of moralising high gods and supernatural punishment.

Moralising high gods

With the transition of human societies from small foraging bands, to large-scale, complex agglomerations, it has been suggested that different cultural adaptations evolved to sustain cooperation than those used in small-scale societies (Purzycki et al., 2016). A belief in moralising high gods is one of a number of institutions that may be adaptations for cooperation and prosocial behaviour in large-scale, complex societies, where otherwise defection would be straightforward (Bloom, 2012). Moralising high gods are powerful deities who are concerned with human morality, who monitor human behaviour, and dispense punishment or rewards depending on how the behaviour aligns with moral codes (Norenzayan et al., 2016).

Many societies have supernatural agents that do not monitor, punish and reward human behaviour in the same way as moralising gods. Some have ancestors who punish their descendants for neglecting them, but otherwise do not intervene in human morality (Whitehouse et al., 2019). Or there may be gods who are responsible for the creation of the universe but who otherwise take no interest in human interactions.

This study offered the opportunity to add to the literature using a population from Northern Ireland, and also to compare a fear of moralising high gods with reputation as proposed mechanisms for cooperation. A study using similar methodology was carried out in China (Ge, Chen, Wu, & Mace, 2019), which is discussed further in chapter 8.

Overview of thesis structure

This thesis investigates witchcraft beliefs and accusations, and belief in supernatural punishment, using a number of different methods.

Chapters 2 and 3 introduce the methods used in this thesis.

Chapter 2 describes the Bantu Witchcraft Dataset that the studies in chapters 5-7 are based on and gives details of its construction using ethnographic source materials.

Chapter 3 gives details of statistical methodology used in the thesis.

Chapter 4 explores pre-existing datasets to examine what society traits may determine the distribution of witchcraft beliefs in sub-Saharan Africa.

Chapters 5-7 use the Bantu Witchcraft Dataset to investigate: 5) the factors that may influence why one sex is accused of witchcraft rather than the other, 6) what factors predict the reasons for witchcraft accusations and 7) what determines whether witchcraft accusations ‘stick’ to individuals, or have a lasting effect on their reputation, and also what determines the outcome of accusations.

Chapter 8 is based on fieldwork I undertook in Belfast, Northern Ireland, using economic games to compare reputational concerns and fear of supernatural punishment as mechanisms for cooperation.

Chapter 9 provides a conclusion.

Chapter 2: The Bantu Witchcraft Dataset

I constructed a dataset as a resource for testing cross-cultural hypotheses on witchcraft beliefs and accusations in Bantu and Bantoid societies from sub-Saharan Africa. In this chapter I give details on the general principles behind cross-cultural research, some background information on the Bantu societies and why they were selected for this project, and further details on the dataset and how it was constructed. Olympia Campbell, an MSc student at UCL Anthropology, helped to produce the dataset.

Cross-Cultural Studies

Human societies are incredibly culturally diverse, and this diversity far exceeds human genetic variation (Pagel & Mace, 2004). Humans speak ~7,000 languages. They believe in numerous supernatural beings, from the high gods of the Abrahamic religions, to rock and tree deities, to ancestral ghosts, and to witches and demons. Marriage systems range from polygynous, where one man is married to several women, to monogamous, to the rarer polyandry, where one woman is married to several men. Subsistence practices vary from groups of hunter-gatherers to large, complex, industrial economies. Human societies have different material cultures, build numerous types of dwelling to live in, and even have different ways of categorising and conceptualising our environments (Gray & Watts, 2017; Kirby et al., 2016; Mesoudi, 2011; Pagel & Mace, 2004).

Comparative cross-cultural studies have been used for some time as a means of understanding the variation between societies. Cross-cultural datasets can test hypotheses relating to the evolution of cultural variation, which may be shaped by a range of forces including the environment and ecology, shared history, demographics and migration and diffusion (Kirby et al., 2016; Nettle, 2009). The comparison of traits across cultures can be used to answer questions such as how adaptive a trait is in particular environment, and whether particular traits tend to co-evolve with one another (Mace et al., 1994). Recent cross-cultural studies have addressed, among others, topics such as the evolution of kinship systems (Rácz, Passmore, & Jordan, 2019), variation in marriage patterns (Minocher, Duda, & Jaeggi, 2019), whether ritual human sacrifice may have promoted the evolution of

stratified societies (Watts, Sheehan, Atkinson, Bulbulia, & Gray, 2016); and the association between supernatural beliefs and the evolution of political complexity (Watts, et al., 2015).

Cross-cultural databases

The development of databases such as the Ethnographic Atlas (EA) (Murdock, 1967) and the Standard Cross-Cultural Sample (SCCS) (Murdock & White, 1969) in the second half of the 20th century, sparked interest in the comparative cross-cultural method. More recently, a number of online databases that use historic, linguistic and archaeological information have been developed in order to test hypotheses on the evolution of cultural traits in societies. These include Pulotu, a database focusing on supernatural beliefs in Austronesian cultures (Watts, Sheehan, et al., 2015), Seshat: Global History Databank (Turchin et al., 2015), the Database of Religious History (Slingerland & Sullivan, 2017), and D-PLACE (Kirby et al. 2016).

The information contained in cross-cultural datasets is usually coded using historical records, for example from the ethnographic observations of anthropologists and travellers. Many use samples of cultures from across the globe, but others have a more specific geographic focus.

I decided to use societies in the EA and the SCCS to create the dataset. Some of the original variables from the EA have been incorporated into the analyses in this thesis, as they provide pre-coded variables that may have relevance for witchcraft beliefs.

The Ethnographic Atlas

The EA was created by George Murdock (1967). It contains some 1291 societies from various regions of the world, but with an emphasis on North American and African societies. The information was originally published in the journal *Ethnology* (Murdock, 1962). It has coding for over 90 cultural traits (Kirby et al. 2016). The societies are pre-industrial, and range from small hunter-gatherer bands

to large societies with complex economies and political systems. The coding for the societies was initially undertaken by Murdock, using information from ethnographies of each society, and further variables were contributed by other coders (Murdock, 1967). Each society has a focal year, or time period to which the data refer. These range from the nineteenth to the mid-twentieth centuries, with the majority of cultures being documented in the early twentieth century (Kirby et al., 2016).

The Standard Cross-Cultural Sample

The Standard Cross-Cultural Sample (SCCS) is based on a subsample of 186 societies from the Ethnographic Atlas. Murdock's intention was to create a database where cultures were as independent from one another as possible (Murdock & White, 1969), to control for correlations between them that arose as a result of historical relatedness. The sample was also selected to include the best-documented societies from each world region. Because the SCCS contains the societies with more detailed information, it also has a greater number of variables than the EA.

Galton's problem

The cross-cultural approach provides an effective means of examining questions about the processes leading to the evolution of cultural traits in societies. However, as with any methodology, there are also limitations.

One of the main problems identified in using the comparative method to test functional hypotheses about cultural traits is that societies cannot be treated as if they are statistically independent from one another (Mace & Holden, 2005; Nettle, 2009). Correlations between the traits of different cultures may occur because of their shared history and geographical proximity, rather than because traits have a functional association. This was originally identified by Francis Galton, and is known as Galton's Problem (Mace & Holden, 2005). Phylogenetic methods provide a solution to this, because they take the ancestral relationships of societies into account. Although in the process of producing this thesis, it became evident that individual level case studies were often more informative than the society-level data in answering questions about witchcraft accusations, I have also made use of

phylogenetic methodology. Further details on the phylogenetic comparative methods are given in the next chapter.

Why does this dataset use the Bantu?

The Bantu cultures of sub-Saharan Africa were chosen for this study for a number of reasons. Many are well documented ethnographically, and belief in witchcraft is widespread within them. The Bantu were also selected because there are two pre-existing phylogenies of the Bantu languages (Currie et al. 2013; Grollemund et al. 2016).

Bantu languages and the Bantu migration

The Bantu language family has over 400 languages and dialects, covering the geographic region from Nigeria and Cameroon, to central Africa, south and southeast Africa. Bantu languages are a part of the larger Atlantic-Congo language tree (Hammarström, Forkel, & Haspelmath, 2019).

The majority of societies in the dataset fall into the category of ‘narrow Bantu,’ or Bantu proper, which form a subset of the larger group of Bantoid languages (Greenberg, 1963; Guthrie, 1948; Klieman, 2003). There are also a small number of Bantoid societies included, such as the Tiv and the Ekoi.

The Bantu migration is well-documented through linguistic, archaeological and genetic evidence, and explains how the societies and languages came to be widely distributed (Diamond & Bellwood, 2003). The migration is thought to have started in West Africa, from somewhere near the Niger river delta in modern-day Cameroon and Nigeria, around 5,000 years ago (Grollemund et al., 2015). From there, speakers of a proto-Bantu language proceeded to disperse through sub-Saharan Africa, migrating and settling in a vast area. They reached Central Africa, the region of the great lakes in Eastern Africa, and also most of Southern Africa (Grollemund et al. 2015). The migrating Bantu brought farming and iron-smelting techniques, and managed to both assimilate with and displace the hunter gatherer populations related to modern Pygmies and Khoisan people, from the regions they moved to (Klieman, 2003; Diamond & Bellwood 2003).

There are two high-quality, time-calibrated linguistic phylogenetic trees available for the Bantu (Currie et al., 2013; Grollemund et al., 2015). The relatedness between the cultures and the diversification of their traits, the availability of the linguistic phylogenetic trees, and the fact that they form a large cross-cultural sample (Holden & Mace, 2003) makes them an ideal population on which to test hypotheses on the evolution of cultural traits such as witchcraft beliefs and accusations, while controlling for the effects of phylogeny. Bantu societies are relatively homogenous in certain respects: for example almost all of them practice agriculture as their main form of subsistence. They vary more widely in their descent and residence, their levels of stratification, and in other key variables.

The Currie (2013) and Grollemund (2015) trees, along with earlier versions of the Bantu language tree (e.g. Holden & Mace 2003; Holden 2002), have enabled researchers to examine various hypotheses relating to cultural evolution in Bantu societies. Their development allowed for tests of correlated evolution to examine whether traits are functionally related (i.e. a change in the state of one trait increases the probability that there is a corresponding change in the state of the other trait, and vice versa) while controlling for phylogenetic relatedness (Nunn, 2011). Previous studies using phylogenetic trees of Bantu languages have produced a number of findings. Holden and Mace (2003) found that the introduction of cattle in Bantu-speaking societies led to transitions from matrilineal (where descent is traced through the female line) to patrilineal (where descent is traced through the male line) social systems. Moravec et al. (2018) used the Bantu language tree alongside four other phylogenetic trees to examine how post-marital residence patterns, or where couples live after marriage, evolved in different linguistic lineages. They found that post-marital residence patterns were specific to the different lineages, rather than being driven by common evolutionary patterns.

Summary of the Bantu Witchcraft Dataset

We made a dataset containing information on the witchcraft beliefs and other relevant variables, from Bantu and a smaller number of Bantoid societies ($n=80$). There was a broad range of how detailed and available information was for each

society. Some societies only had one ethnography containing information on witchcraft beliefs, although this could be extremely informative, as was the case with the Tsonga, for example (Junod, 1912).

The dataset is divided into two sections. One has 57 variables covering society-level traits. 43 of these variables relate to witchcraft beliefs and practices, including common factors relating to accusations, and ideas about how witches are typically thought to look, behave or acquire their powers. 2 variables relate to other supernatural beliefs, 4 have broader information on the society that is not available in the EA (such as frequency of warfare), 6 relate to the position of women in the society, and one assesses the overall quality of the information available.

The other section of the dataset contains individual case studies of witchcraft accusations, recorded by ethnographers, with 26 variables per case. These include information on the accused witch and the accuser, the alleged victim of the witch (sometimes different from the accuser), the reasons for the accusation and whether or not the case appears to be typical for that society. There are 53 societies with 314 case studies, and the number of cases from each culture ranges from 1 to 47.

Coding the dataset

I started work on the dataset, and then provided Olympia Campbell with training on how I had been coding the variables until that point. The dataset was amended several times: new variables were added by both of us, and previous variables were revised or removed. We were mostly limited to English ethnographies, although we did code a small number that are in French. Eva Brandl, a PhD student at UCL Anthropology, also helped by translating German sources for coding.

Variables were coded from existing source materials produced in the nineteenth and twentieth centuries by anthropologists and used in the Ethnographic Atlas. Each society has a particular time focus: the focal year from the Ethnographic Atlas (Kirby et al., 2016). When relevant, additional sources were used when they seemed reliable and within an appropriate date range. The ethnographies range in date from 1827 to 1983, while the focal years of the societies range from 1830 to

1950. We obtained the details of the ethnographies for each society from the D-PLACE website (Kirby et al. 2016; accessible at <https://d-place.org>). A number of the societies were also coded using the Human Relations Area Files World Cultures database (eHRAF World Cultures: available at <https://hraf.yale.edu>). Overall, several hundred ethnographies were consulted to obtain information for the dataset. The number of ethnographies that were accessible to us and coded for each society varied between 1-11. Societies from the SCCS had more ethnographies and information available than those from the EA alone. Olympia coded 19 societies, and I coded 65. A number of societies without any information on witchcraft beliefs or cases could not be included in the study. A bibliography of the documents used in coding can be found in **Appendix 1**.

Olympia and I coded the same four societies to check the level of inter-rater reliability between us. This was fewer than would be ideal, but it had to be balanced with gathering information on as many societies as possible in the time available. Overall, we agreed on 68% of the coding. Where there was disagreement, we discussed why this had occurred, and came to an agreed rating for each variable. Some variables were more straightforward than others to code. For example, it was easier to note when ethnographers mentioned, or did not mention, whether individuals identified as witches were commonly put to death. Other variables were more a matter of judgement, such as those where we estimated the degree of a particular feature, such as the general position of women in a society. In such instances we were more likely to disagree.

During the process of coding, and with advice from Joseph Watts (personal communication) it became apparent that it would be valuable to use a code sheet to record why particular decisions were made. Code sheets are a record and justification of decisions made by coders (for example how decisions were made between conflicting sources), and to demonstrate the transparency and reliability of the data as far as is possible, but they do not contribute to statistical analyses of the dataset.

Many variables were coded with a large number of categories, so that the information was as detailed as possible. However, this not always useful for

statistical analysis, particularly where sample sizes are small, so in the data chapters variable categories are frequently combined.

How the dataset was developed is obviously crucial in demonstrating its viability as a research tool. Variables and their coding categories were developed in order to provide measures of individual and cross-cultural variation and similarities in witchcraft beliefs and accusations. Some of these were developed with specific hypotheses in mind. Others, particularly a number of society-level variables, were developed to explore variation in the overall pattern of beliefs. The number of categories for some variables expanded as the dataset was developed, as situations that had not previously been accounted for were included. There is inevitably some overlap between variables: for example if a chief is suspected of using harmful witchcraft to maintain his power, this will be accounted for in at least three variables from the individual case study.

Almost all of the variables have exclusive categories, except for a few where more than one category per variable was recorded.

A full list of all variables and summary statistics is provided in **Appendix 2**.

How the variables were created

The dataset was originally focused on individual accusations. I included data on society-level traits as more ethnographers give a summary of their overall understanding of witchcraft beliefs than details of individual case studies, and these traits can be useful for cross-cultural comparison.

Below I give a more detailed summary of the variables in the dataset and how straightforward or difficult they were to code. This gives an indication of how reliable we felt the sources and our classifications were. There can never be complete certainty that some traits (e.g. a society's association of witchcraft with cannibalism) were simply not observed or mentioned by ethnographers, and so could be mistakenly coded as absent when they were present. We ensured the coding was cautious in this respect, so that there are quite a few cases where

variables were classified as 'NA' where they could potentially have been coded as 'absent.'

Many variables in the dataset are intended to capture characteristics of witchcraft accusations and witchcraft beliefs, both in terms of ethnographers' impressions of how they usually happened, and where possible details of specific case studies. Therefore the society-level and individual-level variables often overlap: for example, there is a variable covering the sex that witches are most commonly thought to be in a society, and then the sex of accused witches is recorded separately in the individual cases.

Society level variables

Many of the society-level variables characterise witchcraft beliefs and practices surrounding accusations. They do not always directly relate to particular hypotheses about how witchcraft beliefs evolve, but provide an indication of the variation between societies in the dataset. They could also be used to examine the transmission of cultural traits between Bantu societies. Such variables include whether societies had a poison oracle for determining if individuals are guilty of witchcraft, whether they punished individuals thought to have practised witchcraft by killing or ostracising them, or whether they commonly attributed death and illness to witchcraft and sorcery. We also coded if witches were thought to be cannibals, if witches were believed to be motivated by envy, whether the ethnographer was aware of individuals actually attempting to use harmful magic within the society, the animals associated with witchcraft, and if divination (aside from poison oracles) was used to determine the 'guilt' of accused witches. Further cultural traits were also coded: whether 'witches' powers were thought to be innate or learned, if witchcraft was transmitted from parent to child, whether it was generally thought to follow the paternal or maternal line, and whether witches were believed to be aware of their ability to bewitch others, or whether it was thought possible to bewitch someone unconsciously. These variables were mostly not difficult to code, as authors of ethnographies were unambiguous when they discussed them.

There are variables which record how often witchcraft is used to explain death and illness in societies. These had to be estimated to an extent, but ethnographers usually gave their impression of how often deaths and illnesses were attributed to witchcraft.

Where society-level variables involved categorising a trait by level or degree, the coding was more subjective, as it relied on our interpretation of the ethnographers' descriptions and observations. An example of this is the variable on how much witchcraft (or bewitchment) was feared in a society. Variables like this were included in the dataset because they provide more indication of the variation between societies than just recording the presence or absence of witchcraft beliefs, when almost every society in the sample believes in witchcraft to an extent. Such variables can be used to test predictions relating to the correlation of the level of witchcraft belief with other factors.

The fear of witchcraft would be categorised as high if authors recorded that the population had a high level of fear of black magic, that it was a frequent topic of concern or conversation, that people regularly took precautions against sorcery, and it was often thought to be the cause of negative events. For example, among the Baganda 'sorcery was greatly feared and was a matter of constant concern' (Fallers, 1960: 70). This variable focuses on belief in witchcraft rather than the evil eye. A second variable was added as a further measurement of the level of fear and preoccupation with witchcraft: whether individuals move settlement for fear of witchcraft. This occurred in some societies: when people feared they were being bewitched, they would re-locate, either temporarily or permanently.

Even though a society believes in witchcraft, there may not always be many accusations, and particularly open or public ones. For this reason, I included a variable on how often accusations occurred. This variable was mostly straightforward to code, because ethnographers often stated how frequently they believed accusations occurred. Otherwise it often could be inferred from the text if the account described a number of accusations over the time period of fieldwork.

Societal levels of food shortage and levels of infectious disease were sometimes difficult to categorise. These variables were included because previous research has suggested an association between food shortage, and unpredictable environments, with witchcraft beliefs and accusations, and witches are often thought to cause bad weather and spoil crops (Behringer, 1999; Miguel, 2005; Oster, 2004).

Ethnographers mentioned famine or the spread of particular diseases. Sometimes they were fairly precise, with indications of approximately how often and intensely such things affected societies (some actually gave dates), but categorisation might also have to be based on how often drought or other environmental threats were mentioned in the text. The result is that the categories here may not be very exact, and do not distinguish extensively between societies. This is why in the relevant chapters I have used the data from Botero et al., (2014) relating to environmental abundance and climatic stability, which are more fine-grained and probably more accurate measures.

Ethnographers provided details of the sex they believed was most frequently accused of witchcraft in the societies they studied. These varied in clarity and also in consistency, even between anthropologists who worked in the same cultures. For example, many ethnographers refer to abstract sorcerers as 'he,' but this often appears to be the conventional mode of speech for the period, where male is the default category. For example, in an ethnography of the Kamba, generic witches are referred to as 'he' throughout the text, until the author comments 'It is usually old women who are the victims [of witch-killings], less often old men' (Lindblom, 1916:167). In the Chagga, Raum (1940:114) comments that 'poisoners' (the Chagga term for witches) are invariably women. Dundas (1924), also discussing the Chagga, frequently makes reference to 'wizards,' and describes the art of witchcraft as taught from father to son. He states that 'although a man will not ordinarily instruct a woman in the black art, he may teach it to his wife if he is old and his son very young'. He then goes on to confusingly comment that witchcraft can be practised by and against anyone (Dundas 1924: 164).

Although many ethnographers noted that accusations were more likely to fall on a particular sex, there were enough confusing or contradictory accounts to lead to the inclusion of a further variable to show when this was the case, so that a smaller and

more reliable dataset could be used when required. For the Chagga, the code ended up as ‘both sexes’, and the further variable was used to indicate that it was a difficult coding decision.

The most common situations, relationships and groups in which accusations are thought to occur

For some variables, categories are not exclusive, and all categories that applied were recorded for each society. For example, there might be several forms of relationship commonly thought to lead to witchcraft and accusations. Categories are not exclusive for the variables on the most common relationships between accused witches and their accusers, the most common situations leading to accusations, and also the variable relating to the ‘direction’ of accusations. (The variable on the ‘direction’ of accusations refers to broader relationships between accusers and their targets: in some societies bewitchment accusations are thought to occur within agnatic kin groups; in some societies they are thought to be more likely among affinal kin, and in others they are thought to arise between different lineages.)

In terms of society-level ‘reasons’ listed for accusations, anthropologists usually recorded these clearly and there was less ambiguity than for the individual cases. They include categories such as problems with conceiving and fertility, interpersonal disputes, and the targeting of vulnerable individuals who relied on others for food. The main potential issue with this variable was that the ethnographer might not have systematically listed all possible categories for a society. These ‘reasons’ are separate from the precipitating reasons for accusations occurring, such as an illness, death or an unfortunate event, where a ‘witch’ is sought as an explanation.

Women in Bantu societies

I included variables on the position of women in Bantu societies, given how sex is frequently identified as an important characteristic in determining who is accused of witchcraft. I began with one variable on the general position of women, which was coded according to how much autonomy and status they were thought to have.

This was often a difficult cultural trait to quantify, as there can be broad variation within a society in terms of opinions on women's roles. Further variables were added (on whether women can hold religious and political leadership roles, the amount of choice women had in whom they married, and women's legal status and economic independence) which had more precise outcomes, and so were easier to categorise.

Witchcraft accusations and status

Status is also often salient in witchcraft accusations. Individuals lacking in status may at times imply that they have dark powers in order to acquire cooperation and resources from others. In other instances, accusations may be directed at those who hold power, or those with power may be thought to use witchcraft to enhance it. The society-level variables on the relationship of witchcraft to individuals of high and low were usually unproblematic, but they were not covered by many of the ethnographers.

Witchcraft accusations and profit

A further proximate factor involved in witchcraft accusations is they provide profit for people, such witch-doctors, who are employed in order to identify witches and provide counter-magic to the 'victims'. The classifications in this variable reflect that in some societies it was also possible for chiefs to profit from an accusation: they were able to confiscate wives, goods and livestock from condemned witches (Cory & Hartnoll, 1945).

Witchcraft and other supernatural explanations for negative events

As previously mentioned, witchcraft is one of a range of explanations used by Bantu societies for unpredictable negative events. Other supernatural explanations for misfortune include breaking taboos, the actions of a high god, the disapproval of ancestors and the anger of other gods and spirits (e.g. Fallers, 1960; Junod, 1912; Kuper, 1954; Kirby et al. 2016). Societies vary in how much they attribute misfortune to each of these causes. I began coding the presence of different supernatural explanations separately, along with a further variable indicating how

much emphasis was placed on them in comparison to witchcraft. This was intended as a further measure on the importance of witchcraft beliefs in societies. The separate variables for taboos, ancestors and spirits (high gods is variable EA034 in the Ethnographic Atlas) were later combined into one variable. Although these forms of belief are certainly distinct, and of interest in themselves, combining them streamlined the dataset and reduced the time spent coding for society, while retaining the most important information on the salience of witchcraft beliefs.

Legislation

In the colonial era, many countries introduced legislation against witchcraft accusations, which may have had an impact on how frequently they occurred. A variable was included to indicate whether or not legislation against witchcraft accusations was in place during the society's focal year.

Overall quality of data

The quality of information that could be obtained for each society varied greatly (this is discussed further in the Limitations section). Following advice from Joseph Watts (personal communication) I included a variable measuring, on a scale of 1-5, how detailed and coherent the information is for each of the societies in the dataset.

Individual-level case study variables

These variables were intended to cover as many factors associated with accusations as possible.

Not all cases were accusations that were openly directed at the accused. Some of them could be more accurately described as 'suspicions' (Bleek, 1976) that are based on gossip and rumour, which the accused may or may not have been aware of. This is illustrated by the first of these variables, which records whether there is an open accusation, or whether an individual is thought to be a witch, but does not appear to be particularly targeted or accused despite this.

Accusations are both the result of social relationships, and explanations for unpredictable negative events, and it seemed valid to include details of both in the dataset. As described in chapter 1, often an unpredictable negative event occurred, leading those who were affected to search for the witch who caused it. The identification of the witch would then often be based on who the accuser felt might wish to cause them harm.

There are two types of ‘reason’ or cause that are associated with witchcraft accusations. The first relates to the precipitating misfortune that produces a search for a witch, and this is usually a death or illness. It can also be another category of misfortune, such as crop failure, problems with livestock, an individual’s consistent ‘bad luck,’ or loss of money or employment. Where they were given, precipitating causes of accusations were clear and easy to code.

I included three variables on the precipitating causes of witchcraft accusations (misfortune, death and non-fatal illness), and one concerning ‘success’ which could be both precipitating and an aspect of social relations leading to an accusation. This results from suspicions that an individual has achieved success through underhand supernatural means, or through killing and harming others. The negative events were usually clearly described in ethnographies, when authors recorded them.

From a point of view of understanding how accusations work generally, the use of different precipitating factors is relevant, and could potentially determine how serious an allegation of witchcraft is believed to be, as explored in Chapter 7. This is why an accusation following death variable distinguishes between a single death and multiple deaths. The ‘misfortune’ variable covers a diverse range of situations, as it can include an argument between the accused and accuser, but also situations such as livestock loss or illness, poor harvests, or ‘bad luck’ for an individual such as job loss or damage to property.

Previous research has suggested that witchcraft accusations are a means of removing ‘expendable’ individuals in environments where they are burdensome or there is a shortfall in resources (Brogden, 2001; Miguel, 2005; Oster, 2004). Therefore, a variable was included to record whether people were accused (usually

elderly adults) when they were dependent on their families for food and assistance. This was included in relation to the hypothesis that witchcraft accusations are a means of removing expendable individuals while protecting the reputation of those accusing them.

The age of those involved in witchcraft accusations (the accused, the accuser and the alleged 'victim' or 'victims') was coded in the dataset. Many ethnographers only provided details when those involved were particularly old or particularly young, and sometimes they did not mention them at all. However, it seems likely that the very old or very young were identified as such by anthropologists because these were notable characteristics and which might have a bearing on accusations. Intermediate ages (such as whether individuals were middle-aged or younger adults) were not as easy to differentiate from one another in sources. It was usually possible to tell when those involved were adults, so there are many people categorised as 'unspecified age adult', and a certain amount of context given by ethnographers in relation to situations usually gave an indication of whether the accused was elderly, a child or an adult. The age categories therefore had to be broad. There were also incidences where accusations came from more than one person of either varying or unspecified ages, so these have been classified as 'more than one person' or, when communities appear to be more or less unanimous in identifying a 'witch,' as 'whole community.'

The variable on whether kind behaviour was associated with witchcraft accusations was included as some sources suggested that this could be a factor. There are accounts of accusations where a compliment, for example on a child's beauty, or on the health of livestock, was viewed as a covert expression of envy. If the child or the livestock became sick in the near future, the individual who gave the compliment could be under suspicion of practising witchcraft, or possessing the evil eye (Lindblom, 1916).

I included a variable relating to individuals' long-term reputation as a witch. If this was recorded, it relates to the period before the accusation recorded in the dataset. Some people clearly had reputations as witches that lasted for years, and might have numerous deaths and misfortunes attributed to their magic (Bohannon &

Bohannon, 1969; Gluckman, 1967). These individuals might be particularly vulnerable to accusations when numerous deaths occurred, or other unfortunate events that required explanation. For others, an accusation could arise following a particular incident or situation, that was not based on a person's prior reputation as a witch. And more perplexingly, others appear to have lived in their communities with very little consequences from having a reputation for harmful sorcery (e.g. Geertz, 2011).

Accusations also varied in how widespread a consensus there seemed to be that a particular individual was a witch. It became apparent that for some people, the majority of their community collectively agreed on their reputation for witchcraft, whereas for others, accusations arose in the context of a particular relationship but did not have currency beyond it. In quite a number of cases where accusations occur in particular relationships, but then the accused gains a reputation as a witch in the wider community as well.

One variable categorises the relationship in which an accusation occurred.

'Victims' of witchcraft and accusers are not always the same people: an alleged victim's death may precipitate the accusation. Most cases in this variable describe the relationship between the accuser and the accused. The accuser and the 'victim' are quite often the same person. I found a small number of cases where the relationship leading to the accusation is between the accused witch and their alleged victim: for example if there was an argument and the 'victim' then died, the accusers might attribute this to the witchcraft of the individual the 'victim' had argued with.

Accused sex

As might be expected, this variable records the sex of individuals accused of witchcraft.

Coding for case studies includes the sex of the accused witch, the accuser, and the witch's 'victim/s' if different to the accuser. The sex of the accused witch in individual accusations was one of the most straightforward and reliable variables to

code in the dataset, as it was usually recorded by ethnographers and unambiguous. The sex of the other people involved in accusations was also usually recorded by ethnographers, or could be inferred from the text.

The sex of accusers was sometimes difficult to code as it was less often thought to be relevant by ethnographers, and all that was given was a name or an initial. In such instances where the sex of the accuser was indeterminable, it was listed as 'NA'.

How behaviour and reputation are associated with witchcraft accusations is a central factor in investigating why particular individuals are accused, and it seemed important to incorporate this in the dataset. Many historians and anthropologists indicate that witchcraft accusations associated with a reputation for behaving aggressively, or harmfully, towards others, being less cooperative, and not adhering to social norms (Briggs, 2002; Douglas, 1991; Heald, 1998; Wilson, 1969). But Mace et al. (2018) found that individuals accused of witchcraft were not any less cooperative than others in the community. Therefore this distinction appeared to broadly align with the theoretical divisions made between cooperators and free-riders within the literature on the evolution of cooperation, and particularly that suggesting individuals are ostracised for not cooperating (Axelrod & Hamilton, 1981; Fehr & Gächter, 2000; Nowak & Sigmund, 1998; Nowak, 2012).

Therefore the 'antisocial behaviour' variable has categories that are intended to differentiate between situations when those accused of witchcraft are unpopular and behave 'antisocially', or are seen as difficult by many members of their community, and accusations that occurred as a result of arguments or disputes between particular individuals. The rationale is that individuals in the former category are more at risk from serious allegations of witchcraft that are supported by more members of a community.

The variable covers individuals behaving in number of ways that could be perceived as 'antisocial' or damaging to others, but taking into account that often the definition of antisocial behaviour depends on how it is interpreted by others.

When accused ‘witches’ were categorised as being antisocial in general (or repeatedly in their interactions with different people), this was described in the ethnographies. They might, for example, be described as ‘abusive’ (Beidelman 1963: 92) or someone who enjoys frightening others (Bohannon & Bohannon, 1969: 227), or an example such as Chikikumbu from the Ndembu, who was ‘wild and wayward’ and threatened to kill someone over a game of hopscotch (Turner, 1957: 154).

Another category records situations where the ‘witch’ was thought to be taking revenge, using harmful magic, on a person who they believed had mistreated them.

There is a further category for chiefs who were thought to be using harmful magic against their enemies. Coding distinguished this from a situation when individuals who were chiefs or headmen were thought to use harmful magic against those under their rule.

The relationship between the accused witch and their accuser was difficult to code in some instances, when authors only provided vague information. We mainly dealt with this by adding additional categories, so that as well as ‘father-son’ or ‘brother-brother’ accusations, categories were included where the accuser was an ‘unspecified member of homestead’, or ‘affinal kin’ or ‘agnatic kin,’ of the accused. This meant this variable has a large and unwieldy number of categories, but they can be combined for analysis.

The ‘reasons for accusations’ variable (as distinct from the precipitating causes variables) ended up having a large number of categories to capture the broad variation in circumstances. Reasons for accusations could occasionally be difficult to categorise, when situations were complex but had to be reduced to a single type. In these instances, we selected what appeared to be the most significant factor. For example, a wife’s failure to conceive might lead to arguments between her and her in-laws, and subsequently an accusation of witchcraft. This would be classified as a fertility-related accusation, rather than ‘previous disputes’ as that appeared to be the key issue in the accusation.

Reasons could be inferred from relationships, but we were cautious in coding this and tried to avoid making assumptions about situations unless it seemed obvious. For example, a case where a man repudiates his wife as a witch this would be coded as 'marital problems'. When a small child is accused of witchcraft by his parents and expelled from their home this may well have been due to resource shortages. This is a plausible assumption, but if it is not actually verified in the source, it would be coded as 'NA.' There are also cases where the identification of a particular individual as a witch appears random, and occurs more as a result of strong emotions following a death or illness.

Categorising the 'reason' or situation leading to an accusation could be complex. These are sometimes speculation on the part of the ethnographer, but more usually relate to the details of cases provided by the ethnographers' informants. Although they are often stated unambiguously, they are reliant on the perspective of the individuals involved: for example, one informant might think their neighbour was accused because he used witchcraft to achieve success, while another informant might attribute it to his affair with his accuser's wife. This illustrates the conditional nature of much of the data collected here, and the fact that the dataset relies on the information contained within ethnographies, which may not always be reliable.

Decisions between categories were occasionally difficult. A distinction was made between accusations that appear to be driven by competition between the accused and the accuser, and accusations that are driven by the success of the accused 'witch'. These categories are closely related, but distinct in that 'competition' was used for individuals were directly vying for a concrete objective, such as a political position. Where an individual is thought to have used witchcraft to achieve success, although there may be a competitive element in accusations, it is less direct.

The domestic arrangements variable, which records where a 'witch' and their accuser or the victim lived in relation to one another, was included because much witchcraft research has indicated that accusations take place between individuals who live and interact closely (Briggs, 2002; Geschiere, 2015; LeVine, 1963; Wilson, 1951b) and it seemed this would be informative in terms of how

accusations arise. These classifications are based on those used by Wilson (1951a) for the Nyakyusa. In most cases it was straightforward to code, although where accused and accuser lived in relation to one another was not always stated explicitly in ethnographies. This was sometimes inferred from situations: husbands and wives were presumed to be cohabiting (at least in the same homestead, if not dwelling) if not separated or divorced. Neighbours were identified as such by ethnographers: this category was not inferred. In many accounts it appeared obvious that those involved in an accusation lived near to one another, in the same settlement.

Whether divination was used in accusations was included as this can be a key part of the process, although it was not used in every accusation. This was unproblematic to classify, as it was often simply a case of whether ethnographers commented that a diviner had been consulted, or it was obvious from the way the situation was recorded that accusations stemmed only from the accuser/s.

Including a variable for whether an accusation ‘stuck,’ or had a lasting effect on an individuals’ reputation may seem unnecessary, given that all accusations recorded by ethnographers were in some way notable and therefore ‘stuck’. But there was a minority of cases where it was obvious that an accusation had not really taken hold, or had not been accepted by anyone other than one accuser. One instance of this occurred where a man had been fishing and distributed the catch among the women of his homestead, but failed to give some to an old woman. She was thought to be responsible for the subsequent sickness of his child. In response to the situation, the man ostentatiously presented her with a very large fish, and the issue of her ‘witchcraft’ appears to have been resolved (Winter, 1956: 140-141). Accusations were also classified as not sticking if the accused witch was apparently exonerated through divination and the findings of the divination were accepted.

Accusations are often identified as relating to material wealth, either when rich individuals are accused of gaining wealth through nefarious supernatural means, or when the envy of the poor is thought to be directed at those who are better-off (Macfarlane, 1999; Thomas, 1971). I included a variable to indicate whether the accused is rich, poor or high status in relation to their accusers, with a further category to indicate when material wealth and status did not seem to be relevant to

an accusation. This was usually clearly described in the texts, but as with other variables, it is obviously reliant on the ethnographer's knowledge of individual cases and how they recorded them.

The cost of accusations to accusers was usually not difficult to code, when it was mentioned by ethnographers. As with many of the variables, it was not possible to always be certain there was no cost to accusers when it was not mentioned. However, if an accusation appeared to be undisputed, and there was no reported counter-action from the 'sorcerer' or other individuals, it was coded as not having a cost.

Finally, it seemed important to include the outcome of accusations, where this was recorded. The number of categories grew in an attempt to cover the diversity of possible outcomes: for example witches could be killed in an official trial such as a poison ordeal, or subjected to vigilante justice, or beaten and tortured but then remain within the community, or divorced by their spouses. Where ethnographers covered the outcomes of accusations, they were usually clear on what had occurred.

Limitations

There are challenges to creating datasets from ethnographic literature. There may be inaccuracies in the original accounts, although it is difficult to be sure how much inaccuracy there is overall in the ethnographic record (Ember, 1986). There are sometimes contradictions between two ethnographers concerning a particular society: this was occasionally the case in coding the Bantu Witchcraft Dataset. When these problems were encountered, a range of approaches were used to resolve them, such as trying to consult further sources where possible, or making a judgement on which ethnographer appeared to have a more detailed understanding of the subject in question. Statements from ethnographers can be vague and ambiguous, which again may be resolved through consulting further sources, or if that does not prove informative then either coding the information as 'NA' or making a decision based on the evidence available. This means there may be occasional inaccuracies in the coding, although we aimed to avoid this as much as possible.

Coding is also necessarily a reductionist process, which requires society-level traits, or complex situations to be simplified into neat categories. This is both a weakness and a strength: although details and nuances of variation may be lost, it also allows for quantitative testing over a large number of cultures to examine patterns in how cultural traits evolve: this type of question can only be answered using this type of data.

One dilemma encountered when trying to produce an accurate dataset was in whether to code particular traits as absent in a society, or to code the information on them as not available (NA). For example, if there was no reference to the evil eye in an ethnography, I sought to understand whether this was because the belief did not exist in the society, or had the ethnographer not recorded it. Making such distinctions can have a significant impact on the results of any analysis.

Traits were coded as absent when there was a significant level of information provided on a particular topic and it seemed likely that the ethnographer would have discussed a trait if it was present. If there was a reasonable amount of information on related topics and a trait was not mentioned then it seemed likely it was not present. But further sources were checked if they were available, and if a trait was not mentioned in any it was coded as absent (Joseph Watts, personal communication).

The issue of missing data can be problematic, and a recent debate has highlighted the difficulties. Whitehouse et al. (2019) analysed data from 414 societies, and found that moralising high gods followed the development of social complexity in societies, rather than preceding it. This article has been criticised for treating missing data inappropriately. Beheim et al. (2019) accuse Whitehouse et al. (2019) of replacing uncategorised data on the presence or absence of gods with '0,' indicating that the data was available but moralising gods were not present, and therefore influencing the results of their analysis. Such debates highlight the importance of careful consideration of missing data, and the reasons for its absence.

In terms of statistical comparison, it was not possible compare the characteristics of accusations with baseline population information, to answer questions such as how likely it is that, if an individual has a particular trait, they will be accused of witchcraft. For example, in Chapter 5 it would have been useful to test the frequency with which elderly women are accused of witchcraft, relative to the number of elderly women in a population: how likely is it that women are accused because they are elderly and because they are women? Baseline information is not provided in the ethnographies. Instead, the chapter tests how likely it is, given that an accused individual is elderly, that they are female. The dataset can be used to make comparisons between the characteristics of accusations that have already occurred, but cannot analyse how likely accusations are to occur as a result of certain situations. The analyses in chapters 5-7 all examine how likely it is, given an accusation has occurred, that a particular characteristic of that accusation can be predicted based on other variables.

The potential issues of using data from realised accusations are illustrated by recent criticism of an article purporting to show that white police officers in the United States are not racially biased, and no more likely to shoot civilians of minority ethnic groups, than non-white officers (Johnson et al., 2019). The authors examined this using a database of fatal police shootings. Therefore, it did not examine the probability of white officers fatally shooting civilians from ethnic minorities against the number of shooting incidents, including those that were non-fatal, and nor did it take into account the ethnicity of those involved in non-fatal encounters. The study also concluded that there was a higher probability that those fatally shot would be white, but without taking into account how many white and minority civilians are encountered by police officers (Knox & Mummolo, 2020).

The quality and detail of information on the societies in the Bantu dataset varies considerably. The information also varied by topic: some ethnographers write in detail about one subject but not others. This was the case with information on witchcraft belief: some ethnographies record very detailed information on all aspects of beliefs, from which categories of people are most likely to be accused and why, to which animals witches are thought to ride, to descriptions of the methods sorcerers are thought to use to harm their victims. Others only have a

paragraph commenting that belief in witches exists, and others have no information on witchcraft at all and had to be excluded.

Individual-level cases were recorded when they were documented in ethnographies, even if only a limited number of variables could be coded, in order to collect as much data as possible. Only some of the societies in the dataset had individual case studies ($n = 53$).

Individual accusations may not always be representative of the societies they are from. Ethnographers generally did not record cases systematically. Apart from those their informants chose to relate, authors may only describe those that are especially notable or dramatic. They may be biased towards particular types of case, such as those involving more high profile individuals such as chiefs, or those involving particular categories of individuals according to their own interests. The representativeness of cases will vary from society to society, and depends on how the ethnographer recorded them. Monica Wilson (Wilson, 1951a) documenting the Nyakyusa, collected a large number of cases related to witchcraft and sorcery, which may be fairly representative of known cases at the time, but other authors were less methodical in their approach. A variable to indicate whether we thought a particular case was atypical for a society was included in the dataset.

Despite these challenges, the dataset provides a previously unavailable means of examining cross-cultural patterns of witchcraft cases and beliefs in a group of societies as they were in a particular period in time, which would otherwise not be accessible.

Chapter 3: Statistical Methods

In this section I outline the statistical methods used in this thesis, including model selection and model averaging, and phylogenetic comparative methods.

Statistical analysis

Much of the work in this thesis uses an information-theoretic approach (described below). I also use traditional null statistical tests such as chi-square where appropriate, particularly where only a small amount of data could be obtained. I also use aspects of frequentist statistics in conjunction with model averaging, as this can be useful for the purposes of comparison between categories (Harrison et al., 2018).

Logistic multilevel models

Multilevel models are used to analyse data that is hierarchical or clustered in structure (Snijder & Bosker, 2012). When data is clustered into groups or levels, individual data points cannot be considered independent of one another. Random effects are used to control for the non-independence of data points in nested or hierarchical data (Grueber, Nakagawa, Laws, & Jamieson, 2011), which could otherwise lead to statistical errors. In this thesis, individual witchcraft accusations are clustered within societies; therefore the variation between cultures is accounted for in the modelling.

I use multilevel logistic regressions that have a binary outcome variable, and are used to predict the probability that an outcome is 0 or 1.

All multilevel models were performed in R version 3.5.3. (R Core Team, 2019) using the programme lme4 (Bates, 2010), and the model averaging programme MuMIn (Barton, 2018).

Model selection and model averaging

Model selection and model averaging are statistical procedures that can test alternative hypotheses simultaneously. The process allows for the choice of the ‘best’ models, which are identified using information theoretic criteria. IT has advantages over traditional ‘frequentist’ statistics, or null-hypothesis significance testing, which uses a single model and the arbitrary thresholds set by p-values. Crucially, model selection can be used to weight and rank the importance of competing hypotheses. Information theoretic approaches acknowledge that there is no ‘true’ model accurately representing reality, but that models are all approximations of reality, based on the finite and noisy data that is available (Burnham & Anderson, 2004).

The process involves the careful selection of a number of a priori hypotheses, which are then incorporated into a ‘global model’ containing all variables and parameters of interest (Burnham & Anderson, 2002; Harrison et al., 2018). The prior selection of relevant hypotheses is intended to prevent simple ‘fishing’ for significant effects using any possible predictors, and instead ensure that hypothesis testing is rigorous (Harrison et al., 2018).

Model selection and averaging make use of information criteria such as the Akaike Information Criterion (AIC), and the AICc, which is used to correct for small sample sizes (Grueber et al., 2011). Information criteria estimate how much information is lost by a model, while penalising the model’s complexity, as measured by the number of parameters. Unless the sample size is large for the estimated number of parameter (as it is in chapter 4 of this thesis), the use of AICc is recommended (Burnham & Anderson 2002).

The AIC is used to balance the complexity of a model (or number of estimated parameters) with the fit of the model. The information criteria score is then penalized in relation to the number of parameters used, and the penalization is stricter for the AICc (Harrison et al., 2018).

The global model is used to produce a set of candidate models, which contain all possible combinations of the variables entered into the global model. These models are weighted and ranked using information criteria.

From the candidate models, a set of top models is defined. There are various views on how a top model set should be defined. Burnham and Anderson (2002) originally recommended that models with ΔAIC (a measure based on the change in AIC or AICc values relative to the best model) between 0 and 2 should be used for inference. However a higher ΔAIC cut-off may be required to ensure that the best model, is included in the top model set (Harrison et al., 2018; Richards, 2008). But if the cut-off is too high then model sets will be overly complex and will include uninformative parameters (Richards, 2008; Grueber et al., 2011; Harrison et al. 2018). Therefore, selecting a top model set is not straightforward. Here I follow the suggestions of Richards (2008) and Harrison et al. (2018) which indicate that a ΔAIC of 6 as a minimum will provide a 95% probability of including the best model in the top model set.

Model averaging can derive weighted averages of parameters over multiple models in a top model set (Symonds & Moussalli, 2011). This process accounts for the uncertainty surrounding model selection, when a number of models may be the best representation of the data (Harrison et al., 2018; Grueber et al. 2011). It is also an effective means of obtaining parameter estimates while accounting for uncertainty. It is recommended where the weight of the 'best' model is <0.9 (Grueber et al. 2011). The Akaike weight is a number between 0 and 1, where all the models in the top model set add up to 1. It can be considered as analogous to the probability that a given model is the best model (Symonds & Moussalli, 2008).

There are two different methods used in model averaging to estimate the weighting of parameters. For the most part, the models used in this thesis use the more conservative 'zero-averaging' method. When a particular variable is absent from a model in the set, a parameter estimate and error of zero are substituted for that variable, and this occurs for every model the variable is missing from (Grueber et al., 2011; Burnham & Anderson, 2002). This method decreases the effect sizes and errors in models with small weights, which reduces the parameter estimates for

those variables, or produces shrinkage towards zero (Grueber et al., 2011). The other method, used in chapter 4, is known as ‘natural averaging’ or conditional averaging: the parameter estimate for each predictor is only averaged over models which it appears in, and is weighted by the summed weights of those models (Burnham & Anderson, 2002; Grueber et al., 2011). There is no consensus on when each method should be used, but it has been suggested that the zero average method is more appropriate for determining which factors have the strongest effect on the response variable. The natural average may be used when there is a factor of particular interest, which may have a weak effect compared to other covariates (Grueber et al., 2011).

Variance Inflation Factors (VIFs) are the variation observed in the data divided by the variation expected by the most complex proposed model (Richards 2008). They are used to detect the degree of multicollinearity between variables in regression models, or the level of correlation between predictor variables. A high level of multicollinearity can inflate the significance of regression coefficients. VIFs were calculated using the “Car” package in R (Fox & Weisberg, 2019).

Phylogenetic comparative methods

In chapter 4 I make use of phylogenetic comparative methods.

Phylogenetic analysis is a key tool for evolutionary anthropology (Nunn, 2011). The approach stems from the influential realization that the lineages of all organisms can be represented in a tree-like structure, with hierarchical descent from ancestors on the branches, to the species that exist today at the tips (Darwin, 1859; Nunn, 2011). Trees enable researchers to infer information about the evolution of traits, and are crucial in attempting to understand cultural and biological diversity in a comparative way, using explicit evolutionary models (Mace et al., 1994).

Phylogenetic analysis assumes that traits are mainly transmitted vertically (between generations), and not horizontally (or between individuals in a population whose relationship is not parent-child). However, some cultural traits may be transmitted horizontally, but this does not necessarily invalidate the use of phylogenetic comparative methods (Currie, Greenhill, & Mace, 2010).

In a phylogenetic tree, branches represent lineages, and nodes are speciation events, where lineages separate into two descendant branches. The tips of the tree represent species (Nunn, 2011). They compare character states across taxa and the differences between them (Curnoe, 2003). They therefore rest on the following assumptions: that a common evolutionary history is shared by a group of taxa; that cladogenesis, or the split of two species into a clade is accurately represented by bifurcation, and that characters change over time (Curnoe, 2003). In combination with advanced statistical techniques this method has produced results questioning longstanding assumptions concerning adaptation (Nunn, 2011; Pagel, 1999).

Phylogenetic analysis is used to investigate the evolution of both language families and the cross-cultural adaptiveness of traits (Mace et al., 1994). It can estimate the ancestral spread of a cultural trait or linguistic family through societies, and test whether traits are functionally linked, or related to particular ecological circumstances (Mace et al., 1994). It views human cultures and languages as analogous to biological species, which, like species, evolve by descent with modification (Darwin, 1859; Mace et al., 1994; Pagel & Mace, 2004). Where there is a pre-existing linguistic phylogeny, cultural traits can be mapped on to the tree, and the likely forms of these traits in past societies can then be inferred using a statistical model of trait evolution (Opie et al., 2014).

Phylogenetic studies have been used to explore diverse hypotheses, such as whether the adoption of livestock farming by societies is incompatible with a female line of descent (Holden & Mace, 2003), whether social learning is a key feature in human adaptation (Mathew & Perreault, 2015) and even to examine the antiquity of fairy tales (Graça da Silva & Tehrani, 2016). The use of phylogenetic trees can ameliorate the challenge of Galton's problem, which stresses the difficulties inherent in distinguishing whether societies share traits because of shared ancestry or because those traits provide a functional benefit to societies (Mace et al., 1994).

Recent phylogenetic analyses employ Bayesian statistical methods, which have radically altered this form of research. Unlike previous techniques they account for uncertainty in tree selection, and how traits spread on trees (Pagel & Meade, 2006). The Bayesian approach produces a range of trees and model parameters, and then calculates the posterior probability of a phylogeny given the data and existing knowledge of the evolutionary model. The posterior probability is based on both

the likelihood of the data and the prior, or existing knowledge about evolutionary parameters and phylogenetic relationships (Nunn, 2011). The topologies of multiple trees are represented in proportion to their likelihoods (Atkinson, Nicholls, Welch, & Gray, 2005). The Bayesian approach utilizes the Markov chain Monte Carlo (MCMC) algorithm, which starts with a random tree and calculates the likelihood of the data for this tree given a model of evolution. Changes are then made to that tree (for example altering branch lengths) and the likelihood for the second tree is then computed. If the second tree has a higher likelihood it is accepted; otherwise it is accepted with a probability that is proportional to the difference in likelihoods between the trees. The process is then iterated to create a chain of trees which continues until a stable distribution is reached and the likelihoods do not, on average, increase over time. The results before stability is reached are discarded. Trees are then sampled from along the chain at intervals to produce a posterior probability distribution. This can be summarized into consensus trees that maximize the likelihood of the data, or used to calculate the proportion of trees that a particular clade appears in. Uncertainty concerning consensus trees can be accounted for in the analysis (Nunn, 2011).

Phylogenetic analyses are used to test various forms of evolutionary hypotheses, including inferring the ancestral state of a trait and inferring evolutionary patterns. In this thesis, phylogenetic methods are used to test for patterns of correlated evolution between two distinct (or discrete) character traits, to examine whether there is a functional association between them.

Analysis of Discrete Traits

The phylogenetic analyses undertaken here uses the ‘Discrete’ programme in Bayes Traits (v.3) (Pagel, 2017). ‘Discrete traits,’ have distinct states (for example ‘present’ or ‘absent’), as opposed to continuous traits. The Discrete programme tests hypotheses which ask whether two discrete, binary traits have co-evolved, or are functionally linked, along the branches of a phylogenetic tree (Pagel, 1994). The rates of change between two states, i.e. from 0 to 1 or 1 to 0, can be used to model the evolutionary history of a binary trait (Currie & Meade, 2014). Information on the distribution of the characters at the tips of the tree can then be used estimate the rates of change throughout the phylogenetic history of the traits,

using the branch lengths and tree topology (Currie & Meade, 2014).

Using reversible jump Markov Chain Monte Carlo, a search is conducted among a large number of possible tree models, where a mathematical device visits them in proportion to their posterior probabilities. A Markov Chain Monte Carlo (MCMC) algorithm starts with a random tree, and investigates the likelihood of the data under that tree. It then moves on to a second tree, and if the likelihood is higher under that tree then it is accepted. The MCMC then visits parameter values according to their likelihood, in order to obtain samples from the appropriate region of parameter space.

The analysis uses a Reversible Jump Hyperprior (RJHP) (Pagel & Meade, 2006). A reversible jump MCMC method with an exponential prior with mean values ranging between 0 and 20 was used to estimate correlated evolution between high and low levels of witchcraft belief and the focal post-marital residence pattern (see chapter 4). The values were selected from initial maximum likelihood estimates. An exponential prior was appropriate because there were only a small number of changes in each unit of branch length.

The analyses in Chapter 4 were conducted using the Discrete Programme in Bayes Traits (Pagel, 1994, 2017). Each Markov chain was run for 5 million iterations, with a burn-in period of 50,000 iterations, over a posterior sample of 500 language trees from Currie et al. (2013). Each analysis was run four times, with a sampling frequency of 5000 in order to avoid autocorrelation between the samples.

The analyses used a stepping-stone sampling method (Xie, Lewis, Fan, Kuo, & Chen, 2011) to estimate the log marginal likelihood for each model. 100 stones were used for every 10,000 iterations of the Markov chain.

To test for correlated evolution between high and low levels of witchcraft belief, and the presence and absence of societal traits I compared the log marginal likelihoods of the independent and dependent models. In independent models, the traits are constrained to evolve separately, and in dependent models the rate of change in one trait can be influenced by the rate of change in the other. The two types of model were then compared using the log Bayes factors. Bayes factors are calculated as two times the difference of the log marginal likelihood of the

independent model subtracted from the log marginal likelihood of the dependent model. These were then interpreted following Kass & Raftery (1995) showing how strong the evidence is for correlated evolution between the traits. 0-2 is weak support, 2-6 is positive support, 6-10 is strong support, and more than 10 is decisive support. A negative Bayes factor is evidence for the null hypothesis: there is no correlated evolution between the traits. The results of each run were checked in Tracer (Rambaut, Drummond, Xie, Baele, & Suchard, 2018) for convergence.

Chapter 4: The Prevalence of Witchcraft Beliefs in Sub-Saharan Africa

Summary

Why do some cultures believe in witchcraft and not others? Few large-scale, quantitative studies have examined the distribution of witchcraft beliefs, and their association with ecological and cultural traits. Anthropologists and historians have proposed a range of hypotheses, but empirical testing of these has been limited. Here I use a large cross-cultural dataset to test for correlations between witchcraft belief and society-level traits, in a sample of 18,878 individuals from 19 countries in Sub-Saharan Africa. This includes marriage systems, sedentism and mobility, class stratification, and post-marital residence, or where couples live after marriage. Language family, and by inference population history, may explain some of the distribution of beliefs, and was included as a control variable. There was also an indication that witchcraft beliefs may co-evolve with matrilineal residence patterns (where couples live with the husband's family after marriage), although this was not supported in a phylogenetic analysis for correlated evolution. Overall the results indicate little correlation or co-evolution between traits of societies and witchcraft beliefs, perhaps because such beliefs are flexible, and can be adaptive in many ecologies.

Introduction

Beliefs in malevolent individuals, who harm others using magic, have been present in the majority of societies throughout history, but are not universal (Hutton, 2017). There are societies where witchcraft beliefs appear to have never existed, often geographically interspersed between those where fear of sorcery is intense. Examples of such societies include the Fijians in the Pacific, the Slave and the Sekani in Canada, and the Ngaing, Enga and Daribi Papua New Guinea (Hutton, 2017) and the Kogi of Columbia (Singh, 2019). In societies where they are present, the strength of belief in sorcery, and the intensity of fear of witches, also varies (Hutton, 2017). This chapter will explore how the distribution of such beliefs might be a result of co-evolution with socio-ecological factors, such as social stratification and wealth inequality, post-marital dispersal patterns, marriage systems, and levels

of sedentism and nomadism. It also examines the extent to which phylogenetic history might explain the distribution of beliefs.

There is evidence to suggest that witchcraft accusations are frequently the result of competition between individuals, for example for resources, power, status, or reproductive resources (Mace et al., 2018). Accusations often occur between relatives or those who interact frequently (Geschiere, 1999). In evolutionary terms, where local competition for resources is high, selection for altruism between related individuals may be reduced, or even removed completely (Queller, 1992; West, Pen, & Griffin, 2002). This can lead to the evolution of selfish behaviour, where acts that harm the recipient and benefit the actor (in this case accusations) are directed at competitors (Gardner & West, 2004). Those who are accused of witchcraft can suffer severe consequences, such as being ostracised or killed (Gershman 2016). Accusations in some circumstances may even conform to evolutionary definitions of spite, where an actor pays a fitness cost in order to inflict a higher cost on the recipient (Gardner & West, 2004). There can be repercussions for those who make allegations of witchcraft, including retaliatory accusations, poison ordeals, and potential damage to individuals' own inclusive fitness (Hamilton, 1964a, 1964b) if accusations are directed at relatives.

It can therefore be hypothesised that witchcraft beliefs are more likely to evolve in environments where competition between individuals is the most concentrated. Accusations will be adaptive for those who accuse their competitors and so nullify them. The form of competition resulting in witchcraft accusations may vary between societies, meaning that there is an ecological or socio-ecological basis for their distribution. Although theories of witchcraft belief are not unified (Singh, 2019), many sources associate witchcraft beliefs with envy, which is closely associated with competition, as it is the result of perceived inequalities in resources, prestige, luck, and multiple other factors.

To suggest an adaptive nature to witchcraft beliefs is not to negate the fact that they have destructive consequences (e.g. Gershman, 2016). This can be the case both for the individuals accused of sorcery, who often suffer severely, but also in the general operation of societies that adhere to these beliefs. It can be envisaged how the idea

other people in your community may be working black magic against you is associated with marked decreases in trust, and a subsequent loss of cooperative relationships (Gershman, 2016; Hutton, 2017; Golooba-Mutebi, 2005; Swanson, 1964).

Social anthropologists and historians have sought to identify societal traits associated with witchcraft beliefs, (Boyer & Nissenbaum, 1976; Douglas, 1970; Evans-Pritchard, 1937; Hutton, 2017; Kluckhohn, 1944; Sanders, 1995), but there is little consensus about why they arise in some cultures and not others. The societies with belief in witchcraft can also be very different from one another: from the large nation states and cities of early modern Europe (Macfarlane, 1999; Thomas, 1971), to the modern-day Solomon Islands (Kanairara & Futaiasi, 2017). Hutton (2017: 14) commented: ‘There seems to be no functional explanation to account for the tendency of some human groups to believe in witches and some not to do so; those in both categories generally share similar societies, economies and cosmologies, and live in close proximity.’ Hutton came to this conclusion after undertaking a thorough survey of over 300 societies from around the world, and examining their beliefs in malignant supernatural powers. Hutton used qualitative methods, which provide much valuable information, but may not be as effective or un-biased at detecting broader cross-cultural patterns as quantitative methods.

Gershman (2016) undertook perhaps the largest quantitative study to-date on witchcraft beliefs. This examined whether they lead to a decline in trust. The study was based on data from 19 sub-Saharan African countries, and a global sample of societies from the Ethnographic Atlas (Murdock 1967). Gershman identified a robust relationship between the intensity of witchcraft beliefs and factors suggesting a decline in trust and social capital, which led to further decreases in activities such as community-level cooperation, participation in religious activities, and charitable giving.

A few other studies use cross-cultural or quantitative methods to examining how societal traits and ecologies are associated with witchcraft and associated beliefs (e.g. Koning, 2013; Murdock, 1980; Oster, 2004; Swanson, 1964). These findings of studies are discussed further below where relevant.

Here I focus on variables which were hypothesised to produce the greatest amount of competition and conflict within a society, and so liable to be most associated with levels of witchcraft belief in within societies.

Witchcraft beliefs, wealth and inequality

Witchcraft accusations are often associated with envy, as a result of inequality in resource distribution among individuals (Ashforth, 2002; Evans-Pritchard, 1937; Macfarlane, 1999; Thomas, 1971). Destructive envy, or envy leading to destructive action against an envied group or individual, is predicted to occur in environments where there is high inequality, where social comparisons are common, and institutions are weak (Gershman, 2014). Witchcraft accusations may be a form of destructive envy. Research indicates that rich individuals were accused of using witchcraft to acquire wealth, or conversely richer individuals accused poorer individuals whom they believed were bewitching them out of envy. In early modern Essex, those accused of witchcraft were often moderately poor (i.e. not poor enough to qualify for state-given poor relief, but poor enough to look to neighbours for assistance), and their accusers were usually better off, so accusations may have resulted from a fear of envy (Macfarlane, 1999; Gershman 2014). In other societies, wealthy and successful individuals were likely to be suspected of practising witchcraft by those who were less fortunate (Comaroff & Comaroff, 1999; Golooba-Mutebi, 2005). An accusation could be used directly to redistribute resources among the Bantu, as when chiefs accused wealthy men of witchcraft and then acquired their cattle and property (e.g. Cory & Hartnoll, 1945).

This hypothesis is supported by research using experimental economic games, which suggest individuals are willing to sabotage others for personal gain (Abbink & Doğan, 2019). In a mobbing game where players were able to attack other individuals, in an analogous manner to witchcraft accusations, monetary gains were the most crucial factor in decisions to mob other players. The participants appeared to be more motivated by envy than anything else, and coordinated among themselves in order to do so.

The connection between witchcraft beliefs and economic conditions is also indicated by research suggesting that environmental hardship, and a lack of available resources, produce higher levels of witch-hunting. Oster (2004) identified correlations between poor economic circumstances resulting from fluctuations in weather conditions during the ‘little ice age,’ which occurred in Europe between the fourteenth and eighteenth centuries, and the most intensive periods of witchcraft trials. This happened across a number of European countries. Similarly, periods of more pronounced witch-hunting in rural Tanzania increased by 0.085 with periods of extreme rainfall (either too much or too little), which led to severe harvest problems (Miguel 2005). Both Oster (2004) and Miguel (2005) associate these more deprived economic conditions with a tendency to scapegoat ‘expendable’ individuals, which may constitute an adaptive strategy when resources are scarce. When a scarcity of resources is combined with unequal distribution, competition between individuals for what is available is liable to increase.

Post-marital residence and descent

Kinship patterns, such as post-marital residence and descent, greatly influence the structure of societies (Opie et al., 2014; Stone, 2006). Post-marital residence relates to where couples live with after marriage, and all societies have norms in relation to this. Descent patterns determine how individuals trace their ancestry from a common ancestor, and to patterns of inheritance (Stone, 2006). Sometimes descent is traced through the male line (patrilineal descent), sometimes through the female (matrilineal descent), and sometimes through various combinations of both. As these forms of social organisation greatly influence which relatives individuals are likely to cooperate or compete with, it is possible that they have a greater or lesser effect on how much competition exists between individuals, and so on the evolution of witchcraft belief and accusations.

Patrilocal residence, where couples live with the husband’s family after marriage, has been identified as the predominant post-marital residence pattern in human societies (Murdock, 1967). Matrilocal residence, where couples reside with the wife’s family, is less common, being the main form of residence in around 10 percent of societies (Divale, 2011). Other forms, such as neolocal (where couples

live independently of either spouses' family) or duolocal (where couples do not reside together) also exist.

Patterns of descent and residence are often linked: patriliney and patrilocality are frequently found together (Stone, 2006; Divale, 2011). Matriliney and matrilocality are also associated, but there is more variation in residence rules among matrilineal societies (Divale, 2011). These are generalisations, as different combinations occur. In the dataset used for this study, descent and post-marital residence were highly collinear, so the former was excluded from the analysis. The focus here is therefore on post-marital residence patterns, as they were hypothesized as likely to have the most influence on competition.

Murdock used variables from the Standard Cross-Cultural Sample (SCCS) to examine correlations between belief in witchcraft as a cause of illness and societal traits (Murdock, 1980; Murdock, 1967). 81 societies believed witchcraft was a predominant cause of illness, 9 identified it as a predominant cause, 17 thought it was an important auxiliary cause and 24 viewed it as a minor or relatively unimportant cause (Murdock 1980; Kirby et al., 2016). Murdock found that witchcraft beliefs were more likely to exist in societies with patrilineal descent systems, which he attributed to their association with patrilocal post-marital residence. As females disperse, they lose the support of their own kin, and are forced to reside with comparative strangers. Furthermore, patrilineal societies are more likely to be polygynous (Murdock, 1980), and so more conducive to producing witchcraft accusations between co-wives as described above. Murdock was here examining witchcraft beliefs with the assumption that witches are always female. This is not always the case, and there are in fact many societies with male witches (Hutton, 2017; Singh, 2019). But the competition and conflict associated with descent and residence patterns may contribute to the evolution of witchcraft beliefs.

Patrilineal and patrilocal societies may evolve witchcraft beliefs because of a variety of situations where competition arises. Polygynous marriage has been associated with male-male competition, because it produces conflict over inheritance, wealth and status (Betzig, 1986; Smuts, 1992). These factors affect

male reproductive success: men with more wealth are able to obtain more wives and so have more children, while those with less are also comparatively deprived in terms of reproduction (Betzig, 1986). Inheritance disputes between brothers, or between fathers and sons, and competition for higher status positions such as chief or headman, between kin and non-kin, are a common cause of witchcraft accusations (Ardener, 1970; Beattie, 1960; Junod, 1912; Taylor, 1962).

An alternative hypothesis could be proposed: witchcraft beliefs may be more likely in matrilocal and duolocal societies. Both of these residence patterns are associated with low levels of dispersal, often with many related individuals residing together in large dwellings (Ember, 1976). Such saturated environments may lead to local competition between relatives (Johnstone & Cant, 2008). In general, low levels of dispersal in one sex will result in higher levels of within-household competition in that sex, as in the duolocal, matrilineal Mosuo, where co-resident sisters compete for reproductive resources (Ji et al., 2016). There are reduced affinal links between households in societies with low post-marital dispersal, which has been found to lead to reduced cooperation and higher competition. Low levels of post-marital dispersal can mean that there are less affinal links between households and therefore less extensive social networks, which reduces cooperation and increases competition between them. (Wu et al., 2015). Matrilineal, matrilocal and duolocal social organisation might therefore co-evolve with witchcraft belief as a means of selfishly or spitefully harming competitors for resources, even among relatives. There is also competition between male kin in matrilineal societies, as inheritance and titles may be disputed between matrilineally-related uncles and nephews (Chock, 1967).

Polygamy and monogamy

The relationship between co-wives in polygamous marriages has been documented as frequently leading to envy, conflict, and subsequent accusations of witchcraft (Jankowiak, Sudakov, & Wilreker, 2005; Levine, 1962; Strassmann, 1997; Beidelman 1963). Such relationships can be competitive: wives must contend for their husband's affection and resources for themselves and their children. Many ethnographers give the impression that the co-wife relationship is one of the most

likely to produce witchcraft accusations (e.g. Beidelman, 1963; Gouldsbury & Sheane, 1911; Levine, 1962; Taylor, 1962). As with material inequality, co-wife accusations are thought to be motivated by envy, where one wife has more children, or more surviving offspring (Levine, 1962; Strassmann, 1997; Taylor, 1962). An accusation successfully directed at a rival wife may mean the accused is rejected by the husband, and is forced to either return to her own kin, or live elsewhere (La Fontaine, 1963), and perhaps resulting in more available reproductive resources for remaining wives.

Societies with polygyny may be more likely to evolve witchcraft beliefs than those where marriage is monogamous, or where polygamy is more limited. The societies in this sample (described further below) provide an opportunity to test the association between witchcraft beliefs and marriage systems. They have greater variation in marriage systems than in the Bantu societies examined in Chapters 5-7 of this thesis.

Sedentism and nomadism: witchcraft and the ‘walk-away’ rule

In societies with fluid social systems, such as hunter-gatherers and pastoralists, interpersonal conflict can be diffused by separating from difficult individuals and moving to a different camp (Briggs, 2002; Lewis, Strods, Mace, & Migliano, 2014). This is similar to the ‘walk-away rule’ proposed in theoretical evolutionary studies, where cooperators can move away from defectors to an alternative, more cooperative group, thereby promoting the evolution of cooperation (Aktipis, 2011). When such behaviour is harder, because of a more settled environment such as in sedentary agricultural societies, it is possible that witchcraft beliefs and accusations evolved as a means of dealing with interpersonal conflicts.

However, individuals accused of witchcraft are not necessarily un-cooperative. Mace et al. (2018) found no evidence in a population in China that individuals identified as witches were less cooperative in economic games or their real-life behaviour. This view is supported by a substantial proportion of the anecdotal accounts of witchcraft accusations in Bantu societies, where there is no indication

that the accusation is a result of un-cooperative behaviour on the part of the accused.

But a witchcraft accusation may act as a negative reputational ‘tag’ used to differentiate the ‘witch’ from the rest of the population, as in ‘tag-based cooperation’ and assortment (Antal, Ohtsuki, Wakeley, Taylor, & Nowak, 2009). The negative label may sanction the severing of cooperative ties with that individual. Witchcraft accusations may be a mechanism for allowing the ostracism of individuals, while giving some protection to the reputation of the accusers. In other words, this may be reputation-based assortment, but it is less associated the cooperativeness of the accused, and more on whether there is an adaptive advantage to accusers in severing cooperative relations.

Witchcraft belief and phylogenetic ancestry

Correlation between two cultural traits, such as witchcraft belief and residence patterns, may exist as a result of shared ancestry rather than being the result of a functional relationship (Borgerhoff Mulder, George-Kramer, Eshleman, & Ortolani, 2001; Felsenstein, 1985; Mace et al., 1994). Recent cultural phylogenetic analyses have identified shared ancestry as crucial in explaining patterns of cultural traits. Rácz et al. (2019) found that language family was the most important predictor of kinship systems. Similarly Minocher et al. (2019) examined cross-cultural variation in human marriage patterns, and concluded that phylogeny explained twice as much variance as all the other predictors combined. Therefore some of the distribution of witchcraft beliefs may be explained through shared population history, rather than through functional associations with other traits.

Hypotheses, predictions and variables
Overall hypothesis: witchcraft beliefs and accusations are more likely to evolve in societies where there are greater levels of competition between individuals
H1: Witchcraft beliefs and accusations evolve as a result of greater competition for material wealth between individuals.
Predictions: <ul style="list-style-type: none"> • Individuals from societies with greater social stratification and greater inequality will have higher levels of belief in witchcraft than societies with a more egalitarian social structure (<i>Social Stratification</i>)
H2A: Witchcraft beliefs and accusations evolve more in societies with patrilineal descent and patrilocal post-marital residence. In these societies, competition and conflict between individuals is intensified because: <ol style="list-style-type: none"> a) there is greater competition among men for resources and status that can be used to attract wives b) there is greater competition between women in polygynous marriages for reproductive resources from their husbands
Predictions: <ul style="list-style-type: none"> • There will be higher levels of witchcraft belief in individuals from societies with patrilocal post-marital residence patterns (<i>Post-marital residence</i>) • Individuals from societies where there were increased levels of polygynous marriages will have a higher level of witchcraft belief than those from societies with monogamy or limited polygamy (<i>Polygamy</i>)
H2B (alternate to H2A): Witchcraft beliefs and accusations evolve more in societies with lower levels of post-marital dispersal and therefore higher levels of local competition for resources. In matrilocal and duolocal societies, competition and conflict between individuals is intensified because: <ol style="list-style-type: none"> a) There is greater within-household competition between female relatives for reproductive resources due to lower levels of post-marital dispersal b) There is greater competition between households for resources as these forms of social organisation have reduced inter-household cooperation due to the reduced affinal links and social networks between them
Predictions: <ul style="list-style-type: none"> • There will be higher levels of witchcraft belief in individuals from societies with matrilocal and duolocal post-marital residence patterns (<i>Post-marital residence</i>)
H3 Witchcraft beliefs and accusations will arise more when people are less easily able to avoid competitors and individuals they are in conflict with
Predictions: <ul style="list-style-type: none"> • Individuals from societies with higher levels of mobility, such as pastoralists will have lower levels of belief in witchcraft than individuals from sedentary societies (e.g. where agriculture is the main form of subsistence) (<i>Mobility</i>)

Table 4.1 What factors affect the distribution of witchcraft beliefs in sub-Saharan Africa? Showing hypotheses, predictions and variables. Variables are in italics after the predictions they relate to.

Methods

Data

This study uses a dataset combined from a number of sources, which are detailed below.

Outcome variable

The Pew Forum on Religion and Public Life conducted a survey in nineteen African countries: ‘Tolerance and Tension: Islam and Christianity in Sub-Saharan Africa’ (Pew Forum on Religion and Public Life, 2010). Participants were asked the question: ‘Do you believe in the “evil eye” or that certain people can cast curses or spells that cause bad things to happen to someone?’ A separate question ‘Do you believe in witchcraft?’ was not used as the main outcome variable, as it fails to distinguish between notions of supernatural harm and more benign forms of magic (Gershman, 2016). (Results from this question are given in **Appendix 4.2**.) The response to the question on the evil eye will be interchangeably used here with the phrase ‘belief in witchcraft’ from now on. The binary yes/no response to the question was the response variable for all models in examining correlations between witchcraft belief and ecological circumstances. The original survey question included ‘don’t know’ and ‘refused to answer’ as responses, but these were excluded, as the more definite categories provide greater reliability in indicating belief.

Gershman (2016) matched data from Pew with information from Murdock’s Ethnographic Atlas (Murdock, 1962-1971). Using the respondents’ self-reported ethnic identity, Gershman matched every individual in the Pew study to the corresponding culture from the Ethnographic Atlas (EA). Participants from the Pew dataset were matched to 259 cultures from the EA. Gershman’s supplementary data allowed me to import relevant variables for each culture from the EA and match them with variables from the Pew dataset.

Gershman (2016) conducted a thorough analysis of correlations between witchcraft beliefs and cultural and environmental traits, using the same outcome variable as

this study to examine the relationship between witchcraft beliefs and social capital. Therefore those analyses are mostly not replicated here: I used key individual-level control variables, but focused on new society-level measures from the Ethnographic Atlas that were hypothesized to influence the evolution of witchcraft beliefs.

The final dataset contained responses from 18,878 individuals in sub-Saharan Africa, who could be identified as originating from 257 societies in the Ethnographic Atlas.

Individual-level control variables (Pew 2010)

Individual-level control variables taken from the modern Pew Forum data included sex, age (as a categorical variable, with categories ranging from 18-23, 24-30, 31-41 and 42-96), whether subjects were living in a rural or urban environment and their level of education. Findings from the original Pew Forum survey (Pew 2010), such as the fact that Christians and Muslims are equally likely to believe in witchcraft or sorcery, have not been tested in this analysis. Individual-level control variables were selected if they were likely to affect whether individuals believed in witchcraft. Although it might be expected that witchcraft beliefs are more associated with small settlements in rural environments, they are becoming increasingly common in larger towns and cities (Cimpric, 2010; Gershman, 2016).

Society-level variables from the Ethnographic Atlas

Class and social stratification

This was examined using the Ethnographic Atlas variable EA066: Class differentiation: primary. For this variable the original EA classifications range from 1 'Absence of significant class differentiations among freemen (slavery is treated in EA070), ignoring variations in individual repute achieved through skill, valor, piety or wisdom' to 4 'Dual stratification into hereditary aristocracy and a lower class of ordinary commoners or freemen, where traditionally ascribed noble status is at least as decisive as control over scarce resources.' Here the categories were amended to a binary variable. All societies that were relatively egalitarian ('1: Absence of distinctions') were tested against all other categories which have some form of class or wealth distinction.

Post-marital residence

This analysis used variable EA012 Marital residence with kin: prevailing pattern from the Ethnographic Atlas. The focal categories used in the models were duolocalism, matrilocality and patrilocality. Although hypothesis H2 focuses on patrilocality dispersal, the other two systems are included as part of the alternate hypothesis that they may also co-evolve with witchcraft. Other categories constitute post-marital dispersal patterns that are intermediate between the residence patterns of interest, and not predicted to increase the probability of belief in witchcraft. These were combined to form the reference category. This will be referred to as the ‘Combined’ category, and includes: Avunculocal (1), Ambilocal (2), Optionally uxorilocal or ambilocal (3), Optionally Patrilocality (or Virilocal) or Avunculocal (4), Neolocal (6), Uxorilocal (9), Virilocal (10), Ambilocal with a preponderance of uxorilocal practice (11), Ambilocal with a preponderance of virilocal practice (12).

Polygyny and monogamy

The variable EA009: Marital composition: monogamy and polygamy from the Ethnographic Atlas was used. Categories include: 1 (wholly monogamous), 2 (polygyny occasional or limited) and 4-6 (varying forms of polygyny). Category number 3 is ‘sororal cohabit’, and was not present in this dataset. The focal category for this variable was a combination of EA categories 4-6, which covers different forms of polygyny, which was tested against the reference categories 1 and 2.

Sedentism and mobility

I examined this using variable EA030: Housing (Settlement Pattern). Categories range from 1 ‘Fully migratory or nomadic bands’ to 8 ‘Complex settlements consisting of a nucleated village or town with outlying homesteads or satellite hamlets.’ I tested the four categories where societies have some form of mobility (1-4) against those where societies are sedentary (5-8).

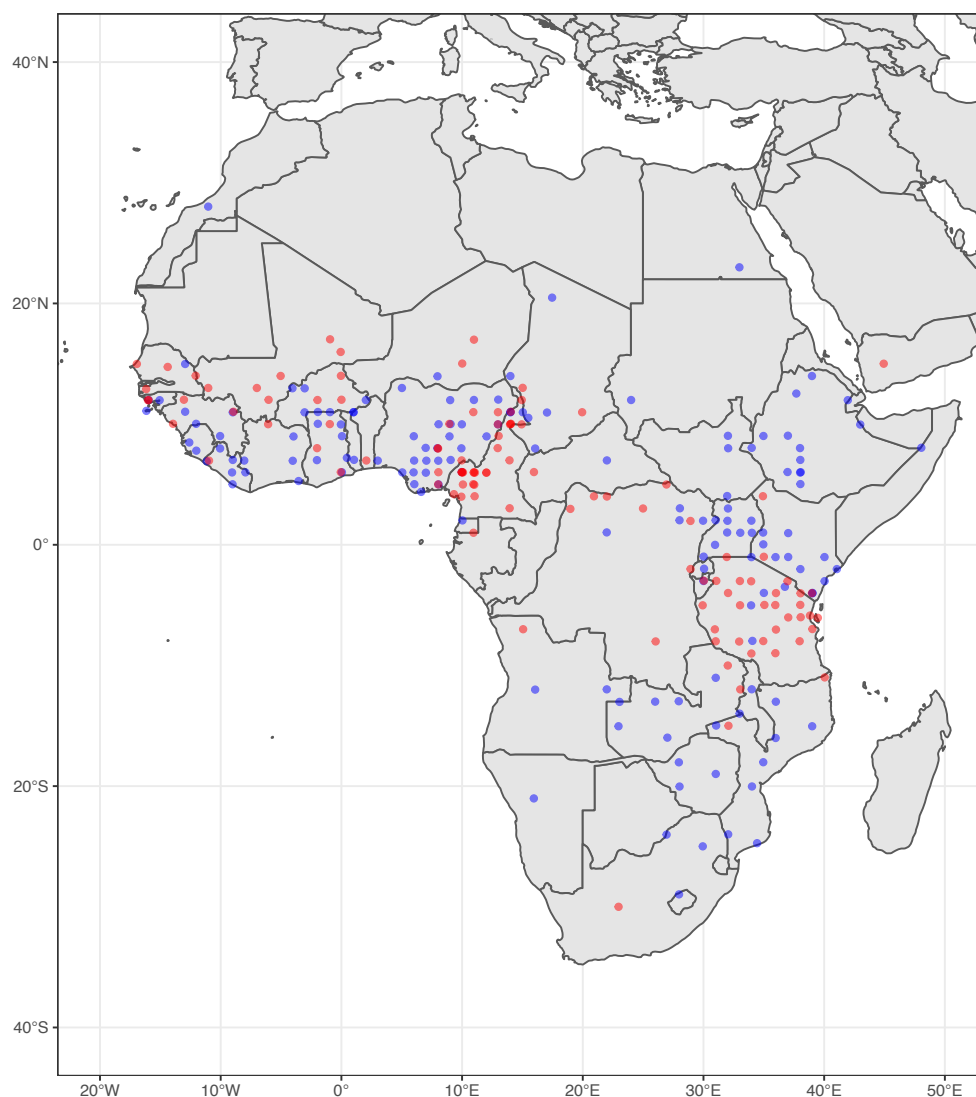


Figure 4.1 The distribution of high and low witchcraft beliefs among societies in the sample (N=259). **Red** = high belief (>50% of individuals per society) **Blue** = low belief (\leq 50% of individuals per society). The points have been jittered. Source: Googlemaps; produced with ggplot2 (Wickham, 2016) and ggmap (Kahle & Wickham, 2013).

Language family

The language family for each society was identified in D-Place and added to the dataset as a control variable (Hammarström et al., 2019; Kirby et al., 2016). There were individuals from societies within 14 African language families: Afro-Asiatic, Atlantic-Congo, Central Sudanic, Dogon, Furan, Ijoid, Koman, Mande, Nilotic, Nubian, Saharan, Songhay, Koman, Ta-Ne-Omotoc and Tuu. There was a wide amount of variation in how many individuals were represented in each family, from the Atlantic-Congo (N=11,908) to the Koman (N= 3).

Here I use language family as a fixed-effect control variable. This is largely because there are not enough language families to form a sufficient number of level 2 groups for a reliable multilevel model.

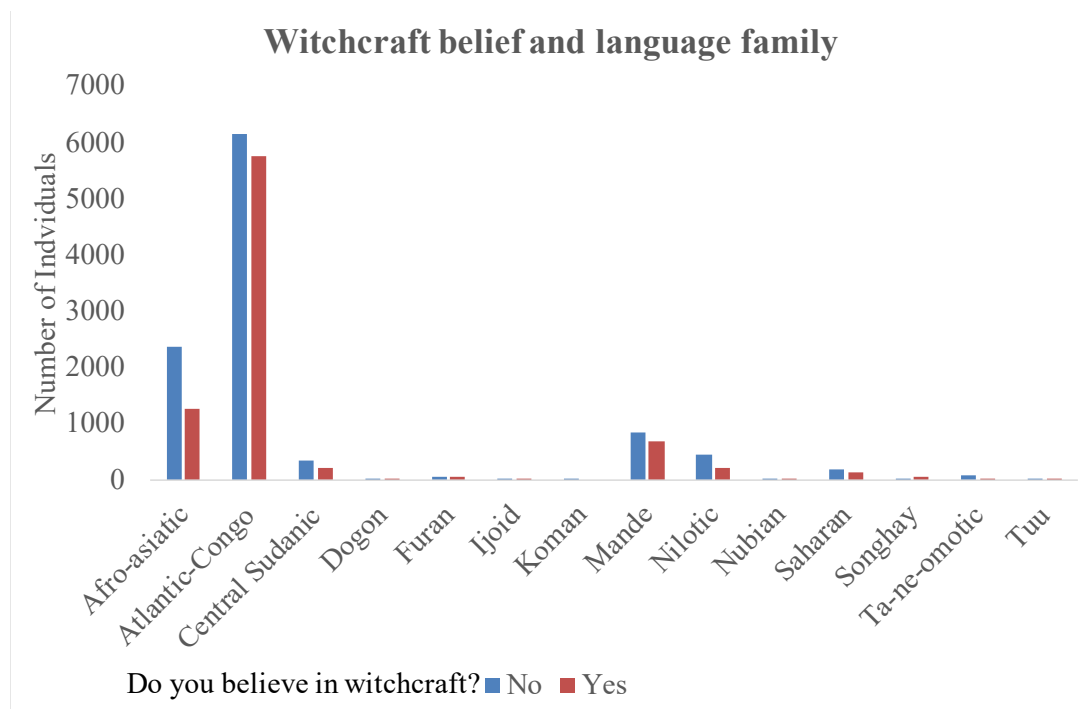


Figure 4.2 showing the counts of how many individuals from the language families included in the sample stated that they believed in witchcraft. The sections in red show individuals who said they believed in witchcraft, and the sections in blue show those who said they did not. A very small number of individuals represent some language families, including the Koman (N=3) and the Nubian (N=10).

Statistical analysis

Variation between societies

I ran a null model and calculated the Intraclass Correlation Coefficient (ICC). The ICC was 0.27, suggesting that 27% of the variation in the outcome variable was attributable to differences between societies. This level indicated that there was some clustering of belief among individuals within cultures, and suggested that a multi-level approach to modelling would be appropriate.

Model-averaging

As previously detailed in chapter 3, I used an information-theoretic, model-averaging approach (Burnham & Anderson, 2002). I ran a multi-level global model, with a binary outcome variable, which was respondents' answer to the question:

‘Do you believe in the “evil eye” or that certain people can cast curses or spells that cause bad things to happen to someone?’ The ‘No’ response was set as the reference category. Ethnographic Atlas societies were set as random effects to control for clustering between groups, and all other variables, including language family, were fixed effects.

The top set of models were those with $\Delta < 6$ (Harrison et al., 2018, Richards Richards 2008), which is recommended as a cut-off for including enough models that there is a probability of including the best model in the top model set (Richards 2008; Harrison et al. 2018).

Phylogenetic analysis of correlated evolution

As there was a correlation between matrilocality and the prevalence of witchcraft belief (see Results section below), I used the Discrete programme in Bayes Traits (Pagel, 1994, 2017) to test for co-evolution of post-marital residence traits while controlling for phylogeny. The methodology behind phylogenetic methods and Bayes Traits is outlined in chapter 3.

There is currently no linguistic phylogeny combining all of the language families in the original sample, so the analysis was conducted using a subsample of the data from 65 Bantu societies, which could be matched to a pre-existing phylogeny (Currie, Meade, Guillon, & Mace, 2013).

Discrete uses binary traits. The distribution of beliefs in the Bantu societies was bimodal, meaning that they could be divided into groups with higher and lower levels of witchcraft belief. Societies where >50% of subjects believed in witchcraft were classified as having a high level of belief in witchcraft (N=30), and societies with ≤50% were classified as having a low level of belief in witchcraft (N=35) (see **Figure 4.1**). For the post-marital residence patterns, two separate categorisations were made. The first had patrilocal residence as the focal category, with all other residence patterns combined together. The second had matrilocality as the focal category, with all other categories of post-marital residence combined together.

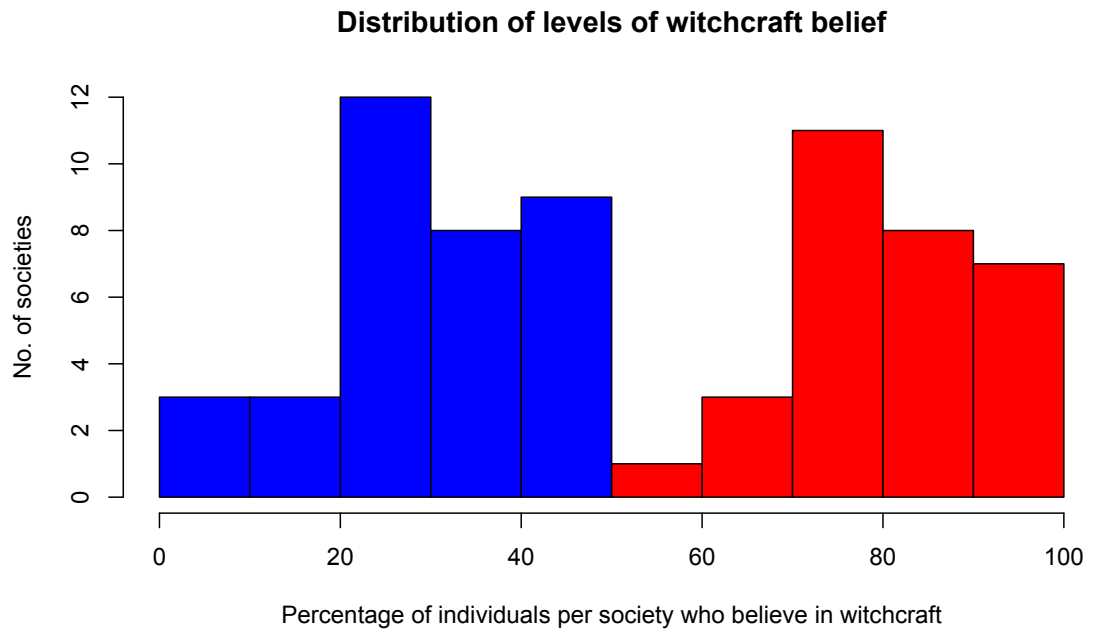


Figure 4.3 showing the bi-modal distribution of levels of witchcraft belief in 65 Bantu societies. The bi-modal distribution indicates that societies can be divided into high and low witchcraft belief, as a binary character that can be used in a Discrete analysis. Societies in blue have a low level of belief in witchcraft. Societies in red have a high level of belief in witchcraft.

Results
Descriptive Statistics

Society-level variables				
	Belief in witchcraft?			X² p-value
	No	Yes	Total	
Total	10,489	8,389	18,878	
H1 Social stratification				
Absence of wealth distinctions	2371	1696	4067	<0.01
Wealth distinctions	6432	5608	12040	
Missing	1686	1085	2771	
H2 Post-marital residence				
Other (ref)	2449	1898	4347	<0.01
Matrilocal	126	201	327	
Duolocal	98	87	185	
Patrilocal	7753	6175	13928	
Missing	63	28	91	
H2 Marriage system				
Monogamy or low polygamy	1320	752	2072	<0.01
Polygamy	9169	7637	16806	
H3 Settlement patterns				
Mobile or semi-mobile	1417	908	2325	<0.01
Sedentary	8405	6987	15392	
Missing	667	494	1161	

Table 4.1 (cont. next page)

Individual-level control variables				X² p-value
Belief in witchcraft?				
	No	Yes	Total	
Education				
Completed primary or less	3562	3711	7273	<0.01
Some or completed secondary	4617	3127	7744	
Post-secondary or higher	2251	1374	3625	
Missing	147	198	345	
Environment				
Urban				
Urban	4049	3396	7445	<0.01
Rural	6528	5014	11542	
Sex				
Male	5674	4528	10202	0.80
Female	4903	3882	8785	
Age				
18-23	2856	2017	4873	<0.01
24-30	2896	2099	4995	
31-41	2447	2030	4477	
42-96	2316	2202	4518	

Table 4.1 Showing descriptive statistics for society level variables and individual-level control variables against the outcome variable of whether or not individuals' believed in witchcraft. The numbers of individuals for each variable are shown.

The category of matrilocal post-marital residence was not significant in the zero-averaged model. However, it was significant in the natural-averaged model: individuals from matrilocal societies were more likely to believe in witchcraft (OR = 2.87, 95% CI [0.17, 7.06], p=0.02) than those in the reference category, although the confidence interval is large due to the small sample size for this group.

In a natural average, parameters are only averaged over models that a predictor is included in (Burnham & Anderson, 2002; Grueber, Nakagawa, Laws, & Jamieson, 2011). There is no clear distinction in the literature between when natural and zero averaging models should be used (Grueber et al. 2011). But Nakagawa and Freckleton (2011) suggest natural averaging should be used when there is a variable of particular interest that may have a weak effect overall, to avoid the results of this variable being affected through shrinkage towards zero. Zero averaging can be used to

Table 4.2	Estimate (SE)	95% CI Low	Odds Ratio	95% CI High	Relative Variable Importance
Intercept	-0.17 (0.32)	0.45	0.84	1.59	
Age: 18-23 (Ref.)					
Age: 24-30	0.03 (0.04)	0.94	1.03	1.13	1.00
Age: 31-41	0.10* (0.05)	1.01	1.10	1.12	
Age: 42-96	0.15** (0.05)	1.06	1.15	1.22	
Age: missing	0.40* (0.20)	1.01	1.49	2.19	
Education: completed primary or less (Ref.)					
Education: some or completed secondary	-0.32*** (0.04)	0.67	0.72	0.78	1.00
Education: post-secondary or higher	-0.46*** (0.05)	0.57	0.63	0.69	
Education: missing	0.15 (0.12)	0.91	1.16	1.47	
Sex: male (Ref.)					
Sex: female	-0.00 (0.02)	0.93	1.00	1.06	0.23

Table 4.2 cont.	Estimate (SE)	95% CI Low	Odds Ratio	95% CI High	Relative Variable Importance
Environment: urban (Ref.)					
Environment: rural	-0.07 (0.04)	0.85	0.93	0.98	0.88
Language family: Afro-Asiatic (Ref.)					
Language family: Atlantic-Congo	0.13 (0.25)	1.04	1.14	2.61	0.27
Language family: Dogon	0.08 (0.58)	0.16	1.09	11.47	
Language family: Furan	0.11 (0.61)	0.17	1.12	13.98	
Language family: Ijoid	-0.06 (0.66)	0.07	0.94	9.65	
Language family: Koman	-3.04 (76.63)	<0.00	0.05	NA	
Language family: Mande	0.01 (0.18)	0.52	1.01	2.10	
Language family: Nilotic	-0.12 (0.31)	0.26	0.89	1.55	
Language family: Nubian	-0.27 (0.82)	0.03	0.76	4.88	
Language family: Saharan	-0.08 (0.37)	0.20	0.92	2.75	

Table 4.2 cont.

	Estimate (SE)	95% CI Low	Odds Ratio	95% CI High	Relative Variable Importance
Language family: Songhay	0.32 (0.77)	0.40	1.38	27.10	
Language family: Ta-Ne-Omotic	-0.49 (0.95)	0.02	0.61	1.11	
Language family: Tuu	0.27 (0.81)	0.20	1.31	36.20	
Language family: Central Sudanic	-0.15 (0.39)	0.18	0.86	1.73	
Post-marital residence: other (Ref.)					
Post-marital residence: matrilocal	0.18 (0.44)	1.12	1.20	6.76	0.18
Post-marital residence: duolocal	0.04 (0.37)	0.24	1.04	6.69	
Post-marital residence: patrilocal	0.04 (0.13)	0.83	1.04	1.92	
Post-marital residence: missing	0.13 (0.47)	0.37	1.14	1.06	
Marriage: monogamy or low polygamy (Ref.)					
Marriage: polygamy	0.20 (0.26)	0.90	1.23	2.36	0.55
Settlement: mobile or semi-mobile (Ref.)					
Settlement: sedentary	0.02 (0.11)	0.67	1.01	1.06	0.10

Table 4.2 cont.	Estimate (SE)	95% CI Low	Odds Ratio	95% CI High	Relative Variable Importance
Settlement: missing	0.03 (0.18)	0.54	1.03	3.53	
Social stratification: no wealth distinctions (Ref.)					
Social stratification: wealth distinctions	0.01 (0.06)	0.77	1.01	1.06	0.09
Social stratification: missing	0.01 (0.08)	0.71	1.01	1.83	
Num. obs.	18878				

*** p < 0.001, ** p < 0.01, * p < 0.05

Table 4.2. Logistic multilevel model results of the model-averaged parameters for the full model average for all models with delta <6. The outcome variable is participants' belief in witchcraft, where they answered 0) 'no' (reference category) or 1) 'yes'. This shows the individual-level control variables (age, sex, rural or urban environment and education level) for the participants of the Pew 2010 survey, language family as a control variable, and the focal variables of interest (social stratification, settlement, marriage and post-marital residence).

determine which factors have the strongest effect on the response variable (Nagakawa & Freckleton 2010; Grueber et al. 2011).

The society-level predictors did not have a significant effect on the odds of whether or not an individual stated they believed in witchcraft, in the zero-averaged model. Individuals from matrilineal societies had slightly higher odds (OR = 1.20, 95% CI [1.12, 6.76]) of believing in witchcraft than individuals from societies with 'other' forms of post-marital residence. People from duolocal (OR = 1.04, 95% CI [0.24, 6.69]) and patrilineal (OR = 1.04, 95% CI [0.83, 1.92]) societies were not more likely to believe in witchcraft than people from societies with 'other' residence patterns. There was no significant difference in witchcraft belief between individuals from societies with higher levels of polygamy, compared to those with monogamous marriage or limited polygamy (OR = 1.23, 95% CI [0.90, 2.36]). Individuals from mobile societies were as likely to believe in witchcraft as people from sedentary ones (OR = 1.01, 95% CI [0.67, 1.06]). People that came from societies where social stratification and wealth distinctions existed were not more likely to believe in witchcraft than those from societies with a more egalitarian social structure (OR = 1.01, 95% CI [0.77, 1.06]).

The individual-level control variables had similar effects on witchcraft belief to those found by Gershman (2016). Older people were more likely to believe in witchcraft than younger people. Those in the 42-96 age category had significantly higher odds (OR = 1.15, 95% CI [1.06, 1.22]) of believing in witchcraft than those in the 18-23 age group. Education also had an effect: people with a partial or a complete secondary education were less likely to believe in witchcraft (inverse OR = 0.72, 95% CI [0.67, 0.78]) than those whose highest level of education was primary school. People who had completed post-secondary education or higher had around two times higher odds of believing in witchcraft than those whose highest level of education was primary school (inverse OR = 0.63, 95% CI [0.57, 0.69]). Men and women were equally likely to believe in witchcraft (OR = 1.00, 95% CI [0.93, 1.06]), and living in an urban or rural environment did not have a significant effect on how likely someone was to believe in witchcraft (OR = 0.93, 95% CI [0.85, 0.98]).

Results: phylogenetic modelling

The Discrete analysis did not provide evidence for correlated evolution between witchcraft beliefs and matrilineal and patrilineal residence (**Table 4.3**). A Bayes Factor calculates whether there is greater support for the independent or dependent model of evolution, where a Bayes Factor of >2 is positive evidence for correlation evolution, >5 is strong evidence, and >10 is very strong (Kass & Raftery, 1995). In this instance, the models had negative Bayes Factors, indicating that the traits are more likely to have evolved independently.

Post-Marital Residence	Bayes Factor
Patrilineal residence	-2.57
Matrilineal residence	-4.65

Table 4.3 Bayes Factors comparing the independent and dependent models of evolution for witchcraft belief and a) patrilineal residence and b) matrilineal residence.

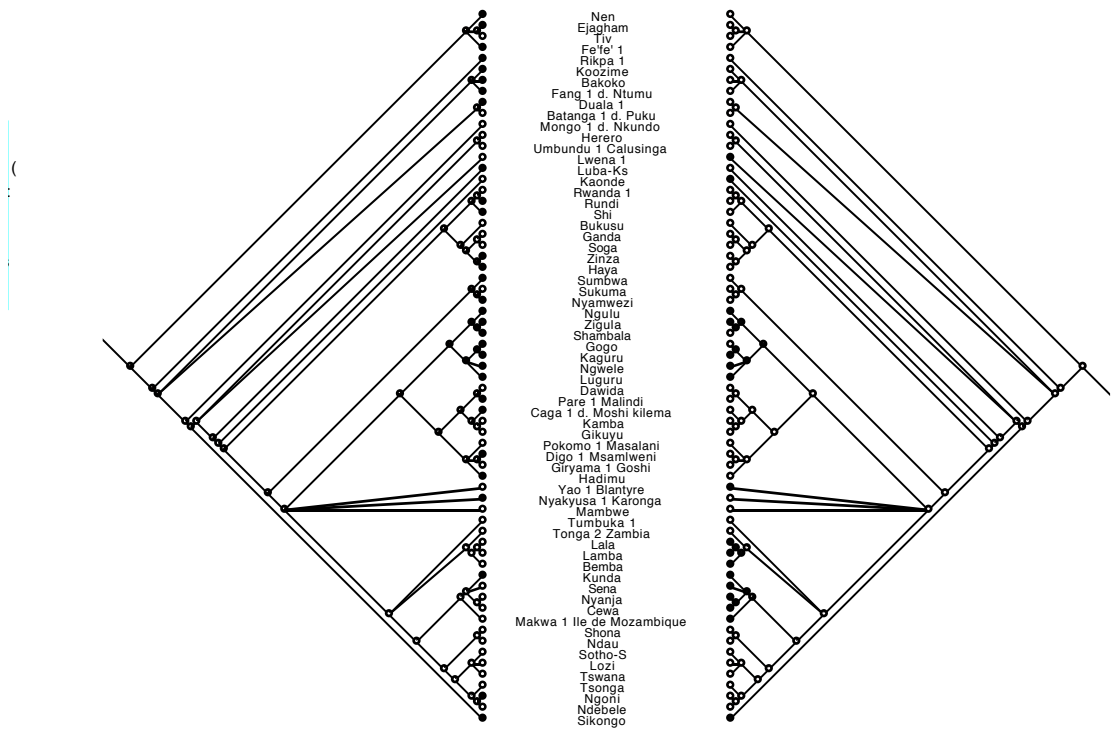


Figure 4.4 Phylogenetic mirror tree, based on a consensus tree from Currie et al. (2013), and pruned to show the 65 societies used in the analysis. The language names of the societies are shown in the middle of the diagram. Witchcraft belief is shown on the left, and black is where a high level of belief is present and white is where there is a low level of belief. Post-marital residence is shown on the right. Black is where residence is matrilocal and white is where there are other forms of post-marital residence. The probability of the character states at each internal node has been reconstructed using Maximum Likelihood. This diagram was produced in the Mesquite programme (Maddison & Maddison, 2017).



Figure 4.5 Phylogenetic mirror tree, from the consensus tree of Currie et al. (2013), pruned to show the sample of 65 Bantu societies. The language names of the societies are shown in the middle of the diagram. For witchcraft belief shown on the left, black indicates a high level of belief and white indicates a low level of belief. On the right, black indicates the presence of patrilocal residence patterns, and white indicates other forms of post-marital residence. The probability of the character states at each internal node has been reconstructed using Maximum Likelihood. This was produced with the Mesquite programme (Maddison & Maddison, 2017).

Discussion

In this study I examined how witchcraft beliefs in Sub-Saharan Africa correlate with society-level variables: social stratification, post-marital residence, marriage systems and mobility. With the exception of post-marital residence, none of the society-level variables had any association with the level of witchcraft beliefs.

Individuals from cultures with a matrilocal dispersal system had a slightly higher probability of believing in witchcraft than those with other forms of post-marital dispersal in the model-averaging. A phylogenetic analysis of the correlated evolution of these traits, using a smaller sample of Bantu societies, suggested it is more likely that these traits evolved independently of one another. The correlation found in model-averaging is contrary to Murdock's (1980) finding that witchcraft

beliefs were more associated with patrilineal (and so probably patrilocal) societies. It is possible that the difference in results between the model-averaging and phylogenetic analysis is due to sampling bias, in either one of the samples, as sample sizes were small, particularly for the latter.

It is clear that witchcraft beliefs occur in societies with a variety of forms of social organisation. Among the Bakweri of the Cameroon, patrilineal relatives were thought to be liable to suffer from *inona*, or envy, and therefore the most likely to practise witchcraft (Ardener, 1970). The Tiv also believed patrilineal relatives were the most envious and so prone to witchcraft, because of inheritance rules: a man's brothers and half-brothers had extensive claims to his land after his death, ahead of his own sons (Ardener 1970). However Mace et al. (2018) documented witchcraft beliefs in the matrilineal, duolocal Mosuo, where accusations were primarily directed at wealthy female heads of household. Similarly, matrilineal groups such as the Chewa and the Kaguru (Beidelman, 1967) have high levels of belief in witchcraft. The various relationship ties and situations leading to competition in societies with matrilineal, patrilocal and intermediate forms of post-marital residence may mean that witchcraft beliefs evolve in all of them, but the situations or individuals that are targeted by accusations may be different.

No association was found between witchcraft belief and social stratification. This contradicts findings from other studies. Swanson (1964) found that witchcraft beliefs increase in societies with greater class and wealth stratification, but weak legal and state systems. In terms of the mode of subsistence, which connects to wealth and stratification, Mulder et al. (2009) suggest that egalitarian hunter-gatherer societies, with a lack of heritable wealth, are less likely to have belief in witchcraft than more stratified cultures. Others have indicated that belief in witchcraft increases in semi-sedentary foraging societies, where there is some accumulation of resources, is even more prevalent in agricultural societies and pastoralists, who have greater amounts of heritable wealth (Koning, 2013; Douglas, 1970).

There may be some explanation for the difference in findings, in that the Pew 2010 sample is fairly uniform: the dominant subsistence patterns are either pastoralism or

a form of agriculture, although there is more variation in the degree of social stratification.

Sorcery and related beliefs have been identified as a 'levelling mechanism,' or a motivation for envy-avoidance, which discourages individuals from over-production, thereby preventing the unequal accumulation of wealth (Evans-Pritchard, 1937; Gershman, 2014). However, previous studies do not appear to suggest that such beliefs lead to more egalitarian societies overall (e.g. Evans-Pritchard, 1937; Golooba-Mutebi, 2005; Kivelson, 2003; Macfarlane, 1999; Thomas, 1971). It might be argued that accusations have a levelling effect only in so far as certain individuals are motivated to conceal wealth that might make them a target of envy.

The lack of a relationship between social stratification and witchcraft beliefs might also be explained by the variety of forms witchcraft beliefs take in different societies (Hutton 2017), leading to an absence of clear patterns in this study. For example, in the stratified Azande, accusations did not often cross class boundaries, because elite and commoners did not interact frequently, and because accusing a member of the political elite was risky for the less well-connected. Instead, accusations occurred most frequently between those of equal status, where it seemed likely that one individual was going to rise above another (Evans-Pritchard 1937).

Similarly, individuals from more polygamous societies were not more likely to believe in witchcraft than those from societies with lower levels of polygamy. This links to research that has identified witchcraft belief in monogamous societies, such as in early modern Europe and North America (Thomas, 1971; Boyer & Nissenbaum, 1974).

There was also no clear difference between individuals from sedentary and mobile societies in their levels of witchcraft belief. There may be other factors leading to the evolution of witchcraft beliefs in these cultures. The majority of mobile societies in the sample were pastoralists, and unlike hunter-gatherers, they have varying degrees of witchcraft belief (Koning, 2013). Within these groups, the high

proportion of visible and vulnerable wealth, and inequality in resource distribution, may be a target for destructive envy (Gershman, 2014). This form of competition may give rise to witchcraft beliefs, and the relatively lower levels of witchcraft belief among hunter-gatherers may then be more attributable to their egalitarian class and resource distribution than their mobility.

Phylogenetic history may explain some of the differences in witchcraft belief between societies, and their modern-day geographical distribution. In this sample, there was some indication that individuals from certain language families were less likely to believe in witchcraft. The language families with the lowest levels of witchcraft belief were Koman, Ta-ne-omotic, and Nubian, which form a disputed branch of the Nilo-Saharan family (Greenberg, 1963). The Ta-ne-omotic languages are from Ethiopia, the Koman are on the border between Ethiopia and Sudan, and the Nubian are from Sudan (Hammarström et al., 2019). The samples for these language groups are very small, especially for the Koman and the Nubian, and so they may not be representative of the wider populations. Other language families all had a significant proportion of witchcraft belief.

This finding requires further testing, as it relies on correlation between witchcraft belief and language families, rather than a phylogenetic analysis, which was not possible as there is no appropriate phylogenetic tree currently available. This might prove a fruitful area for further research. However, would be expected that population history and phylogenetic ancestry have an impact on patterns of witchcraft belief. Recent research on the evolution of kinship systems and marriage systems suggests that language family, and shared phylogenetic ancestry is in fact the most important predictor of both these cultural traits (Minocher, Duda, & Jaeggi, 2019; Rácz, Passmore, & Jordan, 2019).

It seems likely that complex processes have had an impact on the distribution of witchcraft beliefs. While phylogenetic ancestry may affect which societies have the strongest belief in witchcraft, the changes within Africa following colonisation might have influenced its decline in certain parts of the continent.

Limitations

Combination of historic and contemporary data

Caution should be applied in interpreting data from a 2008-2009 questionnaire combined with variables from the Ethnographic Atlas. The ethnographies on which the Atlas is based were mostly written in the nineteenth and early twentieth century, and the socio-ecology in some regions of Africa will have changed over the past 100 years or so.

The appropriateness of combining data from two separate time periods is reliant on there being high levels of vertical transmission of witchcraft beliefs.

In humans, vertical transmission, or the transfer of traits and beliefs from one generation to the next, has been identified in some studies the dominant mode of cultural transmission (Pagel & Mace 2004; Cavalli-Sforza et al. 1982), although this may vary for different cultural traits (Guglielmino & Viganott, 1995).

Horizontal transmission, or peer-to-peer transfer of cultural traits may be less potent and efficacious (Pagel & Mace 2004; Cavalli-Sforza et al. 1982).

Cavalli-Sforza et al. (1982) found that transmission of religious beliefs was particularly strong from parent to child, with an average correlation of .72. The distribution of modern-day witchcraft belief probably stems from at least a certain amount of inter-generational transmission. The results of the ICC show a moderate level of similarity within groups (27%), indicating some vertical transmission of witchcraft belief within societies. This does not preclude the possibility that some of the distribution of witchcraft belief from participants in the Pew Forum survey (2010) was a result of horizontal transmission, or that witchcraft beliefs may have declined in some regions. Elderly individuals were the most likely to believe in witchcraft, which may indicate the belief is slightly declining among younger generations. This is consistent with the findings from the Pew Forum (2010) which suggest that overall adherence to traditional African religious beliefs, while still strong, is also decreasing. It is not possible to be precise about the different rates of horizontal and vertical transmission covering three or four generations.

The combination of historical and recent data was partly undertaken on the basis that if some individuals from a particular ethnic group are no longer living in the same conditions as previous generations a hundred years ago, the level of belief in witchcraft in each society, as a cultural trait, may change more slowly than the shift in the environment.

It is also the case that socio-ecology may remain the same in many parts of Africa, where traditional lifestyles continue. I investigated how likely it was that individuals in the Pew Forum (2010) sample were living in similar socio-ecological settings to those from the Ethnographic Atlas.

The Pew Forum survey does not contain any information on the EA variables, or whether participants were in polygynous marriage or living patrilocally, or matrilocally. Other sources of data from countries in sub-Saharan Africa show how prevalent factors such as polygyny and patrilocal residence were between 2008-2010 (when the Pew Forum survey was conducted and published), or as close as possible. While the data are country-level and cannot be matched to particular ethnic groups, the reports showed that polygyny does still exist in many parts of Africa, ranging from around and that its distribution varies by region and the age of the individuals involved. For married women, the percentage with one or more co-wives ranged from 8-35% at a country-wide level, and for married men the percentage with more than one wife ranged from 8-18% at a country-wide level (Agence Nationale de la Statistique et de la Démographie & ANSD/Sénégal and ICF, 2016; Central Statistical Office/Zambia, Ministry of Health/Zambia, Tropical Disease Research Centre/Zambia, & University of Zambia, 2009; Ministère du Plan et Suivi de la Mise en œuvre de la Révolution de la Modernité - MPSMRM/Congo, Ministère de la Santé Publique - MSP/Congo, 2014; National Bureau of Statistics & NBS/Tanzania and ICF Macro, 2012; National Population Commission & NPC/Nigeria and ICF International, 2014; Ouagadji, Kostelngar Nodjimadji, Tchobkréo Bagamla, Riradjim Madnodji, & Joël Sibaye Tokindang., 2005; Uganda Bureau of Statistics & UBOS and ICF International, 2012). Details are given by country in **Appendix 4.5**.

With regard to post-marital residence, country-level data was available from globaldatalab.org. **Appendix 4.4** contains a table showing measures of a Patrilocality Index (“Patrilocality Index,” 2020). Again, it is not specific to ethnic groupings, but there is some equivalence between matrilocal and patrilocal societies and the modern-day Patrilocality Index.

Further limitations

It is also possible that respondents to the Pew Forum survey were not always willing to acknowledge their belief in witchcraft, and so the true level might have been under-reported. Witchcraft beliefs can be a contentious issue, and those who hold them are not always prepared to discuss them openly (Foxcroft, 2017; Secker, 2013).

Hutton’s (2017) observation that it seems impossible to find functional reasons for witchcraft beliefs existing in some societies and not others, appears to be supported by this analysis. The lack of differences in categories might be explained by the highly labile nature of witchcraft beliefs, where they are associated with a multitude of different, and at times, contradictory situations. For example, the stereotype of who is accused varies greatly: although in many societies a particular kin category is often identified, in some accusations are more likely to be directed at strangers (Hutton, 2017). Accusations can be directed at the rich by the poor, the poor by the rich, or occur between competing equals. It is also likely that some societies will evolve mechanisms other than witchcraft accusations to solve the problems posed by similar situations, which may further account for the lack of clear patterns in the distribution of belief in harmful magic.

Conclusion

This study was a cross-cultural investigation of the distribution of witchcraft beliefs across Sub-Saharan Africa, from 259 societies in 19 countries. It has not identified strong associations between witchcraft beliefs and society-level variables that might be expected to exist. There was an indication that language family, and so by inference phylogenetic history, might account for some of the variation in the distribution of beliefs. There was also a correlation association between witchcraft

belief and matrilineal societies, but after controlling for phylogenetic effects this was not significant. This suggests that the association was not functional.

Questions still remain about why there were no more significant findings in this sample. It has contradicted previous research indicating more stratified societies are more likely to have witchcraft belief, and also the common ethnographic observation that there is an association between witchcraft beliefs and the relationship between co-wives in polygamous marriages.

Society-level variables did not explain most of the variation in witchcraft belief, but the next chapter examines whether patterns of cooperation and conflict in societies influence who is likely to be the target of witchcraft accusations.

Chapter 5: Which sex are the witches? An examination of the factors leading to variation in witch phenotypes

Summary

Although popular representations of witches portray them as female, there is wide cross-cultural variation in which sex is most likely to be accused of practising witchcraft. This chapter examines why in some cultures ‘witches’ are more likely to be male or female, or equally likely to be either sex. It asks whether evolutionary theory can predict when accusations will be directed more at men or women. Such theory would suggest that if witchcraft accusations are the result of competition, they will be directed where competition is the most intense.

I tested this using: 1) a worldwide sample of societies and 2) a sample of individual case studies from the Bantu.

I examined whether society traits such as descent patterns, post-marital residence and levels of class stratification lead witchcraft accusations to be directed more at men or women. These traits did not predict the sex of accused ‘witches’ in Bantu societies. This may suggest society-level patterns of conflict are not uniform enough to determine who is accused, but that competitive relationships at an individual level are more likely to predict accusations by sex.

Within Bantu societies, in the context of affinal kin relationships, accusations were more likely to be directed at women. Women were also more likely to be accused by those they lived with. In contrast, men were more likely to be accused by their genetic relatives, unrelated individuals and people they were not living with. There was an indication in the worldwide sample that women are more likely to be accused in societies with greater social stratification, but that men were not.

The overall results suggest that individual relationships, and the circumstances surrounding accusations, may be more salient in predicting who is accused of

witchcraft than the structural features of societies. Accusations appear to be a highly flexible cultural trait that can be used to nullify competitors, or in any circumstances where they provide benefits to the accuser.

Introduction

Sex is often seen as a defining characteristic of those accused of witchcraft. In a European and North American context, and in popular modern conceptions, witches are often thought of as old and female (Barstow, 1988). However, a substantial cross-cultural variation occurs between different societies' witchcraft beliefs (Geschiere, 2015). Such variation includes the sex mostly likely to be both conceived of as being a witch, and actually accused of practising witchcraft, but it is not clear why this occurs (e.g. Knauff, 1985; Singh, 2019; Thomas et al., 2017; Whyte, 1978; Winkelman, 1984, 2004). This chapter examines whether the variation can be explained through evolutionary theories of conflict, cooperation and competition.

The cultural phenotypes of witches in various cultures have been observed to change in response to large-scale social transformations (Comaroff & Comaroff, 1999). Social anthropologists have investigated the links between features of particular societies, and how witches are envisaged. For example, a comparison of Nyakyusa and Pondo witchcraft beliefs suggested Nyakyusa witches were viewed as greedy because social norms emphasised the importance of food-sharing with non-kin, whereas Pondo witches were viewed as overtly sexual in response to sexual prohibitions within the society (Wilson, 1951b). Nadel (1952) compared the Nupe and the Gwari in Nigeria, whose environment and culture were similar, but whose witchcraft beliefs differed. He concluded that in the Nupe, women increasingly being in a better economic position than their husbands produced stressful marriages, and meant women were more likely to be accused of witchcraft, whereas among the Gwari there was greater equality between men and women, meaning that both might be accused of witchcraft.

If the ecology and traits of a society influence cultural phenotypes of witches, then this will also be true of the sex most commonly accused of practicing black magic.

The worldwide distribution of sex differences

Within some societies, witches are viewed as predominantly female, and accusations are directed exclusively or mainly at women. Mace et al. (2018) found witchcraft accusations mainly targeted women in South-Western China, and similar patterns have been documented in other parts of Thailand, China and India (Nathan et al., 1998; Chaudhuri, 2012). Modern studies of witchcraft within various African societies also show women, and particularly older women, as the most likely victims of witch-hunts (Foxcroft, 2018; Adinkrah, 2011; Drucker-Brown, 1993; Mgbako & Glenn, 2011). For example, between 1970-1988, 80% of the victims of ‘witch’ killings that took place in Sukumaland, Tanzania were women. Those targeted were predominantly elderly by Tanzanian standards, with mean and median ages of 50-60 (Miguel, 2005).

However, there is more of a balance between male and female witch accusations than is often supposed. The European witch hunts of the sixteenth and seventeenth centuries are often viewed as exclusively targeting women, although there was cross-country variation in which sex was accused. In Normandy, Russia, Estonia and Iceland, the majority of victims were male (Levack 2016). Winkelman (1984) undertook a worldwide survey of 47 societies and found that in about a third of them malevolent practitioners (a category of magico-religious practitioners mostly consisting of witches and sorcerers) could be classified as predominantly male or predominantly female. The remaining two thirds of societies believed witches and sorcerers could be either sex.

Similarly, a recent cross-cultural survey of the characteristics of witches and sorcerers from the Human Relations Area File probability sample found no evidence that they were more likely to be women than men (Singh 2019). The SCCS variable recording the sex of witches in 68 societies shows they were divided between those which only believed in male sorcerers (23.6%), cultures where men predominated in terms of power or numbers (30.9%), those where witches were equally likely to be either sex (33.8%) and those where female witches were predominant in terms of power or numbers (11.7%) (Whyte, 1978). Therefore, a larger proportion of societies in the sample identified witches as predominantly

male rather than female. Men were more at risk of being accused of witchcraft than women in seventeenth century Russia, but sex was not such a significant defining factor in determining accusations as whether individuals were thought to pose a threat to the established social order (Kivelson, 2003). In Papua New Guinea, a recent Oxfam report into gender and sorcery-based violence found that sorcery accusations affected men and women almost equally (Thomas et al., 2017), and in some Papuan societies, witches were predominantly male (Knauft, 1985). Men were more likely to be witches in the Navaho (Kluckhohn, 1944) and could be men or women in the Hopi of Arizona (Geertz, 2011).

What causes sex differences in accusations?

From an evolutionary perspective, if accusations are the result of competition between individuals, the sex of accused witches will vary according to the strength of inter- and intra- sexual competition. Who is accused (in terms of both sex and other characteristics) will vary depending on where competition is most intense. Accusers may gain a competitive advantage (or benefits which translate into higher lifetime reproductive fitness) to the cost of those they accuse, whether the proximate payoff is prestige, power, status, resources or the removal of a rival. These questions can be considered as part of a wider investigation: why are some individuals accused and not others? To answer that fully is beyond the scope of this thesis, but an examination of sex differences provides a focused basis for the broader question of factors determining accusations.

Anthropologists have long suggested that witchcraft accusations follow patterns of conflict resulting from the structural features of societies, meaning they arise more often in some relationships than in others (Evans-Pritchard, 1937; Douglas, 1970; Macfarlane, 1999). For example, in a matrilineal society, where inheritance is transferred between mother's brothers and sister's sons, the competition within this relationship leads to frequent witchcraft accusations (Nadel, 1952).

Witchcraft accusations are typically not random: they are almost always motivated by factors arising from the relationships between the accuser and the accused, or the accused and the 'victim' of the bewitchment (Krige, 1947; Macfarlane, 1999).

For accusations to ‘stick,’ or have lasting effects, and which may lead to collective action against the witch, a consensus is required (Park, 1963). Individual accusations will therefore be influenced by the broader social system, as well as interpersonal relationships and the cultural phenotype of witches within a particular culture.

Accusations of women

Male-female competition: witchcraft and the patriarchy

Many authors have suggested that witchcraft accusations are a way for men to exercise control over women, in the context of a patriarchal social system (Barstow, 1988; Nathan, Kelkar, & Xiaogang, 1998) . Although feminist accounts of early modern witchcraft as an entirely gendered phenomenon have been challenged (e.g. (Apps & Gow, 2003), witchcraft accusations, or the threat of an accusation, may form part of a range of coercive behaviours used by men to control women, which ultimately enable them to maximise their own reproductive fitness. Intimate partner violence forms a part of this continuum, and has been posited as a mechanism enabling men to pursue their own mating and fertility preferences. These include pursuing higher family sizes than those desired by their wives, and promoting fidelity in their partners (Stieglitz, Trumble, Kaplan, & Gurven, 2018). In many non-human primate societies, males use violent and coercive behaviour to control females, to induce reluctant partners to mate, and restrict them from mating with other males (Hrdy, 1981; Smuts, 1995). The nearly universal male domination of females in primates (Hrdy, 1981) is associated with the difference in reproductive strategies between the sexes, and particularly with the interest males have in paternity certainty, or ensuring that the offspring they are rearing are their own (Trivers, 1972).

Humans are no exception to the primate order in terms of sex asymmetry, and there is, for the most part, an anthropological consensus that contemporary human societies are male-dominated (Hrdy, 1981). This means that as well as controlling female sexuality, men also tend to control resources and political power (Smuts,

1995). There is variation between societies: some have relative equality between the sexes, such as the Semang (Schebesta, 1929) and hunter-gatherer groups in general (Dyble et al., 2015). In other societies such as the Tsimane, there is a high degree of male control and violence towards women (Stieglitz et al., 2018). There is also variation within societies: in cultures where male aggression against women is common, not all men show these behaviours (Smuts, 1992).

The idea that witchcraft accusations may be a means of men seeking to dominate women is supported by some ethnographic observations. For example, in the Kaguru: ‘The frequent accusations of witchcraft made by men against their wives are undoubtedly related to a man’s great fear that he cannot control his wife’ (Beidelman, 1963: 86). Wives who resisted being controlled by their husbands were listed as a common target of accusations (Beidelman, 1963). In many of the Bantu societies, an allegation of witchcraft could be used as grounds for divorce by either sex (Beidelman, 1967; Cory & Hartnoll, 1945; Junod, 1912), and perhaps a convenient means of rapidly dismissing an uncooperative or infertile partner. The use of witchcraft as grounds for divorce is mentioned more frequently where men are divorcing their wives than when wives divorce their husbands (Middleton, 1953). In the Zulu, the practice of witchcraft among wives was viewed as a serious provocation and acceptable grounds for divorce (Bryant, 1949), and in the Sotho it is given as a reason for men to divorce their wives but not the other way around (Sheddick, 1953).

Patrilineal and patrilocal social systems may be more likely to lead to women being accused of witchcraft. Patrilineal societies trace inheritance and descent through the male line, and in patrilocal societies wives disperse to live with their husbands’ family after marriage. Although there is not complete alignment, the majority of patrilineal societies are also patrilocal (Divale, 2011; Stone, 2006). There is also a general association between patrilineal-patrilocal societies and decreased female status and autonomy, as compared to other forms of social organisation (Whyte, 1978). Murdock (1980) found correlations between patrilineal descent, patrilocal residence, and the overall presence of witchcraft beliefs using the Standard Cross-Cultural Sample (SCCS). He examined these patterns within the assumption that witches are female.

The study of non-human primate societies indicates that dispersal patterns at sexual maturity strongly influence the relative status of females and their vulnerability to male attacks (Smuts, 1992). Among female-bonded monkey groups, females receive support from both male and female kin in the response to male aggression. In species where females disperse from their natal group, akin to patrilocal dispersal in humans, they are more vulnerable to male attacks, because their kin are not available to intervene (Smuts, 1992). Societies with patrilocal residence have been associated with men exercising greater control over women (Hrdy, 1981), and so there may be a greater propensity for men to target women with witchcraft accusations in such societies.

In societies with patrilocal residence, women may be vulnerable to accusations from other affinal kin, as well as their husbands. They enter their husband's household as strangers, and are separated from any support that might be provided by their own relatives. They compete with their in-laws for their husband's time, affection and resources. In such relationships, the reproductive interests of mothers-in-law and daughters-in-law are not always aligned. Husbands can find other partners, meaning daughters-in-law can be viewed as somewhat expendable by their husband's mothers (Sear, 2008), particularly before the arrival of offspring. This can be associated with a scapegoat theory of witchcraft, where vulnerable individuals, or the easiest and most expendable targets, with few connections or other sources of protection, are held responsible for negative events. Anecdotal accounts of accusations, such as those observed by Linda Stone among the Nepalese Brahman caste, suggest that young wives moving into their husband's households are often the target of accusations from their in-laws (Stone, 2006).

Evolutionary explanations of why men may seek to dominate their partners can also contribute to the understanding of general repression of women. Society-level establishment of a patriarchal system, where the balance of power is generally weighted in favour of men, forms part of a more institutionalised version of this pattern.

In a qualitative study of societies in China, India and Thailand, Nathan et al. (1998) explored a hypothesis whereby witchcraft accusations were used by men against women to establish a patriarchal system, when the balance of power between the sexes had previously been more equal. The authors conclude that among the Santhal of Jharkand, India, the threat of accusation from male accusers served to exclude women from religious rituals, degrade the land rights of widows, and generally ensure female adherence to a system more biased towards male authority. This includes a possible transition from matrilineal to patrilineal descent (Nathan et al. 1998). Some Bantu societies have also undergone transitions from matrilineal to patrilineal descent, so this dataset provides an opportunity to examine whether such changes may also prompt the use of witchcraft accusations to promote female compliance in a different geographical region. **Appendix 3** tests the hypothesis that witchcraft accusations were used by men against women to promote a transition from matrilineal to patrilineal social organisation in Bantu societies.

An alternative hypothesis to that involving patrilineal and patrilocal societies leading to the accusation of more female witches could be posited, in that patterns of female-female competition in matrilineal and matrilineal societies might lead to more women being accused. Mace et al. (2018) found only female witches in the matrilineal Mosuo, which they suggested was a result of competition directed at wealthy female heads of household. Other studies suggest that within matrilineal and matrilineal societies, there is substantial competition for reproductive success among non-dispersing female kin residing in the same household (Ji et al., 2013; Sear, 2008).

Female-female competition

Women may be vulnerable to witchcraft accusations from their co-wives in polygynous marriages. This particular relationship has frequently been identified as producing conflicts that lead to accusations (e.g. Jankowiak et al., 2005; Levine, 1962; Strassmann, 1997; Wilson, 1951b). It involves competition, as wives seek to maximise their own access to their husband's time, affection, and provision of resources for their individual offspring. Strassman (1997) examined cases of co-wife accusation among the Dogon of Mali. High levels of infant mortality led to

frequent allegations of poisoning (which is synonymous with sorcery) and related court cases, with the supposition that jealous co-wives were responsible for causing the deaths through supernatural means. This is a common pattern, where differences in fertility, or in the number of surviving offspring, are thought lead to envious witchcraft on the part of the less fortunate (Levine, 1963), and such events are also seen as evidence that sorcery is being practised (Strassmann, 1997). Even without witchcraft, the relationship between co-wives is identified as difficult, but it should be noted that there are many examples where the relationship between co-wives is cooperative, and that there are varying degrees of conflict and cooperation within them (Stone, 2006; Jankowiak et al., 2005). The variation in co-wife relationships has also been loosely attributed to the proximity of co-wife residence, where those that live closer together are more likely to accuse each other of sorcery, and those who live further apart are less likely to do so (Levine, 1963).

In societies with male dispersal, there is less evidence that incoming males are as subservient to their wives and in-laws than women are in patrilocal societies (Stone, 2006), so men may be less likely to be accused by their affinal kin.

Male-male competition

There are circumstances in which competition and envy, and therefore witchcraft accusations, are more likely to be directed at men. When societies have more pronounced social stratification, there is greater variation in male social status and resource acquisition, and such divisions are underpinned by the intergenerational transmission of these elements (Kruger, Fisher, & Wright, 2014). This uneven distribution results in skewed male reproduction, where those with higher status and greater wealth are able to reproduce more successfully (Betzig, 1986).

Differentiation in male resource acquisition is associated with polygynous marriage systems, where a certain percentage of men have more than one wife. The existence of polygyny enhances the skew of reproductive success among men. All the societies in the Bantu sample are polygynous to a degree. In these societies, some men have several wives, some powerful men have a large number of wives and some have none. Therefore men compete with each other for access to resources and status, in order to acquire wives and to maximise their reproductive success.

This has been identified as leading to very intense male-male competition (Betzig, 1986). Females and their families in such systems are constrained in their marriage choices, and often favour wealthy males who can provide the resources to assist in successfully rearing their offspring (Hrdy, 1997).

As men compete with unrelated males for access to status, resources and mates, eliminating competitors through accusations of witchcraft may be an adaptive strategy. As kin may compete with one another when resources are scarce (West et al., 2002) men may also compete with (and accuse) their male relatives for similar reasons: claims to inheritance, cattle and property. These constitute the resources they need in order to obtain wives. For example, among the Banyoro, witchcraft accusations often occurred between brothers as a result of disputes over inheritance, but not between brothers and sisters, whose interests generally did not conflict (Beattie, 1963). Therefore, in societies where greater inequality exists between males in terms of status and resources, it would be expected that there are higher levels of competition between them, and subsequently more witchcraft accusations directed at males.

Methods

Two different sets of data were used to examine what predicts witches being identified as male or female. There are two parts to the statistical analysis. One used data from the Standard Cross-Cultural Sample (SCCS) to test for correlations between societies' most common sex of witches and various cultural traits. The other used the dataset of accusations from Bantu societies to test hypotheses using both individual- and society-level variables to examine whether they predicted the sex of people accused of being witches.

Methods: sex of witches and society-level traits: SCCS sample

This examination of whether the sex of witches, in a worldwide sample of societies, correlated with society-level traits that might influence competition, used data that had already been coded in the Standard Cross-Cultural Sample (SCCS) and the Ethnographic Atlas. It uses society-level data as individual cases were not available. The data was accessed through D-PLACE (Kirby et al., 2016; Whyte,

1978). Whyte (1978) coded a dataset on the relative status of women in 93 societies. 68 of these societies had information on the sex of reputed witches, which fell into the following categories:

- 1) All male
- 2) Both sexes, but male predominance in numbers or power or both
- 3) Both sexes, and equal in numbers, power or both
- 4) Both, but female predominance in number, or power, or both, or only female witches.

The categories where one sex predominates in terms of numbers, power or both could be slightly problematic or misleading. For example, in the ethnography of the Bagisu, male sorcerers are generally believed to be more powerful, but female witches are more numerous. In practice women were more likely to be accused (La Fontaine, 1959). It was not possible within the time available to re-examine the categorisations for the SCCS societies. Despite this proviso, it seems reasonable to conclude that for the most part, where one sex is predominant in terms of power or numbers then that can be classified as the sex with the most witches.

For the analysis they were re-categorised as:

- 1) Mostly male SCCS categories 1 and 2
- 2) Both sexes SCCS category 3
- 3) Mostly female SCCS category 4

Hypotheses, predictions and variables
<p>Overall hypothesis: witchcraft beliefs and accusations evolve where competition and conflict between individuals is more intense and accusers can gain a competitive advantage. Witchcraft accusations will be predominantly directed at the sex which is subjected to greater levels of competition.</p> <p><i>Outcome variables are the most common sex of witches from the SCCS and the sex of individuals accused of witchcraft in the Bantu dataset.</i></p>
<p>H1 Male-female competition: men use witchcraft accusations to control female behaviour (ultimately as a means of enhancing their own fitness), and will be more able to do this when females disperse and are therefore more vulnerable to control by their husbands and affinal kin.</p>
<p>Predictions</p> <ul style="list-style-type: none"> • Accusations within affinal relationships will target women more frequently than men (<i>Relationship</i>) • Accusations in societies with predominantly female dispersal (which have patrilocal or similar patterns of post-marital residence), and patrilineal inheritance, will target women more frequently than men. This will not be the case in societies with predominantly male dispersal (<i>Post-marital residence, Descent</i>) • When the accused and the accuser are living in the same homestead, they will target women more frequently than men (<i>Domestic arrangements</i>)
<p>H2 Female-female competition: women use witchcraft accusations to compete with other women for reproductive resources</p>
<p>Predictions</p> <ul style="list-style-type: none"> • Accusations in affinal kin relationships will be directed at women more frequently than men, or in other relationship categories (genetic kin or individuals they are not related to), and specifically from their co-wives (<i>Relationship</i>).
<p>H3 The scapegoat hypothesis: elderly women are more vulnerable to witchcraft accusations than elderly men, as a result of their post-reproductive status and being viewed as more ‘expendable’ (older men have greater protection from their political and social status)</p>
<p>Prediction</p> <ul style="list-style-type: none"> • When accusations target the elderly, the accused will be more likely to be female (<i>Age</i>)
<p>H4 Male-male competition: when there is higher competition between men for resources, inheritance and status (to facilitate marriage), a greater number of witchcraft accusations will be directed at men</p>
<p>Predictions</p> <ul style="list-style-type: none"> • Accusations in societies with greater social stratification will target men more than women (<i>Social stratification</i>) • Accusations between genetic relatives will target men more frequently than women (as a result of competition for inheritance and resources) (<i>Relationship</i>) • Accusations in relationships between non-relatives will target men more frequently than women (as a result of competition for wives and resources) (<i>Relationship</i>)

Table 5.1 showing hypotheses, predictions and variables for 1) what factors predict the most common sex of witches in a society and 2) whether an individual accused of witchcraft is male or female. Variables are shown in italics.

Variables on societies' descent, post-marital residence and social stratification from the SCCS and Ethnographic Atlas were re-coded for the purposes of this analysis. Details are given in **Table 5.2**.

Fisher's exact tests were conducted to assess correlations between society-level variables and the most common sex of witches in a society. As the sample size was small, the criteria were not met for Chi-square Goodness of Fit tests.

Methods: individual-level case studies from Bantu societies

This study consisted of an analysis of 276 individual accusations taken from ethnographies of 49 Bantu societies where the sex of the accused could be clearly coded. This also uses variables covering social organisation and broader society-level traits from the Ethnographic Atlas (Murdock, 1967), which were re-coded as detailed in **Table 5.2**. The methods for data collection and categorisation in creating the Bantu witchcraft dataset for the individual cases were described in Chapter 2.

The individual case studies from Bantu societies provide the binary outcome variable: were accused individuals male or female? Male was the reference category. Cases where the sex of the 'witch' was not specified were excluded: these included accusations directed at a group of mixed-sex individuals, or any others where the sex of the accused was not clearly identified. There were also a small number of cases in the dataset where 'witches' were classified as 'unknown', which were excluded. Please see **Table 5.2** for further details on individual variables.

Variable name	Description
DV: Sex of accused	0) male 1) female. This includes accusations where a group of men or a group of women were accused.
Relationship:	3 category variable showing whether the accuser is 0) not related to the accused 1) genetically related to the accused 2) affinal kin of the accused.
Domestic arrangements	4 category variable: was the accused 1) living with their accuser 2) a neighbour of their accuser 3) living in the same village or settlement 4) living further apart in different settlements
Age	Binary: is the accused elderly or not? (Generally it was not possible to provide more details on the age of the accused).
Sex of the accuser	Sex of the accuser is a 3-category variable. Accusers were classified as 0) the accuser/s were male 1) Other (where the sex of the accuser/s was a group of indeterminate sex), 2) the accuser/s were female.
Descent	Showing how societies trace descent and inheritance through male, female or mixed lineages. 0) patrilineal descent 1) all other forms of descent. This is a re-classified version the Ethnographic Atlas variable EA043 Descent.
Post-marital residence: two categories (SCCS sample)	Indicating the predominant pattern of post-marital residence in societies. 0) predominantly female dispersal where women reside with their husbands' families after marriage 1) all other categories of post-marital residence, including predominantly male dispersal, where husbands' reside with their wives families after marriage and mixed or other dispersal patterns. Based on

	combined categories from EA variable EA012. The categories were combined in this way to focus on the question of whether is a correlation between female post-marital dispersal and female witches.
Post-marital residence: Three categories (Bantu sample)	Describing the predominant pattern of post-marital residence in societies. 0) predominantly female dispersal where women reside with their husbands' families after marriage 1) predominantly male dispersal, where husbands' reside with their wives families after marriage 2) mixed or other dispersal patterns. Based on combined categories from EA variable EA012.
Social stratification	Binary variable dividing societies into 0) those with some form of class or wealth distinction and 1) an absence of wealth distinctions (egalitarian societies). This was re-categorised from EA066: all categories where societies had some form of class distinction were combined; the category with no class distinctions was left un-altered.

Table 5.2 Summary of the variables used in the analysis. The social stratification, post-marital residence and descent variables were used in both the SCCS worldwide sample and the analysis of the Bantu cases.

Data preparation

As described above, cases where the outcome variable, sex of the accused, could not be categorised were excluded from the analysis. For predictor variables, missing data was treated differently, in order to minimise the loss of further cases. As all variables used for this analysis were non-ordered categorical, missing data was re-coded under a specific category: '99' in the analysis. The results for these categories will be referred to as 'missing'.

Statistical analysis

As in the previous chapter, an information-theoretic modelling averaging approach was applied (Burnham & Anderson 2002), using the R package *MuMIn* (Barton 2015).

A global model was constructed using all predictor variables considered relevant. It is possible to use all predictor variables which might have a potential effect within a model-averaging approach, although this can cause problems with model convergence and parameter estimation (Grueber et al. 2011).

The predictor variables of interest were included in the global model. The variables were also checked for collinearity using the *Car* package (Fox & Weisberg, 2019). All variance inflation factors (VIFs) were under 3, which did not indicate a problematic level of collinearity (Hair, Black, Babin & Anderson 2010).

As well as the predictors, there were two interactions of interest: the interaction between the type of relationship (unrelated, related or affinal) and the domestic relationship of accused and accuser (where they lived in relation to each other), and also between the relationship type between the accused and accuser and post-marital residence. These could not be included in the global model as the interactions produced extremely high SE values, indicating that the model fit was poor (Grueber et al. 2011), as well as producing a number of convergence issues. The most likely cause for this is that there are very small values in a number of the interaction categories. Associations between these variables are examined using chi square tests (**Tables 5.8 – 5.11**) below, and in multilevel models using only the interaction terms of interest in **Appendix 5**. In **Table 5.8**, categories were combined in order to meet the assumptions of chi square tests (further details are given below).

Following exploratory data analysis, predictor variables which had low weightings in the model averaging procedure were excluded from the global model (Grueber et al. 2011). These were measures of the relative amount of status held by women

within societies, including whether women were able to hold political or religious leadership roles, how much freedom women had in choosing their husbands, and how much economic control women had over property or the proceeds of goods they produced.

Results

SCCS Results: society-level data

Tables 5.3, 5.4 and 5.5 present the results of Fisher’s Exact Tests on the most common sex of witches in societies from the SCCS sample, and social stratification, descent patterns and post-marital residence. For each test, the p-value is a measure of whether the proportions of the sex of witches are significantly different, in relation to the value of the society-level trait they are being tested against. The null hypothesis for each test is that the sex of witches is independent of the society-level variable.

Sex of witches	Absence of social stratification	Presence of social stratification	Total
Mostly male	22	15	37
Both sexes	7	16	23
Mostly female	1	7	8
Total	30	38	68

Fisher’s exact test: $p = 0.01$

Table 5.3 SCCS Sample Contingency table showing the results of a Fisher’s Exact Test to examine whether there is a correlation between the most common sex of witches in societies and the absence or presence of social stratification. The significant p-value indicates that the null hypothesis, there is no difference between the sex of witches and social stratification, can be rejected. However, the prediction of greater numbers of societies with predominantly male witches where there is social stratification is not supported: there are more male witches in egalitarian societies than in stratified ones. Conversely there are more female witches in societies with social stratification. There are also more witches of both sexes in societies where class differentiation exists than in those where it does not.

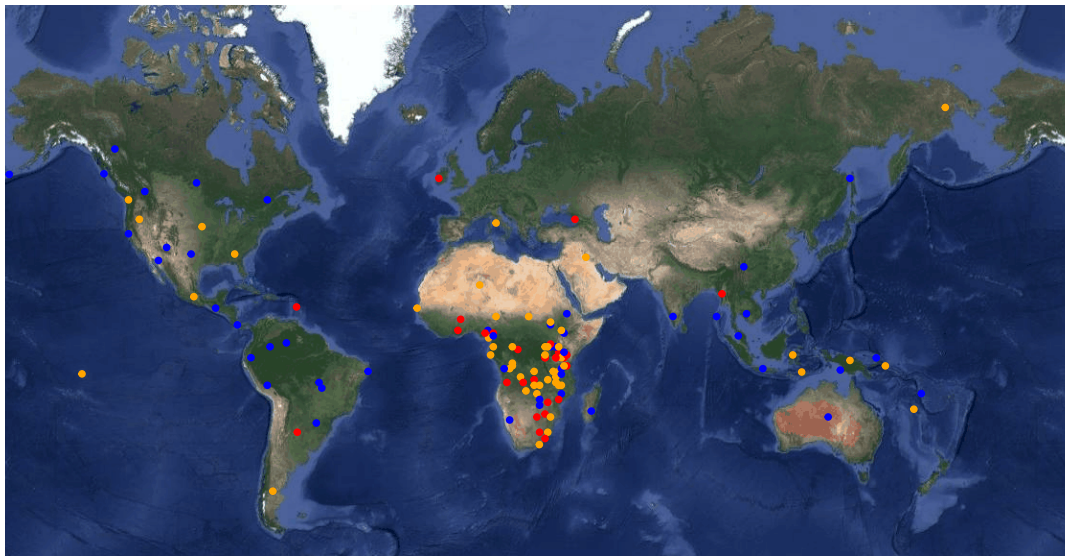


Figure 5.1 Map showing the most common sex of witches in societies drawn from the SCCS (Whyte, 1978) and the sample from the Bantu Witchcraft Dataset. Societies with male witches are represented in blue, societies with predominantly female witches are in red, and societies where witches are equally likely to be either sex are in yellow. This was made using ggplot2 (Wickham, 2016) and ggmap (Kahle & Wickham, 2013).

Sex of witches	Patrilineal descent	Other forms of descent	Total
Mostly male	9	28	37
Both sexes	8	15	23
Mostly female	1	7	8
Total	18	50	68

Fisher's exact test: $p=0.45$

Table 5.4 SCCS Sample Contingency table showing the results of a Fisher's Exact test for correlation between the sex of witches and forms of descent. The results suggest that patrilineal societies are not likely to have either more male witches or female witches than cultures with other forms of descent pattern.

Sex of witches	Patrilocal post-marital residence (female dispersal)	Other forms of post-marital residence	Total
Mostly male	23	14	37
Both sexes	17	6	23
Mostly female	5	3	8
Total	45	23	68

Fisher's exact test: $p=0.66$

Table 5.5 Contingency table showing the number of SCCS societies with patrilocal residence or similar, against other forms of post-marital residence, and how these are distributed in relation to the sex of witches. There are no significant differences in the distribution of the sex of witches and forms of post-marital residence.

Results: accusations of witchcraft by sex in the Bantu

There was a total of 276 case studies, from 49 Bantu societies, where the sex of the accused could be reliably coded.

I used a null model to examine the difference between societies in the sample and calculated an Intra-Class Correlation coefficient (ICC) of 0.16, indicating that 16% of variation in the sex of the accused was due to differences between societies.

As can be seen from **Table 5.6** and **Figure 5.2** a higher proportion of men than women were accused of witchcraft in the sample.

Within the different relationship categories, the odds that an accusation from affinal kin (as compared to one from non-relatives) would target a woman were 7.52 (95% CI [2.48, 22.82]) times more likely than that it would target a man (**Table 5.12**); this was statistically significant. In the context of relationships with relatives, women had a 1.48 (95% CI [1.45-13.44]) higher odds of being accused by their genetic relatives than were men. The highest number of accusations directed at men came from those they were not related to (**Table 5.12**). When accusations occurred between individuals who lived together, as compared to those who lived in different households but the same settlement, the odds of the accused being female were 4.41 (95% CI [1.45-13.44]) times higher than the accused being male. The odds of the accused being male were around four times higher (inverse OR 0.23, 95% CI [0.05, 0.93]) than being female for people who lived in different communities (compared to people living in the same communities).

An equal number of elderly men (N = 17) and elderly women (N = 17) were identified as witches in the sample. Because of the different number of cases per sex, these cases formed 9% of the accused men and 20% of the accused women. In the 'zero' model, as shown in **Table 5.12**, if an accusation targeted an elderly individual, rather than an adult or child, there was a 2.34 (95% CI [0.63, 8.68]) higher odds that the 'witch' was woman rather than a man. This difference was not statistically significant.

The sex of the accusers could be clearly identified for 140 cases (many of the remaining cases had multiple individuals as accusers, classified as ‘Mixed’). Of these cases, men formed 82% of the accusers. 85% of men were accused by other men, and 76% of women were accused by men. Women formed a much smaller percentage of accusers. The sex of the accuser did not have a significant effect on the sex of the accused. When the accusation came from a group of individuals of mixed sex, the odds of the target being male were 1.12 times that of the target being female [inverse OR = 0.89, 95% CI [0.50, 1.57]]. If accusations were made by women, the odds that the accused was male were 1.15 that of the accused being female [inverse OR = 0.87, 95% CI [0.40, 1.89]].

The society-level variables had little correlation with whether the targets of accusations were male or female. There was little difference between societies with and without social stratification in predicting whether accusations targeted men or women (OR = .096, 95% CI [0.44, 2.08]). Similarly, dispersal patterns were not clearly predictive of how likely the accused was to be female compared to male. In societies where men moved to be with their wives’ families after marriage, accusations were as likely to target women as men (OR = 0.96, 95% CI [0.45, 2.05]), compared to societies where women dispersed after marriage. In non-patrilineal societies, accusations had 1.3 higher odds (inverse OR= 0.79, 95% CI [0.34, 1.81]) of targeting men rather than women, compared to patrilineal societies.

I also investigated whether interactions between particular variables were more likely to lead to men or women being accused. This included multilevel models with interactions between relationship categories and post-marital residence patterns, and interactions between relationship categories and domestic arrangements between the accused and the accuser. The results of these models can be seen in **Appendix 5 (tables A5.2 and A5.3)**. None of the interaction terms showed a significant effect, although the results were consistent with the model averaging, showing that accusations in affinal relationships were more likely to target women.

	Female accused	Male accused	Total	X² p-value
Total	87 (32%)	189 (68%)	276	
Relationship				
Unrelated	30 (20%)	117 (80%)	147	<0.01
Genetic Relatives	18 (33%)	36 (67%)	54	
Affinal relatives	29 (76%)	9 (24%)	38	
Missing	10 (27%)	27 (73%)	37	
Domestic Arrangements				
Living together	29 (74%)	10 (26%)	39	<0.01
Neighbours	9 (33%)	18 (67%)	27	
Same Settlement	31(27%)	84 (73%)	115	
Different Settlements	3 (9%)	31 (91%)	34	
Missing	15 (25%)	46 (75%)	61	
Accused Age				
Adult or child	66 (30%)	155(70%)	221	0.03
Elderly	17 (50%)	17 (50%)	34	
Missing	4 (19%)	17 (81%)	21	
Accuser Sex				
Male	39 (34%)	75 (66%)	114	0.05
Mixed	22 (22%)	77 (78%)	99	
Female	12 (48%)	13 (52%)	25	
Missing	14 (37%)	24 (63%)	38	
Descent				
Patrilineal	38 (39%)	59(61%)	97	0.06
Non-Patrilineal	49 (27%)	130 (73%)	179	
Post-Marital Residence				
Female dispersal (ref)	52(35%)	95(65%)	147	0.04
Male dispersal	29 (35%)	55 (65%)	84	
Mixed dispersal	6 (13%)	39 (87%)	45	
Social stratification				
Wealth distinctions	36 (32%)	78 (68%)	114	
No wealth distinctions	34 (25%)	101 (75%)	135	<0.01

Table 5.6 Descriptive statistics showing all variables entered into the final global model by the sex of the individual that was the target of a witchcraft accusation.

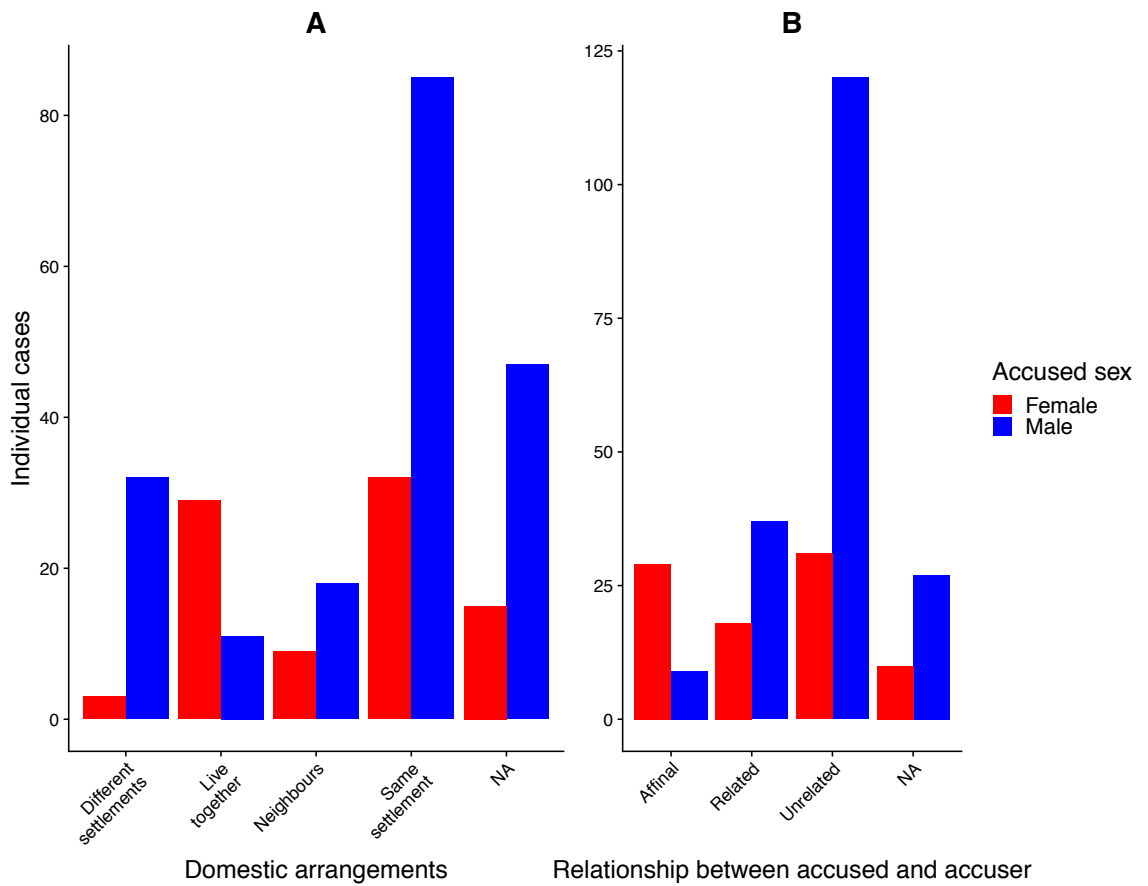


Figure 5.2 Bar charts showing the association between the sex of accused witches and A) where they live in relation to their accuser and B) the category of relationship between the accused and their accuser.

	Female accused	Male accused
Husband-Wife accusations	13	2
Co-wife accusations	7	-
Other affinal kin	10	7
Total	30	9

Table 5.7 showing the counts of men and women accused within the context of affinal relationships. 18% are between co-wives.

Relationship	Female dispersal	Male and other dispersal	Total
Unrelated	21	9	30
Related	9	9	18
Affinal	14	15	29
Total	44	33	77
$X^2 = 3.33$ $df = 2$ $p = 0.19$			

Table 5.8 Individual cases where the accused is female, by post-marital residence patterns, and relationship categories with accusers. The post-marital residence categories are patterns where 1) females disperse, or 2) males disperse combined with ‘other’ dispersal patterns.

	Unrelated	Related	Affinal	Total
Living together	2	4	21	27
Separate households	24	11	5	40
Total	26	15	26	67
$X^2 = 30.34$ $df = 2$ $p < 0.01$				

Table 5.9 Showing individual cases where the accused is female by the domestic arrangements of the accused and the accusers (whether they live together in the same household, or in separate households) and by the relationship category of the accused to the accuser.

	Female dispersal	Male and other dispersal	Total
Unrelated	53	63	116
Related	22	14	36
Affinal	2	8	10
Total	77	85	162
$X^2 = 5.90$ $df = 2$ $p = 0.05$			

Table 5.10 Individual cases where the accused is male, shown by relationship category and post-marital residence patterns where 1) females disperse, or 2) males disperse and ‘other’ dispersal patterns

	Unrelated	Related	Affinal	Total
Same community	72	22	8	102
Different settlements	25	2	1	28
Total	97	24	9	130
$X^2 = 4.08$ $df = 2$ $p = 0.13$				

Table 5.11 Individual cases where the accused is male, shown by where the accused and accuser live in relation to one another and relationship categories. ‘Same community’ is a combination of the ‘Living together’ ‘Neighbours’ and ‘Same settlement’ categories.

Table 5.12	Estimate (SE)	95% CI Low	Odds Ratio	95% CI High	Relative Variable Importance
Intercept	-1.29* (0.51)	0.10	0.27	0.74	
<hr/>					
Age: unspecified age adult (Ref.)					
Age: elderly	0.85 (0.67)	0.63	2.34	8.68	0.72
Age: missing	0.18 (0.61)	0.36	1.20	3.98	
<hr/>					
Relationship: not related (Ref.)					
Relationship: related	0.39 (0.45)	0.61	1.48	3.58	1.00
Relationship: affinal	2.02*** (0.56)	2.48	7.52	22.82	
Relationship: missing	-0.07 (0.53)	0.32	0.92	2.65	
<hr/>					
Domestic arrangements: same settlement (Ref.)					
Domestic arrangements: cohabiting	1.49** (0.56)	1.45	4.41	13.44	1.00
Domestic arrangements: neighbours	0.55 (0.58)	0.56	1.74	5.39	
Domestic arrangements: different settlements	-1.49* (0.72)	0.05	0.23	0.93	
Domestic arrangements: missing	-0.30 (0.44)	0.31	0.74	1.76	

Table 5.12 cont.	Estimate (SE)	95% CI Low	Odds Ratio	95% CI High	Relative Variable Importance
Accuser: male (Ref.)					
Accuser: other	-0.12 (0.29)	0.50	0.89	1.57	0.21
Accuser: female	-0.13 (0.39)	0.40	0.87	1.89	
Accuser: missing	0.09 (0.30)	0.60	1.09	1.99	
Stratification: wealth distinctions (Ref.)					
Stratification: no wealth distinctions	-0.04 (0.39)	0.44	0.96	2.08	0.58
Stratification: missing	0.80 (0.88)	0.40	2.23	12.56	
Descent: patrilineal (Ref.)					
Descent: non- patrilineal	-0.24 (0.43)	0.34	0.79	1.81	0.79
Post-marital residence: female dispersal (Ref.)					
Post-marital residence: male dispersal	-0.04 (0.38)	0.45	0.96	2.05	0.45
Post-marital residence: other	-0.74 (1.01)	0.07	0.48	3.42	
Num. obs.	276				
***p < 0.001, **p < 0.01, *p < 0.05					

Table 5.12 Showing the results of the averaged multilevel logistic models examining what variables correlated with the sex of accused witches. This shows the top models with delta <6. For the outcome variable (sex of accused witches) the reference category was 0) male and the focal category 1) female.

Discussion

The results suggest that accusations in the context of affinal relationships in Bantu societies were more likely to be directed at women than men, and women also more likely than men to be living with their accusers (**Tables 5.7, 5.9 and 5.12**). Affinal kin relationships may be more likely to produce competition directed at women, and so more likely to lead to accusations of sorcery targeting women. But witchcraft accusations are also thought to occur amongst individuals who interact closely (Geertz, 2011; Geschiere, 2015; Wilson, 1951b). This result may be a confirmation of that observation, and indicative of women's general position in Bantu societies. Beattie says of the women in Bunyoro: 'theirs is a much more restricted social world than men's. In a quite literal sense, a woman's place is in the home, so that her attachments tend to be at once fewer and more intense, and so more liable to strain.' (Beattie, 1963: 32). Despite the lack of statistical significance because of the large degree of uncertainty resulting from the small sample size in the interaction terms, **tables A5.2 and A5.3** show that women are more likely than men to be accused by affinal kin they are living with. Levine (1963) commented that women were more likely to accuse a woman within their homestead if witchcraft was suspected, while men were more likely to accuse someone outside of their home, such as a neighbour.

Women who were accused by their co-wives formed a relatively small proportion of the cases of accusations by affinal kin. This is somewhat surprising given the numerous accounts of accusations between co-wives (Strassman, 1997; Levine, 1962, Wilson, 1951; Krige, 1947). It is possible that such accounts have been over-emphasised in the literature: what informants told ethnographers about which relationships lead to witchcraft may be more indicative of people's own perspective on their society than what is actually happening. Although co-wife and in-law relationships are frequently identified as problematic and competitive, there are also examples of cooperation within them (Jankowiak et al., 2005; LeVine, 1962). This result may also be due to sampling bias, where cases recorded by ethnographers and coded in the dataset are not representative of overall patterns.

Results using society-level data from the SCCS, and individual case studies from Bantu societies, suggest that, for the most part, individual competitive relationships

are more predictive of which sex is accused of witchcraft than society-level traits. The ICC also indicated that only a modest 16% of the difference in the sex of the accused could be accounted for by society-level differences. However, the fact that all of the variables included in the analysis contributed to the top models indicates that they had an influence on the outcome of the results. It is possible that with a larger and more detailed sample, society-level differences might have been more pronounced, but this study was constrained by the information that was available in the ethnographic record and could be coded for the dataset.

Among accusations by affinal kin, although the sample size is limited, there were a greater number of cases where men accused their wives ($N = 13$) than where wives accused their husbands ($N = 2$). This could lead to the tentative conclusion that, in line with the hypothesis, witchcraft accusations may at times be used by men as a form of coercive control towards their partners. The threat of a witchcraft accusation may be used to enforce compliance in a partner, or to dismiss one who is infertile or otherwise thought to be unsuitable. Using witchcraft accusations to dismiss partners in these circumstances might generally be a rapid and clear-cut means of doing so, and effective in protecting the reputation of the accuser from allegations of wrongdoing or unfair dismissal. It could provide justification for a divorce without need of further explanation, given the serious implications of a witchcraft accusation. Of course, not all cases are straightforward and there is still space for disagreement.

The greater number of accusations of elderly women being accused fits with research suggesting that in harsh environments, where competition for resources is intense, post-reproductive females who may have to rely on others for provision may be vulnerable to geronticide (Brogden, 2001). Among the Sukuma, elderly women were often suspected of black magic, and even their own children were apparently scared of taking them in. If they did live with their children, they knew that their position was precarious: the author comments that such women ‘will never eat fat pieces of meat, but will know the bones,’ (Cory, 1953: 165). It has been suggested that witchcraft accusations of the elderly forms part of a broader pattern of geronticide, where many societies that were close to subsistence-level condoned either the abandonment or killing of elderly people, and again often with a sex-bias meaning that women were targeted more frequently (Brogden, 2001; Miguel, 2005). Older

men were still vulnerable, but not post-reproductive, and possibly had greater protection as a result of their status, or political acumen, within male-dominated societies.

Contrary to the hypothesis, patrilocal dispersal systems were not more likely to produce female witches, in either the worldwide sample of societies or in the analysis of case studies from the Bantu. Post-marital residence was in fact the variable with the lowest relative importance.

Men were not more likely to be accused of witchcraft in societies with greater wealth inequality, where male-male competition might be expected to be more extreme. Instead, there was an indication in the sample from the SCCS that women are more likely to be accused in societies with social stratification than in egalitarian ones.

Overall the hypothesis that accusations are the result of inter-sexual competition was not supported in the results. This was also the case for female-female and male-male competition: the sex of the accuser did not determine whether it was more likely that the accused was male or female. This suggests more prominent patterns of accusations are difficult to detect, perhaps because the circumstances that they were used in were so flexible.

The SCCS results show that women were more likely to be identified as witches in societies where there were higher levels of social stratification, but men were not. This was contrary to the hypothesis that more competition would be directed towards men in more highly stratified societies. But it does align to previous work examining the relationship between competition and stratification: there is also an association between male hierarchies and male control of women (Betzig, 1986; Kruger et al., 2014). Where there is a skew in male resource-holding, and consequently reproductive success, females are constrained in their mate-choices and will choose high status men (Betzig, 1986). Therefore the two systems of male-male competition and male dominance of women tend to evolve together (Kruger et al., 2014). This does not explain why men are identified more as witches in egalitarian societies in the SCCS sample. It is possible that male-male competition is in fact more intense where it is between equals. Among the Azande, accusations never crossed the

boundaries between aristocracy and commoners. But accusations could occur between individuals of equal status. Being envied for a small increase in wealth could lead to an accusation of witchcraft, which might have provided an incentive to maintain the status quo and avoid wealth accumulation (Evans-Pritchard, 1937).

Limitations

There are a number of limitations to this analysis. Missing data reduced the number of cases that could be used. The coded cases were not collected systematically by ethnographers but were selected according to what they observed and chose to record, so they may not form a wholly representative sample. This may in part explain why there are not more conspicuous patterns of accusation, as well as the fact that the dataset tests accusations against one another, rather than being able to examine them against baseline population rates.

Classifying entire societies into unitary categories can mask substantial within-society variation. Evidence indicates that societies can be variable in terms of residence and descent patterns, and they may not be entirely matrilineal or entirely patrilineal and some literature questions whether such categories are in fact useful and valid (Koster et al., 2019).

The coding of variables in general will be subject to varying degrees of reliability and accuracy. The sex of accused witches was one of the most reliable variables to be coded, as the information was generally available and unambiguous. This was not the case for all variables: for example the age of accused witches was frequently unclear in ethnographies. The majority of individuals could be identified as adults (there was also a very small number of children), but beyond that it was difficult to determine any further information, so they were classified as adults of unspecified age. Consequently there may be more elderly people in the sample than accounted for in the coding.

This analysis is correlational, and so any causation has to be inferred, and cannot be definitively stated. Also, sample sizes are fairly small, especially for the data from the SCCS, meaning that the results of the analysis are not as reliable as they would

be from a larger sample. However, the results do provide a novel quantitative examination of factors influencing whether witchcraft accusations are directed at men or women, using predictions derived from evolutionary theory.

Conclusion

This chapter contributes to the currently limited quantitative examination of factors determining who is accused of practising witchcraft. Overall, a far greater number of men were accused, and the majority of accusers were also male. This supports the literature contradicting the view that witches are mostly female.

The results suggest that particular competitive relationships, such as those between affinal kin residing together, are more likely to lead to women being accused. This reinforces anecdotal accounts of accusations being directed at women by their husband's families. It also may indicate that men are more likely to use accusations as a means of either coercing or dismissing their wives than the other way around: wives did this with their husbands, but to a lesser extent. Men were more likely to be accused by unrelated individuals and genetic relatives, who they may have been competing with for access to resources and prestige. Clear associations were mostly not found in society-level variables. This suggests that across societies, witchcraft accusations are a very flexible 'tool,' that may be adapted to a variety of situations whenever they provide substantial benefits to accusers.

Chapter 6: Witchcraft, the Evil Eye, Inequality and Envy

Summary

Some researchers have suggested that the nature of witchcraft accusations varies in response to socio-ecological settings. Witchcraft beliefs vary from culture to culture, but there has been no previous quantitative cross-cultural investigation of whether the characteristics of accusations vary with social and cultural factors. This chapter examines whether situations where individuals appear to be accused for reasons relating to wealth and status were more likely to evolve in environments where there is greater inequality, more resource scarcity, and weaker legal systems and institutions. Other forms of witchcraft accusation occur, but these were not predicted to be associated with such conditions. There was a tentative association between resource scarcity and more accusations in relation to wealth and status, and they also occurred more in societies with higher levels of jurisdictional hierarchy. But the most important predictor of this form of accusation was the sex of the accused 'witch': men were far more likely to be targeted. I also examine the relationship between similar ecological conditions and the evolution of the evil eye in Bantu societies. There was no clear statistical link between the presence or absence of the evil eye belief and higher social inequality or lower levels of institutional strength. The association between evil eye belief and the presence or absence of large livestock approached statistical significance, suggesting, in line with previous research, that the belief may evolve more frequently in environments where wealth is visible and vulnerable.

Introduction

Research aiming to identify the conditions in which witchcraft beliefs evolve has had mixed results. Some previous research, including Chapter 4 of this thesis, suggests that the existence of witchcraft beliefs in societies is independent of social structure to an extent (Hutton, 2017; Sanders, 1995). However, witchcraft beliefs are also documented more frequently in hierarchical, agricultural and pastoral cultures with weak legal systems, and more rarely in hunter-gatherer societies (Hutton, 2017; Koning, 2013; Swanson, 1964). If society-level traits only have a loose association with the distribution of witchcraft beliefs, do they have an impact

on the circumstances in which witchcraft accusations occur? This chapter looks at how socio-ecological conditions may lead to the evolution of two separate but related phenomena: witchcraft accusations in association with resources and status, and the evil eye belief.

The evil eye belief is related to witchcraft beliefs. It holds that certain individuals can cause harm to other people, livestock or property, through a single glance. It is typically viewed as being motivated by feelings of envy, which are projected towards its object in the form of destructive magic (Maloney, 1976; Spooner, 1970).

Resource scarcity, competition and spite

In this section I discuss the mechanisms that may underpin both witchcraft accusations and belief in the evil eye: selfishness and spite, and the socio-ecological conditions they are thought to evolve in.

The evolutionary definition of spite is a behaviour where an actor pays a cost to inflict a cost on the recipient, or a cost is inflicted on a recipient when there is no benefit to the actor (Gardner & West, 2004; Hamilton, 1970; West & Gardner, 2010). Hamilton (1970) suggested spite would be a rare behaviour, because when evolving in small populations, its increase would lead to the population's extinction. It is probably rarer than selfish behaviour, which increases the fitness of the actor at a cost to the recipient (Hamilton 1964a, 1970; West et al. 2004).

Witchcraft accusations are almost certainly examples of selfish, and perhaps even spiteful behaviour. A chief who accuses a wealthy individual of witchcraft, and confiscates his wives and cattle, may be assumed to be acting selfishly, as there is little identifiable cost and obvious benefits in such an action. Accusations may be more in line with spiteful behaviour when they involve close relatives, such as those between brothers over inheritance: accusing and harming a close relative may at be damaging to the accuser's inclusive fitness.

Some research has sought to empirically test how environmental conditions may lead to the evolution of spiteful behaviour. Prediger et al. (2014) examined the

hypothesis that in environments where resources are scarce, spiteful behaviour is more likely to evolve. They tested this in two groups of pastoralists from Namibia, with very similar social and cultural backgrounds. One group lived in an area of high yield pasture, where resources were relatively abundant, and the other lived in an area of low yield. The two groups played the 'joy-of-destruction' game, where two participants are given equal endowments, and have the option of paying a cost in order to lower the other player's income. The authors suggest there is no monetary gain, punishment or inequity aversion involved in this behaviour: the motivation is solely spite. 40% of participants from the low-yield area were willing to engage in destructive behaviour, compared to just 23% of individuals from the high-yield area. There was also a small effect of income inequality, where pastoralists who owned larger herds were less likely to destroy another's endowment than those with smaller herd, but this was less important than the effect of environmental scarcity overall.

By extension, it could be suggested this study indicates that harmful behaviours, such as witchcraft accusations, are likely to occur in more competitive environments, where resources are scarce for long periods of time. The authors suggest the action of destroying another player's endowment is in fact free of any clear benefits, and does not follow the rational-actor model of economic games. The difference between this and some witchcraft accusations is that in the latter, there often is a tangible gain to accusers, whether this constitutes access to resources, or a gain in personal status that will increase their access to resources, or dismissing a competitor who constitutes a potential threat.

On a related topic, Gershman (2014) distinguishes between constructive and destructive envy. He suggests the two forms of envy evolve according to variations in socio-ecology. With constructive envy, individuals perceive inequality between themselves and others, and are motivated to increase their own outcomes, for example by working harder, and competing with one another, but in a relatively positive sense, which he describes as 'keeping up with the Jones's' (Gershman, 2014: 407). Constructive envy arises under conditions where initial inequality is low, tolerance for inequality is high, and there are ample opportunities for investment. Destructive envy entails decreasing the outcome of the reference group,

rather than seeking to improve one's own outcomes. Destructive envy is more likely to occur in environments where there is greater inequality, weaker institutions, and an absence of property rights. The absence of property rights and institutions means there is nothing to prevent people acting on destructive envy, and property can be easily transferred between individuals or stolen without fear of retaliation or punishment. Under these conditions, there is also a lower tolerance for inequality, leading to individuals being fearful of producing too much, to avoid being the victims of others' envious retaliation.

The evil eye belief: a mechanism for destructive envy-avoidance?

Belief in the evil eye, like the related belief in witchcraft, is widely distributed across the world. It has been reported throughout Europe, the Middle East, and Africa (Roberts, 1976; Spooner, 1970). As the idea is intrinsically bound up with the notion of envy, targets of the evil eye are thought to include people who are wealthy, or beautiful, or have beautiful children (Reminick, 1974). Like witchcraft, it is a means of explaining random misfortune (Spooner, 1970). Unlike witchcraft beliefs, the evil eye does not result in open accusations (Spooner, 1970), although individuals are suspected of possessing it (Reminick, 1974). This was true of the case studies in the Bantu witchcraft dataset: none involved someone being accused of using evil eye, although 19 of the societies were recorded as believing in it. As well as an explanation for misfortune, the evil eye belief is identified as a motivation for pre-emptively avoiding being a target of aggressive actions driven by envy, for example by hiding or not accumulating too much wealth (Gershman, 2015).

Gershman (2015) undertook a thorough analysis of evil eye beliefs, using societies from the SCCS global sample (Murdock & White, 1969). This formed an extension of the constructive-destructive envy hypothesis (Gershman 2014). The evil eye belief was proposed as a mechanism to counter aggressive actions triggered by destructive envy. It was found to be significantly associated with greater wealth inequality, greater technological specialization (a measure of cultural complexity, which indicates higher levels of social inequality) and where formal institutions were lacking. It was frequent in agricultural and pastoral societies, where wealth is

both more visible and more vulnerable (or easily transferable between individuals). Large livestock, such as cattle, are an example of this form of wealth: it is easy to perceive inequalities in herd size between owners. Livestock are also easily transferred between individuals or stolen. Large livestock and dairying may lead to the evolution of the evil eye for another reason, as cattle are liable to stop producing milk for inexplicable reasons, which could be explained with reference to the envious magic of some unknown individual (Maloney, 1976).

Gershman (2015) concluded that as a result of the desire to avoid harmful envy, the evil eye belief results in a decline in productivity, decreased efforts to accumulate wealth, and also in attempts to conceal wealth. Another study, also using data from the SCCS, found that the evil eye was associated with cultural complexity and technological specialization (Maloney, 1976), again suggesting that it may evolve in conditions where there is greater social inequality.

Reasons for accusations

The reasons individuals accuse one other of witchcraft are far from irrational (Macfarlane, 1999). Witchcraft accusations are closely associated with interpersonal relationships, and this has been documented by both anthropologists and historians (Macfarlane, 1999; Sanders, 1995). They tend to follow general patterns, as the result of a number of different factors. These include political rivalry, rivalry in love, interpersonal disputes and grudges, competition between co-wives, and competition for resources, to name a few of the most common.

Witchcraft accusations and ecological conditions

Witchcraft accusations relating to wealth and status may evolve in similar conditions to the evil eye belief.

Ethnographers and historians describe how changes in social conditions can lead to changes in the form taken by witchcraft beliefs and accusations. Ardener (1956, 1970) describes how the concept of witchcraft changed among the Bakweri of the Cameroons. Before the German conquest, they believed in a form of witchcraft known as *liemba*, which was thought to cause sickness, and related to an envy of

property and livestock that arose between relatives. Following the arrival of the Germans and the establishment of plantations, a different form of witchcraft known as *nyongo* appeared, ‘compared with which the old *liemba* was regarded as almost a harmless trifle’ (Ardener, 1970:147). People with *nyongo* were thought to create a zombie labour force from their own relatives, who they killed for this purpose. *Nyongo* were identified by the zombie-built, corrugated tin houses they lived in, and so anyone living in such a house, and who accumulated conspicuous material wealth, was vulnerable to accusation and ostracism. This encouraged people to conceal evidence of wealth and success for fear of accusations. Similarly Geshiere (1999) argues that witchcraft beliefs were modernized: they were adapted from their older association with social relations, to new situations associated with the rise of capitalism and globalisation. It seems probable that shifts in culture and environment are associated with changes in the nature of beliefs and accusation.

The socio-ecology of Bantu societies

There is variation in the environments inhabited by Bantu societies, but the majority lived close to subsistence level. Where resources are scarce, selfish and spiteful behaviours are predicted to be more likely to evolve (Gardner & West, 2004; Prediger et al., 2014). A substantial number of the ethnographies include accounts of famine, drought and starvation. For example Fallers (1960: 38) wrote of the environs of the Baganda: ‘It seems that famines were relatively frequent, and serious, even in wealthy fertile Buganda.’ And the neighbouring region of Busoga was even more prone to them, producing disastrous effects in the less fertile parts of the area (Fallers 1960).

All of the societies in the sample have relatively weak formal institutions, although there is variation between them. The strength of formal institutions is important in relation to witchcraft beliefs because, similarly to socio-ecological factors associated with the evil eye, where there are less legal checks and policing, there is no incentive for individuals to avoid retaliation for harmful acts.

Higher levels of social stratification suggest higher levels of overall inequality between individuals in societies, which will lead to greater competition for

resources that are available. As well as a society's class structure, increased cultural complexity indicates greater inequality. Societies that are sedentary rather than mobile, and have more hierarchies at a local level, are also more culturally complex (Gershman, 2015).

Witchcraft accusations: why is status relevant?

Status and access to resources are intrinsically linked. One definition of status is that it determines priority access to resources in competitive situations (Van Vugt & Tybur, 2015). It therefore has implications for individual fitness: those nearer the top of status hierarchies have preferential access to resources and mates, and those near the bottom have greater difficulty in accessing them (Betzig, 1986).

The association between witchcraft and status is a recurring theme within societies, although the nature of this relationship varies. In many Bantu cultures, chiefs are believed to have magical powers (Beidelman, 1963; Douglas, 1970; Junod, 1912; La Fontaine, 1963). Much of the time, the fantastical powers of chiefs are perceived in an ambivalent light, as they can perform protective measures that are beneficial for their subjects (La Fontaine, 1963), but there are also more negative connotations, where leaders are thought to use black magic to destroy their rivals (Junod, 1912). Chiefs were less likely to be the targets of outright accusations, but this did sometimes happen (Douglas, 1970). High status individuals were also thought to use witchcraft in Papua New Guinea: this relates to the intense and continuous struggle for dominance and authority among big-men (Forge, 1970).

Victims can be high status, low status or equal status in relation to their accusers, depending on the situation and the society. This finding is in contrast to the popular view that accusations mainly target vulnerable, low-status individuals: women, the elderly, the disabled, and, recently, the growing numbers of children who have been accused of witchcraft (Miguel, 2005; Foxcroft, 2017). Research has associated the accusation of vulnerable individuals with harsh environments. Where there are not enough resources to go around, individuals who are regarded as 'expendable' are the most likely to be accused of witchcraft (Miguel, 2005). This happened to a woman called NaMarya, from the Lozi of Zambia. She was 'crippled with old age

and rheumatism, and a burden on the group rather than a help, [she] lacked social support in the village which she married into as an inherited wife'. NaMarya came to be suspected of causing various misfortunes in the village, such as the failure of a hunting ordeal (Gluckman, 1967: 166). This form of accusation sometimes happened to male as well as female victims (e.g. Johnson, 1922).

In a related pattern, individuals sometimes hint that they themselves are witches, with the aim of increasing their own status. When they are otherwise vulnerable, a suggestion that they are able to command occult powers enables them to secure respect, cooperation, and resources they might not otherwise have access to (Beidelman, 1963).

Access to status and resources may be particularly important for men in Bantu societies. Inequalities in male wealth and status are associated with polygynous marriage systems. Individuals with more resources are able to acquire more wives, and reproduce more successfully, meaning there is a large reproductive skew in such societies (Betzig, 1986, Smuts 1995). Therefore, competition between men for wealth and resources is liable to be particularly intense.

The relationship between witchcraft, status and resources is documented in societies outside Africa. Thomas (1971) documents a number of cases from seventeenth century England, such as when a cunning woman (the English equivalent of an African doctor or diviner, but often considered quite low-status) named Joan Peterson was refused payment after curing Christopher Wilson. She foretold that his condition would become ten times worse, and indeed it did. The main pattern of cases in the English records occurs when a poorer 'witch' turns up at a neighbour's begging for food, drink or some form of loan, which was refused (Thomas, 1971; Macfarlane, 1970).

Other reasons for witchcraft accusations

Although many accusations are in some way connected to status and resources, a substantial proportion are not. The motivation of witches in a modern-day South African village was attributed to two factors: personal grudges, and the desire for

the acquisition of wealth (Golooba-Mutebi, 2005). In the Bantu dataset, after status and wealth, the largest category leading to accusations is broadly termed interpersonal reasons (see **Figure 6.1** below). Sometimes individuals are accused of being witches because their behaviour is strange, difficult, or non-conforming, or what might elsewhere be identified as the result of mental illness. One example of this relates to an old woman of the Kaguru who, among other behaviours, claimed she had a child who had died, but returned to her in the form of a lion, and which followed and protected her (Beidelman, 1963). This also includes cases such as disputes between former in-laws, following the breakdown of a marriage due to ill-treatment (La Fontaine, 1963).

The category 'reproduction' includes accusations relating to adultery, fertility and problems relating to marriage and love. For example, a Nyoro husband rejected his wife, on grounds of adultery, and forced her to separate from him. He then re-married, but after some time, he returned to his first wife. Their relationship remained difficult, and when he went blind, it was believed to be the witchcraft of his first wife, taking revenge on him for sending her away and marrying someone else (Beattie, 1963: 33).

Some accusations of witchcraft appeared to be related more to the need for an explanation following a death or misfortune than to any social circumstances between the accused, the victim and the accuser. The targets of such accusations appear to be almost entirely random. An example of this occurred in the Nyanja, when following the death of a child, a group of individuals, who had recently camped in the area, were asked to drink the poison ordeal by the child's kin in order to find out who was responsible. There were no prior 'suspects' or disagreements between the two groups, although of course the fact that the suspects were unknown strangers was significant (Werner, 1906). The identification of the accused may not be as un-biased as it is sometimes portrayed in ethnographies, but where there is no further information provided, this is the most straightforward explanation. This has also been observed to occur in a modern day investigation of witchcraft accusations in India, where some victims appeared to be selected completely at random (Chaudhuri, 2012).

A very small number of accusations (N=2) arise because of strange circumstances, which were explained by witchcraft, such as when a man was caught by a crocodile, but managed to escape. Because crocodiles were linked with witchcraft, his escape rendered him suspicious and tainted and he was forced to live in a hut that was separated from the village, although he was still provided with food (Stayt 1968: 275-276).

The evil eye and witchcraft beliefs have both been associated with the concept of what was originally termed the 'image of limited good' (Foster, 1965). It was identified among peasant agriculturalists, where members of a society share the belief that all desirable things in life such as respect, security, wealth and so on are in finite and limited supply (Foster 1970). This is closely tied to the concept of a 'zero-sum' game, where individual gain can only be accomplished through another's loss (Reminick, 1974). This occurs in environments where resources are scarce, and hence there is greater competition for them: there is not enough for everyone. A farmer can only gain in land if he obtains his neighbour's. Theory on the evolution of these beliefs has placed a slightly different emphasis on them as mechanisms: witchcraft accusations may be viewed as aggressive expressions of competition and envy, which either harm a target of envy, or are a pre-emptive attempt to avoid harm as a result of envy directed at oneself (Thomas, 1971; Macfarlane, 1999). The evil eye has been posited as a mechanism for envy-avoidance. When individuals believe that the evil eye exists, and they may be harmed as a result of others' destructive envy, they may avoid accumulating or displaying wealth (Gershman, 2015). There is

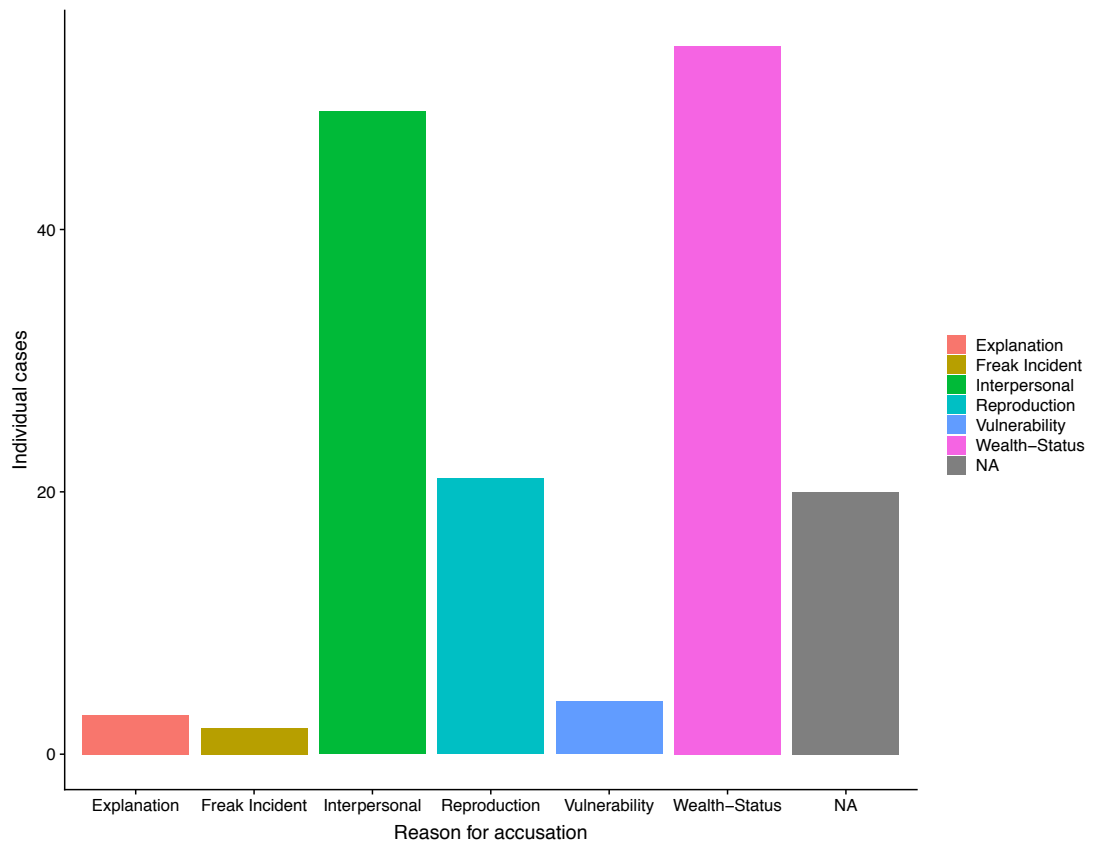


Figure 6.1 Bar chart showing counts of the reasons for witchcraft accusations in the sample from the Bantu witchcraft dataset. Wealth and status related accusations are the largest category, followed by interpersonal reasons. The ‘Explanation’ category relates to cases where accusations appear to be driven more by a need for an explanation for misfortune than any other factor.

some overlap between witchcraft and evil eye beliefs, but they can be viewed as related phenomena emphasising different aspects of an awareness of inequality between individuals and resulting feelings of envy. Therefore the evil eye belief and witchcraft accusations can be seen as cultural traits that facilitate decision-making in uncertain and complex environments (Richerson & Boyd, 2005).

Witchcraft beliefs and accusations

The question of whether reasons for witchcraft accusations may vary according to ecological conditions has never, to my knowledge, been quantitatively examined.

Accusations appear to be a flexible tool that can be used in a variety of situations, and are predicted to be focused on individuals and resources that will most directly benefit accusers in a particular environment.

Witchcraft accusations are therefore divided into two main types for this study: those that relate to competition for resources and status, and those that do not, to examine whether there is a difference in the ecological conditions they are correlated with. The status aspect is included because where resources are limited, those with greater power and status will have more access to them.

Methods

Variables

Below I provide details of the variables, and how some have been re-coded from the original classifications in the Ethnographic Atlas. Although there are more specific reasons for some re-classifications, it was necessary to do this because of the small sample size: models with a greater number of parameters would not have been statistically viable.

The Evil Eye

This was coded as a binary variable, from ethnographies of Bantu societies, as described in chapter 3. Societies were coded as either having the belief ('present') or not having it ('absent'). When coding this variable, it was not always clear whether the belief was present or absent. Coding decisions were made according to whether it seemed likely that the evil eye would have been mentioned if it was present, on the basis of as many sources as possible. If there was a substantial amount of information available on witchcraft and related beliefs, but none of the ethnographers for a particular culture commented on it, the evil eye was coded as 'absent'. Where there was less available information, or it was uncertain whether the ethnographer would have mentioned it, the trait was coded as not available (NA). Societies coded as NA are not included in the analysis.

Accusations: status and resources

This is a binary variable from the Bantu witchcraft dataset. The category 1), or 'status-wealth' consists of accusations that relate to competition for resources, prestige and status. The reference category 0) relates to accusations those that do not involve those factors.

Hypotheses, predictions and variables	
Evil eye belief	Wealth and status-related witchcraft accusations
Hypotheses	
The evil eye belief is a mechanism for avoidance of the effects of destructive envy, and so will occur more in societies where envy is more extensive.	The socio-ecology of societies will affect the ‘causes’ or ‘reasons’ for witchcraft accusations. More status and wealth-related accusations will occur in societies with higher levels of envy and competition for wealth and status, greater social complexity, and where legal institutions are weaker.
<i>Outcome variable: presence or absence of evil eye belief</i>	<i>Outcome variable: 0) accusations are not related to status and wealth 1) accusations are related to status and wealth</i>
Predictions (Variables)	
The evil eye belief will be present in Bantu societies where there is greater inequality between individuals, as indicated by the existence of class and wealth distinctions <i>(Social stratification)</i>	There will be an increasing number of status and wealth-based accusations when societies have greater inequality, as indicated by class and wealth distinctions. <i>(Social stratification, Mobility, Levels of hierarchy in the local community)</i>
The evil eye belief will be present in societies where there is a higher level of visible and vulnerable wealth such as livestock, and absent in societies which do not have much visible and vulnerable wealth. <i>(Animal husbandry)</i>	There will be more status and wealth-based accusations among individuals from societies where wealth is more visible and vulnerable (such as livestock). This form of wealth is more easily transferable between individuals, for example it can be easily transferred between an accused ‘witch’ and their accuser. <i>(Animal husbandry)</i>
	Status and wealth-based accusations will occur more frequently among individuals from societies where there is an overall scarcity of resources, as a result of increased competition. <i>(Resource abundance, Climate stability)</i>
The evil eye belief will be present more frequently in societies with weak formal institutions (as measured by levels of jurisdictional hierarchy) and more frequently absent in societies with stronger formal institutions. <i>(Jurisdictional hierarchy beyond local community)</i>	In societies where institutions are weaker, more accusations will relate to status and wealth, as accusers are not hindered by sanctions that would have prevented such actions. <i>(Jurisdictional hierarchy beyond local community)</i>

Table 6.1 showing the hypotheses, predictions and variables relating to socio-ecological factors that may be associated with the evil eye belief and wealth and status-related witchcraft accusations. The predictions and variables are roughly equivalent for the two phenomena, with the exception of the variables on Resource Abundance and Climate Stability.

This variable includes cases that cross status boundaries, where status inequality appears to be driving the accusation. It therefore includes cases where vulnerable, elderly individuals were ostracised or killed by those with higher status. There are also rivals for chieftanships or headmanships accusing each other, accusations where chiefs accuse non-chiefs and confiscate their cattle or property; accusations as a result of arguments over property, inheritance and resources. There are also cases where individuals are accused of attempting to kill chiefs, and cases where the accused has been 'caught' carrying out magic to win the favour of a chief. It also involves cases where individuals use accusations to either increase their own social standing and other's compliance with their wishes, or to decrease someone else's. There are some cases where successful individuals are accused, because they are gaining too much wealth and recognition for a particular skill. There are also includes cases where vulnerable individuals were accused by the less-vulnerable (although not related to envy, but related to resource-competition and possibly inverse envy). There are only a small number of these (N=4). There are also disputes over inheritance, property and cattle.

Accusations in the other category are predominantly those relating to interpersonal disputes. They relate to marriage, fidelity and fertility and arguments between individuals. Some of these forms of accusation are also associated with envy: co-wives may be envious of their husband's favourite wife, or the wife with the most children, or a man may be envious of someone else's wife. But they are less likely to directly relate to the socio-economic conditions in a society and its material wealth distribution, and would be predicted to occur equally in any society where witchcraft beliefs have evolved.

Social stratification

As in previous chapters, this variable is based on the Ethnographic Atlas variable EA066 Class Distinction: Primary (Murdock & Provost 1973; Kirby et al. 2016). The original variable classification had: 1) no significant wealth distinctions among freemen, 2) wealth distinctions based on the distribution of property, not crystallized into distinct social classes, 3) elite stratification, in which an elite class has control of scarce resources, particularly land 4) dual stratification into a

hereditary aristocracy and a lower class of ordinary commoners or freemen 5) complex stratification into social classes correlated in large measure with extensive differentiation of occupational statuses.

This was re-coded into a binary variable:

0. The society has no wealth distinctions (level 1 of the original variable)
1. Wealth distinctions and hierarchy exist (levels 2-5 of the original variable)

These combinations were selected because the largest variation in envy (and therefore in envy-avoidance mechanisms) was predicted between societies where there was no or little visible wealth differentiation, and where some form of wealth inequity existed, rather than how extensive the inequity was.

Jurisdictional hierarchy (beyond the local community)

This variable is also taken from the Ethnographic Atlas, EA033: Jurisdictional hierarchy beyond local community (Murdock & Provost 1973; Kirby et al. 2016). In the original classifications, the first category '1) Acephalous' means that there are no hierarchies beyond the local community, and communities or groups are largely autonomous. There is then a progressive increase in levels of jurisdiction: 2) is one level (or petty chiefdoms), 3) two levels (i.e. larger chiefdoms), 4) Three levels (i.e. states), 5) Four levels (larger states). This variable is used as a proxy for levels of political complexity (Kirby et al., 2016). It is used here primarily as a measure of the strength or weakness of institutions, after Gershman (2015), where higher levels of jurisdiction indicate stronger institutional development.

This was converted to a binary variable, where 0) indicates acephalous societies (or those with weak institutions), and societies with one level of jurisdictional hierarchy and 1) indicates societies with two, three or four levels of jurisdiction beyond the local community (with higher institutional strength).

Animal husbandry

Livestock is a vulnerable form of wealth, and one where differences in the numbers of animals held by individuals are highly visible, and so may be the cause of

envious comparisons (Gershman, 2014). Livestock deaths, or cessation of milk production, are quite often attributed to the evil eye (Maloney, 1976).

This was re-coded from the Ethnographic Atlas variable EA004 Subsistence economy: animal husbandry, which relates to whether societies have large livestock. The original variable classifies societies' dependence on animal husbandry as one of the following: 1) 0-5%, 2) 6-15%, 3) 16-25%, 4) 26-35%, 5) 36-45%, 6) 46-45%, 7) 56-65%, 8) 66-75%, 9) 76-85%, 86-100%. It was re-coded into a binary variable, where dependence on animal husbandry was 'Absent' for the categories 1 and 2, and 'Present' for the remaining 2-7 (none of the societies in the sample were coded higher than 7).

This follows the coding used by Botero et al. (2014). The divisions were made between 'absent' and 'present' rather than other classifications such as 'moderate' to 'high,' for example, because envy could arise in relation to small differences in livestock ownership, as well as when it forms a larger part of subsistence strategies.

Mobility

As in previous chapters, this variable is taken from the Ethnographic Atlas variable EA030 (Murdock & Provost 1973). This is again divided into societies where there is some level of mobility (categories 1-4 in the original variable), and societies which are entirely sedentary (categories 4-8 in the original variable). This variable was included in the analysis as a further measure of cultural complexity, where sedentary cultures are more complex than mobile ones.

Local hierarchy

This is variable EA032 from the Ethnographic Atlas (Murdock 1967). It examines the levels of hierarchy within the local community, where categories include 2) [*sic*] Independent families, 3) Extended families and 4) Clan-barrios. This was a further measure of stratification and cultural complexity: greater levels of hierarchy indicate increased cultural complexity (Gershman, 2015).

Resource abundance

A broad measure of the amount of natural resources present in the environment of each society. It is taken from Botero et al. (2014). The variable is a principal component, or a composite measure tracking the gradient of a number of ecological predictor variables, including higher primary productivity, increasing exposure to abundant rainfall, and greater biodiversity. Principal component analysis (PCA) is used when there are a high number of highly correlated and related variables, which are likely to lead to an unreliable statistical analysis (Botero et al. 2014). They are then converted into a smaller number of composite variables, removing issues with multicollinearity and reducing dimensionality, but retaining important information.

The level of environmental threat, as defined by frequency of food shortages, droughts and famine was originally collected as a variable for the dataset. Although the narrative descriptions provide some indications of subsistence conditions, the variable used from Botero et al. (2014) is probably a more reliable, and a more fine-grained indicator of resource availability, as it is a composite measure of environmental features, rather than the opinions and impressions of ethnographers.

Climate Stability

This variable is a composite measure of an increasing gradient indicating how reliable the climate is in terms of average annual rainfall and temperature fluctuations, and to having more stable and warm temperatures throughout the year. This was the second principal component (PC2) from Botero et al. (2014).

Methods: evil eye belief in Bantu societies

This analysis was necessarily simple and exploratory, as there was only information on 42 societies, and so not enough to conduct a more detailed study. It was undertaken to see whether it seemed likely that Gershman's (2015) findings on the evil eye in the Standard Cross-Cultural Sample also held true in a different sample of Bantu societies.

Statistical procedures: evil eye beliefs

I conducted Chi Square tests in R to test for relationships between the evil eye and certain cultural traits in Bantu societies. For the test which examined the evil eye and its association with jurisdictional hierarchy, I used a Fisher’s exact test, as the assumptions for chi square were not met (expected frequencies for some of the cells were less than five).

There were 42 Bantu societies in total that could be coded for the presence or absence of the evil eye belief.

Results:

The Evil Eye

Social stratification	Evil eye present	Evil eye absent
Present	12 50%	12 50%
Absent	4 27%	11 73%
$X^2 = 1.23$ $df = 1$ $p = 0.27$ $N=39$		

Table 6.2 Chi square test examining the relationship between the presence or absence of the evil eye belief, and the presence or absence of class stratification in Bantu societies. (3 of the 42 societies did not have information on class stratification.)

Jurisdictional Hierarchy	Evil eye present	Evil eye absent
Lower levels	3 27%	8 73%
Higher levels	16 52%	15 48%
$OR = 0.36$ $95\% CIs = 0.05-1.87$ $P=0.29$ $N = 42$		

Table 6.3 Fisher’s exact test examining the relationship between the evil eye belief, and the presence or absence of one or more levels of jurisdictional hierarchy in Bantu societies. Jurisdictional hierarchy is also an indicator of a society’s level of political complexity (Kirby et al. 2016), so societies where it is ‘Absent’ are less politically complex than those where it is ‘Present’.

Animal Husbandry	Evil eye present	Evil eye absent
Present	15 56%	12 44%
Absent	3 21%	11 79%
$\chi^2 = 3.08$	$df = 1$	$p = 0.08$
N=41		

Table 6.4 Chi square test investigating the relationship between the evil eye belief and animal husbandry in Bantu societies.

Status and wealth-related witchcraft accusations

Statistical analysis

Data preparation

All cases of witchcraft accusations with missing values for the outcome variable were excluded from the analysis. I also removed three missing cases from the social stratification variable, as they caused problems with convergence when included in earlier versions of the models. Cases with missing data on resource abundance and climatic stability were also excluded. This left a dataset with 153 individuals, from 24 societies. Other missing values were substituted with ‘99’ in the analysis, and will be referred to as ‘missing’ in the text below, but this only applies to the variable on the sex of the accused.

Subsistence was initially considered as a variable, because of its association with political complexity. It was excluded from the models as a result of collinearity. All variables were checked for collinearity using the Car package in R (Fox & Weisberg, 2019), and when subsistence was removed, all had an acceptable VIF of <3 (Hair, Black, Babin & Anderson 2010).

The binary outcome variable was whether witchcraft accusations were related to wealth and status, or could be attributed to other factors. I used a logistic multilevel regression to build a global model containing all variables of interest, and then generated a set of candidate models using the MuMIn ‘dredge’ function (Barton 2015). As in previous chapters, societies were included as a random effect. All other variables were included as fixed effects. The top model set included all

models with $\Delta < 6$ (Richards 2008). Model averaging was then used to produce parameter estimates of the models in the top set.

Because these models have categorical and continuous predictors, and some predictors are binary, the variables were standardized by two SDs, using the methods and principles outlined in (Gelman, 2008), and the *arm* package in R (Gelman & Su, 2018) in order to ensure the coefficients were comparable to one another (Grueber et al. 2011).

Results: Accusations relating to wealth and status

Sex of the accused was the most important predictor of status and wealth related accusations. If the target of an accusation was male, the odds that the accusation related to wealth and status were 5.10 times higher than if the accusation target was female, and this was a statistically significant result.

The odds ratio for class distinctions was very close to 1, indicating that status and wealth-related accusations and other forms of accusation had a relatively equal odds of occurring in societies with and without class differences (OR = 1.04, 95% CI [0.66, 1.62]). This was also the case for Local Hierarchy, Climate Stability and Animal Husbandry, where the odds ratios were also 1.00 or close to 1.00.

Where nomadism and settlement were concerned, all else being equal, the odds of status and wealth-related accusations occurring were 1.23 times higher in mobile societies than sedentary ones [inverse OR = 0.81, 95% CI [0.31, 2.16]].

For Resource Abundance, there was a negative odds ratio of 0.57 (95% CI [0.22, 1.57]): the odds of status and wealth-related accusations decrease as environmental resources increase, all else being equal. This was not statistically significant. It is worth noting that there was some evidence this variable had a significant effect when the sex of the accused was not included in the model. This occurred in a 'natural averaged' model, where the parameter estimate for the variable is only averaged over models which it appears in (Burnham & Anderson 2002; Grueber et al. 2011), and is less stringent than a full average. There is a slight indication that

this variable may have an effect on whether status and wealth-related accusations increase, but it is tentative.

	Other forms of accusation	Wealth and status-related accusations	Total	X² p-value
Total	81 (53%)	72 (47%)	153	
Society-level variables				
Social stratification				
No wealth and status distinctions in society	31 (51%)	30 (49%)	61	0.79
Wealth and status distinctions in society	50 (68%)	42 (32%)	92	
Jurisdictional hierarchy				
Acephalous and One Level	49 (60%)	32 (40%)	81	0.03
Two to Four levels	30 (42%)	42 (58%)	72	
Animal husbandry				
Absent	17 (47%)	19 (53%)	36	0.55
Present	64 (55%)	53 (45%)	117	
Settlement				
Mobile	5 (33%)	10 (67%)	15	0.18
Sedentary	76 (55%)	62 (45%)	138	
Local hierarchy				
Independent families	33 (46%)	38 (54%)	71	0.22
Extended families	46 (60%)	31 (40%)	77	
Clan-barrios	3 (50%)	3 (50%)	6	
Individual-level variables				
Sex of the accused				
Male	48 (44%)	62 (56%)	110	<0.01
Female	27 (82%)	6 (18%)	33	
Missing	6 (60%)	4 (40%)	10	

Table 6.5 Descriptive statistics showing witchcraft accusations relating to wealth and status, and accusations attributed to other reasons, and the predictor variables used in the analysis.

Continuous variables:

Variable	Mean	Median	Variance	SD
Abundance	0.60	0.76	0.13	0.36
Stability	0.37	0.26	0.09	0.30

Table 6.6 Descriptive statistics for the two continuous variables used in the models: resource abundance and environmental stability

Table 6.7	Estimate (SE)	95% CI Low	Odds Ratio	95% CI High	Relative Variable Importance
Intercept	0.26 (0.61)	0.39	1.30	4.37	
Accused sex: male (Ref.)					
Accused sex: female	-1.63** (0.51)	0.07	0.19	0.53	1.00
Accused sex: missing	-0.57 (0.69)	0.14	0.56	2.21	
Jurisdictional hierarchy: acephalous and one level (Ref.)					
Jurisdictional hierarchy: 2- 4 levels	0.38 (0.42)	0.64	1.46	3.33	0.60
Resource Abundance	-0.53 (0.51)	0.22	0.57	1.57	0.69
Climate Stability	-0.09 (0.30)	0.50	0.91	1.65	0.29
Stratification: no wealth distinctions (Ref.)					
Stratification: wealth distinctions	0.04 (0.23)	0.66	1.04	1.62	0.24
Settlement: mobile (Ref.)					
Settlement: sedentary	-0.21	0.31	0.81	2.16	0.32
Animal husbandry: absent (Ref.)					
Animal husbandry: present	-0.08	0.55	0.93	1.35	0.26
Local hierarchy: independent families (Ref.)					
Local hierarchy: extended families	-0.01 (0.09)	0.83	0.99	1.19	0.03
Local hierarchy: clan barrios	-0.00 (0.20)	0.67	1.00	1.47	
Num. of obs. 153 *** p<0.001 **p<0.01 *p<0.1					

Table 6.7. Results of the logistic multilevel regression after parameters were averaged. The outcome variable was whether accusations were 0) unrelated to wealth and status or 1) related to wealth and status.

Discussion

In an analysis of witchcraft accusations in Bantu societies, the biggest predictor of whether accusations related to wealth and status was the sex of the accused individual. The fact that men were significantly more likely to be the target of this form of accusation is likely to be associated with the aspects of male-male competition that appear to be prevalent in Bantu societies (see Chapter 5 on sex differences in accusations). Men may compete more with each other for access to status and resources, because these factors have a close association with male reproductive success (Smuts, 1995; Betzig, 1986). Men with greater status and wealth can afford more wives in polygynous Bantu societies, and so have greater numbers of children. There was also a much higher percentage of male ‘witches’ in the sample (77%) than female ‘witches’ (23%). Competition between men may be the most prevalent, and most likely to lead to witchcraft accusations.

In the small sample of accused women (N=33), there is a difference between the number of women who were involved in status and wealth-related accusations (18%), and those who were targeted in other forms of accusation (82%).

Prevalence of resources

Swanson (1964) found no association between overall witchcraft beliefs and the prevalence of resources, when testing for this in societies from the SCCS. However, Oster (2004) and Miguel (2005) found that numbers of accusations increased in relation to environmental shocks. In contrast, this study suggests that even if the prevalence of the beliefs themselves is not related to resource availability, it may have some effect on the pattern of accusations that occur. The marginal increase in accusations relating to resources and status in conditions where resources are scarce is in line with evolutionary theories of selfishness, where accusers stand to benefit directly. When resources are scarce, and competition for them is higher, people will have a greater incentive to make accusations that will provide them with relatively immediate material benefits.

Institutions and jurisdictional hierarchy

Societies with higher levels of jurisdictional hierarchy were more likely to have accusations related to wealth and status than those with lower levels (**Table 6.7**). This was contrary to the prediction that lower levels of institutions and legal systems would mean competition for resources would be under greater forms of social control, and therefore less liable to lead to witchcraft accusations relating to wealth and status. It can perhaps be noted that jurisdictional control in all of these societies was relatively weak, and it is possible that this was not a suitable measure of institutional strength (please see the Limitations section). Or it is possible that status and wealth-related accusations are in fact a means of by-passing institutional measures preventing illicit wealth transmission: by accusing someone of witchcraft, they are effectively rendered unworthy of legal protection.

Contrary to the prediction, class stratification in societies did not increase accusations relating to wealth and status. This may suggest that it is not only social comparison, or envy driven by observation of social inequality, that drives this type of accusation. Instead, envy produced by social stratification and inequality may be exacerbated when resources are especially scarce, which increases competition when some individuals have more material goods than others. In societies that are more egalitarian to begin with, greater resource scarcity would lead to more competition regardless of stratification. Tolerance for inequality may be higher when overall resources are more plentiful, and accusations relating to resources and status are more likely to arise when resources are scarce. This is in line with the findings of Prediger et al. (2014), who found that although a small effect of income inequality, the general scarcity of resources was more predictive of spiteful behaviour.

Some measures of inequality, such as social stratification and local hierarchy, may not be a prerequisite for status-and-wealth related witchcraft accusations. Some authors have observed that accusations are frequently associated with upward mobility (when wealth or status differentiation arises between individuals who were recently equals) (Evans-Pritchard, 1937; Groce & McGeown, 2013). This form of accusation might still occur in societies which are coded as having no wealth distinctions. Instead they may occur when minor inequalities appear in societies,

such as when there is a small but noticeable increase in one farmer's crop in comparison to their neighbours. As shown in **tables 6.5** and **6.6** status and wealth-related accusations occur in these societies. For example, the Nyakyusa are coded in the Ethnographic Atlas variable (EA066) as lacking class distinctions. But some case studies from the Nyakyusa show such differences, such as the case when an elder was thought to be a witch as a result of having built a very big house in a village, among other factors (Wilson 1951). Envy over wealth accumulation is exemplified in another case from the Nyakyusa, when a worker on the Lupa gold fields was accused of witchcraft by co-workers shortly after finding gold. Status and wealth-related cases also involve competition for higher status positions, such as that of village headman, which can happen even in egalitarian societies such as the Yao (Mitchell, 1956). In short, it may be that these societies do not lack observable wealth and status divisions, even though such divisions are less pronounced and formalised than in other communities.

But what this study may suggest is that, as in other chapters, the socio-ecology of a society is less important for the characteristics of accusations than the circumstances of the people involved in the accusation. The numerous purposes that allegations of witchcraft can serve, and the flexibility of the beliefs themselves as, means they have many purposes.

Evil eye beliefs

Gershman (2015), in his study of the evolution of evil eye beliefs, used the SCCS variable 'technological specialization', as a further measure of economic inequality (Murdock & Provost, 1973). This was combined with the class stratification variable in order to produce greater variation in the level of stratification within societies. However, the class variable did not have an effect on the evolution of the evil eye belief, until it was combined with technological specialization to produce a more fine-grained indication of cultural complexity and levels of social inequality.

Unfortunately it was not possible to replicate the combination for this study, because the societies are taken from the Ethnographic Atlas rather than the SCCS (which has the 'technological specialization' variable). Therefore it may be that the indicator of stratification used here is too coarse to identify such patterns.

Other measures associated with the development of cultural complexity, such as whether societies were sedentary or had some degree of mobility, the presence or absence of large livestock, and levels of hierarchy in the local community, did not have an effect on the type of accusations within societies. This again perhaps highlights that the key factors affecting accusations relating to wealth and status are male-male competition and the general availability of resources in the environment.

When trying to predict where the evil eye will evolve, quantifying societal levels of envy is complex, and may not be as closely linked to social stratification as previous studies have suggested. In Greece, some people believed that everyone could have the evil eye, as everyone experiences envy at times (Dionisopoulos 1970). Although Gershman (2014) contends that fear of the evil eye is associated with wealth inequality and ostentatious displays of wealth, and this is certainly a key part of the belief, it is also attributed to other forms of envy that could cover a wide range of circumstances. For example, the evil eye is thought to fall on adults and children who are beautiful, or on particularly fine agricultural produce, well-made bread and cheese, or plants (Dionisopoulos 1970). It can also fall on individual animals that are particularly enviable (Dionisopoulos 1970). These factors could be identified as outside of ostentatious individual wealth accumulation: a peasant with the luck to acquire a particularly fruitful orchard or even a plant could be the target of destructive envy.

The chi-square test for an association between belief in the evil eye and the presence or absence of animal husbandry was approaching statistical significance. The study found the evil eye present in only three societies with no large livestock, and present in fifteen societies that have large livestock. This is consistent with the hypothesis that the evil eye belief is more likely to evolve in societies with visible, and vulnerable wealth (Gershman 2015), where inequality of herd size, and animals that can be easily transferred between individuals might be thought more likely to provoke envious glances. Previous studies have found an association between the evil eye and the presence of large livestock, and also with dairying (Gershman, 2015; Roberts, 1976). As well as livestock being a visible and vulnerable form of

wealth, the association may exist because milk-producing animals can stop producing milk for unknown reasons (Maloney 1976) that require explanation.

Contrary to the hypotheses, in the chi-square and Fisher's exact tests, there was no significant association between societies' belief in the evil eye and the presence or absence of class stratification and jurisdictional hierarchy. The null hypotheses could not be rejected. Despite not being statistically significant, the balance of observations in categories matches the direction of predictions to an extent. The evil eye belief was present in only 3 societies with lower levels of jurisdictional hierarchy, but in 16 where there were higher levels. With class stratification, there were also more societies with higher stratification where the belief was present (N=12) compared to where it was absent (N=4). This provides some very tentative support for the hypotheses that greater political complexity, more social stratification, and more visible and vulnerable wealth in societies may lead to the evolution of the evil eye belief, using a new sample of societies.

Limitations

It is unfortunate that I was not able to test witchcraft accusations and individuals that are accused against the general population who are not accused. As in previous chapters, no information on population baselines was available in the ethnographies. It would have been informative to examine how likely it was people with conspicuous wealth and status would be targeted by witchcraft accusations, but using this dataset it is only possible to examine those who have already been targeted.

The sample size here is small, and so obviously the results must be regarded as tentative. Also the analysis is correlational, so it is not possible to definitely infer causation from the results. For example, the relationship between resource scarcity and accusations may not be causal. The association may be a result of other factors or 'unobservable heterogeneity' in the environment that has produced this association (Prediger et al. 2014).

Jurisdictional hierarchy, which I have used following Gershman (2015), may not be the most suitable measure of institutional strength. All the societies in this sample have relatively weak institutions, and higher levels of jurisdiction may still coincide with a relatively corrupt or weak system.

Finally, although I have made a distinction between two types of accusations, these categorisations are of course simplified. Future research with larger datasets may allow for more fine-grained distinctions between different forms of accusation, and their relationship to social and environmental conditions. It is possible that all witchcraft accusations are forms of selfish and spiteful behaviour which occur in environments where competition is intense, and resources are scarce, whether they directly relate to resources and status or not. The removal of a troublesome neighbour identified as a witch may indirectly free up environmental resources. But it seems possible that greater resource scarcity in the wider environment might produce the evolution of more accusations directly related to competition for resources and status.

Conclusion

This chapter provides a tentative, novel quantitative step in seeking to understand how the form of witchcraft accusations may change in response to ecological conditions. In Bantu societies that frequently faced resource scarcity, accusations providing the most direct benefits to accusers may have been selected for against those which had less immediate benefits. Accusations which involve male-male competition for status and resources appear to be the most prevalent in such circumstances, as these factors have a clear link to the number of wives men can have, and so their number of offspring. There was some indication that higher levels of resource scarcity contributed to accusations relating to wealth and status. Contrary to predictions, this type of accusation was also more likely to occur in societies with higher levels of jurisdictional hierarchy.

The evolution of the evil eye belief was also investigated in a small sample of Bantu societies. The results did not match previous research suggesting that the

belief evolves in societies with greater stratification, and less institutional strength (Gershman, 2015).

Chapter 7: Witchcraft accusations and the severity of outcomes for the accused

Summary

This chapter examines two related questions: 1) what makes witchcraft accusations ‘stick,’ or have long-term effects on the reputation of some people and not others, and 2) what determines an accusation’s outcome for the ‘witch’? Witchcraft accusations are intrinsically linked to the reputation of the accused. They have parallels with the literature on the evolution of cooperation, where behaviours such as gossip and ostracism enable cooperators to assort together and avoid defectors.

I investigate whether an individual’s reputation is associated with the outcome of a witchcraft accusation, and also whether antisocial behaviour on the part of the accused is more likely to lead to accusations ‘sticking’. The results do not provide any clear indication that previous reputation, or antisocial behaviour on the part of the alleged ‘witch’ leads to a more severe outcome. Individuals who were documented as habitually antisocial are likely to maintain a longstanding reputation as a witch, but individuals who do not behave antisocially may also developed a prolonged reputation for sorcery. Accusations were most likely to ‘stick’ when they came from multiple accusers. Circumstances surrounding the accusation, such as the alleged crime of the witch, did not affect the outcome of accusations.

Introduction

Witchcraft accusations are intrinsically linked with the drive to assess others’ characters and reputations (Jordan, 2018). Accusations of witchcraft are based on an individual’s reputation, but if a sceptical attitude is adopted towards the use of black magic, then how is the behaviour of the accused associated with their reputation as a witch? When an individual is identified as a witch, the label does not always ‘stick’ to its target. Are there reasons why some accusations stick and not others? And is this more associated with the behaviour of the accused witch, or with the circumstances surrounding the accusation, or the characteristics of the

society in question, and the motivations of the accusers? What determines whether an accusation is serious enough for drastic action to be taken against ‘witches’ by others in their community?

The outcomes of witchcraft accusations

Witchcraft accusations are frequently associated with severe outcomes for the accused. Large numbers of people accused of witchcraft in the past were executed, or killed through mob violence, and witch murders are still not uncommon in parts of the globe (Foxcroft, 2017; Levack, 2016). In Bantu societies, when witches were not killed, they might be forced to leave their home and settlement (Hunter, 1936; Sheddick, 1953; Turner, 1957). They might leave of their own accord, but also they might be subjected to threats to encourage their departure, by leaving a warning signal such as a vine outside their hut, or burning their home (Soga, 1931).

The literature makes it clear that this was not the case for all accused witches. In some societies, or in a section of cases within societies, individuals accused of sorcery were subtly avoided and gossiped about, but remained within their communities (Bleek, 1976; Edel, 1957; Kluckhohn, 1944). This was the case in the Hopi, where outright accusations did not occur, but suspected witches were avoided, and treated with exaggerated politeness (Geertz, 2011). Subtle ostracism may be relatively low-cost for accusers, and unlikely to lead to retaliation from the ‘witch’ or their kin.

Sometimes accusations do not ‘stick,’ either because they are not accepted by the wider community, or the allegations of witchcraft are not considered serious (for example a misfortune was considered a minor act of black magic but it was not thought to have caused another person serious harm). Accusations in some circumstances involved witches being asked to perform a ritual, such as spitting water, to remove sickness from their alleged victim. (e.g. Hunter, 1936; Wolfe, 1961). Reputed witches sometimes appeared to suffer no consequences, or they appear to have been minor. In such cases they continued to live as members of their communities and were either treated no differently to anyone else, or perhaps with exaggerated respect (Evans-Pritchard, 1937; LeVine, 1963).

Gossip, ostracism and the evolution of cooperation

Gossip is often the foundation of witchcraft accusations, as information is exchanged between individuals about who may or may not be a witch. Gossip is defined here as the exchange of social information about a third party who is not present (Giardini, 2012), and is generally favoured as a low-cost means of acquiring information about others (Schlaepfer, 2018). Gossip can also be error-prone (Giardini & Vilone, 2016), even if it is not a deliberate attempt to mislead others about another individual's behaviour.

Rumours and gossip in general are often the origin of actions taken against individuals in small-scale societies, such as ostracism, shaming and capital punishment (Boehm, 2019; Stewart & Strathern, 2004). In an account of witch-hunts in rural India, Chaudhuri (2012) comments that the identification of a suspect, and a whispering campaign against her, form a typical stage in a pattern that precedes direct action being taken against the accused. The informal portrayal of a particular individual as a malicious and evil being, working to harm others in the community, can then be used with devastating consequences. 'In effect it is the supposed witch who is the victim, but in the world of rumor and gossip, perception is all, and perceptions justify retaliatory violence,' (Stewart & Strathern 2004: 193).

Researchers have examined how behaviours such as gossip and ostracism promote cooperation, by allowing individuals to identify cooperators and avoid defectors, without necessarily having first hand experience of them (e.g. Alexander, 1987; Feinberg et al., 2014; Giardini & Vilone, 2016; Sommerfeld et al., 2007; Wu, Balliet, & Van Lange, 2016c). Cooperators establish a good reputation by cooperating in social dilemmas, or situations where it is in their immediate interest to be selfish, but cooperation benefits others (Kollock, 1998; Milinski et al., 2002; Sylwester & Roberts, 2013; Sylwester & Roberts, 2010). As a result of these actions, cooperators are subsequently more likely to receive benefits from others, such as better access to resources and mates. A bad reputation, in contrast to a good one, can lead to costs, such as social exclusion, and may result in a loss of access to benefits provided by others (Wu et al., 2016). Gossip provides information on who

is a cooperator and who is a defector, allowing cooperators to assort together. Gossip also occurs in the context of social norm violation (this may relate to witchcraft accusations in some instances): it can act as a sanction towards the norm violator, and also provides information to others about the importance of adhering to norms (Bleek, 1976). Witchcraft beliefs have been identified as promoting a negative and fear-based form of group cooperation: the fear of gaining a reputation as a witch ensures that individuals are at pains to adhere to social norms (Gershman, 2016).

But gossip can be also be used to deliberately manipulate information about others in a negative way, and to spread unfounded information (Nowak & Sigmund, 2005; Rucas, Gurven, Kaplan, & Winking, 2010). Some research has identified gossip as a mechanism for gaining access to resources in competitive environments. The negative gossip is used to raise the status of the gossiper relative to the status of the individual being gossiped about (Hess & Hagen, 2019), allowing the gossiper to compete for resources more successfully. A witchcraft accusation may be an adroit means of doing this.

When gossip has been used to form the reputation of a particular individual as a witch, the individual may be ostracised as a result. Ostracism is defined as social exclusion (Lindström & Tobler, 2018). It is closely related to the phenomenon of partner choice, or the ability to select partners that are able and willing to provide benefits, and to reject bad partners (Barclay, 2016). In the context of witchcraft accusations there are two forms of ostracism: one where suspects are forced to leave their communities, and another where they remain within the community but are isolated, and may receive less help and cooperation from others.

Competition between the accuser and the accused

Although individuals' personal characteristics may be associated with their reputation for sorcery (Sanders, 1995) accusations may also be associated with envy (Kluckhohn, 1944), or attempts to gain an advantage over competitors, in line with theories of harmful gossip. Witchcraft accusations work well in the context of negative gossip, because they are unfalsifiable (Evans-Pritchard, 1937). Gossip as a

means of solving social dilemmas, by passing on information on cooperative and uncooperative behaviour, should be true in order to fulfil its role, but competition between a gossip and the target decreases the gossip's veracity (Milinski, 2019). However a widespread consensus on an individual's reputation as a witch may give the accusation the appearance of reliability.

Accusations and consensus

Not all accusations in the Bantu ethnographies were based on widespread opinion, or indeed on the opinion of more than one other individual. Sometimes an argument between two people resulted in an allegation of witchcraft that does not appear to go any further within the community. For example, in a case from the Ndembu, a man called Sandombu accused his wife Zuliyana and her mother of witchcraft. This was in the context of a childless and difficult marriage, and the outburst was prompted by a drunken dispute. This accusation does not seem to have been widely accepted by other villagers, and despite being unwilling to retract it when sober, Sandombu was ordered by a group of elders to make a present of some cloth to his wife and make a payment to his mother-in-law as amends for the slander (Turner, 1957, pp157-161).

If accusations were not based on a widespread consensus, or there was significant opposition to them, those responsible for attacking the witch might be vulnerable to reprisals. The need for consensus was particularly the case when the accused was powerful (Douglas, 1991). In general consensus would have been based on two factors: gossip leading to agreement on individual's reputation as such among a significant proportion of the community, and the use of divination and ordeals as apparent supernatural indicators of witchcraft guilt, which were also used to form a consensus of opinion (Park, 1963). But popular opinion could also override the divination and ordeals. In the Bakongo, an individual who survived the poison ordeal and was 'proved' innocent was usually celebrated. But if the accused was widely thought to be obnoxious, they would be given extra tests, such as being ordered to name different ants and butterflies, which would be challenging under the effects of the ordeal poison, until they failed at one and were killed (Weeks, 1914). In the Kamba, the killing of a suspected witch had to be agreed by a

king'ole, or council of male elders. The witches' accusers had to be able to demonstrate that there was general support for the action, and the accused's closest relative was required to consent to the killing (Dundas, 1915; Penwill, 1951).

Characteristics of the accused

Are individuals accused of witchcraft uncooperative?

Witchcraft accusations, as discussed in previous chapters, may constitute a negative reputational tag (Antal et al., 2009), and have been identified as a way of severing unwanted ties between individuals (Douglas, 1991). In line with theories of cooperation, gossip and ostracism, some researchers suggest that an accusation of witchcraft can occur because the accused individual is not cooperative, or displays antisocial behaviour. Boyer (2001: 20) suggests 'witches' are viewed as 'genuine cheaters' who are trying to gain benefits without paying the necessary costs. The premise is that the label 'witch,' may carry salient reputational information about an individual and their behaviour, even if the idea that the individual is actually practising harmful magic is viewed with scepticism.

Ethnographic accounts describing typical sorcerers and witches appear to fit with the image of them as defectors and cheats. They were thought to have particular personality traits, in keeping with their representation as the antithesis of positive values (Briggs 2002). They were 'rude, mean, or snatching' (Douglas 1970: xviii), angry and argumentative (Douglas, 1991; Heald, 1998; Wilson, 1969) selfish and self-regarding (Kenyatta 1953), and spiteful and full of ill-will (Briggs 2002). Witches were also held to be motivated by jealousy and envy. Ostracism may be used to punish individuals who have a disagreeable disposition, which is predictive of free-riding (Lindström & Tobler, 2018).

Individuals with more longstanding and widely-held reputations as witches may have been the most likely to suffer the most severe consequences of accusations. In the early modern European witch craze, people did not necessarily immediately prosecute neighbours they believed had practised harmful witchcraft against them. Instead it would take around 15-20 years of accumulated incidents (or suspecting that neighbours were responsible for their misfortunes) before reaching the stage

when ‘witches’ were denounced to the authorities (Briggs, 2002). People who suffered a misfortune might blame individuals they were on bad terms with, but in the absence of an obvious suspect, the ‘neighbourhood witch’ might be held responsible (Golooba-Mutebi, 2005: 947).

The personal characteristics attributed to the accused might be subject to misrepresentation, or result from particular circumstances, or exaggerated through harmful gossip. Mace et al. (2018) found no suggestion that individuals thought to be ‘*zhu*’, or witches, in the Chinese Mosuo, were un-cooperative in either real-world behaviour or in economic games, and suggest that competition is a more likely explanation for witchcraft labels. This is borne out by some ethnographic accounts, which suggest that antisocial, selfish or uncooperative behaviour may not have been characteristic of all accused witches. Johnson (1922:123) lived among the Nyasa in the 1880s, and wrote ‘I saw a good deal of an old man who seemed a decent and gentle character.’ The author left the district and returned to find the old man had been burnt as a wizard. ‘I fear that old age or a lack of protection had been his greatest guilt.’

Aside from personality traits, other characteristics tended to be broadly associated with those accused of witchcraft. Individuals with those characteristics may have been more vulnerable to more severe outcomes of accusations, or to accusations that ‘stuck’. These characteristics have mostly been discussed previously. For example being elderly and vulnerable, post-reproductive and female: individuals with these traits would require resources but might not be able to produce them (e.g. Briggs, 2002; Drucker-Brown, 1993; Miguel, 2005).

The relationship of ‘witches’ crimes’ to penalties

Variation in the circumstances surrounding a witchcraft accusation could lead to variation in the outcomes of the accusation. The penalties for using harmful witchcraft were not always the same: in some societies ‘witches’ were only killed if they were thought to have murdered another person through magical means (Leakey, 1977). Barrenness and child mortality were often thought to have been caused by witchcraft, and the death of a child may have been viewed as the greatest

possible loss. Sources suggest that the death of a child was a form of misfortune particularly likely to be regarded as caused by witchcraft (Cagnolo, 1933; Fottrell et al., 2012).

Sorcerers and witches who were thought to have been responsible for the deaths of multiple victims may also have been viewed as more dangerous, and hence more liable to be punished severely. This is of course an extension of an individual's general reputation. An individual with a bad reputation might be more likely to be accused of causing multiple deaths. But following an initial accusation, an individual with a better reputation might receive more condemnation in the community if they came to be held responsible for a causing a greater number of deaths through supernatural means.

Legislation against witchcraft accusations

When the European colonisation of Africa was underway at the end of the nineteenth and early twentieth century, colonisers and missionaries saw the damage inflicted by witchcraft accusations, and often introduced legislation against them (Beidelman, 1967). Externally imposed legislation may have prevented some accused witches from being subjected to the most severe penalties. By the time the ethnographies in the dataset were written, many societies were under such legislation. This led to the viewpoint that the authorities were assisting witches, and that the practise of sorcery was increasing without counter measures such as the poison ordeal and executions (Beattie, 1960; Brown & Hutt, 1935).

The effectiveness of anti-witchcraft laws overall is uncertain. They seem to have often resulted in continued but more covert actions against suspected witches (Golooba-Mutebi, 2005). Yet laws against the persecution of alleged witches appear, at least in some instances, to have prevented the most severe outcomes from being enacted.

There are a number of factors that may influence whether a witchcraft accusation sticks to a particular individual, and whether an accusation has a severe outcome for the accused. Chapters 5-6 examined witchcraft beliefs in the context of society-

level traits but there are no specific predictions concerning such traits that would be associated with accusations sticking. There are certainly some differences in societies in terms of typical outcomes, but the reasons for this are not examined here. Instead the only society level variable is whether societies have legislation in place against allegations of witchcraft.

Methods

Variables

Dependent variable: accusation outcome

This is a binary variable, where the outcome of an accusation witchcraft accusation is divided into: 0) less severe. This covers a range of situations, some of which still impose quite significant costs on the witch, including the ‘witch’ being beaten/forced to divorce or leave those they are living with, but remaining in the community/returning to natal kin. 1) The most severe consequences, where the ‘witch’ is either forced to leave their community or killed.

Dependent variable: does the accusation stick?

This is a binary variable, which was coded to determine whether, following an accusation, the accused acquires or maintains a reputation as a witch. It implies a level of consensus following an accusation, where it is accepted (or apparently accepted) that the individual committed an act of harmful witchcraft. This was applied to accusations with severe outcomes: if an individual is killed or ostracised then the accusation was coded as sticking. But accusations also stick if they have less severe outcomes, for example if an individual was gossiped about as a witch but remained within their community.

Accusations do not stick if the accused witch is thought to have removed the harmful magic from the victim, or for some reason the accusation loses support or strength. This was the case when a doctor of the Livingstonia Mission was accused of killing a chief’s mother through witchcraft. He had treated her for rheumatism, and shortly afterwards she committed suicide. The doctor was accused, along with a number of suspects, but the attempts to determine guilt using the chicken poison

Hypotheses, predictions and variables	
What factors make witchcraft accusations ‘stick’?	What factors are associated with witchcraft accusations having a more severe outcome?
<p>H1: accusations will ‘stick,’ and will have the most severe outcomes when targeting particular individuals provides the most benefits and the lowest potential costs to accusers.</p> <p>This means accusations will stick, and have a more severe outcome for the accused, when they free up resources, without risk to accusers (i.e. if the accused is vulnerable); or where individuals are ‘difficult’ and unpopular, or have a longstanding reputation for witchcraft (which could also be an indicator of unpopularity). Accusations with widespread support in the community will also be more likely to ‘stick’ and will also be more likely to have a severe outcome. Conversely when targeting a high status individual, accusers are more liable to face repercussions, so these types of accusations will be more covert and less likely to have severe outcomes for the accused.</p>	
<ul style="list-style-type: none"> • People with a longstanding reputation as a witch are more likely to be subjected to a specific accusation that ‘sticks’ (<i>Reputation</i>) • Accusations that are supported by more individuals are more likely to ‘stick’ (have a more permanent effect on an individual’s reputation) (<i>Multiple accusers</i>) • Accusations are more likely to stick if the accused is elderly (<i>Accused age</i>) • Accusations are more likely to stick to individuals with a reputation for being ‘antisocial’ or ‘difficult’ (<i>Accused is ‘antisocial’</i>) 	<ul style="list-style-type: none"> • People with a longstanding reputation as a witch are more likely to face a severe outcome in a witchcraft accusation (<i>Reputation</i>) • Where there are more individuals supporting an accusation, the outcome is more likely to be severe (<i>Multiple accusers</i>) • Accusations are more likely to have a severe outcome if the accused is elderly (<i>Accused age</i>) • Accusations are more likely to have a severe outcome when the accused has a reputation for being ‘antisocial’ (<i>Accused is ‘antisocial’</i>) • High status individuals will be less likely to face severe accusation outcomes (<i>Wealth and status</i>)
<p>H2 Accusations are more likely to ‘stick’ and to have more severe outcomes when the accused is thought to have committed a more serious ‘crime’ through witchcraft</p>	
<ul style="list-style-type: none"> • Accusations ‘stick’ more when the accused is thought to have killed someone through witchcraft (<i>Accusation follows death</i>) • Accusations will be more likely to stick when the accused is thought to have killed multiple people through witchcraft (<i>Accusation follows multiple deaths</i>) • Accusations will ‘stick’ more when the accused is thought to have killed a child (<i>Accusation follows child death</i>) 	<ul style="list-style-type: none"> • Accusations have a more severe outcome when the accused is thought to have killed someone through witchcraft (<i>Accusation follows death</i>) • Accusations will have a more severe outcome when the accused is thought to have killed multiple people through witchcraft (<i>Accusation follows multiple deaths</i>) • Accusations will have a more severe outcome when the accused is thought to have killed a child (<i>Accusation follows child death</i>)

Table 7.1 Hypotheses, predictions and variables for the questions ‘What makes accusations stick’ and ‘What produces severe accusations outcomes?’ Variables are shown in italics.

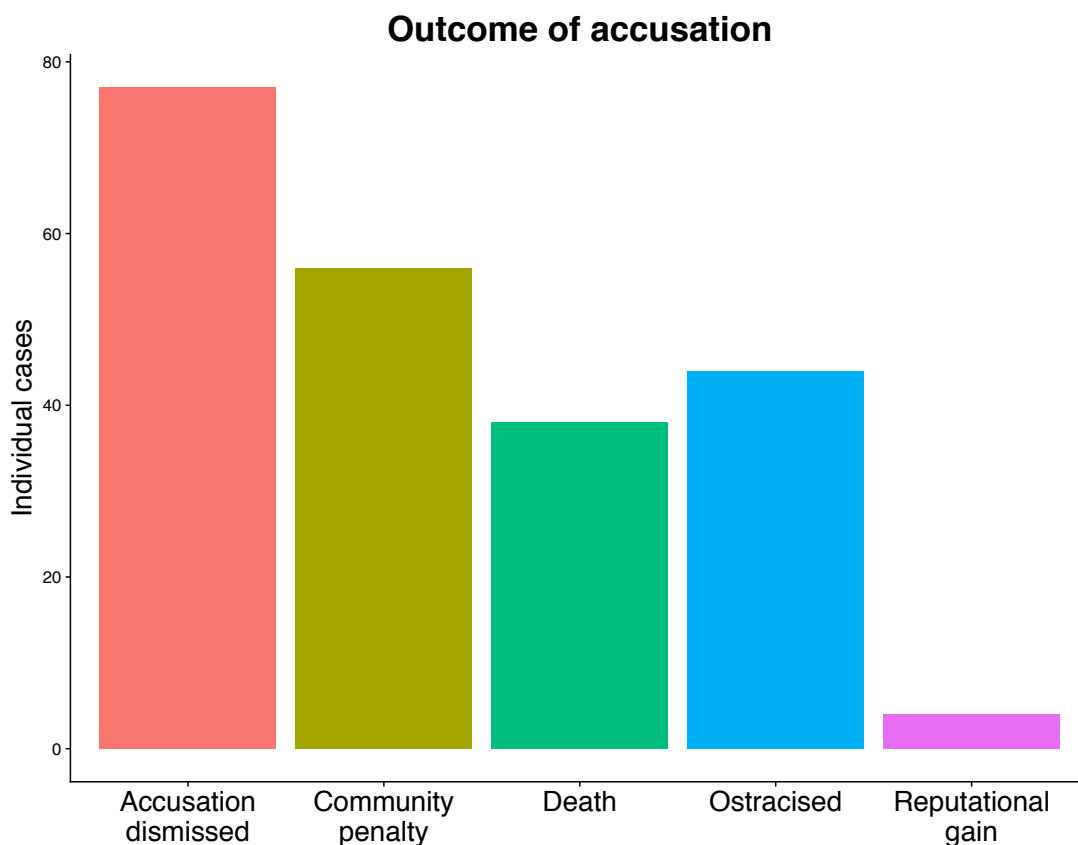


Figure 7.1 A breakdown of the outcomes of witchcraft accusations used for the outcome variable. For the binary variable, the ‘Death’ and ‘Ostracised’ columns were combined and tested against all other outcomes (columns).

Accusation dismissed - the accused survived the poison ordeal, or was made to perform another ritual, and then no further action appears to have occurred in relation to the case. There are also a number of cases where initial accusations do not appear to have escalated.

Community penalty – this is a broad category. The accused may have been ostracised or gossiped about within the community, and gained a reputation as a witch, or they were forced to leave their home but remained in the community, or they were prevented from succeeding to a leadership role.

Death – the accused was made to undergo the poison ordeal and died, or were subjected to another form of trial and killed, or was murdered in a vigilante attack. There are two cases included in this category where the accused would have been murdered but colonial authorities intervened.

Ostracised – this refers specifically to the accused being forced to leave their community.

Reputational gain – in a minority of cases, accusations of witchcraft seem to work in favour of the accused, securing greater cooperation from others than they would otherwise have received.

ordeal resulted in ‘such hopeless confusion that the case was dropped’ (Werner, 1906: 170). A woman in the Nyasa was accused of killing her husband through witchcraft, and tortured as a result, but general belief held that she was innocent and a scapegoat to protect the real murderer (Johnson, 1922). Accusations did not usually stick when divination or poison ordeal declared the accused not guilty of witchcraft.

Predictor variables: society-level

Legislation

A binary control variable, indicating whether or not there is legislation against witchcraft accusations and related practices at the time of the focal year in the Ethnographic Atlas. In most societies this legislation was imposed by colonial rule.

Individual-level variables

Age

A binary variable indicating whether the accused was elderly or not. The ‘non-elderly’ category mostly contains adults, with a very small number of children.

Sex

Whether the accused was male or female. Some accusations were also directed at more than one man or more than one woman. Where accusations were directed at a group of individuals, if the group was not clearly male or female, it was coded as ‘NA.’

Reason

There are different causes given for accusations. This variable describes the situation leading to a particular individual being identified as a witch, rather than the precipitating cause (such as death, illness or misfortune). The reasons for accusations have been grouped into four main categories: 1) fertility (which includes reasons or disputes relating to marriage, childbirth and fidelity), 2) interpersonal disputes 3) accusations relating to wealth and status 4) a miscellaneous category containing several smaller categories. Category 4 includes cases where the need for an explanation of a negative event seemed to prevail over any other cause, and accusations as a result of unusual events. It also includes situations where the main reason for the accusation seems to have been that was the accused was vulnerable, but the number of these cases was small (N=5).

Wealth and status

A binary variable identifying whether the accused witch is an individual with significant wealth and status or not.

Precipitating cause: death

A binary variable showing whether the accusation was precipitated by a death or not.

Precipitating cause: multiple deaths

A binary variable indicating whether the accused was believed to have caused the death of more than one person through witchcraft.

Precipitating cause: death of a child

This binary variable shows whether the accusation was sparked by the death of a child.

Reputation

This variable indicates whether or not the accused was recorded as having a longstanding reputation as a witch. For example, Schebesta's informants pointed out an 'epileptic boy... about whom the local sages said that he was the most formidable magician in the district. Everyone seemed to have a terrible aversion to encountering him, although he was little more than a child.' (Schebesta, 1936: 240). Where there was no evidence that an individual had held a long-term reputation as a witch prior to the accusation, and there was thought to be sufficient detail in the case study, it was coded as not present. Where cases were not detailed on this matter, they were coded as 'NA'.

Antisocial behaviour

This variable relates to whether the accused witch is thought to have behaved in a way that is uncooperative or damaging to others, or violates social norms on a relatively regular basis. There are two categories for this variable: 1) nothing in the source indicated regular 'antisocial' behaviour on the part of the alleged witch 2) the 'witch' is described as regularly behaving in a way that does not conform to social norms, or could be considered antisocial and uncooperative. For example,

individuals in the latter category might be described as having a ‘violent character’ (Kiwanuka, 1972: 69). The individual was perceived as difficult or uncooperative in general, such as Isaak in the Kaguru, who was ‘unpopular and aggressive’ (Beidelman, 1963: 76). They might be continually arguing with different people, or gossiping maliciously, or failing to repay loans or demanding financial support from kin on an ongoing basis. The key factor in this variable is that the behaviour appeared to be consistent over time, and that it occurred in relationships with at least more than one person. Many cases of witchcraft were associated with arguments or difficult situations between two specific individuals that might be perceived as antisocial by the accuser, but where these occurred in the context of a particular relationship or situation this was not included as ‘antisocial behaviour’.

Multiple accusers

This is a binary variable. If there were multiple accusers, an individual was identified as a witch by more people than those immediately involved in the accusation. For example, a woman being accused of sorcery by two of her co-wives would not be included under multiple accusers, but if others in a settlement were recorded as sharing their view it would be counted as multiple accusers.

Relationship

This indicates the relationship of the accused to the accuser, and is divided into three categories: 1) Unrelated 2) Related 3) Affinal kin.

Domestic arrangements

Whether the accused lives either with their accuser in the same dwelling, or is their neighbour, or lives in the same settlement (i.e. usually a village) or further away from their accuser.

Data preparation

For the examination of whether or not accusations ‘stick’ there were 240 cases where the outcome variable could be coded, from 48 societies. Cases where information on whether or not the accusation was lasting were excluded from the analysis.

220 individual cases in the Bantu witchcraft dataset gave information on the outcome of the accusation for the accused, which came from 45 societies. All cases where information on the outcome variable was missing were excluded from the analysis.

For all predictor variables, missing data was replaced with the code '99' in the statistical analysis. It will be referred to as 'missing' from now on.

Statistical analysis

Accusation outcomes and whether accusations 'stuck' to the accused were the outcome variables for two logistic multilevel models. As in previous chapters, two global models were constructed containing all variables of interest. The 'dredge' function in MuMIn (Barton 2015) was used to create sets of candidate models. Top model sets were then created containing models where $\Delta < 6$ (Richards 2008; Harrison et al. 2018). Parameters were then averaged over the top model sets.

All variables in both of the global models were checked for collinearity using the Car package in r (Fox & Weisberg, 2019). All Variance Inflation Factors (VIFs) were under 2, indicating there was not a problematic level of collinearity (Hair, Black, Babin & Anderson 2010).

Several variables had low weightings in the analyses or were not included in the top model set, and so were excluded from the final model. This is because including all variables is not only computationally more intensive, but also with small datasets, it is preferable to have fewer parameters per number of observations.

For the model examining whether accusations stick or not, the variables excluded from the final analysis were: multiple deaths, reasons for accusations, age of the accused, relationship of the accuser to the accused, and whether or not the 'witch' was wealthy and high status. For the severity of outcome of accusations, the variables excluded from the final model were: the reason for the accusation, whether the precipitating event of the accusation was a death, whether the alleged

witchcraft victim was a child or not, and whether the accused witch was thought to be responsible for multiple deaths.

The variable examining whether the accused was antisocial or not was excluded from the analysis looking at severity of outcome, because the small categories led to an unstable analysis overall. The variable was not significant, except for the missing data, and this result is due to chance, as the data are presumed to be missing completely at random. The results showed that where the accused was described as antisocial, they were more likely to be subjected to extreme outcomes (OR = 2.18, 95% CI [0.76, 6.27], $p=0.14$), as compared to when the accused was not described as antisocial.

Results

I ran null models to examine whether the outcome of accusations, and whether or not accusations ‘stuck’ clustered by societies. The Intra-Class Correlation Coefficient for the outcome of accusations was 0.27, suggesting that 27% of variation could be accounted for by society-level differences. In examining whether accusations tended to stick or not, there was a similar ICC of 0.26, indicating 26% of variation could be explained by differences between cultures

None of the predictors had a significant effect on the severity of accusation outcomes. Individuals living in societies without legislation against witchcraft accusations had a higher odds (OR = 1.41, 95% CI [0.46, 4.32]) of being ostracised or killed, rather than face a less severe penalty, than those living in societies with legislation. The odds of elderly individuals facing severe penalties in witchcraft accusations were equivalent to those of younger adults and children (OR = 1.01, 95% CI [0.68, 1.52]). Accusations from multiple people were not more likely to have severe outcomes than those from a single person (OR = 1.02, 95% CI [0.79, 1.32]). The odds that men accused of witchcraft would face a severe penalty were 1.13 times as high as those of women.

	Outcome: less severe	Outcome: death or ostracism from the community	Total	X² p-value
Total	141 (64%)	79 (36%)	220	
Society-level				
Legislation				
Legislation exists	99 (83%)	20 (17%)	119	0.02
Legislation does not exist	41 (68%)	19(32%)	60	
Missing	22 (54%)	19 (46%)	41	
Individual-level				
Accused sex				
Male accused	85 (62%)	53 (38%)	138	0.43
Female accused	49 (70%)	21 (30%)	70	
Missing	7 (58%)	5 (42%)	12	
Relationship				
Unrelated	70 (60%)	46 (40%)	116	0.15
Related	31(69%)	14(31%)	45	
Affinal	26 (79%)	7 (21%)	33	
Missing	14 (54%)	12 (46%)	26	
Accusation follows death/s				
No	75 (71%)	31 (29%)	106	0.07
Yes	53(61%)	34(39%)	87	
Missing	13 (48%)	14(52%)	27	
Accusation follows multiple deaths				
No	114(67%)	57(33%)	171	
Yes	14 (64%)	8 (36%)	22	
Missing	13 (48%)	14 (52%)	27	
Accused has longstanding reputation as a witch				
Yes	34 (77%)	10 (23%)	44	<0.01
No	80 (70%)	35 (30%)	115	
Missing	27 (44%)	34 (56%)	61	
Multiple accusers				
No	65 (65%)	35 (35%)	100	0.73
Yes	68 (64%)	38 (36%)	106	
Missing	8 (57%)	6 (43%)	14	
'Bewitched' victim is a child				
No	97(69%)	44 (31%)	141	0.15
Yes	17(59%)	12(41%)	29	
Missing	27 (54%)	23 (46%)	50	
Accused is 'antisocial'				
No	98 (74%)	35 (26%)	133	<0.01
Yes	14 (70%)	6(30%)	20	
Missing	28 (42%)	39 (58%)	66	
Accused age				
Adult or child	112 (67%)	56 (33%)	168	0.25
Elderly	17 (59%)	12 (41%)	29	
Missing	11 (50%)	11 (50%)	22	
Wealth and status				
No	93 (72%)	37 (28%)	130	<0.01
Yes	30 (66%)	15 (43%)	45	
Missing	17 (39%)	27 (61%)	44	

Table 7.2 Descriptive statistics showing the association between accusations where the outcome was severe (the accused was either killed or forced to leave their community, and where outcomes were less severe. All variables that were initially considered in the analysis are included, although some were later excluded.

Table 7.3	Estimate (SE)	95% CI Low	Odds Ratio	95% CI High	Relative Variable Importance
Intercept	-1.29* (0.51)	0.10	0.27	0.74	
Legislation: yes (Ref.)					
Legislation: No	0.35 (0.57)	0.46	1.41	4.32	0.40
Legislation: missing	0.38 (0.59)	0.52	0.46	4.64	
Reputation as a witch: yes (Ref.)					
Reputation as a witch: no	-0.15 (0.45)	0.35	0.86	2.08	0.69
Wealth and status: no (Ref.)					
Wealth and status: yes	0.15 (0.41)	0.51	1.16	2.61	0.75
Wealth and status: missing	0.91 (0.68)	0.66	2.50	9.45	
Accused sex: male (Ref.)					
Accused sex: female	-0.12 (0.30)	0.49	0.88	1.60	0.20
Accused sex: missing	-0.05 (0.39)	0.44	0.95	2.03	
Accused age: adult or child (Ref.)					
Accused age: old	-0.02 (0.20)	0.68	1.01	1.52	0.14
Accused age: missing	0.09 (0.32)	0.59	1.09	2.02	
Multiple accusers: no (Ref.)					
Multiple accusers: yes	0.02	0.79	1.02	1.32	0.09
Multiple accusers: missing	-0.02	0.60	0.98	1.60	
Num. of obs. 220					
*** p<0.001 ** p<0.01 *p<0.1					

Table 7.3 The results of model averaging with the outcome variable of whether an accusation had a less severe (0) or more severe (1) outcome, where the accused was ostracised or killed. Parameters were averaged over a top set of models with $\Delta < 6$.

	Accusation 'sticks'	Accusation does not stick	Total	X² p-value
	194 (81%)	46 (19%)	240	
Society level				
Anti-witchcraft legislation	122 (82%)	26 (18%)	148	0.02
No legislation	21 (64%)	12 (36%)	33	
Missing	51 (86%)	8 (14%)	59	
Individual level				
Multiple accusers: yes	114 (62%)	70 (24%)	184	<0.01
Multiple accusers: no	11 (25%)	33 (75%)	44	
Missing	10 (83%)	2 (17%)	12	
Accused is not rich/high status	104 (78%)	30 (22%)	134	0.35
Accused is rich/high status	48 (86%)	8 (14%)	56	
Missing	42 (84%)	8 (16%)	50	
Victim is not a child	120 (82%)	26 (18%)	146	0.02
Victim is a child	18 (62%)	11 (38%)	29	
Victims is a child: missing	56 (86%)	9 (14%)	65	
Accused age: not old	149 (86%)	24 (14%)	173	0.89
Accused age: not old	35 (88%)	5 (12%)	40	
Missing	21 (78%)	6 (22%)	27	
Accused sex: male	128 (84%)	25 (16%)	153	0.29
Accused sex: female	59 (77%)	18 (23%)	77	
Accused sex: missing	7 (70%)	3 (30%)	10	
Accused is not 'antisocial'	114 (76%)	36 (24%)	150	0.03
Accused is 'antisocial'	21 (95%)	1 (5%)	22	
Accused is 'antisocial': missing	59 (87%)	9 (13%)	68	
Accusation follows a death	91 (81%)	21 (19%)	112	0.50
Accusation does not follow a death	80 (78%)	22 (22%)	102	
Accusation follows a death: missing	23 (100%)	0 (0%)	23	

Table 7.4 Descriptive statistics for whether an accusation 'sticks' or not. The figures are given by numbers of individuals, rather than societies.

Table 7.5	Estimate (SE)	95% CI Low	Odds Ratio	95% CI High	Relative Variable Importance
Intercept	-0.93* (0.43)	0.16	0.39	0.92	
Legislation: yes (Ref.)					
Legislation: No	0.76 (0.78)	0.47	2.15	9.89	0.63
Legislation: missing	-0.21 (0.48)	0.32	0.81	2.08	
Multiple accusers: yes (Ref.)					
Multiple accusers: no	-1.58***	0.09	0.21	0.48	1.00
Multiple accusers: missing	-0.97 (0.91)	0.06	0.38	2.27	
Child 'victim': no (Ref.)					
Child 'victim': yes	0.32 (0.54)	0.47	1.37	3.97	0.35
Child victim: missing	-0.05 (0.30)	0.53	0.95	1.71	
Accused is 'antisocial': no (Ref.)					
Accused is 'antisocial': yes	0.07 (0.24)	0.07	0.54	4.11	0.41
Accused is 'antisocial': missing	-0.25 (0.43)	0.33	0.77	1.81	
Accused sex: male (Ref.)					
Accused sex: female	0.07 (0.24)	0.67	1.07	1.71	0.22
Accused sex: missing	0.28 (0.68)	0.34	1.32	5.06	
Accusation follows death: no (Ref.)					
Accusation follows death: yes	0.41 (0.20)	0.71	1.04	1.53	0.15
Accusation follows death: missing	-0.07 (0.35)	0.46	0.93	1.88	
Num. of obs. 240					
*** p<0.001 **p<0.01 *p<0.1					

Table 7.5 The model-averaged parameters from a logistic multilevel regression, where the outcome variable was whether an accusation 'stuck' to its target (0) or did not have lasting implications for the individual accused of witchcraft (1).

The results for whether an accusation ‘stuck’ to a particular individual or not were mostly non-significant. An exception to this was the number of accusers: when an accusation was made by multiple individuals, the odds were nearly five times higher that it would stick than when an accusation was made by a single individual (inverse OR = 0.21, 95% CI [0.09, 0.48]). An accusation precipitated by a death, as compared to those that were not, was not more likely to stick to the accused (OR = 1.04, 95% CI [0.71, 1.53]).

The variable for whether the accused had a longstanding reputation as a witch was not included in the final analysis for whether witchcraft accusations stuck or not. The categories for this variable were not balanced, making the results unreliable. Where individuals had longstanding reputations for witchcraft, accusations tended to stick (N=50). Having a longstanding reputation as a witch could be viewed as identical to having an accusation that ‘stuck’. However, a longstanding reputation indicates that an individual was thought to be a witch before the accusation in the dataset took place. An accusation which ‘sticks’ means the accused continues to be thought of as a witch after the accusation in the sample. There was therefore a high level of overlap between these two variables: results suggested that accusations of individuals without a longstanding reputation for witchcraft had a higher odds of sticking to them than to individuals who did not have a longstanding reputation for witchcraft. There was one case where this did not happen, in the Ndembu. Sandombu (the same individual from the example above, relating to his wife) had previously been accused of witchcraft, and had a reputation as a sorcerer in his village, according to the ethnographers’ informants. He was alleged to have used harmful sorcery in a separate incident, but a council of village elders declared he was not guilty on this occasion and ordered his accusers to pay a fine (Turner, 1957: 160). Accusations also stuck to those who did not previously have a reputation as a witch (N=91).

Discussion

The results of the analyses show that where witchcraft accusations came from multiple accusers, they were more likely have lasting effects on the accused’s reputation, or to ‘stick’ (**table 7.5**). This is not a surprising result, as having multiple accusers, and having a lasting reputation as a witch are obviously related.

It confirms how important consensus is in maintaining reputational tags. But the analysis leaves unclear why some accusations are more likely to be believed by more individuals, and therefore to have more lasting effects for those accused.

When individuals were identified as antisocial, or uncooperative, in the ethnographic accounts, accusations were more likely to stick (**table 7.5**) but not to a significant level. Not all accused witches were viewed as uncooperative. Where the accused was antisocial, they were more likely to receive a lasting reputation as a witch, but accusations also ‘stuck’ when the accused did not appear to have been habitually uncooperative.

Instead, as discussed in previous chapters, it appears more plausible that accusations often relate to competition between individuals and disputes, so shifts in personalities and motivations will make a substantial difference to the process of an accusation. Witchcraft accusations may involve the manipulation of individuals’ reputations when accusers stand to gain from this but may also provide information on uncooperative individuals in certain circumstances.

There was no indication that personal characteristics such as age and sex meant the accused was more likely to gain a lasting reputation as a witch. The wealth and status of the accused also had no effect, and so was excluded from the final analyses.

There was no support for any of the hypotheses relating to why some accusations may have more severe outcomes than others. Neither a high level of group consensus, or a longstanding reputation as a witch were associated with the severity of outcomes for accusations. There are two possible explanations for this. One is that the severity of the outcome is random and hence not reflected in the results, but this seems unlikely. The other is that there is unseen heterogeneity in the data, and subtleties in situations could not be captured by the coding or the accounts in ethnographies.

Some variation was explained by differences between groups. With very few exceptions the societies in the Bantu witchcraft dataset have death and or ostracism

as common punishments for witchcraft, and it seems likely that different societies would have norms of how penalties were enforced.

Some of the lack of pattern can perhaps be explained through further reference to ethnographic accounts. Although the Azande are not a Bantu society, they are similar, such as in their use of poison rituals, and their witchcraft beliefs have been documented in incredible detail. Evans-Pritchard (1937) commented that witches were not necessarily ostracised, and that some witches were well-respected members of the community, even when they were believed to have committed multiple murders. Furthermore, witchcraft could be viewed as a passing state, common to many individuals and lighting on one person after another. Yet also he comments that those who were thought to have killed through sorcery were put to death in the past, and those who killed through witchcraft were fined (Evans-Pritchard 1937). Penalties in the Azande seem to have been variable, in line with Evans-Pritchard's observation that their overall beliefs were contradictory.

The form of 'crime' the witch was believed to have committed had no relationship to either the outcome of the accusation or whether the accusation 'stuck'. If the accusation was thought to be the result of a death, the death of a child, or multiple deaths, it was not more likely to have a severe outcome for the accused, or to result in a lasting reputation as a witch. This is surprising, in a sense that where the accused was thought to have committed a more serious offence the outcome should also be more severe, as suggested by Evans-Pritchard's account of the Azande.

But witchcraft accusations are also driven by social relations, and the association between the precipitating event of the accusation (an illness, death or misfortune), and the relationship between the accused and the accuser, is not always clear. The precipitating event may be incidental to many, if not all accusations, whereas the exact circumstances of the relationship between the accused and the accuser, and the relationship of the accused to others in the community, may be more relevant.

Moreover, a longstanding reputation as a witch did not mean that accusations were more likely to have a severe outcome. This can perhaps be explained with reference to the Azande again (Evans-Pritchard, 1937), and other societies such as the Hopi

and the Mandari (Geertz, 2011; Buxton, 1963), where a longstanding reputation for harmful witchcraft was not necessarily very damaging. Taking strong action against the accused may well be a costly undertaking in certain circumstances.

The theoretical accounts of ostracism being used to punish and exclude free-riders as part of the evolution of cooperation do not seem to concur with numerous real-world accounts of witchcraft accusations, or with a substantial number of the accusations in this dataset. Which individuals are ostracised, or killed, is not necessarily associated with 'antisocial' or difficult behaviour.

Some accusations can be explained with reference to biological market theories of partner choice. An individual's overall 'market value' or willingness and ability to provide benefits to others, compared to others in the environment, leads to their being chosen as partners by others (Barclay, 2013, 2016; Hammerstein & Noe, 2016; Noë & Hammerstein, 1994). Individuals can be dismissed if they are unwilling or unable to provide to particular partners (Barclay, 2016). This may apply to a number of cases in the dataset, where individuals are no longer attractive partners, although they are not 'antisocial' overall, and a witchcraft accusation constitutes the breaking of a tie (Douglas, 1991).

On the basis of these analyses, it could be argued that that there has not been enough emphasis placed on the function of ostracism outside cooperation. In support of this, there is one study, using economic games and agent-based modelling, which suggested that a certain amount of ostracism is in fact incidental, or not based on the behaviour of those who were ostracised (Lindström & Tobler, 2018). Individuals were paired in economic games, and then were able to select partners for future rounds. Ostracism was found to be strongly path-dependent: those who were randomly not partnered in the early rounds were less likely to be chosen as partners in later rounds, as individuals tended to select players they had already been paired with (Lindström & Tobler, 2018). This occurred when there was little free-riding on the part of participants.

Witchcraft accusations are for the most part probably less random than the ostracism in the experiment conducted by Lindström and Tobler (2018). But the

study suggests that ostracism is not always associated with free-riding, and can in fact arise from straightforward circumstantial factors. Other motivating factors include competition and envy. An examination of workplace bullying, a phenomenon where particular individuals are victimised and ostracised at work, found that around two thirds of cases occurred where bullies were envious of their targets. This occurred particularly when targets might have received promotions or held qualifications not held by the bullies (Zapf & Einaronson, 2003).

Individuals who are not free-riders, but are burdensome may be accused of witchcraft, such as where the elderly or children are targeted. Research using a virtual ball-tossing game called cyberball has shown similar effects: participants who were too slow in throwing the ball tend to be ostracised as they decrease the earning potential of other participants and caused frustration (Wesselmann, Wirth, Pryor, Reeder, & Williams, 2015). This was not found to be the case in this sample (accusations were not more likely to stick to or have severe outcomes for the elderly) although number of individuals that could be identified as burdensome in this dataset is small.

Limitations

In coding some of the variables used in this study, it was not possible to be certain how much of the information in texts was an accurate reflection of individuals and situations. The data is coded from what is second or third hand information: it is based on gossip. It is possible that more accused witches were thought of as antisocial and uncooperative than ethnographers recorded, and this is why accusations occurred. Or individuals might in some instances have an unfounded reputation for antisocial behaviour. People would have had diverse perspectives on the situations that occurred. But with that caveat in place, it does appear from the context of many of the accounts that on balance, accusations were more associated with situations and particular relationships, than with repeatedly antisocial behaviour on the part of the accused.

In the ethnographic accounts of accusations, there is almost certainly a bias, as it is likely that ethnographers recorded the more memorable cases that ‘stuck.’ This is why only 19% of these cases are those that did not stick.

The severity of an accusation outcome was probably dependent on a number of factors that unfortunately could not be captured in the data. For example Hunter (1936) discussing witchcraft in the Pondo, suggests that following an illness or an accident, the preferred explanation was dependant on the temperament of the patient. Sometimes accidents were simply accidents, and sometimes they were sent by witches. It could be supposed by extension, that the brutality of reprisals towards suspected witches was also dependent on the personalities of the individuals involved. The dynamics of witchcraft accusations are complex, and multidimensional, but here have necessarily been simplified.

There would have been fluctuations in the amount of fear and aggression within societies at any one time that determined how harshly suspected witches were treated. The factors determining such societal variations are probably quite complex and may depend on a mixture of environmental hardships (as documented by Oster, 2005; Miguel, 2005) and culture, including the intra-community stresses present at that time, and the role of those in power in provoking or subduing levels of accusation. For example there would have been a difference between leaders who feared witches and were keen to take action against them (Werner, 1906) and others who actively sought to prevent witchcraft beliefs and accusations amongst their subjects.

Conclusion

This chapter examined why some witchcraft accusations stick and others do not, and why some accusations lead to more severe outcomes for their targets than others. When accusations came from multiple accusers, they were more likely to stick to their targets, highlighting the importance of consensus. But there was little evidence to suggest why some individuals receive lasting reputations as witches. Witchcraft beliefs and ostracism do not appear to fully align with the hypothesis that they are used to promote cooperation through targeting and excluding

defectors. Where the accused was recorded as having an antisocial character, accusations were likely to stick, but they also stuck to individuals who were not identified as antisocial. Contrary to common perceptions of witchcraft accusations, individuals who were older and female were not more likely to face harsher penalties, or to have more longstanding reputations as witches.

Chapter 8: Supernatural punishment and the audience effect as mechanisms for cooperation

Summary

This chapter explores two proposed mechanisms for cooperation: reputational concerns, in the form of the audience effect, and fear of supernatural punishment from high gods. Individuals' knowledge that their behaviour is being observed is thought to increase cooperation, as developing a reputation for prosocial behaviour is beneficial. Fear of supernatural punishment may prevent cheating in larger societies, where other cooperative mechanisms may be too costly. This study compared observation by humans, and a belief in supernatural monitoring and punishment, as mechanisms for cooperation.

I conducted a lab-in-field experiment in Belfast. There were two experiments: 1) Participants rolled a dice in a cup, and the resulting throw determined the amount of money they won for themselves or charities. They could cheat if they wished to do so by reporting the wrong result. The prediction was participants with a belief in omniscient and punishing gods would cheat less than those without it. 2) A donation experiment: participants were asked to make a public decision on how to divide a stake between themselves and their chosen charities. The experiments were conducted in secular settings and in or near churches: the latter were intended to act as a contextual prime for religious sentiments.

Results suggested that the majority of participants were extremely honest in the dice experiment. Those who believed 'very much' in hell earned less, and those who believed 'somewhat' in hell, earned more than would be predicted. There were no clear differences in how much subjects were prepared to give to charities. There was no effect of contextual priming.

It is difficult to interpret the findings in terms of participants' beliefs about supernatural punishment. Participants may have felt observed performing the experiment, or have been reluctant to cheat charitable organisations.

This is related to a study conducted by colleagues in China who used a similar methodology. Instead of varying secular and religious locations, experiments were conducted in large and small communities. The researchers found that individuals from larger communities gave less in donations than those in smaller communities.

This was attributed to reputational concerns being stronger when residents know each other better in smaller communities.

Introduction

Religious belief has existed in almost every society in the world throughout history (Peoples, Duda, & Marlowe, 2016). A growing body of research examines religious belief from an evolutionary perspective, asking whether it serves an adaptive purpose, or alternatively whether it is a ‘by-product’ of various cognitive processes (Boyer, 2003; Oviedo, 2016). This chapter focuses on one particular aspect of this: whether a belief in moralising deities, or high gods, that observe human behaviour and reward or punish accordingly is an adaptation for cooperation.

Religious beliefs, and particularly belief in supernatural punishment, have similarities with the other supernatural beliefs investigated in this thesis. Such beliefs appear to all be associated with, or possibly derived from, the reputational concerns that arise from being monitored and punished by others (Boyer 2003). The evil eye belief is a proposed mechanism for envy-avoidance, which may motivate individuals to either conceal or avoid accumulating wealth (Gershman 2014). Those who do not conform and amass and display wealth will suffer from supernatural punishment. In one respect, despite their extremely damaging consequences, witchcraft beliefs may promote cooperation, in that individuals who gain a reputation for standing out or behaving selfishly, or refusing to comply with social norms, risk punishment, in the form of being tagged as a ‘witch’ and suffering fitness-damaging consequences as a result (Douglas, 1991; Geertz, 2011; Golooba-Mutebi, 2005; M. H. Wilson, 1951b). Witchcraft beliefs may therefore encourage a kind of forced conformity (Gershman, 2016). Fear of supernatural punishment, where high gods monitor human behaviour, and are believed to punish those who do not adhere to the ‘rules’ has been proposed as another mechanism for cooperation (Johnson, 2005; Peoples et al., 2016; Roes & Raymond, 2003; Watts et al., 2015; Botero et al., 2014; Norenzayan et al. 2016). The three types of supernatural belief are all potentially proximate mechanisms associated with reputational monitoring and punishment for individuals who do not ‘toe the line’ or cooperate in a particular respect.

I will now discuss in more detail how religious beliefs are thought to promote cooperation and prosocial behaviour. It is thought to do so in a number of ways: adherence to costly religious practices serves as a means of signalling individual qualities (Power, 2017a) and demonstrates commitment to a group, thereby increasing trust and compliance with social norms. Increased trust enables the expansion of cooperative networks (Irons, 2001; Atran & Henrich, 2010; Ensminger, 1997; Norenzayan et al., 2016; Sosis, 2003a; Tan & Vogel, 2008). Other authors have examined the effects of a fear of divine punishment on promoting prosocial behaviour (Johnson, 2005; Norenzayan et al., 2016; Peoples et al., 2016; Roes & Raymond, 2003; Swanson, 1960; Botero et al., 2014).

Experiments seeking to test whether religiosity overall (rather than solely belief in supernatural punishment) enhances cooperation have mixed findings, both in terms of results, and in how these have been interpreted (Galen 2012; Oviedo, 2016). This may be for a number of reasons. Religious individuals have been found to attribute higher levels of prosocial behaviour to themselves than to those without religious belief, but separating the prosocial effects of religion from reputation management, or other psychological effects, is complex to assess empirically (Norenzayan & Shariff 2008; Bloom 2013; Galen 2012; Oviedo 2016). Many studies find some association between religion and cooperation, but the effects are usually small. Effects are also associated with particular forms of religiosity, such as belief in hell, or belief in a benevolent god as opposed to an authoritarian one (Oviedo 2016). Other research has not found support for religion as a mechanism for cooperation. For example, a large-scale, cross-cultural study of 5-12 year olds found that children from more religious households were less likely to share with their peers, and that greater religiousness was inversely associated with altruism. However, religious parents were more likely to believe that their children had increased empathy towards others and sensitivity to injustice (Decety et al., 2015). The analysis of these authors has been criticised since publication, and the results have been modified, so that the effect of religious belief is more moderate, or accounted for by country-level differences, as were parents' ratings of their children's empathy and sensitivity to injustice. The original finding of slightly decreased

altruism in highly religious households, as compared to moderately religious ones, remained but at a reduced significance (Shariff et al., 2016).

Belief in supernatural agents with an active interest in enforcing human morality is a further suggested mechanism by which religion may promote cooperation, among those of the same faith. Moralising high gods are thought to have co-evolved with the transition from small-scale societies to larger and more complex settlements (Botero et al., 2014; Johnson, 2005; Peoples et al., 2016; Roes & Raymond, 2003; Swanson, 1964). In such societies, anonymity and fleeting interactions mean there is less pressure on individuals to follow prosocial norms, and defection is easier (Purzycki et al., 2016). Therefore the high costs of monitoring and punishing defectors are effectively ‘outsourced’ to deities (Johnson & Krüger, 2004; Laurin et al., 2012; Schloss & Murray, 2011).

In some respects it seems obvious that moralising high gods must promote cooperation and ‘good behaviour’. The texts of all major religions explicitly encourage prosociality in their followers (Norenzayan & Shariff, 2008). For example, Christianity has scriptures such as the Ten Commandments instructing ‘thou shalt not kill’, and ‘thou shalt not steal,’ and many religions have proverbs such as ‘do others as you would have done unto you’ (Baumard & Boyer, 2013). Adherents believe they will receive supernatural rewards if they observe such rules, and supernatural punishment if they do not.

Research has tested the moralising high gods/supernatural punishment hypothesis through two methodologies. One uses large, cross-cultural datasets to examine co-evolution between larger settlements, increasing societal complexity and increasingly omniscient and punitive gods (Johnson, 2005; Peoples et al., 2016; Roes & Raymond, 2003; Watts et al., 2015; Botero et al., 2014). Such macroevolutionary studies have largely found an association between the development of moralising high gods and societal complexity. However, earlier studies were correlational (e.g. Johnson, 2005; Roes & Raymond, 2003), and it is not straightforward to pinpoint the factors that are sustaining cooperation in such societies, between gods and secular laws and institutions, as they often arise around the same time (Slingerland, 2015; Watts, Greenhill, et al., 2015). It has also been

suggested that the wider concept of broad supernatural punishment, for example from ancestral spirits and forces such as karma, can drive the evolution of political complexity, although high gods are required to sustain it (Watts, Greenhill, et al., 2015).

The other methodology used to test the supernatural punishment hypothesis involves the use of psychological experiments, to examine whether greater belief in moralising and punitive gods increases individual participants' willingness to cooperate or reluctance to cheat (Lang et al., 2019; Purzycki et al., 2016; Xygalatas et al., 2018; Purzycki et al., 2018; Henrich et al., 2010). Some of these have as their basis the finding that many people appear to be willing to cheat, but on a small scale (Fosgaard, 2013; Shalvi, Dana, Handgraaf, & De Dreu, 2011). They use measures of dishonesty, where participants have the opportunity to distribute resources according to their personal preferences, under the guise of following an impartial process without fear of detection, unless they are constrained by a belief in punitive supernatural agents who are able to observe their cheating. Participants toss a coin or roll a dice to determine earnings in an experiment, but the true roll or throw cannot be observed by anyone except participants themselves (Lang et al., 2019; Purzycki et al., 2016; Xygalatas et al., 2018; Purzycki et al., 2018).

The precise relationship between belief in moralising gods, religion and prosocial behaviour remains unclear. Some studies have found no support for the idea that fear of supernatural punishment promotes individual cooperation (Bourrat, Atkinson, & Dunbar, 2011); others have found that that moralising and non-moralising deities both influence morality (Purzycki, 2013). Further conflicting evidence comes from studies reporting that anticipation of supernatural rewards, but not punishment, promotes cooperation, and others where a belief in supernatural punishment, but not reward, is associated with prosocial behaviour (Oviedo, 2016).

Individuals who describe themselves as religious may vary in their level of commitment to their religion, in how frequently they practice, and how often they experience concerns about supernatural monitoring and punishment. This may

explain some differences in previous experimental results, and is relevant to this study as well.

The fear of supernatural punishment is associated with another proposed mechanism for cooperation among non-relatives in humans: reputation. Fear of supernatural punishment may have developed as an extension of the reputational concerns arising from monitoring and punishment by others (Boyer, 2003). Reputational theories posit that individuals are motivated to develop a positive social reputation through cooperation, which results in them being more able to obtain future benefits and partnerships; a negative reputation as a result of defecting may result in sanctions and avoidance by others (Alexander, 1987; Barclay, 2013, 2016; Milinski et al., 2002; Nowak & Sigmund, 1998; Roberts, 2015; Schlaepfer, 2018).

Reputational effects rely on individuals making decisions about who to cooperate with, using shared and coordinated knowledge (or agreement on an individual's reputation), based on either personal experience or information provided by others (Schlaepfer, 2018). Therefore humans also have a propensity for reputation management. A large body of empirical evidence demonstrates that visibility, and awareness of observation by others promotes cooperation and discourages cheating. For example, being observed increases the size of donations to church collections, and improves willingness to sign up to public goods such as energy efficiency schemes and blood donation (Soetevent, 2005; Yoeli, Hoffman, Rand, & Nowak, 2013; Lacetera & Macis, 2010; Satow, 1975).

Few studies examine two cooperative mechanisms together (García et al., 2014) and no published studies have investigated the moralising high gods (MHG) hypothesis by comparing it with another mechanism for cooperation. Instead, published research has compared MHG with other less punitive supernatural agents, or examines how it increases cooperation over geographical distances (Lang et al., 2019; Xygalatas et al., 2018). In this study, I examine two proposed mechanisms concurrently to see which appears to promote charitable donations more effectively: fear of supernatural monitoring and punishment by high gods, or awareness of donation decisions being observed by other humans.

Research Location

This research was undertaken in Belfast, the capital city of Northern Ireland. Northern Ireland is the most religious part of the UK, with 45% of inhabitants attending church regularly (Ashworth, Loring, Hanson, Caton, & Perkins, 2007). 82.3% of the Northern Irish population identify themselves as Christians (NISRA, 2012). Northern Irish Christians are divided between two main religious denominations, Catholic (40.8% of the population) and Protestant (42.1% of the population) (NISRA, 2012). The Roman Catholic Church is the largest single denomination. The Protestant faith in Northern Ireland is further broken down into the Church of Ireland, the Presbyterian Church and the Methodist Church. 10.1% of people in Northern Ireland stated that they have no religion in the 2011 census, and 0.8% belonged to another religion including Hinduism, Sikhism, Islam, Buddhism and Judaism (NISRA 2012).

Belfast is the capital city of Northern Ireland, which is part of the United Kingdom (Figure 2). Belfast Local Government District (BLGD) had an estimated population of 339,600 in June 2016, out of an overall population of 1.862 million in Northern Ireland according to the Northern Ireland Statistics and Research Agency (NISRA) (NISRA, 2017).



Figure 8.1: Northern Ireland and the Republic of Ireland (Google maps).

History: conflict and religion

The city's recent history of conflict is relevant. The division between Catholics and Protestants, and the sectarianism between those who favour union with Great Britain, and those who favour nationalist independence, remain predominant characteristics. The conflict is aligned with religion, with most Catholics favouring the nationalist or republican stance, and most Protestants supporting the unionist or loyalist cause, but without total correlation between the two. The primary cause of differences in the conflict was Northern Ireland's constitutional status as part of the UK (Mitchell, 2006). There is a general academic consensus that religion served as an ethnic marker, but was not politically relevant further than that (Mitchell, 2006). Yet it is undeniably relevant to the city's past and present demography.

Current situation

Segregation between the two religious populations is still prevalent. In general, West Belfast is Catholic and the East is Protestant. The majority of schools (95%) are segregated by religion (CAIN, 2017). As well as the east-west split, the city is further divided into areas that are predominantly Catholic and Protestant (Hughes,

Campbell, Hewstone, & Cairns, 2007), with only a small number of middle class areas that are approaching a balance between the two (NISRA 2012).

The conflict situation has greatly improved but has not been eliminated. Perhaps most tellingly, the 'Peace Walls' remain a feature of the city. These were erected in areas where the worst sectarian violence between Catholics and Protestants occurred. In 2016 there were 109 peace walls across the whole of Northern Ireland (Black, 2016). Sectarian related killings also continue, although they are now far more infrequent (CAIN, 2017).

The persistence of higher levels of religiosity in Northern Ireland compared to the rest of the United Kingdom may be connected to the recent conflict. There is some evidence suggesting that religiosity is more pronounced in threatening and risky environments (Norenzayan & Hansen, 2006). Religious rituals have also been associated with providing comfort in threatening situations (Legare & Souza, 2012).

There is a wide range of socio-economic conditions within Belfast, which includes both very affluent and very deprived areas (Plöger, 2007). However, a combination of the reduction of conflict, regeneration and a rise in Belfast's industries, including tourism and the film have led to a subsequent expansion of the city's overall economy (Gaw, 2016).

Recent research in Northern Ireland has examined the evolution of cooperation among Catholics and Protestants in Belfast. Silva & Mace (2014, 2015) tested the parochial altruism hypothesis, that conflict promotes in-group favouritism and hostility toward the out-group. They found that the conflict between Catholics and Protestants led to reduced cooperation between the groups, but no evidence that it promoted in-group favouritism. Instead, socio-economic status was the biggest predictor of cooperative behaviour.

There are several reasons why Belfast was a suitable field site for this study:

1. The high levels of religiosity in the population.

2. The homogeneity of the population, with less international immigration than the rest of the UK, facilitates examination of how levels of religiosity affect cooperation and charitable giving.
3. The variability of socio-economic status across the city allows for comparative work from this perspective.
4. In addition the city has a large number of churches, which can be used as religious ‘primes’.

Hypothesis and predictions
Hypothesis: belief in moralising high gods is a more effective mechanism for cooperation than being observed by others (the audience effect)
<p>Predictions</p> <ul style="list-style-type: none"> • Donation levels from participants who believe in supernatural punishment (hell) and reward (heaven) will be roughly equal to donation levels from participants who do not believe in heaven and hell. But earnings from the dice game will be lower for participants who believe in heaven and hell than for those who do not believe in heaven and hell. • When individuals believe in high gods and the experiment is conducted in or near a church (a contextual prime), they will earn less in the dice game than in other locations and individuals who do not believe in high gods • Participants who choose religious institutions as their charitable organisations will earn less in the dice game than participants who only choose secular organisations • Participants who believe in heaven and hell will earn less in the dice game than participants who do not believe in heaven and hell. • Participants with more commitment to religious practices will earn less in the dice game than participants with a low level of religious practices

Table 8.1 Hypothesis and predictions relating to the relative efficacy of belief in moralising high gods and the audience effect as mechanisms for cooperation (charitable donations)

Our experiment was designed to quantify the relative efficacy of reputational concerns and belief in punitive high gods as mechanisms for maintaining large-scale cooperation. Fear of moralising high gods is predicted to be a more effective mechanism for cooperation in that the effects of supernatural punishment, as for believers, will more severe and longstanding than any reputational effects. There is however an alternative hypothesis, in that being observed performing an action by others can lead to immediate and observable reactions such as disapproval or endorsement, with immediate sanctions if defection is observed, in which case reputational effects may be more salient. Monitoring by supernatural agents

resulting in punishment is less immediate, and therefore may not result in decreased cheating, or at least not as effectively.

Methods

Ethical approval

This study was approved by the UCL Ethics Committee, Application 8669/002.

Data collection

With the help of four other experimenters, I conducted a lab-in-field experiment from June-July 2017. Data collection took place in nine public locations in Belfast, and these were divided between five secular locations (parks and other public areas) and four churches (two Protestant and two Catholic). Churches were used as a contextual ‘prime’ to invoke religious sentiments in participants, enabling us to examine whether this had a measurable impact on behaviour compared to secular locations. Our experiments at churches coincided with service times to increase numbers of participants and maximise any priming effect.

Experimental procedure

Passers-by were approached and recruited at random in various locations. All participants were asked to give their verbal consent to taking part in an anonymous experiment. They were asked to select two charities to which they would like to donate money. They had the choice of two secular organisations, Marie Curie Cancer Care and Oxfam, and also a church or religious organisation of their choice to which we would donate money on their behalf.

All participants undertook two experiments, which were each performed twice, once for each organisation they selected.

- 1. The dice experiment** following a similar procedure to Gachter & Schultz, (2016) and Dai, Galeotti, & Villeval, (2017). Participants were asked to roll a dice in a cup, where only they could see the result of the throw, and then

report it to the experimenters. We used a six-sided dice with three colours, so the dice has each colour on two sides (Dai et al., 2017). There are three possible outcomes to each roll: red, yellow or blue, with an equal probability of $1/3$. The colour thrown determined how £2 was divided between themselves and their chosen charity or religious organisation. Because only participants could see the result of the dice throw, they had the opportunity to cheat, if they chose to do so, without detection and therefore without reputational concerns becoming an issue (Fischbacher & Föllmi-Heusi, 2013; Gächter & Schultz, 2016). They were asked to roll the dice twice: the first throw was to determine their earnings, and the second throw was to ‘check the dice is working’. This was to give participants the opportunity to practice ‘justified dishonesty’, where individuals lie, but minimally, in order to preserve an image of themselves as honest (Fischbacher & Föllmi-Heusi, 2013; Gächter & Schultz, 2016). When participants roll the dice twice, they have the option of reporting the throw with the highest payoff, regardless of whether it was the one they were asked to disclose, which is less dishonest than entirely fabricating the result.

Participants were then paid according to the colour of the throw they reported. This would allow statistical analysis to determine whether there was an effect of belief in supernatural on participants’ winnings in the game. If all participants reported honestly, then each colour should appear with an equal probability of $1/3$.

- 2. The donation experiment.** Participants were given £2 and asked how they would like to divide it between themselves and their chosen charity. They could donate all of it, keep all of it, or divide the money between the two. They did this twice, once for each charitable organisation, so they could donate up to £4 in total. This formed the ‘public’ section of the experiment, where being observed by the experimenters and perhaps other bystanders could influence decision-making. Again subjects did this twice, once for each of their charities.

The order the experiments were performed in was randomised so that participants undertook either the donation experiment or the dice experiment first.

Experimenters were rotated between conducting the experiments and asking the questionnaire, to mitigate experimenter effects. Participants were afterwards asked to complete a brief questionnaire on demographic and socioeconomic information. They were asked how frequently they undertook religious practices such as reading the bible, attending religious services and praying, and how much they believed in divine punishments and reward, and in the existence of heaven and hell, along with other questions on their religious beliefs (See **Appendix 8** for further details.)

Results

Participants

208 participants were recruited in various locations in Belfast. The mean age of participants was 44 ± 17.6 , and 46% were female.

Participants varied in their religiosity, with 61% stating they had some religious belief, and 36% who said they did not (the remaining 3% were unsure). The religious portion of the sample came from a range of denominations, but were predominantly Christian, with 39% identifying themselves as Catholic, 11% as Irish Anglican, 36% adhered to a form of Protestantism, and the remainder followed other faiths. 30% of participants believed ‘very much’ in hell, while 45% of participants did not believe in hell at all. This was slightly different from heaven, with 42% who believed in it ‘very much’ and 31% who did not believe in it at all. 50% stated that they undertook some form of religious practice, such as praying or attending religious services, on a regular basis.

Location	Total subjects	Female N	Mean Age	Dice Earnings			Donations		
				Mean	SD	Median	Mean	SD	Median
Victoria Square	21	7	36	2.05	1.20	2	3	1.14	3
Botanic Gardens	40	20	43	1.85	1.14	2	3.83	0.38	4
Ormeau Park	49	25	43	2.10	1.16	2	3.73	0.64	4
City Hall	21	13	36	1.93	1.50	2	3.23	1.20	4
Titanic Quarter	30	13	38	1.93	1.01	2	3.6	0.82	4
St Patrick's Roman Cathedral	15	10	55	1.20	1.01	1	3.73	0.70	4
Belfast South Methodist Church	8	6	71	2.25	1.30	2	3.88	0.35	4
The Parish Church of St George	14	6	62	2.07	1.27	2	3.36	0.93	4
St Anne's Cathedral	10	3	41	2.00	1.25	3	3.6	0.70	4

Table 8.2 Descriptive statistics showing participant numbers, gender, mean age, dice earnings (mean, SD, median), and donations (mean, SD and median) for each location.

The dice experiment

Overall levels of honesty in the game

I tested the overall sample to examine how honest participants appear to have been when reporting the results of their dice throws. The true level of cheating cannot be known, but comparison of the aggregate results with the expected probability distribution can suggest where it may have occurred (Gächter & Schultz, 2016). I conducted a one-sample Kolmogorov-Smirnov test for discrete data, to examine whether the reported distribution of earnings in the dice experiment is significantly different from the expected distribution. Results ($D = 0.03$, $p = 0.98$) suggest there is no significant difference between participants' earnings and the predicted distribution of earnings.

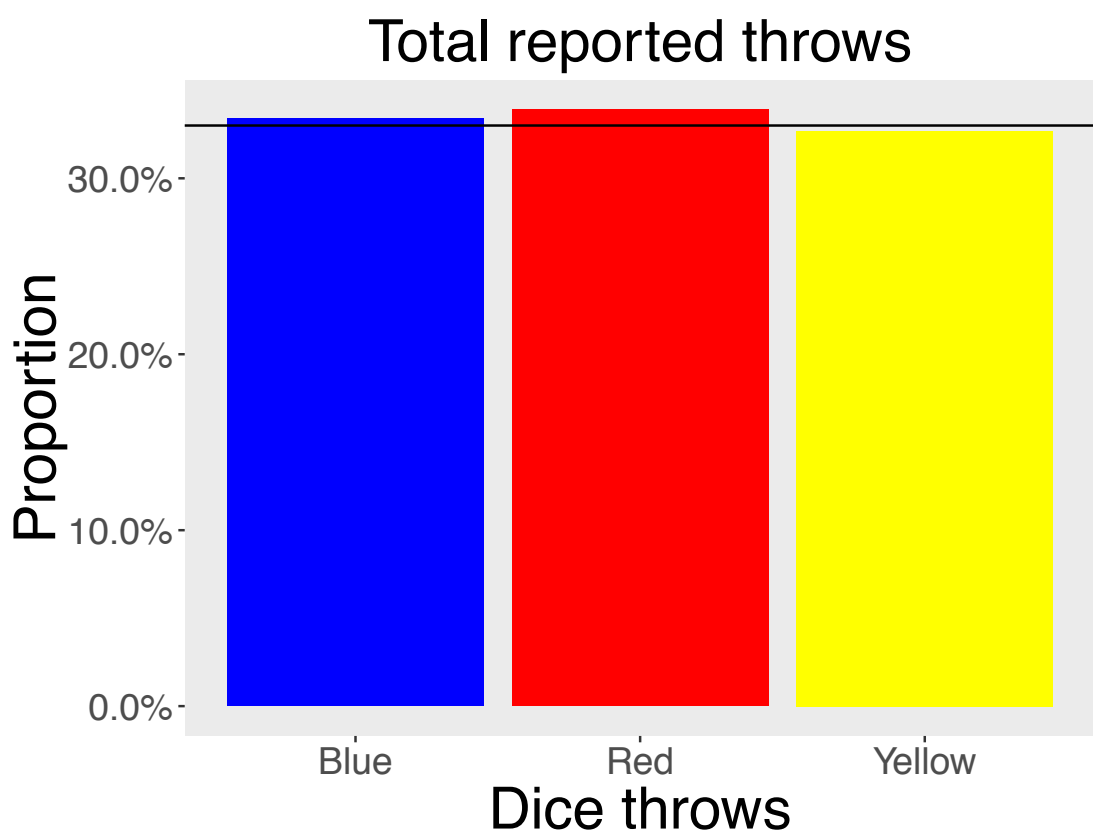


Figure 8.2 The total distribution of dice throws reported by participants in all locations, expressed as percentages. The black line shows the theoretical expected distribution of throws.

I then analysed aggregated dice throws against variables associated with different aspects of religion.

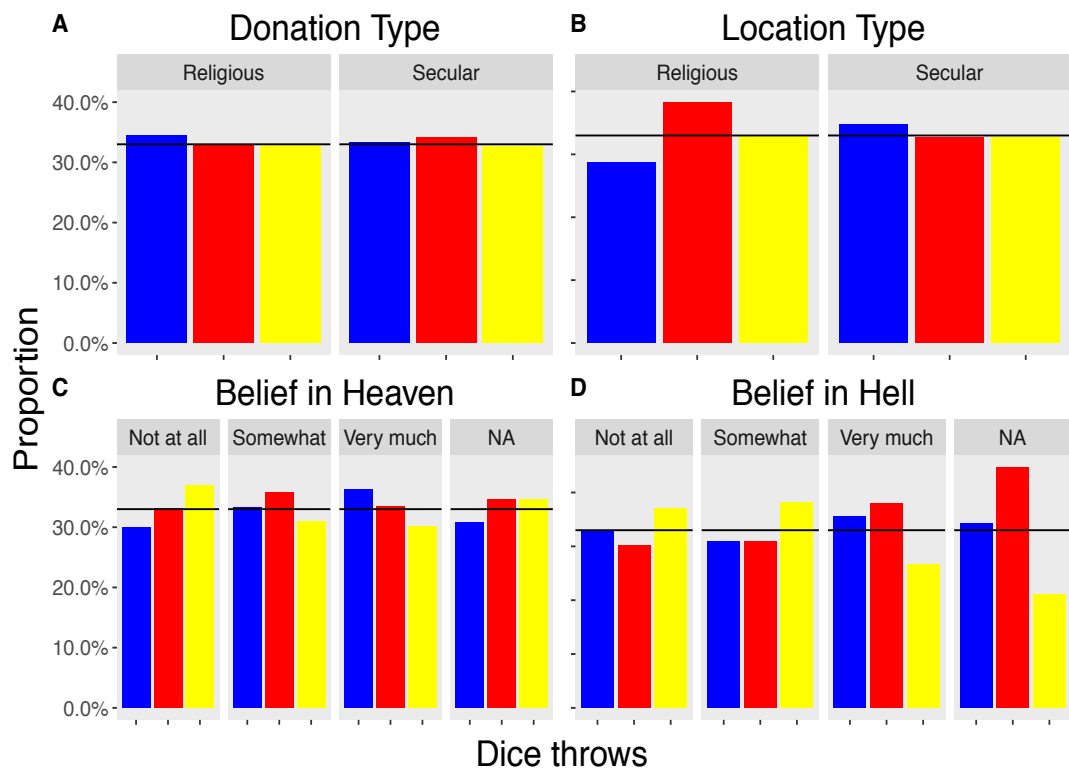


Figure 8.3 Proportion of dice throws by variable: A) Dice throws according to whether participants chose to donate to at least one religious organisation or solely secular charities. B) Dice throws in secular and religious locations. C) Dice throws according to participants' response when asked if they believed in heaven. D) Dice throws according to participants' response when asked if they believed in hell.

Choice of religious or secular institutions

Earnings from the dice experiment were then analysed according to whether participants chose entirely secular institutions to donate to (N=147) or selected a religious institution as one of their choices (N=61). There was no significant difference in dice winnings between those who had chosen a religious institution (Mdn = 2) and those who chose secular organisations (Mdn = 2) (Wilcoxon rank sum test: $W = 4934$, $p = 0.24$).

Belief in heaven and hell

This was calculated as a separate measure of religiosity from participation in acts of religious devotion such as prayer and attending services. Participants were asked whether they believed in heaven and hell.

Those who responded 'Very much' or 'Somewhat' were classified as 'believing in heaven or hell', and those who responded 'Not at all' were classified as 'not believing in heaven or hell'.

The participants who did not believe in heaven (Mdn = 2) did not have significantly different earnings from those who did (Mdn = 2) (Wilcoxon rank sum test: $w=4525$, $p=0.41$). Similarly the earnings of participants who believed in hell (Mdn = 2) did not differ significantly from the earnings of those who did not (Mdn = 2) (Wilcoxon rank sum test: $W = 4962$, $p = 0.17$).

However, earnings differed between those who believed 'very much' in hell (Mdn = 2) as one category, and those who believed 'somewhat' or 'not at all' in hell (Mdn = 2) as another category (Wilcoxon rank sum tests: $W = 4612$, $p = 0.05$) (I discuss this further below). This was not the case for those who believed 'very much' in heaven (Mdn = 2), as compared to those who believed 'somewhat' or 'not at all' (Mdn = 2) (Wilcoxon rank sum test: $W = 4864$, $p = 0.68$).

Contextual priming: religious and secular locations

There was no apparent effect of contextual priming. Participants in secular locations (Mdn = 2) did not have significantly higher earnings than participants in religious locations (Mdn = 2) (Wilcoxon rank sum test: $W= 3511$, $p=0.44$).

Religious practice

This is a measure of the frequency with which participants undertook various forms of religious practice (prayer, reading religious texts and attending services).

Participants could score a maximum of 12 (a high level of religious practice) and a minimum of 0 (no religious practice). They were then divided into two groups: high practice (score ≥ 7) and low practice (≤ 6).

Participants who had high levels of religious practice (Mdn = 2) did not have significantly different earnings in the dice game from those with low levels of religious practice (Mdn = 2) (Wilcoxon rank sum test: $w= 5244$, $p = 0.90$).

	B (SE)	P-value	95% CI Low	Odds Ratio	95% CI High
Religious practice	0.02 (0.05)	0.61	-0.14	0.97	0.08
Importance of religion	0.24 (0.21)	0.26	-0.18	1.27	0.67
Location (Secular)	0.19 (0.37)	0.61	-0.53	1.20	0.91
Sex (Male)	0.20 (0.29)	0.50	-0.38	1.22	0.77
Belief in hell: “somewhat”	-0.05 (0.51)	0.92	-1.14	0.95	0.85
Belief in hell: “very much”	-1.07 (0.54)	0.05	-2.14	0.34	-0.01
Belief in heaven “somewhat”	0.14 (0.51)	0.78	-1.14	0.87	0.85
Belief in heaven “very much”	0.37 (0.65)	0.57	-0.90	1.45	1.67
Financial concerns in the past year “yes”	0.29 (0.32)	0.37	-0.35	1.34	0.93
Financial concerns in next month “yes”	-0.05 (0.38)	0.90	-0.79	0.96	0.69

Table 8.3 Ordinal regression with participants’ total earnings in the dice game as the dependent variable. None of the variables has a significant effect, with the exception of where participants stated that they believed ‘very much’ in hell. The results indicate that participants with this belief are 0.34 times less likely to earn the maximum £4 in the dice experiment than those who do not believe in hell, or only believe ‘somewhat’ in hell.

As the results from **Table 8.3** suggest, in line with the overall finding that little cheating has occurred, most independent variables do not have an impact on participant earnings in the dice game.

The exception to this is where participants stated that they believed ‘very much’ in hell, and had a reduced likelihood of earning the maximum £4 stake in the dice game. Those who believed ‘somewhat’ in hell were more likely to earn £4. This result is further illustrated in **Figure 8.4**.

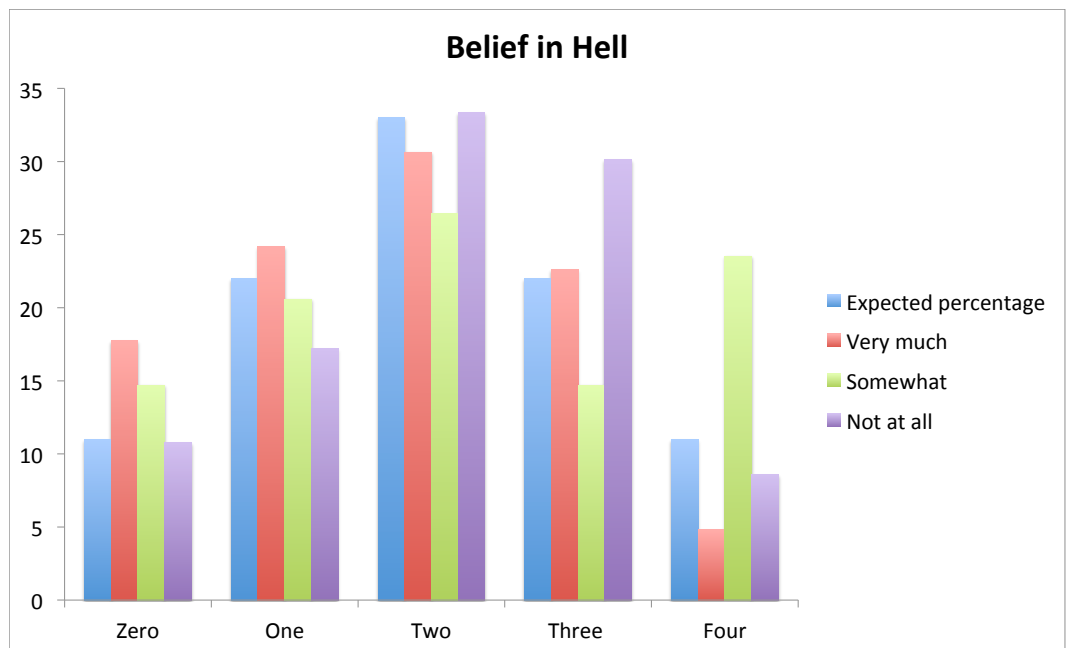


Figure 8.4 Histogram of predicted earnings and actual earnings from the dice game, grouped participants' stated level of belief in hell. Participants who believed 'very much' in hell were less likely to earn the full stake of £4. Those who believed 'somewhat' in hell were more likely to earn the full stake of £4.

The donation experiment

In the donation experiment, 74% of participants opted to donate their total £4 stake to charitable organisations (£2 to each organisation). Of the 61 participants who chose to donate to a religious organisation, 53 described religion as being 'very' or 'somewhat' important to them. The secular charities were chosen more frequently overall, with 55 participants who only donated to secular organisations describing religion as being 'very' or 'somewhat' important to them.

	B (SE)	P-value	95% CI Low	Odds Ratio	95% CI High
Intercept	0.95 (0.93)	<0.61	-0.86	2.58	2.83
Religious practice	-0.06 (0.05)	0.26	0.82	0.94	1.04
Sex (male)	-1.03 (0.41)	0.01*	0.15	0.36	0.77
Location (secular)	0.14 (0.53)	0.79	0.39	1.16	3.24
Belief in hell (somewhat)	-0.12 (0.70)	0.92	0.41	0.89	2.38
Belief in hell (very much)	0.16 (0.53)	0.75	0.41	1.18	3.34
Age Centred	0.53 (0.24)	0.03*	1.00	1.03	1.06
Financial concerns in next month 'yes'	-0.52 (0.47)	0.25	0.24	0.59	1.48

Table 8.4 Logistic regression showing whether or not participants donated the full £4 stake to charities as the dependent variable. Donations were converted to a binary variable (one category of donations from £0-£3 and one category for £4), as very few participants donated less than £2. Men had lower odds than women of donating the full stake to their chosen charities: 82% of women donated £4, as compared to 67% of men, who were more likely to give £2 or £3. Older participants were also more likely to donate their full stake.

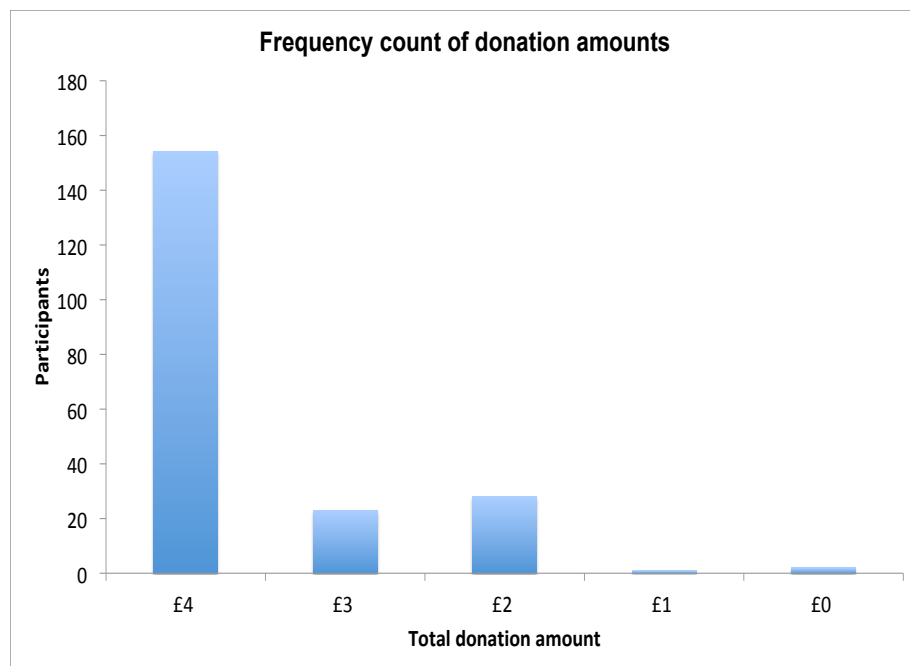


Figure 8.5 Frequency count showing the total amount participants donated by participants to their two chosen organisations. Most participants donated the full stake of £4.

Discussion and limitations

Overall the results show a very low level of cheating by participants in the dice game. Such low levels of cheating are surprising when contrasted with other studies using this methodology (Dai et al., 2017; Fischbacher & Föllmi-Heusi, 2013; Gächter & Schultz, 2016; Purzycki et al., 2016). In the public ‘reputation’ condition, when participants chose how much money from their stake to donate to charity, the choice between religious or secular organisations made no significant difference to the amounts donated by an individual. Most participants gave their full stake, although men were less likely to donate their full stake than women. Older participants were more likely to donate their full stake than younger ones.

It is difficult to draw salient conclusions relating to participants’ belief in supernatural punishment from the results above. However, participants’ ideas concerning hell did have a small effect on the dice earnings. Those who believed in it ‘very much’ were less likely to win the highest possible amount in the dice

experiment than would be predicted by probability. Those who believed ‘somewhat’ in hell were more likely to win £4 than would be predicted by the expected distribution.

This finding should be interpreted with caution, because overall levels of cheating are low. As reasons for this result are unclear and the sample size is somewhat small, it is possible that for this variable, participant earnings were unbalanced due to chance. However, a previous experiment using the dice-in-cup format concluded that nuns were willing to cheat to their own disadvantage, in order to appear honest and not greedy, in line with their vow of poverty (Utikal & Fischbacher, 2013). Those who believed in hell ‘very much’ may have thought it preferable to refrain from earning the highest amount on reputational grounds, in a similar way to the nuns.

But if the result was due to reputational concerns, it should have also occurred with other measures of religiosity. Perhaps this group may have believed generosity and self-denial was less likely to result in supernatural punishment than cheating, even for their own loss. Those who only believed ‘somewhat’ in hell earned £4 more often than would be expected, and so were possibly less concerned by the supernatural consequences of cheating. Those who did not believe at all in hell were more likely to receive £3, the second largest stake, than would be predicted by probability, which again suggests some support for the supernatural punishment hypothesis.

There are a number of possible reasons why the results are for the most part inconclusive.

Participants may have been more reluctant to cheat charitable organisations than they would have been to cheat experimenters. Previous research using dice tasks, where participants won money from the experimenters, have detected greater levels of cheating (Dai et al., 2017; Fischbacher & Föllmi-Heusi, 2013; Gächter & Schultz, 2016; Purzycki et al., 2016).

Low levels of cheating may have occurred because even if experimenters and other observers could not see the result, participants may have been conscious of having an audience, whereas in other studies they were left to record their results on a computer (e.g. Gächter & Schultz, 2016).

The results could show an effect characteristic of the population of Belfast as a whole, with social norms of greater honesty. This would be in line with findings that levels of honesty in subject pools are associated with national levels of corruption and rule violation (Gächter & Schultz, 2016).

There may have been a high enough level of economic stability within the population as a whole to make cheating for the stake size we were able to offer less tempting: for example, the median hourly earning in Northern Ireland for a full-time job was £12.22 in 2016 (NISRA 2016). The effect of differing stake sizes has been shown to influence behaviour in economic games and this differs across populations (Raihani, Mace, & Lamba, 2013).

Similarly there was no difference between participant earnings in secular and religious locations. Some studies have found no or little effect of contextual priming (see Purzycki et al., 2016; Xygalatas et al., 2018). Other research found that religious primes affect religious and non-religious individuals equally (Randolph-Seng & Nielsen, 2007; Shariff & Norenzayan, 2007), which could be interpreted to mean that non-religious participants are subconsciously influenced by religious symbolism, but also questions the interpretation of whether the religiosity of the prime is central to the cooperative behaviour.

The rainy weather and the time needed to conduct the experiment (around 10-15 minutes), affected recruitment: a lot of people declined once told of the time it would take. Many people we approached as participants preferred to give us a donation for the charities instead of participating in the experiment. Participating in the experiment could itself be considered a prosocial act: those who agreed were willingly giving their time in order for us to collect data, albeit with a potential monetary reward. This may therefore have led to a certain amount of self-selection among participants, where only those with more cooperative tendencies took part.

In addition, peoples' wish to provide money instead of participating is in line with the findings of a study examining decisions to undertake prosocial acts on the basis of effort rather than fiscal or moral costs (Lockwood et al., 2017). The authors found that when the cost of an act was high in terms of effort, people were less willing to put in that effort to benefit others than they would be to benefit themselves. When the costs were lower, prosocial acts were more likely to be undertaken. It appears that people often found providing a small charitable donation to be a less costly cooperative act than participating in the experiment.

As mentioned above, the difference between levels of cheating in this study and in others that have used this methodology previously is surprising (Fischbacher & Föllmi-Heusi, 2013; Gächter & Schultz, 2016). However, this is not the first study using aggregate results to detect cheating outside the laboratory which has had such results. Abeler, Becker, & Falk (2014) rang participants at their homes and asked them to toss a coin four times and report how many times they threw heads or tails. There was no evidence that participants cheated: in fact, a higher percentage reported heads (the non-winning outcome) than tails. Similarly, Jacobsen & Piesovan (2016) asked participants to roll a dice and report the throw, where payoffs were dependent on the number rolled. They found no evidence of dishonest behaviour when results were aggregated in this treatment.

The number of studies with positive results from using the die-in-cup and coin toss methodologies may also be a result of publication bias, where, aside from those mentioned above, only studies with positive results are selected for publication. Furthermore, not all participants are expected to lie, as studies using these methods find there is a consistently honest proportion of the subject pool (Fischbacher & Föllmi-Heusi, 2013; Gächter & Schultz, 2016). In order to cheat in such experiments, it must occur to the participant that it is possible, with a sufficiently low chance of detection, and they must be motivated to do so. It may even be the case that in some situations, subjects cheat, but at a disadvantage themselves, in association with reputational concerns (Utikal & Fischbacher, 2013). However it should be noted that this latter study had a very small subject pool.

Colleagues in Gansu province, China, carried out a related study (Ge et al., 2019). The experimental procedures were the same, however they varied the reputational context of the setting. Ge et al. predicted that reputational effects would be more pronounced in small communities, where inhabitants had resided for a long time and knew each other better than in cities, where individuals may be more anonymous. The results showed that there was no significant effect of a belief in supernatural punishment in either the dice experiment or donations. There was overall a fairly low level of cheating, although participants who chose to donate to religious organisations appeared to have some ‘justified dishonesty’ in the dice experiment. Reputational concerns appeared to motivate donations, where those in smaller communities were more likely to donate their full stake. Those who participated more in religious practice also gave more in the donation experiment, again suggesting that there is an association between this and reputational concern. They posit this may be attributable to religious meetings and collective activities providing greater opportunities for meeting and gossip (Wu, Balliet, & Van Lange, 2016), and associated with research showing that religious practice is correlated with a more prosocial reputation (Power, 2017a).

Conclusion

Low levels of cheating by participants in Belfast make it difficult to draw any definite conclusions about the relative efficacy of reputational concerns and belief in supernatural punishment as mechanisms for cooperation. Participants did appear to earn significantly less from the dice game when they believed ‘very much’ in hell, but the sample size is small, and it cannot be discounted that this result is due to chance. There are a number of reasons why participants may have behaved honestly for the most part, including feeling observed despite the privacy of the dice condition, social norms of honesty, insufficient financial incentives or a reluctance to cheat charitable organisations.

Chapter 9: Conclusion

This thesis aims to further understanding of supernatural beliefs from an evolutionary perspective, including understanding how witchcraft accusations are used by individuals, how they may be adaptive, and the ecological conditions that may lead to the evolution of witchcraft beliefs. It also compares the supernatural punishment hypothesis with observation by other humans as mechanisms for cooperative behaviour.

My research examined two forms of supernatural belief, which have similar characteristics but also some significant differences. There is some support for the hypothesis that witchcraft beliefs and accusations are a mechanism allowing accusers to nullify competitors, as well as individuals who are otherwise difficult or burdensome to them. It is harder to draw any firm conclusions about the supernatural punishment and audience effect from the research undertaken in Belfast. However, the results of a sister experiment in China (Ge et al., 2019) suggest that reputational concerns are more relevant than fear of supernatural punishment in promoting charitable donations.

Contribution of this thesis

Very little previous research has examined witchcraft accusations and beliefs from the perspective of evolutionary anthropology, although others have taken such an approach in examining the characteristics of the practitioners of black magic (Singh, 2019). Some research was not explicitly identified as adopting evolutionary theory, but examined the characteristics of magico-religious practitioners and how these varied between different types of society (Winkelman 1984, 1986). Others have also sought, through both quantitative and qualitative methods, to investigate the types of society and ecological conditions where witchcraft beliefs arise (Koning, 2013; Murdock, 1980; Nadel, 1952; Swanson, 1964; Hutton 2017; Wilson 1951).

In the process of examining these questions, I created a new resource for quantitative analysis (with help from Olympia Campbell), containing information on historic witchcraft accusations and beliefs in Bantu societies. The Sub-Saharan

Bantu were partly chosen because their widespread witchcraft beliefs provided sufficient information to create the dataset.

I used experimental economic games to collect data in Belfast, with the aim of investigating whether participants' donations to charity appeared more motivated by observation from gods or humans.

The quantitative methodology used to analyse witchcraft accusations has not, to my knowledge, been applied to them before. I attempted to record available cases as systematically as possible, and to analyse a) their relationship to societal traits in a cross-cultural dataset and b) patterns that occur in accusations. While other disciplines have produced valuable information, most accounts have been descriptive and have not undertaken statistical cross-cultural comparisons. Historians have collected detailed data, with a large number of case studies such as Macfarlane (1999) and Briggs (2002), but have mainly used descriptive statistics that relate to a single society or community. I was also able to make use of an extensive cross-cultural dataset (Gershman, 2016; George Peter Murdock, 1967; Pew Forum on Religion and Public Life, 2010) in order to examine whether witchcraft beliefs evolve in certain social and ecological conditions.

The research provides a form of 'real-world' examination of how negative reputational tags are used to harm individuals in competitive environments, thereby reducing the competitive strain on those who provide the tags. This has been discussed in theoretical papers (Antal et al., 2009; Lehmann et al., 2009), but not extensively in real-world experiments from an evolutionary perspective (with the exception of Mace et al., 2018). Similarly it provides an examination of how ostracism is used in real-world conditions. Exploring witchcraft beliefs and accusations using a cross-cultural evolutionary approach has also highlighted that the competition within particular forms of relationship appears to be a more salient predictor of witchcraft accusations than society level factors.

Overview of findings

In this section I summarise the effects of the society-level variables used throughout the thesis and how this fits with prior research, followed by the individual-level

variables. **Figure 9.1** is a schematic diagram showing how the questions, variables and datasets were used throughout the thesis.

Society-level traits

One striking finding of this thesis is that, for the most part, the characteristics of societies were not associated with witchcraft beliefs and accusations when tested using quantitative methods. This is not consistent with the findings of some cross-cultural research examining similar questions (Murdock, 1980; Winkelman, 1986; Swanson, 1964), or with the writings of anthropologists who have suggested that witchcraft accusations track areas of social tension inherent in social structures (e.g. Marwick, 1970). It does however support Hutton's (2017) conclusion that the existence of witchcraft beliefs could not be associated with any particular features of societies. Belief in witchcraft occurs in societies with a range of forms of social organisation (including various descent and post-marital residence patterns), a broad range of social stratification, and varying levels of polygamous marriage.

It is possible that the patterns of social tension in different societies are unique, and patterns of witchcraft accusations reflect this (Douglas, 1991), so that broad patterns are not represented in cross-cultural research. For example Wilson (1951b) and Nadel (1952) identified very localised causes for patterns of witchcraft beliefs and accusations, such as unique norms around food-sharing (Wilson 1951b) or the way that the increasing economic power of women in one society led to their being more frequently accused (Nadel 1952). Others have noted that witchcraft beliefs are not systematic (Ashforth, 2002; Comaroff & Comaroff, 1999). Geschiere (2015: 604) commented that witchcraft discourses are in fact 'chameleonic,' and that 'In this treacherous field of study, researchers may have to resign themselves to working with fuzzy notions that exhibit a common core, but at the same time engender highly variable and constantly changing elaborations.'

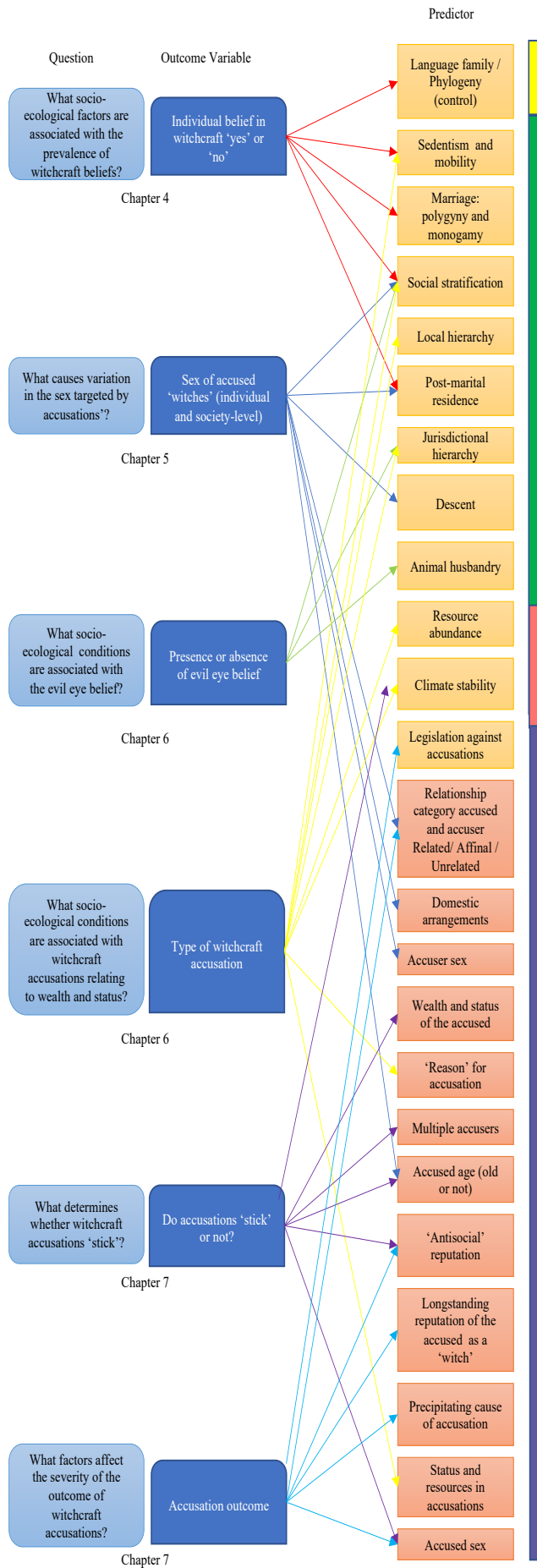


Figure 9.1 (previous page). Schematic diagram showing the main questions, outcome variable, predictor variables and datasets used in the chapters on witchcraft belief in this thesis. The datasets for the predictors are indicated by colour on the right. Yellow is from D-Place (Kirby et al., 2016). The green variables are from the Ethnographic Atlas (Murdock, 1967), the pink are from Botero et al. (2014) and the purple are from the Bantu dataset.

Social stratification, or the division of societies into different classes, did not have an effect either on the distribution of witchcraft beliefs, or the characteristics of witchcraft accusations. This is perhaps one of the most surprising results from this thesis, given how frequently witchcraft accusations have been associated with economic inequality, competition, and the division of societies into classes or castes (Golooba-Mutebi, 2005; Kanairara & Futaiasi, 2017; Kivelson, 2003; Macfarlane, 1999; George Peter Murdock, 1980; Thomas, 1971). In connection with this, witches are often portrayed as greedy and envious individuals, who use their powers to acquire others' resources for themselves (Douglas, 1991; Strathern, 2012).

The lack of an effect from social stratification can possibly explained in that witchcraft accusations can occur over material goods where differences between individuals are relatively small. Such differences can be crucial in societies close to subsistence level.

Social stratification did show a marginal effect on the distribution of the evil eye belief among Bantu populations: only 4 societies without stratification were recorded as believing in the evil eye (**Chapter 6**). But it had no effect either on the distribution of witchcraft beliefs, or on whether accusations were more likely to relate to wealth and status.

Related to the levels of social stratification, and wealth accumulation, was the level of resources available in the surrounding environment. The Resource Abundance variable did have a very small effect, in that accusations relating to status and wealth were more likely to occur in societies with limited resources, although not to

a significant level. This gives modest support to other research which has identified a greater association between resource scarcity and witchcraft belief, or more broadly between witchcraft accusations and environmental hardship (Ashforth, 2002; Behringer, 1999; Miguel, 2005; Oster, 2004).

Witchcraft belief, post-marital residence and descent patterns

This thesis did not find a clear relationship between the distribution of witchcraft belief and matrilineal and patrilineal societies, and descent patterns. The results of Chapter 4 contained a modest suggestion that higher levels of witchcraft belief were associated with matrilineal rather than patrilineal groups, but after controlling for phylogenetic effects the correlation was not significant.

Similarly, social organisation did not have an effect on which sex was most likely to be accused of witchcraft. Again this may be related to the fluidity of the belief, meaning that accusations are directed wherever they are 'useful'. In the matrilineal Mosuo of China, accusations were mostly directed at more wealthy female heads of household; in patrilineal and patrilineal societies where women have less autonomy, perhaps women are more vulnerable to allegations of witchcraft from those who have a higher status, in a 'scapegoating' pattern of accusation.

The lack of association with descent and post-marital residence is not consistent with the only other study to have examined this cross-culturally. Murdock (1980) found that witchcraft was more frequently used to explain illness in patrilineal societies, which he attributed to the conflicts associated with patrilineal residence patterns and polygamous marriage. Patrilineal marriages meant that married women had to experience the difficulties and conflicts of living with relative strangers, and so were more liable to be identified as witches, and the frictions and jealousy involved in co-wife relationships also rendered them vulnerable to accusations. Murdock took a different approach to that in this study. When talking about descent and witchcraft beliefs, he assumed that witches are always female, so his proposed explanation for the finding is not relevant to societies with male or mixed sex witches. His main interest was examining witchcraft beliefs in the context of how often they are used to explain illness.

Murdock's conclusion came from a single study. The question of descent and post-marital residence has not been examined by other cross-cultural research (e.g. Singh, 2019; Swanson 1964), so there is not yet a significant weight of cross-cultural, quantitative evidence indicating whether descent and residence are connected to patterns of witchcraft belief. But extensive studies of individual societies have documented witchcraft beliefs with a broad array of descent and residence patterns, including numerous patrilineal (e.g. Brown & Hutt, 1935; Bryant, 1949; Junod, 1912; Lambert, 1956; Leakey, 1977; Penwill, 1951; Soga, 1931; Winter, 1956) and matrilineal (e.g. Beidelman, 1963, 1967; Johnson, 1922; McVicar, 1934; Mitchell, 1956; Tew, 1950; Torday & Joyce, 1905; Whiteley, 1950; Young & Fosbrooke, 1960) groups.

Societies differ in the people who are most likely to be accused of witchcraft. In Bantu societies, and also among the Chinese Mosuo, accusations seem on the whole to have been directed towards the enviable: those who were either more well off, or who were equals but gaining status (Mace et al., 2018; Richards, 1935). The individuals most at risk of being accused also varies between societies: in early modern Europe and England, accusations seem to have frequently directed towards the poor and destitute, enabling more wealthy individuals to refuse providing any forms of support (Macfarlane, 1999; Thomas, 1971).

Witchcraft beliefs and accusations were less associated with polygynous marriage than anthropological accounts would suggest. Societies with a history of higher levels of polygynous marriage (Chapter 4) did not have more witchcraft belief, and accusations between co-wives formed a small percentage of the Bantu dataset (7 cases, or 2% of the total) (Chapter 5). Ethnographers of numerous societies have observed that witchcraft accusations frequently arise as a result of competition between co-wives, and were told this was the case by their informants (e.g. LeVine, 1962, 1963; Richards, 1935; Sheddick, 1953; Whiteley, 1950; Wilson, 1951a; Strassmann, 1997). It may be that this form of accusation has been over-represented in the literature, but it is also possible that it is simply under-represented in sample of individual cases used in Chapter 5, which is composed of cases that ethnographers observed and chose to record, rather than systematic data collection.

The jurisdictional hierarchy of societies was not significantly associated with witchcraft accusations relating to wealth and status, or the distribution of belief in the evil eye. This variable shows the number of jurisdictional levels beyond the local community, and is also used as a measure of political complexity (Gershman, 2015; Kirby et al., 2016; George P Murdock & Provost, 1973). However, the evil eye was slightly more likely to be present in societies with higher levels of jurisdictional hierarchy (Chapter 6). Although this variable was used as an indicator of the level of formal institutional strength, thought to limit the growth of witchcraft beliefs (Gershman, 2015; Koning, 2013) it may also be associated with higher levels of cultural complexity, which are thought to promote witchcraft beliefs. Perhaps the use of the measure in this context is more aligned with increasing cultural complexity than formal institutional strength, which could explain why the results from this variable were in the opposite direction to predictions.

Previous research has identified a link between animal husbandry and the evil eye. Livestock is thought to be a form of visible wealth, that easily gives rise to envy between individuals, and therefore increased belief in the evil eye as a mechanism for envy-avoidance (Gershman, 2014; Roberts, 1976). Witchcraft beliefs have also been associated with animal husbandry, as witches are thought to bewitch livestock and steal milk (Hutton, 2017; M. H. Wilson, 1951b). The results from this thesis, using a new sample of societies, are not inconsistent with this hypothesis. The evil eye was present in more Bantu societies that relied on large livestock for subsistence than did not, and only present in 3 societies where there was no large livestock. This result was approaching statistical significance, although within a very small sample, but it suggests some support for the hypothesis that evil eye beliefs arise as an envy-avoidance mechanisms, where wealth differences between individuals are easily visible, and may produce higher levels of envy. The presence of livestock was not associated with wealth and status-related accusations.

Individual-level variables

The forms of competition involved in witchcraft accusations vary. Sometimes the competition between individuals is direct and obvious, such as between those vying for a political position, or co-wives competing for a husband's favour and resources. There are also situations where the competitive aspect is less obvious, such as when elderly and vulnerable individuals are held to be scapegoats for misfortune. The competitive aspect is less obvious, but such accusations are thought to occur in societies very close to subsistence level, where the removal of 'expendable' people will enable others to access resources (Miguel, 2005).

Examples of such cases were rare in the dataset. Accusers have little obvious and direct gain from targeting such individuals, particularly when they are not kin or otherwise dependent on their accusers. Any increase in accusers' access to resources and reduction in competition can only be inferred as a potential benefit. But this type of witchcraft accusation seems to be prevalent in modern cases, for example those targeting older women and children in Malawi (Chilimampungu & Thindwa, 2011; Mgbako & Glenn, 2011).

Relationship categories

Relationship categories had an effect on the findings in relation to the sex of accused witches, but had no bearing on whether accusations were more likely to stick or have a severe outcome for the accused. Accusations from affinal kin were more likely to be directed at women, when they were living with them: this was a result of competition and conflict between wives and their husbands. It was also a result of competition between co-wives, or between a wife and her husband's family: in both cases the accused and their accusers are competing for access to the husband's time and resources. There has not, to my knowledge, been previous published research that has quantitatively tested association between affinal kin accusations and the sex of the accused.

Accusations track patterns of interaction

Much other research, including recent reports from human rights-based accounts of accusations, notes that accusations take place in the context of close relationships:

between partners, family members and neighbours, and those who interact frequently (Briggs, 2002; Swanson, 1964; Thomas et al., 2017). The variable examining the domestic arrangements of accused and accusers measured where they live in relation to one another. Accusations by people the accused were living with were more likely to be directed at women, and accusations from individuals living in different settlements were far more likely to target men. This is probably a reflection of the different spheres inhabited by the sexes: women by and large remained in or near the home, and men tended to have greater freedom of movement.

The variable examining purported reasons for accusations had one clear finding: accusations associated with wealth and status were far more likely to target men. This, along with the more frequent accusations of men in the sample overall, may suggest that in the Bantu societies, male-male competition for wealth and status is particularly intense. This makes sense in the context of evolutionary theory: in societies with inequality in the distribution of wealth and resources among men, more intense competition would be predicted, because of their association with male reproductive success (Betzig, 1986). It is also the case that the acquisition of wealth and status belongs to the male sphere of activities.

‘Antisocial’ witches and long-term reputations

The reputational characteristics of accused witches generally did not have an effect on the probability of a particular outcome, such as facing a severe penalty for witchcraft. This is not inconsistent with previous research findings: a long-term reputation as a witch capable of harmful magic has not always led to severe repercussions, and many individuals seem to simply have received this label with only minor consequences, or none at all (Evans-Pritchard, 1937; Geertz, 2011). Here, because of the nature of the data as realised accusations, I was unable to test the extent to which having a reputation as ‘antisocial’ led to gaining a reputation as a witch, which was frequently identified as occurring in the literature (e.g. Beidelman, 1963; Geertz, 2011; Walker, 1967; Edward H. Winter, 1956). But no previous research has examined whether such a reputation may affect the severity of accusation outcomes, or whether it is more likely to make accusations ‘stick’.

Another question concerning witchcraft beliefs is how an individual's reputation as a witch relates to their behaviour, and market value as a cooperative partner. The data from this study suggests that some individuals were accused because their behaviour was routinely antisocial, but this was not the case for all accusations. This finding is not in line with most evolutionary research on ostracism, which has viewed it predominantly as a mechanism for promoting cooperation, allowing cooperators to assort by excluding defectors (e.g. Feinberg et al., 2014; Nakamaru & Yokoyama, 2014). Future research, in line with Abbink & Doğan (2018), could take into account the extent to which ostracism occurs where relationships are competitive and resources are finite.

This does not mean that ostracism is never mechanism for cooperation, but that it may often be associated with competition, or even incidental (Abbink & Doğan, 2019; Lindström & Tobler, 2018). It is also more in line with biological market theories of partner choice, where an individual's overall 'market value' is taken into consideration, along with their prosocial tendencies or willingness to provide benefits to others (Barclay, 2013, 2016; Hammerstein & Noe, 2016; Noë & Hammerstein, 1994). This includes the fact that individuals can be chosen or dismissed not only for their overall qualities, but willingness to confer benefits on particular partners (Barclay, 2016). This appears to relate witchcraft accusations where interpersonal difficulties and arguments arise, and the accusation is used to dismiss those who are not viable cooperative partners.

Multiple accusers

The finding that when multiple accusers are involved in witchcraft accusations the likelihood that the accusations 'stick' increases is not surprising. This illustrates the need for consensus in accusations, as observed in previous research (Douglas, 1991; Park, 1963), and also the importance of agreement between individuals in order to condition behaviour in relation to reputational systems (Schlaepfer, 2018). It can be inferred the agreement among multiple accusers was typically driven by gossip, in line with previous research showing that gossip is used to spread reputational information, and coordinate group actions such as the ostracism of

particular individuals (Feinberg et al., 2014; Giardini & Vilone, 2016 ; Stewart & Strathern, 2004).

Future directions

Religious belief and witchcraft belief are both vast and complex systems of thought. In this thesis they are constrained to what may be their evolutionary functions in promoting cooperation and defeating competitors. Many other facets of these beliefs have not been investigated here, such as why witches are believed to be able to fly, or transform into animals. Exploring these phenomena could lead to fascinating investigations of the cultural evolution of such beliefs.

The analyses undertaken using the Bantu accusation dataset in this thesis have a limitation, in that they only test witchcraft accusations as realised events, and examine the likelihood of one characteristic of accusations against another. For a fuller understanding of how and why witchcraft accusations occur, they should be tested against population baselines. This would enable researchers to answer questions such as, given the percentage of elderly women in a population, how likely is it that older women will be accused of witchcraft? Or how likely is it that women will be accused of witchcraft by their affinal kin if they are living with them?

Currently it can be challenging to access data on witchcraft accusations in modern-day societies. The exact number of victims of witchcraft-related violence is unknown. In countries where it is more prevalent, there is little state or judicial intervention, and no systematized means of monitoring, recording or responding to accusations and other related abuses (Secker 2012; Foxcroft, 2017). Some charities and human rights-based organisations do collect information, such as the Oxfam report from Papua New Guinea on gender-based and sorcery-related violence (Thomas et al., 2017). Access to datasets like this can be restricted, given their sensitive nature and the need to protect the individuals involved. But analysis using such data could broaden knowledge of the circumstances surrounding accusations, as well as enhancing the response to witchcraft-related violence and protecting those at risk from it.

All the analyses using the Bantu Witchcraft Dataset had relatively small samples and therefore need to be treated with caution. Replication of the results with a more comprehensive dataset, which could be extended to societies outside of the Bantu, may be a potential next step. This could include societies from the larger Niger-Kordofanian language tree, of which the Bantu are a subgroup.

A larger language tree, or expansion of the number of societies in the analysis, could also be used to further explore the findings from chapter 4 relating to the phylogenetic roots of witchcraft beliefs. The societies in the dataset all have some form of belief in witchcraft. But societies from other language groups may have more variation, which could offer possibilities for exploring the evolutionary ancestry of the trait, and in addition allow tests of correlated evolution with other cultural variables.

In chapter 4, the percentage of people from different language families who believed in witchcraft varied considerably, suggesting that phylogenetic history may have an influence on the distribution of the trait. However, the sample sizes for the language families with lower belief in witchcraft were very small, so this result is not reliable. The phylogenetic ancestry of witchcraft beliefs has not been previously investigated in relation to their distribution, so this is potentially an area for further research.

Further data collection would allow for the testing of different hypotheses, such as how frequently there are accusations between mother's brother's and sister's sons in matrilineal societies, or how patrilineal inheritance affects witchcraft accusations between fathers and sons, and fathers and brothers.

The lack of belief in witchcraft among African hunter-gatherers, relative to societies with other forms of subsistence, is another potential area for further investigation. The thesis could not test this, due to a lack of data from hunter-gatherer groups in both the Bantu and Pew Forum (2010) data. Witchcraft belief is not found among many hunter-gatherer groups in Africa, and this is presumed to be because of their egalitarian social structure and higher levels of mobility (Koning, 2013). But witchcraft belief does exist among foraging groups in Australia (Hutton,

2017). This may be because these societies are not as egalitarian as those in Africa. Australian groups have a higher level of social complexity than 'simple' hunter-gatherer groups, with some forms of resource storage. The belief in witchcraft may be a result of other forms of competition within their societies: for example some groups such as the Tiwi have very intense competition between men for marriage partners (Hart & Pilling 1960). It is possible that other factors may relate to the difference in witchcraft beliefs between Australian and African hunter-gatherers, which comparative studies might shed further light on.

The results suggest that multiple theories of witchcraft beliefs, whether they are seen as acting as a social strain gauge, a levelling mechanism or a means of severing ties from difficult individuals are not incompatible with one another. Accusations in the dataset occur in many different contexts, with many different purposes: they are directed at the young, at the old, at those with high levels of status and those who lack connections and prestige. Contrary to what might be predicted given the nature of the serious penalties sometimes inflicted on those accused of witchcraft, individuals also sometimes appear to seek a reputation for sorcery as a means of enhancing their own status and gaining compliance and cooperation from others (Beidelman, 1963). The study also found cases where the selection of a target appeared to be more associated with the need for an explanation following a misfortune, than to the characteristics or circumstances of the accused.

Anthropologists have noted that beliefs about witchcraft can be confusing and contradictory within societies, and that informants are sometimes uncertain about their own knowledge of how witchcraft operated (Culwick & Culwick, 1935; Evans-Pritchard, 1937; Malinowski, 1953). Where such beliefs are uncertain and un-standardised (or unwritten), there is potential for them to be adapted to different situations: '... witchcraft beliefs do not constitute a primordial and bounded total system, torn loose from any social context. This vision fails to capture the fluid manner in which villagers situationally invoke witchcraft beliefs as they encounter perplexing events, experience prolonged conflict in marriage, or suffer unspeakable misfortune (such as the untimely deaths of their kin).'

(Niehaus, 2001: 192-193).

Witchcraft accusations and beliefs appear to be complex phenomena, which potentially serve multiple proximate functions. Their fluidity and their adaptation to various situation and ecologies may account for the inconclusive findings in some aspects of this study.

Final remarks

Witchcraft beliefs and accusations can lead to the death, ostracism, torture and expulsion of individuals from their communities and are thought to lead to reduced trust and cohesion within societies (Gershman, 2016). Such beliefs and accusations are sometimes portrayed as irrational superstitions, but despite the lack of clear patterns found, this study concurs with the findings of previous researchers that accusations are, for the most part, not random. Instead, they appear to be a flexible cultural tool, used in diverse situations where competition and conflict arise between individuals. However, the study has shown that there are some relationships and situations where competition may be more intense, and so more likely to lead to accusations.

In highlighting the potential of quantitative cross-cultural studies to complement the wide range of qualitative material that is available on witchcraft beliefs and accusations, the study offers an additional level of explanation for beliefs that are still prevalent in many parts of the world, and can have such harmful consequences.

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Appendix 1: Bibliography of sources used to make the Bantu Witchcraft Dataset*

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* This does not cover all the sources consulted; only those with information that was used in the construction of the dataset.

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Appendix 2: Bantu Witchcraft Codebook

Society name

EA: Focal Year

Individual case variables

Source

Accused ID

1. No outright accusation of individual/s takes place (i.e. an individual is thought to be a witch but they do not suffer adverse consequences or are not openly accused)

	Count	Percentage
1. Yes	43	14
2. No	259	82
NA	12	4
Total	314	100

2. The accusation follows misfortune (not including death or a non-fatal illness)

	Count	Percentage
1. The accusation follows a run of bad luck and misfortune for the accuser	5	2
2. The accusation occurs as a result of a particular incident or argument between 'witch' and accuser	48	15
3. The accusation follows a misfortune which is attributed to the 'witch'	34	11
4. The accusation is not a result of particular misfortune	182	58
NA	45	14
Total	314	100

3. The accusation follows a death or deaths

	Count	Percentage
1. Yes, following the death of an individual	105	33
2. Yes, following multiple deaths	28	9
3. No, the accusation is not linked to a death	147	47
4. The 'witch' is alleged to have unsuccessfully attempted to kill someone	1	0
NA	33	11
Total	314	100

4. The accusation is the result of a non-fatal illness, including mental illness, that ‘witch’ is thought to have caused

	Count	Percentage
1. Yes	64	20
2. No	207	66
NA	43	14
Total	314	100

5. The accusation occurs because the ‘witch’ has been successful or thought to have used witchcraft to try and gain success

Success here is defined as the ability to attain status, skill, influence or wealth.

	Count	Percentage
1. Yes	47	15
2. No	191	60
3. ‘Witch’ is thought to have helped someone else achieve success	1	1
NA	75	24
Total	314	100

6. The ‘witch’ is dependent on kin for food or assistance

	Count	Percentage
1. Yes	4	1
2. No	260	83
3. Dependent on non-kin for food and assistance	1	0.3
NA	49	16
Total	314	100

7. The accusation is the result of the perceived violation of a social norm or antisocial behaviour by the accused

	Count	Percentage
1 Yes, behaves in a way perceived as selfish or harmful towards another individual on a particular occasion	24	8
2 Yes, continual ‘antisocial’ behaviour towards other people by the accused	16	5
3 No	136	43
4 Witch is presumed to be punishing antisocial behaviour, or harmful act, from ‘victim’	30	10
5 Witch is a chief who is expected to display harmful behaviour towards his enemies	3	1
6 The witch is difficult or ‘antisocial’ by implication	7	2
NA	98	31
Total	314	100

8. Kind behaviour by the ‘witch’ towards another individual is later linked to death/misfortune/illness of that individual

	Count	Percentage
1 Yes (admiration)	2	1
2 No	239	75
3 The behaviour is thought to be the medium of witchcraft, e.g. giving food or drink	2	1
NA	71	23
Total	314	100

9. The accused has a longstanding reputation for ‘bad’ witchcraft

	Count	Percentage
1 Yes	46	15
2 No	164	52
3 The ‘witch’ has encouraged others to think of them as such (self-accusation)	8	3
NA	96	30
Total	314	100

10. How widespread is support for an accusation?

	Count	Percentage
1 The 'witch' or 'witches' are viewed as such by the community	75	24
2 The 'witch' is accused by a specific individual, but also has reputation as a witch in the wider community	31	10
3 The story is relayed as historic or a legend in the ethnography	20	6
4 One person accuses another, or a few people are responsible for the accusation, but there is no indication the accused is widely thought of as a witch by the community	145	46
6 Accusation seems to stem from divination only	7	2
NA	36	12
Total	314	100

11. Relationship driving the accusation:

	Count	Percentage
1 Father-offspring	7	2
2 Mother-offspring	6	2
3 Parents-offspring	2	1
4 Husband-wife	16	5
5 Co-wives and children of co-wives	10	3
6 Siblings	12	4
7 Unrelated individuals	99	31
8 Multiple unrelated individuals	40	13
9 Non-specific related individuals (exact relationship not specified)	12	4
10 Uncle – nephew or niece	9	3
11 Aunt – nephew or niece	0	0
12 Cousins (cross and parallel)	5	2
13 Self-accusation	6	2
14 Diviner	7	2
15 Unidentified witches	5	2
16 Affinal kin (non-specific)	18	6
17 Leader-subject	10	3
18 War enemies	5	2
19 Classificatory kin	3	1
NA	42	13
Total	314	100

12. Accuser sex

	Count	Percentage
1 Male	128	41
2 Female	27	9
3 More than one person (sex not specified or both sexes)	54	17
4 Whole community	56	18
5 Diviner	1	0
NA	48	15
Total	314	100

13. Accuser age

	Count	Percentage
1 Old	8	3
2 Middle-aged	20	6
3 Young adult/teenager	12	4
4 Child	0	0
5 Multiple individuals (mixed or undefined ages)	63	20
6 Whole community	56	18
7 Unspecified age adult	105	33
NA	50	16
Total	314	100

14. Is the 'victim' different to the accuser?

	Count	Percentage
1 Yes	182	58
2 No	60	19
3 No victim	14	4
NA	58	19
Total	314	100

15. 'Victim' (of witchcraft) age

	Count	Percentage
1 Old	15	5
2 Middle aged	9	3
3 Young adult/teenager	34	11
4 Child	40	13
5 Multiple individuals (of mixed or unspecified ages)	20	6
6 Whole community	3	1
7 Unspecified age adult	112	35
8 Livestock	3	1
9 No victim	13	4
NA	65	21
Total	316	100

16. 'Victim' (of witchcraft) sex

	Count	Percentage
1 Male	126	40
2 Female	51	16
3 More than one person (of both sexes or unspecified sex)	21	7
4 More than one man	15	5
5 More than one woman	5	2
6 Livestock	3	1
7 No victim	13	4
NA	80	25
Total	314	100

17. Accused age

	Count	Percentage
1 Old	35	11
2 Middle-aged	21	7
3 Young adult/teenager	19	6
4 Child	3	1
5 Multiple individuals	31	10
6 Whole community	1	0
7 Unspecified age adult	186	59
NA	18	6
Total	314	100

18. Accused sex

	Count	Percentage
1 Male	180	57
2 Female	86	27
3 More than one person (either mixed sex or unspecified)	15	5
4 More than one male	13	4
5 More than one female	3	1
6 Unknown witches	2	1
NA	15	5
Total	314	100

19. Reason for accusation

Unlike the situation relating to accusations in the society-level variables, each case has only one category for this variable. For individual variables, this could usually be categorised as a single factor.

	Count	Percentage
1 Problems with fertility/ childbirth	11	3
2 Previous disputes	68	22
3 The accused is thought to have behaved in an uncooperative or antisocial manner	10	3
4 Direct competition between the accuser and the accused	27	8
5 Romantic rejection or marital problems	18	6
6 Accused relies on others for food or assistance	1	0
7 Accused is vulnerable and lacks family or protection	5	2
8 Accusation results from a refusal of financial help	2	1
9 Inheritance-related disputes	5	2
10 The accused is successful	20	6
11 The accusation is attributed to the envy and jealousy of the 'witch'	5	2
12 The accusation seems more attributable to the need for an explanation for misfortune, than to the 'witch' or their interactions with others	17	5
13 The accused is 'lucky' or 'unlucky' in a particular situation or freak incident	3	1
14 The accused is seeking to promote their own reputation as a 'witch'	3	1
15 The 'witch' is assumed to be taking revenge on others	4	1
16 The 'witch' has a characteristic or disorder, such as epilepsy, that appears to have led to the accusation	2	1
NA	113	36
Total	314	100

20. (Domestic arrangements) Where do the 'witch' and accuser live in relation to each other?

	Count	Percentage
1 Live in the same homestead	42	13
2 Neighbours	30	10
3 They live close by, e.g. in same village	122	39
4 They live further apart, e.g. in different settlements	42	13
NA	78	25
Total	314	100

21. Divination used (excluding poison ordeal)

	Count	Percentage
Yes	60	19
No	170	54
NA	84	27
Total	314	100

22. Does the accusation stick?

	Count	Percentage
1 Yes	145	46
2 No	48	15
3 Yes, or partially yes, but with no adverse outcome for the 'witch'	42	13
NA	79	26
Total	314	100

23. Is the accused rich or poor?

	Count	Percentage
1 Rich	21	7
2 Poor	9	3
3 Not specified	29	9
4 Wealth is not relevant to the case	164	52
5 The accused is a leader or another prominent individual	35	11
6 The accused is an associate or relative of a prominent individual	6	2
NA	50	16
Total	314	100

24. Cost of accusation to accuser/s

	Count	Percentage
1 No cost and belief that the accused is a witch is shared by many	76	24
2 No cost to specific accusers	131	42
3 Associated cost, e.g. has to undergo poison ritual	8	3
4 Makes amends to the 'witch' and the 'witchcraft' is lifted	2	1
5 Suffers (non-supernatural) retaliation from the 'witch'	7	2
6 Police were called but unable to catch the suspects who killed the accused	1	0
7 Suffers reputational damage as a result of the accusation	6	2
8 Has to pay a fine for a false accusation	7	2
9 Accused of witchcraft	3	1
10 Accuser benefits from accusation	7	2
NA	66	21
Total	314	100

25. Outcome of accusation for accused

	Count	Percentage
1 Undergoes poison ordeal and dies	8	3
2 Undergoes poison ordeal and survives	7	2
3 Unofficially killed	16	5
4 Killed following a trial / official judgement	11	4
5 Exiled from community (either forced or self-imposed)	42	13
6 Ostracised in the community (avoided / gossiped about)	11	4
7 Made to perform a ritual or pay a fine, and then the accusation of witchcraft is dismissed	17	5
9 None	53	17
10 'Witch' is physically beaten or tortured, but remains in the community	5	2
11 Commits suicide to avoid being executed	1	0
12 Undergoes trial and is imprisoned	6	2
13 Rejected by kin or divorced so that either the accused or the accusers move (household breakup) but not ostracised by the community as a whole	19	6
14 Prevented from succeeding to a leadership role as a result of the accusations	3	1
15 The 'witch' uses their reputation to gain / maintain authority and / or status	3	1
16 Protected from more severe outcome by authorities / illegality of witchcraft accusations	4	1
17 Gains a reputation for witchcraft	14	4
NA	94	30
Total	314	100

26. Does this appear to be an atypical case for the society?

	Count	Percentage
Yes	45	14
No	239	76
NA	30	10
Total	314	100

Society-Level variables

1. Fear of witchcraft

	Count	Percentage
1 No or little fear of witchcraft	4	5
2 Medium fear of witches	22	27
3 High level of fear and paranoia about witchcraft	31	39
NA	23	29
Total	80	100

2. Frequency with which witchcraft accusations occur

	Count	Percentage
1 Accusations seem to be rare or non-existent	2	3
2 Witchcraft is mainly attributed to unknown and unidentified witches	1	1
3 Accusations occur, but infrequently	5	6
4 Accusations occur with some frequency	21	26
5 Accusations occur constantly	15	19
6 Accusations were formerly high but now illegal	4	5
NA	32	40
Total	80	100

3. Role of gossip is mentioned in identifying individuals as witches

	Count	Percentage
1 Yes	17	21
2 No	3	4
NA	60	75
Total	80	100

4. Is there a supernatural explanation for misfortune or moral enforcement/punishment other than witchcraft and high gods, e.g. ancestors, spirits, and taboos?

	Count	Percentage
1 Yes	41	51
2 No	1	1
3 Yes but it is not clearly specified that this can occur in relation to bad behaviour outside neglected this supernatural power	26	33
NA	12	15
Total	80	100

5. Witchcraft seems to predominate over other forms of supernatural explanation or sanction

	Count	Percentage
1 Yes	27	34
2 No, ancestors / spirits / taboos / high gods take precedence	5	6
3 Divided between witchcraft and other forms of supernatural sanctioning; not possible to tell from the sources whether one is more common than the others	29	36
NA	19	24
Total	80	100

6. Environmental threats: food shortage and drought

	Count	Percentage
1 High: regular food shortages / drought at all times of year	1	1
2 Food shortages or drought appear regularly at particular times of year, most years	16	20
3 Medium: periodic food shortages / drought	23	29
4 Food is generally available	11	14
NA	29	36
Total	80	100

7. Environmental threats: disease

	Count	Percentage
1 High: threat of disease at all times of year Illness is feared	14	18
2 Medium: there is a periodic threat of illness	21	26
3 There is a low level of threat from disease	5	6
NA	40	50
Total	80	100

8. Engagement in war

	Count	Percentage
1 High engagement in war with neighbouring groups	8	10
2 Medium engagement in war	15	19
3 Little or no engagement in war	6	7
4 Previously high levels of warfare, but it has declined since colonial rule began	28	35
NA	23	29
Total	80	100

9. Witchcraft as a response to death

	Count	Percentage
1 There is no such thing as a natural death; always witchcraft	5	6
2 The majority of deaths (>50%) are thought to be caused by witchcraft (e.g. all those except of the very old or very young. Death is primarily attributed to witchcraft but occasionally ancestors.)	38	48
3 Some deaths are thought to be caused by witchcraft (<50% but >0)	14	17
4 No deaths attributed to witchcraft	2	3
NA	21	26
Total	80	100

10. Witchcraft a common explanation for misfortune or illness (other than death)

	Count	Percentage
1 Yes; witchcraft is a very/the most common explanation for illness and misfortune	17	21
2 Common; witchcraft is used to explain some or particular types of misfortune and illness	32	40
3 No; witchcraft is occasionally used as an explanation but other supernatural factors are given more weight	7	9
NA	24	30
Total	80	100

11. Witchcraft is commonly punished by death (including by the poison ritual)

	Count	Percentage
1 Yes	29	36
2 No	6	8
3 The nominal punishment is death, but this is not normally enforced	1	1
4 Death was previously the punishment, but this has declined due to missionary and colonial influence	18	22
5 Officially sanctioned death was previously the punishment; vigilante killings may occur occasionally	7	9
NA	19	24
Total	80	100

12. Witchcraft is commonly punished by ostracism (banishment) (either enforced by community or self-imposed by witch)

	Count	Percentage
1 Yes	29	36
2 No	15	19
3 Yes, in the past	3	4
NA	33	41
Total	80	100

13. Witchcraft is commonly punished through performance of a ritual or providing payment to make amends by the witch (i.e. there is a process of reconciliation after a disagreement)

	Count	Percentage
1 Yes	21	26
2 No	17	21
NA	42	53
Total	80	100

14. Court procedures and litigation are used to prosecute alleged witches (but not including ordeals for witch detection).

	Count	Percentage
1 Yes	21	26
2 No	17	21
NA	42	53
Total	80	100

15. Is witchcraft thought to be driven by envy?

	Count	Percentage
1 Yes	45	56
2 No	3	4
NA	32	40
Total	80	100

16. Are kind behaviours likely to arouse suspicion of witchcraft?

	Count	Percentage
1 Yes	6	8
2 No	14	17
NA	60	75
Total	80	100

17. Is witchcraft associated with cannibalism?

	Count	Percentage
1 Yes	28	35
2 No	11	14
3 Witches are thought to use body parts of their victims in black magic	2	2
NA	39	49
Total	80	100

18. Most common direction of accusations:

For this variable, each society is coded as with many categories as were mentioned by ethnographers.

The 'direction' relates to broad groups or relationships where witchcraft accusations are thought likely to occur, as opposed to the more specific relationships in variable 19.

	Count	Percentage
1 Between close family or individuals who are co-habiting	28	35
2 Between wider family (non-specific)	6	8
3 Within lineage	12	15
4 Within the community	20	25
5 Between communities	2	3
6 Attributed to unknown witches	0	0
7 Elite within the political unit	6	8
8 Paternal (agnatic kin)	8	10
9 Maternal kin	7	9
10 Affinal kin	15	19
11 Neighbours and those who the accuser interacts frequently with	21	26
12 Between lineages	3	4
13 Witches are strangers	1	1
14 Within clan	1	1

19. Relationships where accusations (or witchcraft) are thought to occur frequently

For this variable, each society is coded as with many categories as applicable.

	Count	Percentage
1 Siblings	18	23
2 Father-offspring	8	10
3 Mother-offspring	2	3
4 Co-wife – co-wife	17	21
5 Nephew-uncle – Niece-uncle	10	13
6 Rejected suitor – object of affection	5	6
7 Individuals in competition	8	10
8 Husband-wife	21	26
9 Wife's kin – husband's kin	14	18
10 Unrelated individuals	19	24
11 Grandfather – grandchildren	1	1
12 Cousins	2	3
13 Strangers	1	1
14 Paternal aunt – niece/nephew	1	1
15 Son – father's age-mate	1	1
16 Marriage guardian – ward	1	1
NA	32	40

20. The behaviours and situations mentioned as most likely to lead to accusations in general (causes which appear to be fairly common or are portrayed as typical in this society. One-off examples are not included.)

For this variable, societies are coded with multiple 'situations' where applicable.

	Count	Percentage
1 Problems with fertility / childbirth	30	38
2 Previous disputes	44	45
3 Uncooperative or antisocial behaviour	23	29
4 Environmental insecurity, e.g. epidemics, crop failure	27	34
5 Direct competition between accuser and accused	31	39
6 Rejected suitor	6	8
7 Accused relies on family for food and assistance	2	3
8 Accused is vulnerable and lacks family or protection	6	8
9 Rich do not help the poor	2	3
10 Inheritance-related issues	12	15
11 Individual has been successful	20	25
12 Disputes over dowry or bride-price	2	3
13 Incest and other sexual taboos	7	9
14 Catching smallpox	1	1
15 Death of a chief	2	3
NAs (societies without any commonly identified situations)	19	24

21. Most common age of witches

	Count	Percentage
1 Adults of any age	22	27
2 The elderly	15	19
3 Middle-aged adults	0	0
4 Young adults	2	2
5 Children	1	1
6 Anyone of any age	6	8
NA	34	43
Total	80	100

22. Most common sex of witches

	Count	Percentage
1 Always male	1	1
2 Always female	0	0
3 Equally likely to be either sex	33	41
4 Mostly male	11	14
5 Mostly female	19	24
6 Male sorcerers are thought to be more powerful, but the majority of witchcraft accusations are against women in association with interpersonal domestic conflicts	2	3
NA	14	17
Total	80	100

23. Information offered by author about most common sex of witches is confusing/contradictory

	Count	Percentage
1 Yes	12	15
2 No	41	51
NA	27	34
Total	80	100

24. Role of class, status and wealth

	Count	Percentage
1 The poor are accused by the rich	7	9
2 The rich and successful are accused by the poor / less wealthy	13	16
3 Both 1 and 2	3	4
4 Accusations are often directed at the political elite	1	1
5 There is no clear role of class or wealth	11	14
6 The political elite are largely exempt from accusation, or accusations do not cross class boundaries	7	9
NA	38	47
Total	80	100

25. The cost of witchcraft accusations to accusers within the society in general

	Count	Percentage
1 Accusers are expected to undertake a poison ordeal	5	6
2 Identifiable accusers do not appear to risk punishment	17	21
3 Responsibility for accusations appears to be diffuse within the community	1	1
4 Accusers fear retaliation by the accused or even the spirit of the accused	2	3
5 Both 1 and 4	2	3
6 There are serious reputational consequences for accusing someone of being a witch if the accusation is 'disproved'. Compensation may be required	4	5
7 If the accused is not guilty according to the poison ordeal, the accuser must pay heavy compensation	5	6
8 Both 1 and 7	2	3
NA	42	52
Total	80	100

26. Poison ordeal in relation to witchcraft accusations?

	Count	Percentage
1 Yes, the accused take a poison ordeal	26	32
2 No	7	9
3 Yes, it is sometimes or always administered to animals (usually chickens) instead of the accused	6	8
4 The ordeal existed previously but it is now illegal or defunct	13	16
5 The poison ordeal is used in the society but is not specifically referenced with regard to witchcraft	2	3
6 Some form of ordeal is used to detect 'witches' but the poison ordeal is not clearly specified	5	6
7 The poison ordeal is used and is sometimes administered to slaves or other human substitutes for the accused	1	1
NA	20	25
Total	80	100

27. Is witchcraft innate or learned?

	Count	Percentage
1 Innate	8	10
2 Learned	7	9
3 Learned and innate in the same individuals	5	6
4 Learned and innate: different for different individuals	7	9
NA	53	66
Total	80	100

28. If witchcraft is transmitted vertically, down which line?

	Count	Percentage
1 Paternal	5	6
2 Maternal	8	10
3 Both	6	8
NA	61	76
Total	80	100

29. Attitudes towards the culpability of witches

	Count	Percentage
1 Witches do not know they are bewitching others	1	1
2 Witches act consciously	24	30
3 Witchcraft can be both conscious and unconscious, depending on the individual	12	15
NA	43	54
Total	80	100

30. Do accusations connect to pre-existing disputes?

	Count	Percentage
1 Yes	44	55
2 No	0	0
NA	36	45
Total	80	100

31. Gender roles: women and political leadership

	Count	Percentage
1 Women hold leadership roles in their own right	14	17
2 A certain number of women hold leadership positions, but mostly as regent because there is no male heir. Female rules are mentioned but seen as exceptional	16	20
3 Women are not considered for leadership under any circumstances	12	15
NA	38	48
Total	80	100

32. Gender roles: women and religious leadership

	Count	Percentage
1 Women can hold leadership roles in their own right, such as priestesses or witch-doctors	25	31
2 A certain number of women hold religious positions, but generally they are lower status and / or fewer in number than their male counterparts	12	15
3 Women do not appear to be considered for religious leadership under any circumstances	5	6
NA	38	48
Total	80	100

33. Gender roles: marriage

	Count	Percentage
1 Women mostly have choice in who they marry	23	29
2 Women cannot choose who they marry, but men can	7	9
3 It is variable depending on circumstances (there are different ways of arranging marriages)	3	4
4 Mostly neither sex has a choice of marriage partner	10	12
NA	37	46
Total	80	100

34. Gender roles: general position of women

	Count	Percentage
1 Women appear to be very subordinate to men; e.g. not allowed to take decisions in the household	12	15
2 Women are slightly subordinate (e.g. they should obey their husband in certain matters) but they also have some autonomy	39	49
3 Women appear to have equal status to men in many ways; they can take decisions; their advice is sought and can be decisive	8	10
NA	21	26
Total	80	100

35. Legal status of women

	Count	Percentage
1 Women have equal legal rights to men	2	3
2 Women do not have equal legal rights to men	23	28
NA	55	69
Total	80	100

36. Women have some economic independence (e.g. are able to own property or keep proceeds from their own produce)?

	Count	Percentage
1 Yes, to a large extent	13	16
2 Partially	17	21
3 No	4	5
NA	46	58
Total	80	100

37. Individuals who have lower social status or are less able to access help (e.g. elderly) can use claims of witchcraft to gain assistance and/or respect:

	Count	Percentage
1 Yes	3	4
2 No	10	13
NA	67	84
Total	80	100

38. Powerful individuals are thought to use witchcraft and are exempt from the persecution others are subject to (witchcraft enhances their power):

	Count	Percentage
1 Yes	14	17
2 No	19	24
NA	47	59
Total	80	100

39. Is divination (other than the poison ritual) used?

	Count	Percentage
1 Yes	60	75
2 No	3	4
NA	17	21
Total	80	100

40. Author documents evidence that people are actually trying to use malicious magic

	Count	Percentage
1 Yes	19	24
2 No	12	15
NA	49	61
Total	80	100

41. Animals associated with witchcraft

For this variable, all categories that were mentioned by ethnographers were recorded.

Animal	Count
Owls	14
Bats	1
Cats	3
Rodents	3
Eagle	2
Chameleon	1
Frogs and toads	2
Cows	1
Snakes	12
Baboons	4
Hyenas	9
Other birds	6
Ant-eaters	2
Leopards	3
Lions	3
Insects	2
NA	66

42. Traits associated with witchcraft

	Count	Percentage
1 No distinguishing physical traits are associated with witchcraft	7	9
2 Old age and inflamed eyelids are associated with the evil eye	1	1
3 Witches catch smallpox	3	4
4 Witches can run fast	1	1
5 Successful hunters are likely to be witches	1	1
6 Ugliness	1	1
NA	66	83
Total	80	100

43. Different categories of witchcraft and sorcery (as described in Evans-Pritchard 1937)

	Count	Percentage
1 Yes, a distinction is made between 'sorcery' that can be practised or purchased by anyone, and witches who have more supernatural attributes and innate powers	13	16
2 No	23	29
NA	44	55
Total	80	100

44. The ethnographer mentions scepticism in society regarding magical practices

	Count	Percentage
1 Yes, in relation to particular doctors and divination but not witches	14	17
2 The existence of witchcraft is widely accepted	15	19
3 Witchcraft is widely accepted, but there is scepticism regarding some cases	3	4
4 The society does not have witchcraft beliefs, or very few	1	1
NA	47	59
Total	80	100

45. Physical proximity is a requirement for witchcraft to work, and moving away is thought to bring safety

	Count	Percentage
1 Yes	14	17
2 No	15	19
3 Witchcraft can work from both nearby and over large distances	3	4
NA	48	60
Total	80	100

46. Is there a clear statement that in some instances divination is rejected when not giving the 'right' answer, or that witch-doctor is clearly led to the right answer, or is aware who is likely to be sought as accused

	Count	Percentage
1 Yes	18	22
2 No	6	8
NA	56	70
Total	80	100

47. Belief in the evil eye?

	Count	Percentage
1 Yes	19	24
2 No	23	29
NA	38	47
Total	80	100

48. Are there anti-witchcraft societies?

	Count	Percentage
1 Yes; there is a society for the prevention of witchcraft and its members cannot be accused of witchcraft	1	1
2 There is an informal group of anti-witchcraft 'protectors'	3	4
3 There is an anti-witchcraft society; it is not clear whether members are exempt from accusation	5	6
4 No	29	36
NA	42	53
Total	80	100

49. The ethnographer notes that people threaten or imply they are going to use witchcraft against others

	Count	Percentage
1 Yes	14	18
2 No	13	16
NA	53	66
Total	80	100

50. It is viewed as acceptable to use harmful witchcraft on certain occasions, against those who are viewed as difficult or are widely disliked, or whom one has what is thought to have a legitimate grievance against:

	Count	Percentage
1 Yes	20	25
2 No	8	10
NA	52	65
Total	80	100

51. Do individuals profit economically from witchcraft accusations?

	Count	Percentage
1 No	0	0
2 Yes, witchdoctors and medicine men	18	22
3 Yes, witchdoctors and medicine men. Chiefs are also able to confiscate goods and livestock	14	18
NA	48	60
Total	80	100

52. Is the practice of witchcraft thought to be increasing or decreasing in the society?

	Count	Percentage
1 Increasing	12	15
2 Decreasing	3	4
NA	65	81
Total	80	100

53. Do sources suggest there has been a shift from matrilineal/matrilocal systems to patrilineal/patrilocal ones?

	Count	Percentage
1 Yes, recently (within 100 years)	9	11
2 Yes, in the more distant past	4	5
3 No	24	30
4 No, but the system has some mixture between matrilineal and patrilineal influences	12	15
NA	31	39
Total	80	100

54. Do people move for fear of witchcraft?

	Count	Percentage
1 Yes, and this sometimes leads to the establishment of new villages	4	5
2 Yes, individuals sometimes leave villages if they fear they are being bewitched	9	11
3 No	7	9
NA	60	75
Total	80	100

55. Is there colonial legislation against witchcraft accusations and prosecutions?

	Count	Percentage
1 Yes	25	31
2 No	10	13
NA	45	56
Total	80	100

56. How well is the society documented at a particular time focus?

	Count	Percentage
1 Excellent	19	24
2 Good	20	20
3 Fairly good	14	18
4 Quite poor	8	10
5 Poor	19	24
Total	80	100

Appendix 3: The sex of accused witches and the transition from matrilineal to patrilineal social systems

This dataset provided the opportunity to undertake an exploratory, quantitative test of the hypothesis previously examined by Nathan et al. (1998), using case studies of cultures from China, Thailand and India. Nathan et al. suggested that when societies undergo a transition from a relatively egalitarian balance of power between the sexes to a more patriarchal system, men use witchcraft accusations against women to enforce their compliance in the new system. As there were a number of Bantu societies where ethnographers indicated that there had been a transition from a more matrifocal system to more patriarchal one, this was coded in the dataset.

Hypothesis: Witchcraft accusations are directed against women by men in order to enforce a more patriarchal social system

Prediction: in societies where authors mention that a transition from a matrifocal to patrilineal/patriarchal social system has taken place, a greater number of accusations will be directed at women.

The variable from the Bantu witchcraft dataset originally had several categories but has been reduced to binary groupings. It therefore includes: 0) societies which are patrilineal, or matrilineal, and there was no indication that any form of transition between them took place. 1) Societies where ethnographers have indicated that there was a transition from matrilineal to patrilineal social organisation. There are also societies that contain elements of both patrilineal and matrilineal descent.

Matrilineal to Patrilineal transition			
No transition (ref)	40 (31%)	90 (69%)	130
Transition from matriliney to patriliney	14 (24%)	45 (76%)	59

Table A3.1

There was a substantial amount of missing data for this variable, and so I ran a separate model-averaging analysis, using the same methods, variables and procedures as detailed in Chapter 2, but excluding cases where there was no information on transitions between matriliney and patriliney. This left 24 societies where there was no transition between matriliney and patriliney, as societies were either matrilineal or patrilineal, with no indication that there had been a change in

descent patterns. There were eight societies where ethnographers had commented there might have been a change from a more matrilineal to patrilineal system, or where descent patterns contained elements of matrilineity and patrilineity. This left 189 cases in the dataset, and as previously predictors were weighted and averaged over models with $\Delta AIC < 6$ of the best model. The reference category was cases where there had not been a transition (N of cases = 130, N of societies = 24), leaving 59 cases (N of societies = 8) where it was indicated that such transitions had taken place.

Results

The results for the sub-sample of cases and societies with information on transitions from matrilineal to patrilineal social systems did not show that the odds of accusations being directed at women rather than men significantly increased in these societies (OR = 1.29, 95% CI [0.30, 5.64], $p=0.74$) over those in societies where no transition had taken place.

Nathan et al. (1998) used qualitative methods and a very small sample of societies. They provide an interesting and plausible account of how there may be a society-level increase in accusations of women by men. However, it is possible that this was specific to those societies, and in the Bantu a transition from matrilineity to patrilineity took a different trajectory. Women in matrilineal Bantu societies do not have high status, although on balance it appears to be slightly better than in patrilineal ones. It is also the case that there is no further evidence for this hypothesis provided by other authors: Nathan et al (1998) are the first to outline it. Therefore, with no further evidence and with only one small quantitative examination, this hypothesis remains inconclusive.

Appendix 4: additional data from Chapter 4

Appendix 4.1: Top ten models from model selection in Table 4.2

Table A4.1 Top ten models from Chapter 4 model averaging: ‘Do you believe in witchcraft?’

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Intercept	-0.15 (0.23)	0.17 (0.09)	-0.18 (0.22)	-0.42 (0.28)	-0.43 (0.27)	-0.14 (0.23)	0.17 (0.09)	-0.21 (0.22)	-0.36 (0.35)	-0.07 (0.19)
Age: 18-23 (Ref.)										
Age: 24-30	0.03 (0.05)	0.03 (0.05)	0.03 (0.05)	0.03 (0.05)	0.03 (0.05)	0.03 (0.05)	0.03 (0.05)	0.03 (0.04)	0.03 (0.05)	0.03 (0.05)
Age: 31-41	0.10* (0.05)	0.10* (0.05)	0.10* (0.05)	0.10* (0.05)	0.10* (0.05)	0.10* (0.05)	0.10* (0.05)	0.11* (0.05)	0.10* (0.05)	0.10* (0.05)
Age: 42-96	0.15** (0.05)	0.15** (0.05)	0.15** (0.05)	0.15** (0.05)	0.15** (0.05)	0.15** (0.05)	0.15** (0.05)	0.15** (0.05)	0.15** (0.05)	0.15** (0.05)
Age: missing	0.40* (0.20)	0.40* (0.20)	0.40* (0.20)	0.40* (0.20)	0.40* (0.20)	0.40* (0.20)	0.40* (0.20)	0.39* (0.20)	0.40* (0.20)	0.40* (0.20)
Education: completed primary or less (Ref.)										
Education: some or completed secondary	-0.32*** (0.04)	-0.32*** (0.04)	-0.32*** (0.04)	-0.32*** (0.04)	-0.32*** (0.04)	-0.32*** (0.04)	-0.32*** (0.04)	-0.31*** (0.04)	-0.32*** (0.04)	-0.32*** (0.04)
Education: post-secondary or higher	-0.47*** (0.05)	-0.47*** (0.05)	-0.47*** (0.05)	-0.47*** (0.05)	-0.46*** (0.05)	-0.47*** (0.05)	-0.47*** (0.05)	-0.45*** (0.05)	-0.47*** (0.05)	-0.46*** (0.05)
Education: missing	0.15 (0.12)	0.15 (0.12)	0.15 (0.12)	0.15 (0.12)	0.15 (0.12)	0.15 (0.12)	0.15 (0.12)	0.16 (0.12)	0.15 (0.12)	0.15 (0.12)
Sex: male (Ref.)										
Sex: female						-0.00 (0.03)	-0.00 (0.03)			

Table A4.1 Cont.	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Environment: urban (Ref.)										
Environment: rural	-0.08*	-0.08*	-0.08*	-0.08*	-0.08*	-0.08*	-0.08*	-0.08*	-0.08*	-0.08*
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Language family: Afro-Asiatic (Ref.)										
Language family: Atlantic-Congo			0.53*	0.47*						
			(0.23)	(0.23)						
Language family: Dogon			0.20	0.44						
			(1.08)	(1.09)						
Language family: Furan			0.28	0.52						
			(1.05)	(1.07)						
Language family: Ijoid			-0.21	-0.30						
			(1.27)	(1.27)						
Language family: Koman			-11.85	-10.42						
			(64.00)	(45.26)						
Language family: Mande			0.10	0.01						
			(0.35)	(0.35)						
Language family: Nilotic			-0.40	-0.50						
			(0.45)	(0.45)						
Language family: Nubian			-1.12	-0.87						
			(1.32)	(1.33)						
Language family: Saharan			-0.27	-0.37						
			(0.66)	(0.67)						
Language family: Songhay			1.09	1.33						
			(1.06)	(1.07)						

Table A4.1 Cont.	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Language family: Ta-Ne-Omotic			-1.80 (0.98)	-1.83 (0.99)						
Language family: Tuu			0.85 (1.31)	1.09 (1.32)						
Language family: Central Sudanic			-0.54 (0.57)	-0.61 (0.57)						
Post-marital residence: other (Ref.)										
Post-marital residence: matrilocal					1.07* (0.45)					0.94* (0.45)
Post-marital residence: duolocal					0.31 (0.79)					0.18 (0.79)
Post-marital residence: patrilocal					0.20 (0.21)					0.26 (0.20)
Post-marital residence: missing					0.83 (0.89)					0.65 (0.88)
Marriage: monogamy or low polygamy (Ref.)										
Marriage: polygamy	0.36 (0.24)			0.33 (0.25)	0.46 (0.25)	0.36 (0.24)		0.36 (0.24)	0.35 (0.24)	
Settlement: mobile or semi-mobile (Ref.)										
Settlement: sedentary									0.22 (0.29)	
Settlement: missing									0.38 (0.46)	

Table A4.1 Cont.	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
AIC	23351.45	23351.74	23353.05	23353.37	23353.42	23353.44	23353.73	23354.58	23354.62	23354.83
BIC	23437.76	23430.19	23533.50	23541.67	23471.11	23447.59	23440.03	23433.04	23456.62	23464.67
Log Likelihood	-11664.73	-11665.87	-11653.52	-11652.69	-11661.71	-11664.72	-11665.86	-11667.29	-11664.31	-11663.42
Num. obs.	18878	18878	18878	18878	18878	18878	18878	18878	18878	18878
Num. groups:	257	257	257	257	257	257	257	257	257	257
Var: Ethnic Atlas (Intercept)	1.16	1.17	1.03	1.02	1.13	1.16	1.17	1.16	1.15	1.14

*** p < 0.001, ** p < 0.01, * p < 0.05

Table A4.1 shows the Estimates (SD) of the top ten models from Chapter 4, table 4.2’s model selection from logistic multilevel models. The outcome variable was participants’ individual yes/no response to the question ‘Do you believe in the “evil eye” or that certain people can cast curses or spells that cause bad things to happen to someone?’, where ‘No’ was the reference category. The Level 2 variable is the participants ethnic group from the Ethnographic Atlas. This table shows the results from the individual control variables (age, education, urban or rural, sex), the language family (as a control) and the society-level variables of interest (Settlement, Marriage, Post-Marital Residence and Polygamy). The final society-level variable, Social Stratification, is not shown as it did not appear in the top ten models.

Appendix 4.2: Prevalence of witchcraft beliefs

The original Pew Forum (2010) survey had two questions relating to witchcraft belief. One was tested in Chapter 4, where participants were asked ‘Do you believe in the “evil eye” or that certain people can cast curses or spells that cause bad things to happen to someone?’. The question: ‘Do you believe in witchcraft?’ is used here as the outcome variable with the same predictor variables as in Chapter 4.

	Belief in witchcraft?		Total
	No	Yes	
Total			
H1 Social stratification			
Absence of wealth distinctions	2305	1762	4067
Wealth distinctions	6578	5462	12220
Missing	1796	1084	2880
H2 Post-marital residence			
Other (ref)	2389	1958	4347
Matrilocal	117	210	327
Duolocal	101	84	185
Patrilocal	8012	6025	14037
Missing	60	31	91
H2 Marriage system			
Monogamy or low polygamy	1407	665	2072
Polygamy	9181	7625	16806
H3 Settlement patterns			
Mobile or semi-mobile	1523	802	2325
Sedentary	8348	7004	15352
Missing	718	502	1220
Language family			
Afro-Asiatic	2575	1075	2750
Atlantic-Congo	5918	5990	11908
Central Sudanic	355	203	558
Dogon, Furan, Ijoid	87	68	155
Koman, Nubian	95	6	101
Mande	961	571	1532
Nilotic	462	211	673
Saharan	195	128	323
Songhay, Tuu	31	56	87

Table A4.2 Descriptive statistics showing the focal variables and language family control variables: how participants responded when they were asked ‘Do you believe in witchcraft?’

Variable	Coefficient	SE	Relative Variable Importance	P-value	CI	OR	CI
Intercept	-0.86	0.47		0.07		0.42	
Class							
Absence of wealth distinctions (ref)							
Wealth distinctions	0.12	0.21	0.33	0.58	0.74	1.13	1.71
Missing	0.07	0.20		0.72	0.73	1.08	1.59
Post-marital residence							
Other (ref)			0.45				
Matrilocal	0.70	0.87		0.42	0.37	2.00	11.02
Duolocal	-0.02	0.70		0.98	0.24	0.98	3.86
Patrilocal	0.12	0.22		0.58	0.74	1.13	1.73
Missing	0.40	0.84		0.63	0.29	1.49	7.72
Marriage system							
Monogamy or low polygyny (ref)							
Polygyny	0.40	0.37	0.73	0.29	0.71	1.49	3.09
Missing	-0.99	1.05		0.35	0.05	0.38	2.96
Settlement							
Some mobility (ref)							
Sedentism	0.01	0.13	0.12	0.96	0.77	0.99	1.28
Missing	-0.04	0.23		0.86	0.62	0.96	1.50
Language family							
Afro-Asiatic (Ref)							
Atlantic-Congo	0.69	0.30	1.00	0.02*	1.11	2.01	3.62
Central Sudanic	-1.31	0.73		0.07	0.06	0.27	1.12
Dogon, Furan, Ijoid	0.42	0.89		0.63	0.27	1.53	8.77
Koman, Nubian	-3.22	1.12		0.00**	0.00	0.04	0.36
Mande	-0.01	0.45		0.99	0.41	0.99	2.39
Nilotic	-0.32	0.57		0.57	0.23	0.72	2.21
Saharan	-0.38	0.85		0.65	0.13	0.68	3.61
Songhay, Tuu	1.22	1.07		0.25	0.41	3.39	27.65

Table A4. 3 Showing the model averaged parameters and the focal variables for an alternate question to that asked in Chapter 4. Participants were asked ‘Do you believe in witchcraft?’ The outcome variable is their response: 0) ‘No’ or 1) ‘Yes’

Appendix 4.3: Equivalence of contemporary and historic post-marital residence patterns in sub-Saharan Africa

Country	Post-marital residence (derived from the EA)	Country result Patrilocal Index (2010)
Botswana		-0.22
Herero	Other	
Bemba	Other	
Luo	Other	
Cameroon		1.30
Bamileke	Patrilocal	
Bamum	Patrilocal	
Banen	Patrilocal	
Congo, DRC		0.86
Lugbara	Patrilocal	
Bwaka	Patrilocal	
Luvale	Patrilocal	
Djibouti		0.05
Afar	Patrilocal	
Esa	Patrilocal	
Ethiopia		0.70
Amhara	Other	
Makonde	Patrilocal	
Makua	Patrilocal	
Guinea-Bissau		2.25
Balante	Patrilocal	
Futajalon	Patrilocal	
Mundang	Patrilocal	
Mozambique		1.01
Ndau	Patrilocal	
Nyanja	Matrilocal	
Plateau Tonga	Other	
Nigeria		1.87
Fon	Patrilocal	
Edo	Patrilocal	
Kipsigis	Patrilocal	

Tanzania		1.26
Gusii	Patrilocal	
Sukuma	Other	
Pare	Patrilocal	
Uganda		1.22
Nyankole	Patrilocal	
Nyoro	Other	
Soga	Patrilocal	

Table A4.4 Showing country-level data from the Patrilocality Index for 2010 (the year the Pew Forum survey was conducted), against a random sample of three societies per country and the post-marital dispersal system for that society as categorised in Chapter 4. The Patrilocality Index has positive values for patrilocality, and negative values for matrilocality. The score is given as a log of the percentage of patrilocal/matrilocal residence in the region.

This is an imprecise means of examining how much the conditions of individuals from societies in the Ethnographic Atlas in the focal year they were documented may correspond to conditions of the participants in the more recent Pew Forum survey (2010).

For some countries, the historic and contemporary residence patterns seem to match, so that Botswana scores low on the patrilocality index, and has societies that were classified as ‘Other’ (or not patrilocal) in the EA. In other countries, there is less similarity: in Djibouti, the EA societies were patrilocal, but the modern-day Patrilocality Index score is 0.05.

Country	Country-wide percentage of married women in polygynous marriages ~2010	Country-wide percentage of married men in polygynous marriages	Source
Chad	35-49% depending on region	26-38% depending on age	DHS Report 2004 (Ouagadji, et al., 2005)
Congo, DRC	8%-31% depending on region	9%-18% depending on region	DHS Report 2013-14 (Ministère du Plan et Suivi de la Mise en œuvre de la Révolution de la Modernité 2014)
Mali	35% (15-49 yrs of age)	~19% (15-49 yrs of age)	DHS Report 2012-13 (Cellule de Planification et de Statistique - CPS/SSDSPF/Mali, Institut National de la Statistique - INSTAT/Mali, Centre d'Études et d'Information Statistiques - INFO-STAT/Mali, 2014)
Nigeria	33% overall	17% overall	DHS Report 2013 (National Population Commission & NPC/Nigeria and ICF International, 2014)
Senegal	32% overall	17% overall	DHS 2015 (Agence Nationale de la Statistique et de la Démographie & ANSD/Sénégal and ICF, 2016)
Tanzania	21% overall	10% overall	DHS 2010 (National Bureau of Statistics & NBS/Tanzania and ICF Macro, 2012)
Uganda	25% overall	17% overall	DHS 2011 (Uganda Bureau of Statistics & UBOS and ICF International, 2012)
Zambia	14% overall	8% overall	DHS 2007 (Central Statistical Office/Zambia et al., 2009)

Table A4.5 (Previous page). Polygynous marriages in African countries, close to the dates of the Pew Forum survey, taken from the Demographic and Health Surveys (DHS) programme. The countries shown are 8 of the 19 used for the analysis of the distribution of witchcraft beliefs (Chapter 4). Overall figures for men and women are shown where possible, but most reports noted substantial variation by region and respondent age.

Appendix 5: additional data from Chapter 5

Table A5.1. The top ten averaged models from chapter 5 model averaging. Which sex are the witches?

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Intercept	-1.68*** (0.45)	-1.35** (0.48)	-1.64*** (0.38)	-1.34** (0.41)	-1.48*** (0.44)	-1.22** (0.45)	-1.28** (0.47)	-1.14* (0.44)	-1.43*** (0.43)	-1.10* (0.45)
Age: unspecified age adult (Ref.)										
Age: elderly	1.22* (0.48)	1.20* (0.47)	1.22* (0.48)	1.15* (0.46)	1.13* (0.46)	1.12* (0.47)	1.22** (0.47)	1.14* (0.46)		
Age: missing	0.31 (0.69)	0.20 (0.69)	0.23 (0.71)	0.32 (0.69)	0.39 (0.69)	0.33 (0.69)	0.14 (0.70)	0.27 (0.69)		
Relationship: not related (Ref.)										
Relationship: related	0.46 (0.44)	0.48 (0.44)	0.50 (0.45)	0.42 (0.43)	0.36 (0.44)	0.40 (0.43)	0.53 (0.44)	0.46 (0.43)	0.36 (0.44)	0.39 (0.43)
Relationship: affinal	2.01*** (0.55)	1.95*** (0.54)	2.08*** (0.55)	2.17*** (0.55)	2.09*** (0.55)	1.97*** (0.55)	2.06*** (0.54)	2.09*** (0.55)	1.81*** (0.54)	1.77*** (0.53)
Relationship: missing	-0.01 (0.51)	0.02 (0.52)	0.02 (0.51)	-0.01 (0.49)	-0.07 (0.50)	-0.02 (0.50)	0.07 (0.51)	0.02 (0.50)	-0.04 (0.51)	0.01 (0.51)
Domestic arrangements: same settlement (Ref.)										
Domestic arrangements: cohabiting	1.52** (0.56)	1.52** (0.56)	1.53** (0.56)	1.47** (0.55)	1.47** (0.56)	1.56** (0.55)	1.52** (0.55)	1.54** (0.55)	1.51** (0.57)	1.51** (0.55)
Domestic arrangements: neighbours	0.61 (0.56)	0.54 (0.56)	0.51 (0.57)	0.64 (0.57)	0.73 (0.58)	0.69 (0.57)	0.46 (0.56)	0.61 (0.57)	0.46 (0.56)	0.40 (0.55)
Domestic arrangements: different settlements	-1.35 (0.71)	-1.42* (0.71)	-1.47* (0.72)	-1.56* (0.72)	-1.42* (0.72)	-1.42* (0.71)	-1.55* (0.72)	-1.56* (0.72)	-1.42* (0.71)	-1.47* (0.71)

Table A5.1 cont.	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Domestic arrangements: missing	-0.21 (0.44)	-0.28 (0.44)	-0.26 (0.44)	-0.28 (0.43)	-0.23 (0.43)	-0.25 (0.43)	-0.32 (0.43)	-0.30 (0.43)	-0.28 (0.44)	-0.33 (0.43)
Stratification: wealth distinctions (Ref.)										
Stratification: no wealth distinctions	-0.22 (0.47)	0.01 (0.48)			0.02 (0.53)	0.04 (0.51)			-0.16 (0.49)	0.06 (0.49)
Stratification: missing	1.36 (0.74)	1.52* (0.72)			1.28 (0.69)	1.32* (0.67)			1.46 (0.76)	1.60* (0.73)
Descent: patrilineal (Ref.)										
Descent: non-patrilineal		-0.65 (0.46)				-0.65 (0.50)	-0.53 (0.45)	-0.52 (0.51)		-0.68 (0.47)
Post-marital residence: female dispersal (Ref.)										
Post-marital residence: male dispersal				-0.20 (0.46)	-0.25 (0.55)	0.14 (0.61)		0.12 (0.55)		
Post-marital residence: other forms				-1.77* (0.82)	-1.64 (0.85)	-1.28 (0.83)		-1.49 (0.82)		
AIC	289.23	289.36	290.16	289.94	289.55	289.89	290.88	290.92	291.67	291.67
BIC	336.29	340.04	329.99	337.01	343.85	347.82	334.32	341.61	331.50	335.11
Log Likelihood	-131.61	-130.68	-134.08	-131.97	-129.77	-128.95	-133.44	-131.46	-134.84	-133.83
Num. obs.	276	276	276	276	276	276	276	276	276	276
Num. groups: Society	45	45	45	45	45	45	45	45	45	45
Var: Society (Intercept)	0.47	0.35	0.64	0.32	0.26	0.19	0.49	0.26	0.57	0.41

*** p < 0.001, ** p < 0.01, * p < 0.05

Table A5.1 (previous page) shows the Estimates (SD) of the top ten models from Chapter 5, table 5.12's model selection from logistic multilevel models. The outcome variable was whether an individual or group of people accused of witchcraft was male or female, where 'Male' was the reference category. The Level 2 variable is society. This table shows the results from the individual control variables (age of the accused, the category of relationship between the accused and the accuser, 'Domestic arrangements' or where the accused and the accuser live in relation to each other,). It also shows society-level variables of interest (social stratification, descent pattern and post-marital residence). A further Level 1 variable, 'Sex of the accuser' is not shown in this table, as it was not included in the top ten models.

Appendix A5.2: Multilevel models with interaction terms
Chapter 5: Which Sex are the Witches?

	Estimate	SE
Intercept	-1.15***	0.31
Post-marital residence: female dispersal (Ref.)		
Post-marital residence: male dispersal	-0.17	0.58
Post-marital residence: other	-2.80*	1.27
Post-marital residence: unrelated (Ref.)		
Relationship: related	0.04	0.52
Relationship: affinal	2.83**	0.86
Relationship: missing	-0.04	0.53
Post-marital residence: female dispersal*unrelated (Ref.)		
Post-marital residence: male dispersal*related	1.20	0.84
Post-marital residence: other*related	-13.15	2094.85
Post-marital residence: male dispersal*affinal	-1.08	-1.08
Post-marital residence: other*affinal	2.62	1.80
Post-marital residence: male dispersal*missing	-0.26	1.07

Table A5.2 Multilevel model where sex of the accused witch is the outcome variable, where 0) male is the reference category and female 1) is the focal category. This shows the variables of post-marital residence and relationship category, and then additionally where interaction terms have been fitted. None of the interaction terms are significant. As in the results from model averaging in Chapter 5, women are more likely to be accused in the context of an affinal relationship.

	Estimate	SE
Intercept	-0.48	1.04
Domestic arrangements: living together (Ref.)		
Domestic arrangements: neighbours	-0.29	1.14
Domestic arrangements: same settlement	-0.69	1.08
Domestic arrangements: different settlements	-17.13	1328.61
Relationship: unrelated (Ref.)		
Relationship: related	-0.06	1.35
Relationship: affinal	3.24*	1.31
Relationship: missing	18.22	4477.61
Domestic arrangements: living together*unrelated (Ref.)		
Domestic arrangements: neighbours*related	-17.89	9729.70
Domestic arrangements: same settlement*related	0.59	1.44
Domestic arrangements: different settlements*related	17.10	1328.62
Domestic arrangements: missing*related	0.45	1.62
Domestic arrangements: same settlement*affinal	-3.03	1.56
Domestic arrangements: different settlements*affinal	14.99	1328.62
Domestic arrangements: missing*affinal	-0.38	1.91
Domestic arrangements: neighbours*relationship: missing	-18.68	4477.61
Domestic arrangements: same settlement*relationship: missing	-19.03	4477.61
Domestic arrangements: different settlements*relationship: missing	-17.49	5184.49
Domestic arrangements: missing*relationship: missing	-17.81	4477.61

Table A5.3 Multilevel model where the outcome variable is the sex of the accused individual, where 0) male is the reference category and 1) female is the focal category. The predictors are the category of the relationship between the accused and the accuser, and the domestic arrangements, or where they live in relation to one another. The model also shows the interaction terms between the two variables. Because the counts for some of the parameters are very small, this has led to large SEs. None of the interaction terms are significant. The model shows that women are significantly more likely to be accused by their affinal kin, as in the larger averaged models in Chapter 5.

Appendix 6: additional data from Chapter 6

Table A6.1. The top ten averaged models from chapter 6 model averaging. What individual socio-ecological factors are associated with status and wealth-based accusations?

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Intercept	-0.11 (0.27)	0.22 (0.22)	-0.08 (0.27)	-0.30 (0.39)	0.26 (0.70)	-0.07 (0.26)	0.06 (0.40)	0.29 (0.25)	0.23 (0.22)	0.67 (0.65)
Accused sex: male (Ref.)										
Accused sex: female	-1.58** (0.50)	-1.64** (0.50)	-1.57** (0.50)	-1.55** (0.50)	-1.60** (0.50)	-1.67*** (0.50)	-1.57** (0.50)	-1.70*** (0.51)	-1.63** (0.50)	-1.70*** (0.50)
Accused sex: missing	-0.56 (0.69)	-0.54 (0.69)	-0.57 (0.69)	-0.60 (0.69)	-0.54 (0.69)	-0.66 (0.68)	-0.56 (0.69)	-0.61 (0.71)	-0.56 (0.69)	-0.58 (0.68)
Jurisdictional hierarchy: acephalous and 1 level (Ref.)										
Jurisdictional hierarchy: 2-4 levels	0.65 (0.35)		0.61 (0.36)	0.70 (0.36)	0.62 (0.36)	0.63 (0.35)	0.67 (0.35)			0.56 (0.35)
Resource abundance	-0.71 (0.37)	-0.73 (0.41)	-0.90* (0.45)	-0.82* (0.40)	-0.62 (0.39)		-0.68 (0.37)		-0.96* (0.47)	
Climate stability			-0.33 (0.45)						-0.44 (0.45)	
Stratification: no wealth distinctions (Ref.)										
Stratification: wealth distinctions				0.28 (0.40)						
Settlement: mobile (Ref.)										
Settlement: sedentary					-0.38 (0.68)					-0.79 (0.62)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Animal husbandry: absent (Ref.)										
Animal husbandry: present							-0.23 (0.42)			
AIC	200.07	201.25	201.52	201.57	201.75	202.12	201.78	202.56	202.28	202.44
BIC	218.25	216.40	222.73	222.79	222.96	217.28	222.99	214.68	220.46	220.62
Log Likelihood	-94.03	-95.62	-93.76	-93.79	-93.87	-96.06	-93.89	-97.28	-95.14	-95.22
Num. obs.	153	153	153	153	153	153	153	153	153	153
Num. groups: Society	24	24	24	24	24	24	24	24	24	24
Var: Society (Intercept)	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.26	0.07	0.00

***p < 0.001, **p < 0.01, *p < 0.05

Table A6.1 shows the Estimates (SD) of the top ten models from the main analysis in Chapter 6 from logistic multilevel models. The outcome variable was whether a particular witchcraft accusation was associated with wealth and status (1), or with other factors such as interpersonal disputes (this was the reference category). The Level 2 groups are societies. A further society-level variable, Local Hierarchy, was not included in the top ten models.

Table A6.2. Reasons for accusations (status and wealth based or not) and socio-ecology, when the sex of the accused is excluded

	Estimate (SE)	95% CI Low	Odds Ratio	95% CI High	Relative Variable Importance
Intercept	-0.27 (0.55)	0.25	0.76	2.26	
Jurisdictional hierarchy: acephalous and one level (Ref.)					
Jurisdictional hierarchy: 2-4 levels	0.78* (0.36)	0.66	2.19	4.30	0.67
Resource abundance	-0.94* (0.44)	0.16	0.39	1.21	0.87
Climate stability	-0.39 (0.48)	0.47	0.68	1.67	0.30
Stratification: wealth distinctions present (Ref.)	0.34	0.63	1.41	1.90	0.28
Stratification: wealth distinctions absent	(0.44)				
Settlement: mobile (Ref.)					
Settlement: sedentary	-0.36 (0.70)	0.43	0.70	1.94	0.32
Animal husbandry: absent (Ref.)					
Animal husbandry: present	-0.31 (0.46)	0.54	0.74	1.57	0.25
Local hierarchy: independent families (Ref.)					
Local hierarchy: extended families	-0.24 (0.23)	0.77	0.78	1.26	0.05
Local hierarchy: clan-barrios	0.23 (1.10)	0.62	1.26	1.66	

Num. obs.

153

*** p < 0.001, ** p < 0.01, * p < 0.05

Appendix 7: additional data from Chapter 7

Table A7.1	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Intercept	-0.95*	-1.11**	-0.73	-0.85**	-0.66*	-0.93*	-0.90**	-1.23*	-0.99*	-0.73*
	(0.39)	(0.39)	(0.40)	(0.32)	(0.34)	(0.42)	(0.34)	(0.48)	(0.49)	(0.36)
Legislation: yes (Ref.)										
Legislation: no	1.14	1.28*	1.10			1.24*		1.34	1.28	
	(0.63)	(0.58)	(0.63)			(0.60)		(0.70)	(0.69)	
Legislation: missing	-0.32	-0.26	-0.39			-0.32		-0.33	-0.38	
	(0.57)	(0.54)	(0.57)			(0.55)		(0.61)	(0.60)	
Multiple accusers: yes (Ref.)										
Multiple accusers: no	-1.66***	-1.56***	-1.54***	-1.66***	-1.54***	-1.46***	-1.59***	-1.63***	-1.52***	-1.48***
	(0.42)	(0.42)	(0.43)	(0.42)	(0.43)	(0.42)	(0.42)	(0.43)	(0.44)	(0.43)
Multiple accusers: missing	-1.04	-0.95	-0.80	-1.18	-0.94	-0.78	-1.11	-1.01	-0.77	-0.93
	(0.87)	(0.88)	(0.91)	(0.88)	(0.92)	(0.92)	(0.88)	(0.89)	(0.93)	(0.92)
Child 'victim': no (Ref.)										
Child 'victim': yes		1.03				0.94	0.80			0.72
		(0.53)				(0.54)	(0.53)			(0.54)
Child 'victim': missing		-0.15				-0.12	-0.26			-0.24
		(0.47)				(0.48)	(0.47)			(0.48)
Accused is 'antisocial': no (Ref.)										
Accused is 'antisocial': yes			-1.52		-1.50	-1.43			-1.50	-1.48
			(1.13)		(1.13)	(1.13)			(1.14)	(1.13)
Accused is 'antisocial': missing			-0.64		-0.66	-0.53			-0.67	-0.57
			(0.47)		(0.47)	(0.47)			(0.47)	(0.47)

Table A7.1 Cont.	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Accused sex: male (Ref.)										
Accused sex: female								0.35	0.33	
								(0.43)	(0.43)	
Accused sex: missing								1.38	1.37	
								(0.93)	(0.91)	
AIC	217.04	216.87	217.09	217.72	217.79	217.72	218.77	218.53	218.65	219.39
BIC	237.92	244.71	244.93	231.64	238.67	252.52	239.66	246.38	253.45	247.24
Log Likelihood	-102.52	-100.43	-100.54	-104.86	-102.89	-98.86	-103.39	-101.27	-99.32	-101.70
Num. obs.	240	240	240	240	240	240	240	240	240	240
Num. groups: Society	48	48	48	48	48	48	48	48	48	48
Var: Society (Intercept)	0.62	0.37	0.60	0.89	0.85	0.42	0.74	0.82	0.77	0.76

Table A7.1 Showing Estimates (SD) of the top ten averaged models from Chapter 7, table 7.3: severity of outcome, from logistic multilevel models. The outcome variable was whether a witchcraft accusation had a 0) less severe outcome or 1) more severe, where the accused ‘witch’ was ostracised or killed.

Table A7.2	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Intercept	-1.93*** (0.00)	-1.37*** (0.36)	-1.12*** (0.31)	-1.63*** (0.40)	-1.18** (0.40)	-1.99*** (0.00)	-1.74*** (0.47)	-1.47*** (0.37)	-1.94*** (0.48)	-2.08*** (0.60)
Accused is 'antisocial': no (Ref.)										
Accused is 'antisocial': yes	0.91*** (0.00)	0.75 (0.64)	0.61 (0.62)	0.74 (0.62)	0.74 (0.64)	0.93*** (0.00)	0.90 (0.64)	0.77 (0.64)	0.89 (0.65)	0.91 (0.66)
Accused is 'antisocial': missing	1.25*** (0.00)	1.22** (0.40)	1.44*** (0.38)	1.48*** (0.38)	1.23** (0.41)	1.28*** (0.00)	1.25** (0.40)	1.25** (0.40)	1.29** (0.40)	1.15* (0.46)
Legislation: yes (Ref.)										
Legislation: no	0.96*** (0.00)			0.87 (0.60)		0.94*** (0.00)	0.94 (0.62)		0.96 (0.62)	0.91 (0.60)
Legislation: missing	1.21*** (0.00)			1.06 (0.57)		1.14*** (0.00)	1.16* (0.59)		1.17* (0.59)	1.14* (0.57)
Wealth and status: no (Ref.)										
Wealth and status: yes	0.14*** (0.00)	0.24 (0.47)			0.06 (0.50)	0.16*** (0.00)	-0.02 (0.49)	0.27 (0.46)	0.13 (0.48)	0.17 (0.46)
Wealth and status: missing	1.19*** (0.00)	1.15* (0.46)			1.11* (0.46)	1.15*** (0.00)	1.15* (0.45)	1.13* (0.46)	1.28** (0.48)	1.10* (0.47)
Accused sex: male (Ref.)										
Accused sex: female					-0.50 (0.44)		-0.44 (0.43)			
Accused sex: missing					0.00 (0.81)		0.01 (0.81)			

Table A7.2 Cont.	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Accused age: adult or child (Ref.)										
Accused age: old						0.15*** (0.00)		0.16 (0.55)		
Accused age: missing						0.61*** (0.00)		0.63 (0.57)		
Multiple accusers: yes (Ref.)										
Multiple accusers: no									0.05 (0.39)	
Multiple accusers: missing									-0.60 (0.81)	
Reputation as a witch: yes (Ref.)										
Reputation as a witch: no										0.22 (0.55)
Reputation as a witch: missing										0.45 (0.59)
AIC	258.92	259.59	262.15	262.18	262.18	261.81	261.83	262.37	262.25	262.36
BIC	286.03	279.92	275.70	282.51	289.29	295.70	295.72	289.49	296.14	296.25
Log Likelihood	-121.46	-123.79	-127.07	-125.09	-123.09	-120.91	-120.91	-123.19	-121.13	-121.18
Num. obs.	219	219	219	219	219	219	219	219	219	219
Num. groups: Society	45	45	45	45	45	45	45	45	45	45
Var: Society (Intercept)	0.87	1.19	1.13	0.84	1.26	0.77	0.92	1.06	0.88	0.77

*** p < 0.001, ** p < 0.01, * p < 0.05

Table A7.2 Showing Estimates (SD) of the the top ten averaged models from Chapter 7, table 7.5: does the accusation ‘stick’?, from logistic multilevel models. The outcome variable was whether a witchcraft accusation 0) did not stick or 1) stuck.

Appendix 8

Appendix 8.1: Recruitment letter

Hello!

You are invited to participate in an experiment about decision-making and charitable giving being carried out under the auspices of University College London. **The experiment and questionnaire should take around 10-15 minutes, and you have the opportunity to win up to £8 in the process.** Please read this information sheet carefully and feel free to ask if you have any questions.

We are recruiting approximately 800 participants at random from in and around Belfast. You will be asked to play a game and then answer some questions about yourself. The game should take around 5-10 minutes, during which you may receive some money, and you may donate all or part of it to some charitable or religious organisations, according to the rules of the game or your personal willingness.

All the data we are collecting is anonymous so we will not ask you for your name, and all answers to the questionnaire are strictly confidential. The data we obtain may be used in a scientific publication. You will not be identifiable from the details you give us, and if you do not wish to answer a particular question then you do not have to.

Your participation in this is entirely voluntary. You have the right to withdraw at any time, and you will not be penalized for this.

Please review details above. If you are interested in participating in this study please make sure you understand the relevant information.

Many thanks for your support and consideration!
Department of Anthropology, University College London

Appendix 8.2: Experimental protocol

Ecological and social determinants of cooperation: Belfast

Preparation for the experiment :

Equipment:

Portable table with seats, 1 Dice, 1 Opaque high cup with lid, 2 iPads, 3 charity boxes, Cash (£1 and £2 coins), Results sheet A & B, Information sheet, Questionnaire (on iPads)

Dice quality check (taken from Gächter & Schultz 2016)

The dice used by the experiments need to be tested for quality to ensure they will not bias the results. Roll each dice in a cup 120 times. Run χ^2 (5) tests to see whether the distribution of values is within the expected range. This is to be checked against the numbers of simulated dice rolls in a computerised random number generator. If $\alpha = 0.05$, then χ^2 values should be below 11.07 with a probability of 95%. The distribution can also be checked against a simulated distribution with the Kolmogorov-Smirnov test.

For the experiments:

Experimenter 1: recruitment

[Don't approach anyone who looks under 18.]

[If they look like they might not be over 18] *Are you over 18 years of age?* [If answer is YES then proceed]

Hi, we are students doing a project on decision-making and charitable donations. Would you be willing to take part in an experiment and complete a questionnaire? This should take no more than 15-20 minutes of your time.

You will also have the opportunity to win some money in the experiment, for donation to charitable organisations and for you to keep.

All the data we are collecting is anonymous so we will not ask you for your name. We will ask you for a few details about yourself, but you will not be identifiable from them, and all answers are strictly confidential.

You also have the right to withdraw at any time, and you will not be penalized for this.

Please read the information sheet [provide sheet] and let us know if you would like to proceed.

Wait for a reply and if positive then proceed:

Thank you very much. My colleague is going to conduct the experiment with you.

Experimenter 2 explains the game, carries out the game and records the results

Explanation of the game

[Take the participant to the table and demonstrate the game]

Now we are going to play a game, and you may win some money.

The game involves making some decisions about donating money to charitable organisations and you may also win some money for yourself.

Stage 1: choose the organisation

Here is a list of charitable organisations [read list]. Please could you pick two you would like to donate money to:

1. A church or religious institution of your choice
2. Marie Curie Cancer Care
3. Oxfam

[Record choices in order on the Results Sheet A /B, the orders of experiments are different in A and B]

Stage 2: Game

The experiment we are conducting involves rolling a dice to determine how much money you win for these organisations and how much you win for yourself. The balance of the amounts is different for every participant. Your first throw decides how much money goes towards [organisation name] and how much you will receive. If your throw is red, then the organisation will receive £2.00, and you will win nothing. If you throw blue, then the organisation will receive £1.00 and you will receive £1.00. If you throw yellow, then you will receive £2.00 and the organisation will receive nothing, and so on. [Show sheet with the divisions on.]

The second throw is just to ensure that the dice is working properly. You can throw the dice more than twice but only the first throw counts.

You will need to record the throw and the payments which determine the amounts on the sheet of paper provided. You can see from the sheet how much will be donated for each number on the dice.

You can throw the dice here [show participant to the booth with table].

Is that clear?

If you have any questions please let me know.

OK, so we will do the experiment for the first organisation you chose [organisation name]. Please throw the dice now. Please keep in mind the first colour you throw.

Please throw the dice again. [They can throw it more than once if they wish.]

Please record the first colour you threw by circling it on the piece of paper provided. Please circle the amount of money that will go to you and the amount that will go to [organisation name].

We will now do the experiment for the second organisation you chose [organisation name]. Please throw the dice now. Please keep in mind the first colour you throw.

Please throw the dice again. [They can throw it more than once if they wish.]

Please record the colour you threw by circling it on the piece of paper provided. Please circle the amount of money that will go to you and the amount that will go to [organisation name].

Finally, I am going to ask you to make a choice. I am going to give you £2.00. You can decide: how much would you like to give to [first organisation] and how much would you like to keep for yourself? The choice is entirely yours, and you can divide the money as you wish, or keep all of it, or give it all to the organisation.

[Record the participant's decision]

And here is a further £2.00. Again, please decide how much you would like to donate to [second organisation] and how much you would like to keep for yourself. Again, it is entirely up to you.

[Record the participant's decision]

OK, thanks very much. We've finished the experiment.

My colleague is now going to ask you a few questions about yourself.

Experimenter 1 asks questionnaire

[Put the participant's ID from the result sheet to the Questionnaire on iPads]

Now I am going to ask you a few details about yourself, but I will not ask you for your name, so the questionnaire is anonymous and you will not be identifiable from any of it. What is more, all answers are strictly confidential and the data we are collecting is for research use only.

You also have the right to withdraw at any time, and if you are not sure or don't want to answer any of the questions, please feel free to say so.

[Ask questions and record the answers on iPad]

[Calculate the amount the participant won and prepare the money]

Here is the total amount you won from the game.

Please do not discuss the game and the questionnaire with anyone else. Thank you very much for your time.

Appendix 8.3: Results sheets

Participant ID _____

Results sheet A

Participant's choice of charity institutions (number in order):

Marie Curie Cancer Care _____ Oxfam _____

Church/religious organisation of your choice (Name and location):

Game 1 Roll dice twice, and report the first number (\surd in the cell)::

Dice	Red	Blue	Yellow
------	-----	------	--------

You win	£0	£1	£2
---------	----	----	----

Money to charities	£2	£1	£0
--------------------	----	----	----

Institution
1

Institution
2

Game 2 Your decision (write the amount in the cell):

Institution 1	£	You	£
------------------	---	-----	---

Institution 2	£	You	£
------------------	---	-----	---

Total amount won: _____

Experimenter name: _____

Results sheet B

Participant's choice of charity institutions (number in order):

Marie Curie Cancer Care _____ Oxfam _____

Church/religious organisation of your choice (Name and location):

Game 1	Your decision (write the amount in the cell):
--------	---

Institution 1	£	You	£
---------------	---	-----	---

Institution 2	£	You	£
---------------	---	-----	---

Game 2	Roll dice twice, and report the first number (✓ in the cell):
--------	---

Dice	Red	Blue	Yellow
------	-----	------	--------

You win	£0	£1	£2
---------	----	----	----

Money to charities	£2	£1	£0
--------------------	----	----	----

Institution 1

Institution 2

Total amount won: _____
 Experimenter's name: _____

Appendix 8.4: Belfast questionnaire

Location

Date (recorded by iPad automatically)

Time at start of interview (recorded by iPad automatically)

Time at end of interview (recorded by iPad automatically)

1. Interviewer
2. Participant ID
3. Gender of the participant
 - i. Male
 - ii. Female
4. How old are you this year?
5. What is your current marital status? [Do not read]
 - i. Not married, not living with boyfriend or girlfriend
 - ii. Not married, living with boyfriend or girlfriend
 - iii. Married
 - iv. Separated
 - v. Divorced
 - vi. Widowed
 - vii. Refused to answer
 - viii. Hard to say/don't know.
6. Do you have any children
 - i. Yes
 - ii. No
7. [If yes] How many children do you have?
8. Where were you born?
9. Did you grow up in a rural or urban environment [do not read answers]?
 - i. Rural area
 - ii. Town
 - iii. City
 - iv. Don't know
 - v. Refused to answer
 - vi. Other [record answer]
10. Where do you currently live?
 - i. Here (within 10 minutes walk of area interview is being conducted)
 - ii. 10-30 minutes walking from here
 - iii. 10-30 minutes by vehicle from here
 - iv. 1-2 hours by vehicle from here
 - v. More than 2 hours by vehicle from here
 - vi. Don't know
 - vii. Refused to answer
 - viii. Other [record answer]
11. Which neighbourhood/village/town do you live in?

12. How long have you lived in your current place of residence?
- i. Less than 3 years
 - ii. 3-5 years
 - iii. 5-10 years
 - iv. 10-20 years
 - v. More than 20 years
 - vi. Don't know
 - vii. Refused to answer
13. What is your country of birth?
- i. Northern Ireland
 - ii. Republic of Ireland
 - iii. Scotland
 - iv. England
 - v. Wales
 - vi. Other [record response]
14. What is the highest level of education you have completed?
- i. Primary school
 - ii. GCSEs/O-level/NVQ 1-2/BTEC Level 1-2/Equivalent
 - iii. AS/A levels/NVQ Level 3/BTEC Level 3/Equivalent
 - iv. Undergraduate/Equivalent
 - v. Graduate/Postgraduate/Equivalent
15. In which profession/occupation are you doing most of your work? If you do not work currently, characterise your major work in the past! What is/was your job there?
- [Write in and code according to list below but do not read list]
- i. Employer/manager of establishment with 10 or more employees
 - ii. Employer/manager of establishment with less than 10 employees
 - iii. Professional worker [lawyer/accountant/teacher etc]
 - iv. Supervisory – office worker: supervises others
 - v. Non-manual – office worker: non-supervisory
 - vi. Foreman and supervisor
 - vii. Skilled manual worker
 - viii. Semi-skilled manual worker
 - ix. Unskilled manual worker
 - x. Farmer: has own farm
 - xi. Agricultural worker
 - xii. Member of armed forces, security personnel
 - xiii. Unemployed
 - xiv. Retired
 - xv. Housewife/husband
 - xvi. Caring/service industry
 - xvii. Government/civil service
 - xviii. Member of the clergy/monk/nun etc
 - xix. Student
 - xx. Don't know
 - xxi. Refused
 - xxii. Other (record answer)
16. How many people younger than 18 live in your household?
- i. One
 - ii. Two

- iii. Three
- iv. Four
- v. Five
- vi. Six or more
- vii. [Don't read] don't know
- viii. [Don't read] refused

17. How many adults live in your household?

- i. One
- ii. Two
- iii. Three
- iv. Four
- v. Five
- vi. Six or more
- vii. [Don't read] don't know
- viii. [Don't read] refused

18. Which of these does your household count as income?

- i. Salaries/wages
- ii. Non-regular income
- iii. Scholarship
- iv. Pensions
- v. Investment
- vi. Benefits
- vii. Refused
- viii. Other [record answer]

19. Here is a list of incomes. Please indicate which letter of the group your household falls under, before taxes and other deductions [show iPad]:

- i. £0-£10,000
- ii. £10,001-£20,000
- iii. £20,001-30,000
- iv. 30,001-£40,000
- v. 40,001-£50,000
- vi. £50,001-£75,000
- vii. £75,001-£100,000
- viii. £100,001-£200,000
- ix. More than £200,000

20. Do you have any religious belief?

- i. Yes
- ii. No
- iii. [Do not read] Don't know
- iv. [Do not read] Refused

21. Does anyone close to you have any religious belief [record answer]?

- i. Yes
- ii. No
- iii. [Do not read] Refused
- iv. [Do not read] Don't know

22. What religion, religious denomination or body were you brought up in?

- i. Roman Catholicism
- ii. Presbyterian Church in Ireland
- iii. Church of Ireland

- iv. Methodist Church in Ireland
- v. Other Protestant religion
- vi. Agnosticism
- vii. No religion
- viii. Other

23. Would you describe yourself as adhering to any of the following religions or belief systems?

- i. Roman Catholicism
- ii. Presbyterian Church in Ireland
- iii. Church of Ireland
- iv. Methodist Church in Ireland
- v. Other Protestant religion
- vi. Agnosticism
- vii. No religion
- viii. Other

24. Please could you tell me how important religion is to you in your life. Is it:

- i. Very important
- ii. Somewhat important
- iii. Somewhat unimportant
- iv. Not at all important
- v. [Do not read] Don't know
- vi. [Do not read] Refused

25. Have you donated any money to religious organizations (such as Protestant or Catholic churches, or to religious individuals such as Catholic priests or Protestant ministers) in the past twelve months?

- i. Yes, I have made donations
- ii. No, I haven't made donations
- iii. [Do not read] Refused
- iv. [Do not read] Don't know

26. Approximately what was the value of the goods you donated?

27. In the past twelve months have you done any of the following [They can pick more than one]:

- i. Prayed
- ii. Apart from weddings or funerals, gone to a church/temple/other place of worship to attend a religious service
- iii. Read the Bible/Koran/Torah/other religious texts

28. Do you do the above regularly, or only occasionally?

- i. Regularly (fixed time)
- ii. Occasionally, voluntarily
- iii. Occasionally with other people

29. Do you believe that God punishes people for doing something bad?

- i. Yes
- ii. Somewhat
- iii. No
- iv. [Do not read] don't know
- v. [Do not read] refused

30. Do you believe that God rewards people for doing something good?

- i. Yes
- ii. Somewhat
- iii. No
- iv. [Do not read] don't know
- v. [Do not read] refused

31. There are some people who believe in things which cannot be seen, and others who believe these things are just in our imagination. What do you think? Which of the following might exist in your personal view?

- 1. Fate
- 2. Fortune
- 3. Supernatural or immortal beings
- 4. Ghosts
- 5. Immortal soul
- 6. Aliens
- 7. Guardian angels
- 8. God
- 9. None
- 10. Don't know
- 11. Refused
- 12. Other [record answer]

32. Do you believe that some people can harm other people through supernatural means?

[Do not read]

- 1. Yes
- 2. Somewhat
- 3. No
- 4. Don't know
- 5. Refused

33. How much do you believe in heaven?

- i. Very much
- ii. Somewhat
- iii. Not at all
- iv. [Do not read] don't know
- v. [Do not read] refused

34. How much do you believe in hell?

- i. Very much
- ii. Somewhat
- iii. Not at all
- iv. [Do not read] don't know
- v. [Do not read] refused

35. Have there been times in the past year when you did not have enough money to pay your bills/rent/mortgage or other necessities?

- i. Yes (then let the participant choose from A, B, and C)
- ii. No
- iii. [Do not read] Don't know
- iv. [Do not read] Refused

36. Do you worry that in the next month your household will have a time when it does not have enough money to pay your bills/mortgage/rent, or other necessities?

- i. Yes
- ii. No
- iii. [Do not read] Don't know
- iv. [Do not read] Refused

37. Would you feel uncomfortable walking around in certain neighbourhoods because people there are from a different religion?

- i. Yes
- ii. No
- iii. [Do not read] Don't know
- iv. [Do not read] Refused

38. If you were working and had to change your job, would you prefer a workplace with people of only your own religion, or a mixed religion workplace?

- i. Own religion only
- ii. Mixed religion workplace
- iii. Other (write in)
- iv. Don't know
- v. Refused

39. Thinking of the neighbourhood where you live, is this a place where you feel you can be open about your own cultural identity?

- i. Yes (definitely)
- ii. No (definitely)
- iii. Yes (probably)
- iv. No (probably)
- v. Don't know
- vi. Refused

40. What do you think the experiment was about?

[Do not read]

- 1. Honesty
- 2. Deception/cheating
- 3. Charity
- 4. Fairness
- 5. Religion
- 6. Don't know
- 7. Refused