



## Review Article

## Religious signaling and prosociality: A review of the literature

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## ABSTRACT

The costly signaling theory of religion states that costly religious behaviors, badges, and bans (“religious practice” for short) are signals of commitment to the ingroup and its moral code. Such signals are proposed to increase cooperation. Here we review the empirical literature, which suggests that religious actors are often perceived as especially trustworthy and may be more likely recipients of help and cooperation. The evidence does not present a clear picture regarding the actual trustworthiness nor prosocial tendencies of religious actors. Limited available evidence suggests that routine forms of religious behavior are associated with ingroup favoritism. High-cost, infrequent, highly social forms of religious practice are associated with an increase in religious identity, but also an expanded social identity and greater tolerance for outgroup members. Following the literature review, we provide a discussion of proposed future research directions pertaining to the costs and benefits of religious practice, moderators, secular versus religious practice, and mediation of the relationship between observed religious practice and perceptions of religious actors’ trustworthiness.

## 1. Introduction

Religious practice can be puzzling. It often costs religious adherents resources and time without providing clear benefits; it may even cause harm or death to the performer or others. Religious practice can be time-consuming (e.g., praying 5 times a day), physically demanding (e.g., fasting, pilgrimage), financially expensive (e.g., offering food, tithing), and stigmatizing among outsiders (e.g., wearing a headscarf). Despite such costs, religious practice is common across the globe. One attempt to understand it is the costly signaling theory of religion. In brief, this theory states that religious practice is a signal of commitment to the ingroup and its moral code.

Such signals are suggested to increase intragroup cooperation. When a group of people cooperate collectively, everyone in the group may benefit. In a cooperative group, however, an individual may gain the most by defecting and free-riding on the cooperative efforts of others (Sosis, 2003, 2005). Costly signaling may be a method for solving the problem of free-riding. Group members want to discriminate between those who will cooperate and those who will attempt to free-ride;

individuals who are committed to the group—and will thus presumably cooperate with group members—signal that commitment with costly religious practice. Individuals who are not committed to the group are less likely to participate in religious practice and can thus be identified and avoided.<sup>1</sup>

This paper will examine the costly signaling theory of religion as it relates to prosociality. We will begin with a brief description of the theory. Next, we will consider the adaptive value of religious costly signals. Then we will discuss the mechanism; that is, how religious practice might honestly signal prosocial commitment. After this, we will ask two questions derived from the tenets of costly signaling theory of religion: Does religious practice enhance trust and prosociality? Does religious practice signal ingroup commitment? We will review empirical literature relevant to these questions in an attempt to answer them. Finally, we will conclude with a discussion of proposed research directions that emerge from empirical inconsistencies and avenues insufficiently explored.

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### 1.1. Costly signaling theory of religion

Late last century, several researchers laid the groundwork for costly signaling theory of religion. These ideas came out of biology (Zahavi, 1975, 1977; Zahavi & Zahavi, 1997), anthropology (Rappaport, 1979, 1999), sociology (Allison, 1992), and economics (E. Berman, 2000; Carr & Landa, 1983; Frank, 1988; Iannaccone, 1992, 1994; Spence, 1973).

The extravagant train of a peacock may appear metabolically wasteful (Zahavi & Zahavi, 1997), and the vigorous stotting of gazelles reduces the speed at which they travel when pursued by predators (Caro, 1986). Why, then, do these traits and behaviors exist? Costly morphological structures and behaviors may function to signal some underlying unobservable trait, such as high genetic quality, health, or vigor (Grafen, 1990; Zahavi, 1975, 1977; Zahavi & Zahavi, 1997). The costliness of these signals is purportedly what makes them reliable; only strong, healthy individuals can pay the costs of these traits and behaviors, which Zahavi (1975) referred to as handicaps (for a critical discussion see Penn & Számadó, 2020).

In parallel, social scientists proposed that certain human behaviors served as signals relevant to social contracts, such as rituals serving as public vows (Rappaport, 1979, 1999), and the observable physiological indicators (e.g., facial expressions) of ‘moral’ emotions, such as guilt, serving as signals of intentions to behave cooperatively (Frank, 1988).

Other hypotheses go a step further and propose that the costs of such signals are integral to their functions. Researchers argued that costly religious prohibitions and behaviors discourage outsiders from converting (Carr & Landa, 1983) or keep free riders—those whose participation or commitment would have been low—from joining a group (Allison, 1992; E. Berman, 2000; Frank, 1988; Iannaccone, 1992, 1994). These individuals are not committed enough to submit to the costs and restrictions. Religious prohibitions and behaviors thus signal religious group membership (Carr & Landa, 1983), cultural kinship (Allison, 1992), or likelihood of participating in religious activities (E. Berman, 2000).

According to the costly signaling theory of religion—dubbed by Sosis and Bressler (2003)—costly religious practice is a credible sign of religious adherents’ commitment and loyalty to their ingroup and the ingroup’s rules or moral code (Cronk, 1994; Irons, 1996a, 1996b, 2001; Sosis, 2000, 2006; Sosis & Alcorta, 2003).<sup>2</sup> The *ingroup* has been variously described as adherents’ fellow believers (Cronk, 1994), members of the adherents’ society (Irons, 1996a) or (religious) community (Irons, 1996a, 2001), and the adherents’ religious group (Sosis, 2000). Researchers in this area typically seem to use the term *cost* in the general sense of *expenditure*, *sacrifice*, or *loss*, and *signal* in the general sense of *sign* or *indication*. Later, we will unpack how to unite this with an evolutionary perspective on costs and benefits.

Costly signalers should ultimately benefit from costly signaling by gaining trust, acceptance, and higher social status from ingroup members (Bulbulia, 2004b; Fischer & Xygalatas, 2014; Irons, 2001; Xygalatas, 2008). If the benefits an individual receives from group members outweigh the costs of religious practice, then religious practice provides a net gain for the individual (Dow, 2008). Interacting preferentially with costly signalers should benefit perceivers because costly signalers should be particularly trustworthy, generous, and cooperative (Sosis, 2006).

Three major categories of religious costly signal appear in the literature: behaviors, badges, and bans (Sosis, 2006).

Religious *behaviors* include ritual performance, religious service attendance, tithing, prayer, and pilgrimage. Religious behaviors often cost adherents time, energy, and financial resources, as well as opportunity costs.

Religious *badges* are physical markers of religious group membership

that are worn or displayed, such as tattoos, facial hair, forehead markings, threads, beads, rings, garments, and headwear. Badges may burden adherents in various ways such as by stigmatizing adherents among outgroups (Iannaccone, 1992; Sosis, 2006; Sosis & Alcorta, 2003; Villa, 2020), causing them physical discomfort (Ansari & Solomon, 2015; Sosis, 2006) such as pain (Ansari & Solomon, 2015), or reducing their physical attractiveness (Jordan, Yekani, & Sheen, 2020; Mahmud & Swami, 2010; Pazhoohi & Hosseinchari, 2014; Swami, 2013).

Religious *bans* (also known as *taboos*) include prohibitions on consuming certain foods or drinks, entering certain outgroup religious buildings, cutting hair, using certain kinds of technology, performing certain sexual acts, accepting certain medical interventions, and wearing jewelry. Religious bans can be costly inasmuch as they deny adherents access to beneficial resources and opportunities. Bans may also have the knock-on effect of hindering access to permissible resources. For example, religious actors obeying bans on certain foods may have a difficult time socializing with outgroup members even if socializing with outgroup members is permissible. Sosis and Bressler (2003) noted, “food taboos limit an individual’s ability to socially interact with nongroup members” (p. 219), and Wenham (1981) remarked that ‘Old Testament’ food laws (e.g., Cohen, Gorvine, & Gorvine, 2013) made it difficult for Israelites to eat with their Gentile neighbors. As another example, Inge (2017) reported on Salafi Muslim women in London who struggled to pay for university because they obeyed the Islamic ban on interest, leaving student loans, which incurred interest, unavailable to them.

We will refer to all three categories of religious costly signals as *religious practice* for the sake of efficiency. Note that we apply the term *religious practice* to any religious behavior, badge, or ban, not just to recurring or habitual behaviors.

The literature notes multiple types of cost. Religious practice may cost time. It may cost money or material resources. It can be energetically or otherwise somatically costly (e.g., fasting, self-flagellation). There may be opportunity costs, too; time, resources, and energy invested in religious activities cannot be invested elsewhere.

Barker, Power, Heap, Puurtinen, and Sosis (2019) created a framework of human costly signaling based on three types of signal cost: material capital, embodied capital, and social capital. Capital may be burned, transferred, risked, or forgone. For example, calories may be *burned* in a performance; food may be shared with (that is, *transferred* to) other people; firewalking puts the performer at *risk* of bodily harm; fasting involves *forgoing* food.

As many readers may be unfamiliar with the potential costs to social capital of religious practice, we will provide two real-world examples. We draw the first example from rural festivals in South India, where some villagers perform religious acts to thank the village deity for granting their wishes (Power, 2015). Although there are embodied costs to many of these acts (e.g., fatigue, burned feet, spear wounds), the villagers Power observed were more concerned with reputational costs, which were often incurred if an act went wrong. The devotional acts could go wrong in various ways. For example, one act involved throwing coconuts to break them. Should a coconut not break, that would be cause for concern. Another act involved walking across a bed of hot coals; should an actor fall, that would generally be considered a failure. These misfires were typically taken as a sign of disapproval from the goddess Mariyamman, whose rejection indicated immoral behavior on the actor’s part. A failed act could thus lead to harmful gossip, reputational harm (perhaps for the actor’s whole family), and cut social ties. Villagers who are not committed to the group’s moralistic, punishing goddess may be unwilling to perform religious acts that put their reputations at risk, whereas villagers who believe the religious acts could put them in the good graces of the goddess may judge the acts to be worth the risk.

We draw our second example from Evangelical Christian communities in Minnesota and New York where similar (though smaller) risks to social capital were reported by Winchester and Guhin (2019). Prayer, both private and public, was an important religious behavior among these groups, and praying in front of a group could boost one’s status.

<sup>2</sup> For background on costly signaling of commitment in general, see for example Nesse (2001), Yamaguchi, Smith, and Ohtsubo (2015), Bliege Bird, Ready, and Power (2018), Quillien (2020), and Roberts (2020).

However, some individuals were anxious about praying in front of a group, because their prayers would be evaluated by the community, who cared a great deal about the way prayer was performed. Prayer was meant to be sincere, informal, spontaneous conversations with God, without “empty” ritual or formula. The community could judge a prayer to be insincere, perhaps because the actor did not display enough emotion, or perhaps because the actor displayed too much. This could be taken as a sign that the actor was “putting on spiritual airs” (p. 39). This risk of being perceived as insincere may be particularly discouraging to those who do not hold to the group’s religious values and may, therefore, fear being exposed.

### 1.2. The adaptive value of religious costly signals

As we have mentioned, the costly signaling theory of religion was derived partly from biology. Evolution is crucial for the biological understanding of costly signaling, so it is appropriate to consider the role evolution plays in religious costly signaling (Alcorta & Sosis, 2005; Bulbulia, 2004a, 2004b; Bulbulia & Sosis, 2011; Dow, 2008; Irons, 1996a, 1996c, 2001; Schloss, 2009; Sosis, 2004; Sosis & Alcorta, 2003; Sosis, Kress, & Boster, 2007). In our view, religious signals are probably the result of interplay between biological and cultural evolution. On a logical basis, any or all of the following may be true:

1. Religious signals are byproducts of other evolved behaviors.
2. Humans possess an evolved psychological mechanism for displaying religious signals.
3. Humans possess an evolved psychological mechanism for seeking and responding to the religious signals of others.

It is difficult to know with certainty which of these three, or their combinations, are responsible for religious signals, and it is further possible that this depends on which signal is being considered. Nonetheless, we want to make some general assumptions or hypotheses.

Some theorists have seemed inclined to borrow theorizing about biological signals such as peacock trains. When considering religious signals, we think this is somewhat useful, but the logic is not entirely the same. Wearing a hijab (even an ornate one) is probably not following the same biological principles as growing an ornate peacock’s train, which would be much costlier for a weaker peacock to accomplish compared to a more genetically robust peacock.

Tooby and Cosmides (2020), considering the evolution of language and communication, posited that humans possess content-specialized neural programs that respond in fitness-enhancing ways to categories that were historically of great adaptive significance to our ancestors, such as *mate*, *ally*, or *enemy*. While what we call “wife” varies across languages, that culturally evolved word taps into the more basic concept of *mate*, which we surely evolved to be attuned to. We think religious signals act in much the same way. We doubt there is a gene or set of genes that tells us, “Watch out for those pork eaters, they are our enemies”; it is more likely that we possess genetically evolved systems to detect friend or foe, and cultures have evolved religious signals that tap into these systems, to tell us that people who eat or do not eat a certain thing, or who wear certain garments or do not, are friend or foe.

Cultural evolution builds on biologically evolved cognitive mechanisms (Boyer, 2001; Sperber, 1996; Tooby & Cosmides, 1992) whose function is to assess a given individual along a number of dimensions, such as whether they uphold social contracts (Cosmides, Barrett, & Tooby, 2010), whether they intend to invest in a dyadic relationship (Barclay, 2013; Quillien, 2020; Tooby & Cosmides, 1996), whether they are committed to a coalition (Cimino & Delton, 2010; Tooby & Cosmides, 2010), or whether they can be trusted to tell the truth (Mermelstein, Barlev, & German, 2021; Sperber et al., 2010). In turn, it is likely that selection designed mechanisms motivating an individual to convince others that the individual is a reliable and trustworthy interaction partner. To the extent that the selection pressures leading to the

evolution of these cognitive mechanisms involved the transfer of information in the presence of conflicts of interest, people should be sensitive to the costs incurred by the sender of a signal when assessing the reliability of such signals (Henrich, 2009). This provides a basic infrastructure on which cultural evolution can build: If individuals are predisposed to consider costly signals as more reliable, cultural practices that involve costly signals will tend to be successful cultural attractors (Henrich, 2009; Sperber, 1996).

These practices will then also be fostered by learning and cultural selection processes. In broad strokes, learning mechanisms lead people (under ecologically valid conditions) to do more of the things that they perceive to have generated good outcomes in the past; for instance, a religious leader may—consciously or unconsciously—perceive that new members who underwent an initiation ritual are more trustworthy, and decide to make the ritual mandatory for all new recruits. Alternatively, a cultural item may be successful because of blind selection; for instance, groups that recruit their members on the basis of their willingness to take part in costly rituals may be less likely to dissolve than other groups, or more likely to be imitated, ensuring the prevalence of costly rituals even if group leaders are generally ignorant of the role of the ritual in keeping out uncommitted individuals.

In sum, if costly signaling dynamics shape some religious behaviors, it is likely by acting at the level of both biological and cultural evolution, whereby cultural evolution builds on the cognitive infrastructure provided by natural selection (Northover & Cohen, 2017a). We note that there does not need to be any selection at the genetic level on religious behavior per se for biological evolution to be relevant to religious costly signaling. Religious thought and behavior might be a byproduct of other brain mechanisms (Barlev, Mermelstein, & German, 2017; Boyer, 2003), but understanding the evolutionary origin of these mechanisms is still relevant to understanding religion.

It is also worth giving some attention to the distinction between the proximate and ultimate senses of “cost” and “benefit.” Psychologies are the product of ultimate costs and benefits: Selection will tend to make more common psychological systems that reliably deliver their holders reproductive benefits and spare their holders reproductive costs. However, because organisms cannot perceive fitness directly, individual behaviors are the product of proximate costs and benefits, contingent on the design of the underlying psychology. Our evolved psychologies interact with the perceivable elements of our circumstances to guide behavior moment-to-moment. This means that when considering the logic of costly signaling itself and the emergence of costly signaling systems, one must take care to focus analysis on costs and benefits at the ultimate, evolutionary level. But when considering the performance of individual behaviors, even costs and benefits with no ultimate consequences may, under some circumstances, be relevant. In the same way that a person mistaking the sound of wind-rustled leaves for the sound of a dangerous snake avoids this perceived cost despite the stimulus posing no ultimate cost, a person who believes a ritual will offer them eternal afterlife may pursue this perceived benefit despite the absence of any ultimate benefits. The relevant questions for analyzing religious costly signaling thus become: (1) how have ultimate costs and benefits shaped the design of human costly signaling psychology? (2) how does this design influence how individuals perceive the costs and benefits of alternative religious practices, and how they respond to those perceived costs and benefits? and (3) how does the structure of an individual’s environment, culture, and history, in interaction with their evolved psychology, give rise to the specific cost and benefit perceptions that drive their behavior?

### 1.3. How religious practice might honestly signal commitment

Given the benefits to individuals of being perceived as committed group members, it seems logical for uncommitted group members to use religious practice to fake commitment. In biology, there may be signals that are impossible to fake because of biological or physical realities. For

example, a tiny whale cannot signal its size with the same giant splash as a much larger whale (Tooby & Cosmides, 2020). However, this is not the case for religious signals. An apostate could donate a large amount of money to a religious organization, abstain from eating pork, produce prayer, or perform rituals even if he does not believe. Why should we expect religious practice to reliably signal commitment? Here we cover proposed mechanisms for honest signaling. First, we review ideas related to differential costs and benefits. Second, we discuss differential anticipated costs and benefits. Finally, we conclude with a brief discussion of how observability relates to honesty.

### 1.3.1. Differences in costs and benefits

Here we discuss differential costs and benefits. Carr and Landa (1983) argued that the benefits gained from following religious dietary laws are less substantial for converts than for longtime members of a religious group, because converts are not trusted as much as existing members. Allison (1992) argued that outgroup would-be free-riding invaders could be kept at bay if those behaviors signifying cultural kinship were easy for ingroup members to perform, but difficult for outsiders to learn. Some religious rituals, for example, rely on so much inside knowledge that if one is not raised in the religion and actively participating, it is quite hard to perform the rituals accurately. These authors thus described situations in which costs may be greater and benefits smaller for outgroup members (or converts) relative to ingroup members. These differential costs and benefits should discourage outsiders from joining a religious group. It seems to us that this may protect a group from invading free-riders, but also keep out potential cooperative converts.

Iannaccone (1992, 1994) argued that those who are very successful in the secular world (e.g., high income earners) are less likely than those who are less successful in the secular world to join a religious group that bans secular activities and commodities, because the former would suffer especially great opportunity costs. Differences in opportunity costs may thus result in honest signaling: Those who are unsuccessful in the secular world do not have much (opportunity) to lose by giving up secular activities; furthermore, they may be especially motivated to join and remain with the religious group, because they do not have a good alternative to fall back on (i.e., the secular world). Thus, those who obey the religious group's bans are perhaps those who are especially committed to the religious group.

Dishonest signalers risk punishment, loss of reputation, and ostracism should their dishonesty be revealed (Barker et al., 2019); that is to say, both honest and dishonest signalers may pay the same cost (or no cost) when the signal is sent, but dishonest signalers pay additional costs when their dishonesty is exposed (Brusse, 2020).

### 1.3.2. Differences in anticipated costs and benefits

When discussing costly signaling theory from biology, we stated that (theoretically) only high-quality individuals can bear the cost of burdensome physical traits (e.g., an extravagant train) and behaviors (e.g., stotting). However, the costly signaling theory of religion does not claim that only committed group members can bear the cost of religious practice. With some exceptions discussed above, the time, financial, and energetic costs of religious practice should be the same for committed and uncommitted members.

However, those who are committed to a religious group likely anticipate different payoffs than those who are not committed to a religious group (Bulbulia, 2004b; Sosis, 2003). Individuals who participate in religious practice are more likely to believe the tenets of the group's religion, and those tenets may include ideas about supernatural rewards for religious practice and punishments for breaking religious rules. These beliefs factor into an individual's cost-benefit analysis. A fully committed believer may think that participating in religious practice will guarantee her a blissful afterlife, and that failing to participate will result in an eternity of suffering in hell. A nonbeliever may expect fewer benefits of religious practice and smaller costs to

forgoing it. For example, a nonbelieving Catholic priest in the process of leaving the priesthood described going to Mass as "just a waste of time" (Dennett & LaScola, 2015, p. 49).

Sosis (2003) furthermore argued for the importance of early indoctrination. Children who are raised within a certain religious tradition grow into adults who are accustomed to the rules and restrictions of that tradition. These indoctrinated individuals are less tempted to shirk religious practice compared to converts, who anticipate greater opportunity costs to religious practice.

Lang, Chvaja, Purzycki, Václavík, and Staněk (2022) conducted an experiment addressing the concept of differential anticipated benefits. Although their study does not involve religious practice, it evaluates the mechanism of costly signaling. First, Czech university students played a variation of the public goods game that enabled Lang and colleagues to identify cooperators and free-riders. Participants were then told they would play multiple rounds of the public goods game with the following procedure: Each of four players would receive an equivalent endowment of money and then anonymously decide how much, if any, of that endowment to contribute to the common pool. The money contributed to the common pool would then be multiplied by two, and each player would receive an equal portion of the resulting product, in addition to however much of their endowment they kept for themselves. In this game, contributing to the common pool is considered cooperative behavior, whereas withholding money is a form of free-riding.

Participants were informed that they would play all rounds of this game with the same group of players. Then they were presented with two different groups and asked to choose one to join. Participants received instructions explaining that whichever of the two groups they joined, they were expected to contribute as much to the common pool as possible so everyone in the group would benefit, although their contributions were anonymous. However, one group required a payment—a portion of the endowment—before each iteration of the game. The instructions stated that participants would make these payments, which did not go into the common pool nor benefit any group members, to indicate their intentions concerning the size of their contributions to the public pool. Participants were given the choice to join either the group that required these costly signals, or the group that did not. The size of the payment required by the costly signaling group depended on whether the participant had been randomly assigned to the low-cost or high-cost condition.

Participants in the low-cost condition were told they could either join a group that exacted no payment (the no-signaling group) or one that required 2.5% of their endowment before each iteration of the game (the signaling group); participants in the high-cost condition were told they could either join a group that exacted no payment (the no-signaling group) or one that required 15% of their endowment before each iteration of the game (the signaling group).

When costs were high, free-riders were less likely than cooperative players to join the signaling group (32% and 57% respectively). It therefore seems likely that requiring costly signals for group membership increased the proportion of cooperative group members. What is harder to ascertain is the reason for this. One possibility is that cooperators joined signaling groups more often than free-riders because cooperators predicted a greater benefit to joining signaling groups than the free-riders did. Participants in a pilot study who chose the costly signaling group were more likely than those who chose the non-signaling group to predict that every member of their group would cooperate, resulting in their taking home the maximum payout. In other words, individuals who anticipated greater benefits from joining the costly signaling group were more likely to join it despite the initial costs it entailed.

### 1.3.3. Observability

To be effective, a signal must not only be sent, but received. For example, a hamster may deposit a scent mark as a demonstration of his vigor and dominance, but this signal must be perceived in order for it to



be an act of communication (Cohen, Johnston, & Kwon, 2001). Many instances of religious practice are private and thus go unobserved. Without any observers, religious practice cannot communicate anything (e.g., commitment) about the religious actor.

If unobservable practice cannot serve as a signal, does a costly signaling framework have anything to say about it? Perhaps. Some forms of private religious practice, such as reading or memorizing sacred texts, increase the actor's religious knowledge, and that knowledge may be assessed and/or demonstrated publicly (Sosis, 2006). Furthermore, many religious behaviors are practiced both privately and publicly; individuals who forego the private practice of these behaviors are more likely to forget to do them in the company of others (Sosis, 2006) or to do them poorly. Those who observe this poor performance may infer that the actor has been shirking private religious practice, much like an instructor observing a student fail an exam may infer that the student has been shirking private study of course content.

## 2. Empirical evidence

Here we review the empirical literature. When we discuss data, we will usually refer to the people who participate in religious practice (i.e., by performing religious behaviors, wearing badges, and/or obeying bans) as *religious actors*. This terminology does not assume cost nor the existence of signals. Note that we mean *actor* in the sense of someone who does something; we do not wish to imply that religious actors are insincere. To locate relevant research papers, we conducted a PsycInfo search on January 8, 2023 with the search terms “relig\* and signal\*”. We identified additional papers from the citations of the papers we already had. We include studies that report measures of religious practice as well as trust or prosociality, or people's perceptions of the trustworthiness or prosociality of religious actors.

With each finding, we report an effect size to aid interpretation. Some of the effect sizes were reported in the original articles. We calculated a few others based on descriptive statistics reported in the original articles. Occasionally we asked original authors to provide effect sizes or output to enable us to calculate effect sizes.

We do not include studies which merely focus on religious identity (such as being religious or nonreligious, or Jewish or Hindu or Christian), because such identities may or may not indicate religious practice; they may imply beliefs or social identities.

We have organized the empirical literature around two major questions derived from the tenets and predictions of the costly signaling theory of religion: First, does religious practice enhance trust and prosociality? Second, does religious practice signal ingroup commitment?

### 2.1. Does religious practice enhance trust and prosociality?

According to the costly signaling theory of religion, costly religious practice increases trust within groups (Irons, 1996c; Sosis, 2000; Sosis & Alcorta, 2003). This is proposed to work because costly religious practice signals commitment and loyalty to other members of the ingroup (Irons, 1996c; Sosis, 2000; Sosis & Alcorta, 2003), a commitment to behave unselfishly (Irons, 2001), and a commitment to the group's moral code (Irons, 1996c, 2001), which likely includes ingroup altruism (Sosis & Alcorta, 2003). Reflecting on his experience with Yomut Muslims, Irons (2001) applied his theory to their religious rituals:

The rituals of Islam...communicated commitment to a set of rules concerning appropriate moral behavior. They reinforced basic moral rules of not lying, not stealing, not killing, and not committing adultery...During my thirty months of residence with the Yomut, they...communicated a commitment to the worldwide community of Muslims, a commitment to basic morality, and a commitment to care for the most unfortunate members of their society. (p. 301).

Costly religious practice is also proposed to increase intragroup cooperation (Irons, 2001; Sosis, 2000; Sosis & Alcorta, 2003), perhaps

due to enhanced trust (Sosis, 2000; Sosis & Alcorta, 2003).

According to the costly signaling theory of religion, costly religious practice increases trust and prosociality *within groups*. However, we will examine trust and prosociality both within and between groups, because several studies have investigated the effects of religious practice between groups (e.g., Blais, Ellis, Wingert, Cohen, & Brewer, 2018; Chia & Jih, 1994; Clingingsmith, Khwaja, & Kremer, 2009; Ellis et al., 2018; Hall, Cohen, Meyer, Varley, & Brewer, 2015; McCullough, Swartwout, Shaver, Carter, & Sosis, 2016; Orbell, Goldman, Mulford, & Dawes, 1992; Ruffle & Sosis, 2010; Shaver, Lang, et al., 2018; Widman, Corcoran, & Nagy, 2009; Xygalatas et al., 2013). We will explore the issue of ingroups versus outgroups when we address our second major question, “Does religious practice signal ingroup commitment?”

Here we address our first major question, “Does religious practice enhance trust and prosociality?” In the sections that follow, we break this question down into its implied components. First, we consider if religious actors are highly trustworthy and prosocial people. Then, we consider if religious actors are *perceived* to be highly trustworthy and prosocial people. Next, we consider if religious actors receive high levels of trust and prosociality (e.g., cooperation, generosity) from perceivers. Finally, we consider if practicing groups possess high levels of intragroup trust and prosociality.

#### 2.1.1. Are religious actors highly trustworthy and prosocial?

Xygalatas et al. (2013) conducted a study in Mauritius, an island nation about 550 miles east of Madagascar. The dominant religion of Mauritius is Hinduism and the context of the study was the Hindu festival of *Thaipusam*. The authors considered two group rituals: a mild ritual involving prayers and singing (low-ordeal), and an extreme ritual involving pain, injury, and physical effort (high-ordeal). Performers of the high-ordeal ritual, called the *kavadi*, (a) pierced their bodies with needles, weighted hooks, and skewers, (b) carried heavy objects, (c) spent over four hours dragging carts attached to their backs via skin-piercing hooks, and finally (d) climbed a mountain barefoot.

The authors recruited study participants from among the festival attendees. All participants took part in the low-ordeal ritual and either took part in or observed the high-ordeal kavadi ritual. After either completing the low-ordeal ritual or the high-ordeal ritual, participants took a brief survey. Then they chose whether to anonymously donate a portion of their subject payment to a local Hindu temple. On average, participants who had just performed or observed the high-ordeal kavadi ritual donated more money to the temple than participants who had just performed the low-ordeal ritual (Cohen's  $d = 0.73$ ).

However, in an economic game study conducted by Bulbulia and Mahoney (2008), the number of self-reported hours New Zealand Christians spent “in Christian practice” was not significantly correlated with their generosity toward other Christian participants ( $r = 0.19$ ).

Xygalatas et al. (2018) conducted a study in Mauritius in which Hindu Mauritians played a game called the Random Allocation Game. In each round, a single player rolls a die and allocates money to one of two recipients according to the outcome. Before rolling the die, the player chooses which recipient he/she would prefer to give money to. The die has two potential outcomes, such as black or white; if one outcome occurs (e.g., black), the player can give the money to the preferred recipient (by placing it into a cup); if the other outcome occurs (e.g., white), the player is supposed to give the money to the unpreferred recipient (by placing it into a different cup). Importantly, the player does not reveal his/her choice to the experimenter. Therefore, the player can cheat. Researchers cannot detect specific instances of cheating, but they can detect likely cheating among groups by comparing the distribution of allocations to the binomial distribution expected by chance.

The participants played a particular version of the Random Allocation Game called the Self Game, in which participants allocated money either to themselves or to an anonymous Hindu from a distant village. They each played 30 rounds.

After playing the game, participants indicated how frequently they

took part in three religious rituals deemed most important by another sample from the same population: personal prayer, the annual pilgrimage of Maha Shivaratri, and the kavadi ritual (described previously).

On average, participants allocated slightly more money to themselves than would be expected from fair play. Neither frequency of personal prayer nor frequency of pilgrimage had any significant effect on the outcome of the Self Game ( $\beta$ s of 0.02 and  $-0.04$ , respectively). However, frequency of participation in the kavadi ritual was associated with fairer allocations ( $\beta = -0.09$ ).

Atkinson (2018) conducted a similar study on the island of Tanna in the Melanesian nation of Vanuatu. Participants were recruited from a Christian village and a cluster of *Kastom* (traditional/indigenous) hamlets. Participants played the Self Game (allocating money to oneself versus a distant coreligionist). Atkinson considered the relationship between money allocations and frequency of two religious rituals: (1) church attendance, a community ritual performed at the Christian village, and (2) prayer, a private ritual performed (in unique ways) at both the Christian and *Kastom* sites. As with the Mauritian participants (Xygalatas et al., 2018), some Tannese participants cheated to benefit themselves. Atkinson found no relationship between money allocation and frequency of church attendance (statistics unreported). However, frequency of prayer was positively associated with allocation to the distant coreligionist (and therefore less cheating) ( $OR = 1.59$ ).

Tan and Vogel (2008) conducted a trust game experiment (Berg, Dickhaut, & McCabe, 1995) at a German university. Participants completed a self-report religiosity scale (De Jong, Faulkner, & Warland, 1976) which measured three dimensions of religiosity: *belief*, *experience*, and *ritual*. The ritual dimension measured the following: how often participants attended worship services, whether or not participants belonged to a church, how often participants contributed funds to church, how often and why participants read the Bible, and in how many religiously affiliated organizations, groups, or activities they participated. Trustees who were higher in religiosity sent a larger proportion of their money back to trustors than trustees who were lower in religiosity. This effect was driven specifically by the dimensions of *ritual* ( $\beta = 0.10$ ) and *experience*.<sup>3</sup> It is worth mentioning that this study utilized a small sample ( $n = 48$ ) and should thus be interpreted with caution, though participants each completed multiple trials, increasing power.

Soler (2012) studied Brazilian adherents of Candomblé, an Afro-Brazilian religion. Using an 11-item scale (the Candomblé Religious Signaling Scale, or CRSS), she asked 253 adherents to indicate the degree to which they participated in religious practice, such as attending religious feasts, avoiding forbidden foods, fasting, lighting candles, dressing in white on Fridays, and regularly visiting the *terreiro*, the place of religious congregation. Individuals with higher scores on the CRSS reported having conducted a greater number of cooperative acts toward other members of their *terreiro* in the past ( $n = 206$ ;  $\beta = 0.31$ ). Higher CRSS scores were also associated with greater contributions to a public goods game played with other members of their *terreiro* ( $n = 199$ ;  $\beta = 0.22$ ).

A study conducted by Orbell et al. (1992) produced evidence that religious actors may be particularly cooperative, but perhaps only with ingroup members. We will discuss this study in more detail later (see “Does religious practice signal ingroup commitment?”).

Sosis and Ruffle (2003, 2004) conducted a cooperative game with members of secular and religious Israeli intentional communities (*kibbutzim*). This “common-pool-resource dilemma” economic game

involved two players with a pool of 100 shekels available to them both. Each player indicated how much of the money he or she wished to claim. If the total amount requested by the players was greater than 100 shekels, neither player received anything. If not, each player received the amount he/she requested and the unclaimed money (the money remaining after the players made their requests) was increased by 50% and split evenly among the two players. The number of shekels requested by players was used as a measure of cooperation, with fewer shekels indicating greater cooperation. Gameplay was anonymous, but participants knew that their game partners were members of their *kibbutz*.

Among religious men, frequency of synagogue attendance was negatively correlated with the number of shekels claimed ( $r = -0.18$ ). When the authors controlled for several factors, such as the degree to which participants predicted their game partners would cooperate, religious men requested fewer shekels than religious women, nonreligious men, and nonreligious women. This result was driven by the men who attended synagogue daily requesting fewer shekels than other participants. The relationship between cooperation and synagogue attendance was not found among religious women ( $r = 0.05$ ). Among the secular *kibbutzim*, men and women were equally cooperative.

Dengah (2017) interviewed 56 active members of a neoPentecostal church in Brazil. Frequency of volunteering for the church significantly and positively related to both frequency of church service attendance (Somers' delta = 0.39) and frequency of offering money (Somers' delta = 0.25). If church service attendance and money offers are considered costly behaviors and volunteering for the church is considered a form of ingroup cooperation (or community service, as Dengah referred to it), these data support the hypothesis that costly religious behaviors are signals of a willingness to cooperate with the religious ingroup. However, volunteering for the church may be thought of as a costly behavior itself, so perhaps what this study shows is that costly religious behaviors correlate with each other.

In summary, evidence regarding the prosociality of religious actors is mixed. One study (discussed in Fischer & Xygalatas, 2014; Xygalatas et al., 2013) suggests that religious actors may be more generous toward members of their ingroup, but another study failed to obtain strong evidence for this (Bulbulia & Mahoney, 2008). A direct investigation of trustworthiness found evidence that religious actors are especially trustworthy (Tan & Vogel, 2008), but two studies (Atkinson, 2018; Xygalatas et al., 2018) found that religious practice was associated with less selfish cheating for only two out of five measured religious behaviors. The results of four studies (Dengah, 2017; Orbell et al., 1992; Soler, 2012; Sosis & Ruffle, 2003, 2004) suggest that religious actors may be particularly cooperative, although this relationship was qualified in two studies (Orbell et al., 1992; Sosis & Ruffle, 2003, 2004). Overall, the evidence is inconclusive.

### 2.1.2. Are religious actors perceived as highly trustworthy and prosocial?

Ruffle and Sosis (2010) conducted an experiment with Israeli Jews. Participants were asked to imagine they had traveled to an unfamiliar Israeli town where they participated in a local group activity with strangers. Participants imagined one of three group activities: watching a music performance, taking a workout class at a fitness center, or praying (at a synagogue for men; with a women's prayer group for women). Next, participants were told to imagine that they had left their wallet behind at the location of the group activity. Participants indicated how likely they felt it was that their wallet would be returned to them. This was taken as a measure of trust in the strangers. On average, participants in the praying condition indicated greater trust compared to participants in the music and workout conditions (Cohen's  $d = 0.84$  and  $0.39$ , respectively).

Purzycki and Arakchaa (2013) investigated costly religious behaviors in the Tyva Republic of Inner Asia. Ritual cairns, consisting of piles of stones and tree branches, are an important part of Inner Asian religious traditions. At ritual cairns, Tyvans burn incense and leave food,

<sup>3</sup> According to the text of Tan and Vogel (2008, p. 840), the effect was driven by the dimension *belief*; however, Table 5 (Tan & Vogel, 2008, p. 843) shows that the effect was driven by the dimensions *experience* and *ritual*, and not the dimension *belief*. A personal communication with J. Tan (July 29, 2018) confirmed that the text was in error, whereas Table 5 was correct: The effect was driven by *experience* and *ritual*, but not *belief*.

tobacco, money, or prayer ties for local spirits. Purzycki and Arakchaa tested and supported the hypothesis that Tyvans who perform rituals at cairns are trusted more than Tyvans who do not; a fictional character who always left offerings at cairns was rated by Tyvan participants as more trustworthy than fictional characters who did not ( $r = 0.24$ ).

Hall et al. (2015) conducted a series of experiments designed to investigate the effect of religious costly signaling on perceived trustworthiness from the perspective of both ingroup and outgroup members. In the first two experiments, Christian undergraduates rated fictional target persons as more trustworthy when the targets said that they gave 10% of their income to a religious charity (partial  $\eta^2 = 0.08$  and  $0.03$  for Experiment 1 and Experiment 2, respectively). This was the case both when the target was a Christian who donated to a Christian charity and when the target was a Muslim who donated to a Muslim charity.

In the third experiment, the intended costly signal consisted of obeying religious dietary bans. The targets (Catholic or Muslim) were described as attending a business dinner at a restaurant which did not offer religiously permissible food. In one condition, the targets chose to eat the forbidden food; in another condition, they did not; and in a third condition, no information was given regarding the targets' choice. The participants rated the targets as more trustworthy when they avoided food (thus obeying a religious ban) than when they ate (disobeying a ban) or when there was no information; partial  $\eta^2 = 0.03$ .

In the fourth experiment, Christian participants read one of two vignettes about a target who either behaved in a moral and trustworthy manner (returning a lost wallet with all its contents) or in an immoral and untrustworthy manner (keeping the money in the wallet). They were then asked which of three options was most likely: (1) the target was a Catholic, (2) the target was a Catholic who followed all the rules of his religion, such as dietary rules, or (3) the target was a Catholic who disregarded all the rules of his religion, such as dietary rules. The first option (the target was a Catholic) is the correct choice, because the second and third options are subsets of the first; that is, Catholics who follow religious rules and Catholics who break religious rules are subsets of the larger set of all Catholics. However, on tasks like this, participants may be lured into choosing an incorrect subset option if it seems representative of the target (Tversky & Kahneman, 1983).

When the target behaved in a trustworthy manner, participants more often picked the second choice (the target was a Catholic who followed the rules) than the third (the target was a Catholic who ignored the rules);  $r = 0.12$ . When the target behaved in an untrustworthy manner, participants more often picked the third choice (the target was a Catholic who did not adhere to the rules) than the second (the target was a Catholic who followed the rules);  $r = 0.73$ . The same pattern of results was obtained from participants who were given a Muslim version of the options (the target was a Muslim, a Muslim who followed all the rules of his religion, or a Muslim who disregarded all the rules of his religion);  $r = 0.29$  (trustworthy behavior) and  $r = 0.47$  (untrustworthy behavior).

Northover and Cohen conducted multiple experiments similar in design to those of Hall et al. (2015). In one experiment, Muslim North American university students rated a target as more trustworthy when he was described as observing all of his religion's rules than when he was described as not observing all of his religion's rules (partial  $\eta^2 = 0.17$ ; Northover & Cohen, 2015–2017). This was the case both when the target was Muslim, like the participants, and when he was Catholic, a religious outgroup member. A replication of the experiment obtained the same general results among Catholic students (partial  $\eta^2 = 0.10$ ) and atheist/agnostic students (partial  $\eta^2 = 0.03$ ) at Arizona State University.

In another experiment, non-Muslim Amazon Mechanical Turk (from now on, "MTurk") workers in the United States rated a Muslim target as more trustworthy when he obeyed Islamic dietary laws than when he disobeyed them (Cohen's  $d$ s of  $0.42$  and  $0.34$ ; Northover, Bigman, & Cohen, 2016). This experiment was replicated with a similar sample and obtained the same results (Cohen's  $d$ s of  $0.52$  and  $0.38$ ).

In a final experiment, US non-Hindu MTurk workers rated a Hindu vegetarian target as more trustworthy when he abstained from eating

meat than when he ate meat (Northover & Cohen, 2017b). This was the case both when the target's reason for being vegetarian was religious and when it was secular (Cohen's  $d = 0.70$ ).

In a series of experiments, McCullough et al. (2016) asked anthropology students at the University of Connecticut to rate the trustworthiness of male faces. Some of the faces bore Christian religious markers—a cross of ashes on the forehead like those worn by some Christians on Ash Wednesday (Experiment 1 and 2), or a cross necklace (Experiment 3). The faces that bore these religious badges were judged to be more trustworthy than the same faces without the religious markers. This was the case among both Christian and non-Christian participants.

Ellis et al. (2018) conducted a series of experiments in which participants, in the context of imagining they needed to hire someone to paint their house, evaluated a prospective house painter named Isa. Participants viewed screen captures from Isa's Facebook page and occasionally additional information about Isa, then they rated Isa on his trustworthiness. Each experiment involved multiple versions of Isa, with each participant randomly assigned to one of them.

In the first experiment, Isa's religious affiliation was manipulated: Some participants were told that Isa was a practicing Christian, and others were told that Isa was a practicing Muslim. His religious affiliation was also listed on his Facebook page. Practicing was manipulated as well: In the signaling condition, Isa obeyed religious dietary rules; in the non-signaling condition, he disobeyed the rules. Participants—psychology undergraduates at Arizona State University—gleaned this information from a comment Isa left on his Facebook page about his boss having taken him out for Korean barbecue: In the signaling condition, Isa commented that he could not eat anything because he had given up meat for Lent (Christian condition) or because the food was not halal (Muslim condition). In the non-signaling condition, Isa commented that he had eaten a "ton of meat" despite having given up meat for Lent (Christian condition) or the food not being halal (Muslim condition). In the signaling condition, Isa also displayed a religious badge in his profile picture: He held a rosary (Christian condition) or wore a *taqiyah* (Muslim condition). The target who refrained from eating the religiously forbidden food was trusted more than the target who ate the food, partial  $\eta^2 = 0.02$ . A similar second experiment with MTurk workers (in contrast to the first experiment's undergraduates) also found that targets who ate the food in violation of their religious values were trusted less than those who did not eat the food, partial  $\eta^2 = 0.01$ .

We will discuss the third experiment later (see "Mediators"). In the final experiment, the Christian version of Isa was removed; Isa was either a Muslim or a vegetarian. Once again, he either followed dietary rules by abstaining from meat or broke those rules by eating meat. As in the other experiments discussed above, Isa was rated as significantly more trustworthy when he avoided meat, including when he was a vegetarian (partial  $\eta^2 = 0.02$ ).

An experiment conducted by Northover, Ayers, Krems, and Cohen (2017) suggests that Muslim badges may increase perceived trustworthiness among ingroup members but not outgroup members. We will discuss this study in more detail later (see "Does religious practice signal ingroup commitment?").

Chia and Jih (1994) asked mostly Christian high school students in Illinois to judge images of people. Each student was shown images of four women and asked to choose the one with whom they would most associate certain positive traits, including trustworthiness. For half of the students, one of the women was dressed as a Catholic nun; for the other half, she was dressed casually. This woman was chosen as the individual most likely to possess positive traits more often when she was dressed as a nun than when she was dressed casually.

The students repeated the procedure with images of four men. For half of the students, one of the men was dressed as a Catholic brother; for the other half, he was dressed casually. The pattern of results was the same as it was for the woman: The man was chosen as most likely to possess positive traits more often when he was dressed in Catholic



clothing compared to casual clothing.

The researchers carried out the same experiment with Muslim secondary school students in Malaysia. Malaysian students did not rate the targets more positively when they wore Catholic attire; in fact, target ratings were slightly lower when they wore Catholic attire.<sup>4</sup>

Shaver, Lang, et al. (2018) studied the effect of religious badges on perceived trustworthiness in Mauritius. Christian and Hindu Mauritians rated the trustworthiness of ten male target faces. Five targets were of Afro-Mauritian ancestry (and thus of ingroup ancestry for Christian participants), and five were of Indo-Mauritian ancestry (and thus of ingroup ancestry for Hindu participants). Some of the targets displayed a religious badge—either a cross pendant necklace (a Christian badge) or white prayer ashes on the forehead (a Hindu badge).

Compared to targets of ingroup ancestry with no religious badge, targets of ingroup ancestry with a religious ingroup badge were rated as more trustworthy, but not significantly so. Targets of ingroup ancestry with a religious *outgroup* badge were rated as significantly *less* trustworthy. Religious badges had seemingly little effect on targets of outgroup ancestry.

Singh and Henrich (2020) also made use of fictional targets when investigating bans among the Mentawai of Siberut Island, Indonesia. The Mentawai are a people who practice a traditional shamanic religion. The researchers presented 68 Mentawai villagers with information on two fictional shamans. Shamans from this culture submit to certain taboos, and participants were informed that both shamans obeyed all of the taboos. However, one of the shamans also denied himself resources that were not taboo. Participants judged this one to be more generous and trustworthy than the other (mean estimated probability of choosing the more abstaining shaman over the minimally abstaining shaman  $Pr = 0.88$ ).

Power (2017a) conducted a 20-month field study in two South Indian villages populated by Hindus and Christians. Power's research team asked 782 adults (97% of the population) to list the names of those among the villagers who possessed certain qualities considered desirable by the villagers, including generosity. Power then compared these name lists to information concerning individuals' religious practices—whether or not they worshipped at a church or temple at least once a week, the frequency of participation in public rituals weighted by their cost (as judged by a random sample of villagers), and, for Hindus, whether or not they often became possessed by a deity.

Villagers who attended a church or temple for worship at least once a week were more likely to be nominated by other villagers as being generous ( $OR = 1.83$ ). To a lesser extent, public rituals were also associated with generosity; the greater a villager's frequency and costliness of public rituals, the more likely that villager was to be nominated as generous ( $OR = 1.04$ ). Possession, however, was not significantly related to generosity nominations ( $OR = 0.62$ ).

Widman et al. (2009) asked psychology students to rate targets on their kindness and morality. Participants with high scores on a doctrinal orthodoxy scale rated targets as kinder and more moral when the targets wore cross necklace pendants ( $\eta^2 = 0.20$ ); participants with low doctrinal orthodoxy scores (by median split) did not rate targets significantly differently when they did or did not wear crosses ( $\eta^2 = 0.12$  [D. Widman, personal communication, September 17, 2019]). However, the total sample size was quite small ( $n = 37$ ), and thus the results should be interpreted cautiously.

In summary, the weight of evidence suggests that religious actors are perceived as particularly trustworthy by ingroup members. Several studies suggest that religious actors are also perceived as trustworthy by

outgroup members, whereas other studies do not. Two studies (Power, 2017a; Singh & Henrich, 2020) suggest that religious actors are perceived as especially generous.

### 2.1.3. Do religious actors receive high levels of trust and prosociality from perceivers?

Recall the study conducted by McCullough et al. (2016) in which students rated male target faces bearing Christian badges as more trustworthy than the same faces without badges. In a trust game, the religiously-marked target men were also offered more money than the unmarked men, by both Christian and non-Christian participants.

In an electroencephalography study, Blais et al. (2018) measured participants' neural activity while the participants played a computer coin toss game. The game purportedly involved two players. Participants were told their game partner was in another room, but participants actually played against a computer. Participants were shown their supposed game partner's profile, which included a photo, name, and some facts about the partner. (To sell the deception, participants were asked to complete a profile for themselves which, they were told, would be seen by their game partner.). Based on the profiles, participants learned that their fictional game partner was either a Christian or a Muslim and that the target either practiced ("I almost always volunteer for causes associated with my religion") or did not practice ("I never volunteer for causes associated with my religion"). Participants were all self-reported Christians.

Participants were told that one player, the *reporter*, would flip a coin and tell the other player, the *receiver*, the outcome of the coin flip (i.e., heads or tails). The reporter could lie about the outcome or tell the truth. The receiver's job was to guess if the reporter was telling the truth after each coin flip. Participants were told that they were randomly assigned to the role of receiver, and thus their partners were reporters. Participants were furthermore told that they would win money if their guesses were correct for 80% of the coin flips. Therefore, if a participant indicated that his/her partner was telling the truth, this was considered a decision to trust; and if a participant indicated that his/her partner was lying, this was considered a decision to distrust. Participants played 100 rounds (i.e., 100 flips of the coin).

All game partners (i.e., the computer) told the truth 66% of the time, and participants generally came to trust their partners 66% of the time, regardless of their partner's religious affiliation and practicing status. It seems that participants paid more attention to their partner's behavior than their partner's profile information. In the first round, before participants observed any partner behavior (i.e., telling the truth versus lying), 45 trust decisions were made for practicing partners, whereas 43 trust decisions were made for nonpracticing partners (partial  $\eta^2 = 0.01$ ). This difference was not statistically significant.

However, the relation of neural responses with trust decisions differed for participants in the practicing condition compared to participants in the nonpracticing condition. For participants with practicing partners, there was a positive correlation between alpha suppression over parietal cortex and trust decisions, but that same correlation was negative for participants with nonpracticing partners. Alpha suppression is likely reflective in this experiment of a mindset to trust (vs. not) an interaction partner.

This pattern of correlations tracked whether people were interacting with religious actors (versus not), and not whether the interaction partner was Christian or Muslim, supporting the idea that religious behaviors trigger similar trust processes when the religious actor and perceiver share a religious group affiliation and when religious group affiliations differ.

Recall Shaver, Lang, et al.'s (2018) study in which Christian and Hindu Mauritians rated the trustworthiness of ten male target faces who were either of Afro-Mauritian or Indo-Mauritian ancestry and who sometimes displayed religious badges. Participants also played a trust investment game. This was much like the standard trust game, but instead of sending money to one trustee, the participants could divide

<sup>4</sup> We were unable to obtain standardized effect sizes for this study; the statistics necessary to compute standardized effect sizes were unreported and neither Chia nor Jih could (understandably) locate the 28-year-old data; E. Chia, personal communication, September 13, 2019; C-S. Jih, personal communication, September 11, 2019.



their endowment among the ten targets. For example, an individual participant might keep 10% of his endowment and give 30% to one target, 40% to a second target, and 20% to a third target.

Compared to targets of ingroup ancestry with no religious badge, targets of ingroup ancestry with an ingroup religious badge were significantly more likely to receive money from participants ( $OR = 3.96$ ) and received a significantly greater amount of money. Although targets of ingroup ancestry with an outgroup badge were rated as significantly less trustworthy (discussed previously), they were not less likely to receive money ( $OR = 1.54$ ) nor did they receive a lesser amount of money. Religious badges had seemingly little effect on targets of outgroup ancestry ( $OR = 1.16$  for ingroup religious badge;  $OR = 1.21$  for outgroup religious badge).

Interested in whether religious behavior can serve as a form of insurance, Chen (2010) analyzed Indonesian household data collected from May 1997 to August 1999—just before, during, and after the Indonesian financial crisis. Chen investigated whether a household's religious behaviors (i.e., sending children to expensive Islamic schools and participating in communal Qur'an study) influenced the likelihood of credit constraint. A household was deemed credit constrained if it lacked necessities and the money to buy them for the following week, and therefore required credit or charity to obtain food.

Households most affected by the financial crisis switched a greater number of their children to Islamic schools, even though Islamic schools were more expensive than non-Islamic schools. Households that increased the number of children they sent to Islamic schools at the peak of the financial crisis experienced greater reductions in the likelihood of credit constraint 4 months later.

Results were similar regarding Qur'an study groups. The more negatively impacted by the financial crisis households were, the more likely they were to increase their attendance at communal Qur'an study. Households that increased their Qur'an study group attendance during the financial crisis were 49% less likely to experience credit constraint 4 months later. Households that did not increase attendance were also less likely to experience credit constraint, but to lesser degrees: 23% for households with unchanged attendance, 21% for households with decreased attendance, and 6% for those that did not attend at all.

Chen (2010) hypothesized that religion serves as a form of insurance, with individuals contributing resources to the religious ingroup and those resources being redistributed to those who behave most religiously. Among Indonesian villages, donations were usually given to mosques during communal Qur'an studies. Part of the donated money could be given to people in need. In a report prepared for the World Bank, religious learning groups (which include communal Qur'an study groups) were cited by Indonesians as one of the most important, effective, and trustworthy means of dealing with poverty (Mukherjee, 1999). Perhaps individuals who sent their children to Islamic schools and spent time at communal Qur'an study received aid from coreligionists.

Indonesians seemed to increase their religious behavior strategically (not necessarily consciously), as households affected most negatively by the financial crisis were most likely to increase religious behaviors. Furthermore, this seeming effect of economic distress on religious behavior was not found in areas where credit was offered by banks or microfinance institutions.

Previously, we discussed an experiment in which Israeli Jews imagined they had watched a music performance, exercised, or prayed with a group of strangers (Ruffle & Sosis, 2010). Participants were told that after the activity, one of the strangers from the group asked to use their phone. Participants indicated how long they would allow the stranger to use their phone; this served as a measure of altruism. On average, participants in the praying condition indicated greater altruism compared to participants in the music (Cohen's  $d = 0.48$ ) and workout (Cohen's  $d = 0.55$ ) conditions. It is worth considering that the greater

(hypothetical) altruism in the praying condition may have been the result of religious priming (Shariff, Willard, Andersen, & Norenzayan, 2015).<sup>5</sup>

A study conducted by Soler (2012) with 253 Brazilian adherents of Candomblé was also discussed earlier. Higher scores on Soler's Candomblé Religious Signaling Scale were associated with self-reported instances of receiving cooperation, although the relationship was marginally significant and the effect size was rather small (partial  $r = 0.13$ ).

Finally, recall the field study conducted by Power (2017a) in two South Indian villages populated by Hindus and Christians. Remember that villagers who attended a church or temple for worship at least once a week were more often nominated by other villagers as generous. Power (2017b) also found that villagers who attended a church or temple at least once a week were more likely to be in a reciprocal relationship in which both individuals sought support from each other in the form of loans, help finding work, advice, babysitting, companionship, and so on ( $OR = 1.13$  for one village and 1.27 for the other). This effect seemed largely driven by regular worshippers being perceived as generous. To a lesser degree, villagers who performed costlier and more frequent public rituals were also more likely to be in a reciprocally supportive relationship; for example, individuals who had completed two difficult and costly acts in the previous year were 1.2 and 1.1 times as likely. However, the association between public ritual and reciprocal relationships was not apparently driven by perceived generosity. Villagers who became repeatedly possessed were less likely to be in a reciprocally supportive relationship, significantly so for one village ( $OR$  of 0.87 and 0.93). To clarify these effect sizes, Power (2017b, p. 3) calculated that a 30-year-old woman of the Akamutaiyar caste living in one of the villages was predicted to be in a reciprocal relationship with another woman of the same caste with one friend in common about 4.1% of the time. If she worshiped regularly, the percentage was 4.6; if she had performed one costly and difficult public ritual in the previous year, the percentage was 4.4; and if she was recurrently possessed, it was 3.5.

In summary, two studies suggest that religious actors, compared to nonpracticing individuals, are more likely to be trusted by ingroup members (McCullough et al., 2016; Shaver, Lang, et al., 2018). One study did not find behavioral evidence for this (Blais et al., 2018), although it did intriguingly find a difference in neural activity during trust decisions between participants with practicing partners and those with nonpracticing partners. Religious actors may be more likely to receive help and cooperation from ingroup members (Chen, 2010; Power, 2017b; Ruffle & Sosis, 2010; Soler, 2012). Furthermore, one study (McCullough et al., 2016) suggests that religious actors are also trusted more by outgroup members, although results from another study (Shaver, Lang, et al., 2018) suggest that religious badges may have no effect on trusting behaviors with outgroup members. Overall, the evidence thus far suggests that religious actors receive high levels of trust and prosociality from perceivers.

#### 2.1.4. Do practicing groups possess high levels of trust and prosociality?

Recall the study conducted by Xygalatas and colleagues (Fischer & Xygalatas, 2014; Xygalatas et al., 2013) involving the Mauritian Hindu festival of Thaipusam. The authors found that on average, participants who had just performed or observed the high-ordeal kavadi ritual (involving pain, injury, and physical effort) donated more money to a Hindu temple than participants who had just completed the low-ordeal ritual (involving prayers and singing). Indeed, kavadi observers donated more money (Cohen's  $d = 1.20$ ) than kavadi performers (Cohen's  $d = 0.73$ )—although not significantly so ( $p = .15$ ). Among those who either performed or observed the kavadi ritual, the greater the amount of perceived pain involved in the ritual, the greater the donations,  $r = 0.36$ .

<sup>5</sup> We thank an anonymous reviewer for suggesting this.

Sosis (2000) investigated intragroup cooperation among communes. Using commune longevity as an index for intragroup cooperation, he collected historical data on 200 American communes from the nineteenth and early twentieth centuries. Sosis found that religious communes lasted longer than secular communes. The mean lifespan of secular communes was 6.4 years, whereas the mean lifespan of religious communes was 25.3 years, and within the first two years of existence, secular communes were four times as likely to dissolve as religious communes. It is worth noting that Sosis obtained these results despite excluding all Hutterite communes, which were deemed too successful for analysis. The Hutterites have established a greater number of communes than any other group and these communes have outlasted all others in the United States; North American Hutterite colonies still exist today (Hutterian Brethren, n.d.). Because Hutterite communities are religious, inclusion would have moved results even further in support of Sosis's hypothesis.

Sosis and Bressler (2003) then evaluated required behaviors, badges and bans—which they referred to as *costly requirements*—among the communes. Costly requirements were related to clothing, hairstyle, trial periods for membership, surrendering material belongings, fasting, and knowledge (e.g., of the Bible). Non-monogamous marriage (e.g., group marriage, free love) was considered costly because it limited members' ability to socialize outside the commune, where they may have been perceived as sexual deviants. Additional costly requirements included celibacy and mutual criticism (i.e., members of the commune publicly criticizing each other). Finally, there were costs related to family structure: families not residing together, and parents forfeiting 'ownership' of their children to the group. Costly requirements also included bans and restrictions on (a) the consumption of coffee, alcohol, or other drinks; (b) the consumption of meat or other foods; (c) the use of tobacco; (d) the ownership of photographs; (e) the use and ownership of technology and other items; (f) the wearing of jewelry; (g) communication with the outside world; and (h) gambling. The researchers found enough information regarding costly requirements for 83 communes; these were included in analyses.

Consistent with the hypothesis that religious practice increases intragroup cooperation, there was a positive correlation between the number of costly requirements and commune longevity among religious communes, but not secular communes. In other words, the greater the number of costly requirements imposed on members by religious communes, the longer the religious communes lasted.

However, the number of costly requirements did not predict whether a commune failed as a result of economic troubles nor whether it failed as a result of internal dispute. The communes in the data set failed for various reasons, such as persecution and natural disasters; Sosis and Bressler (2003) felt that failure due to economic troubles or internal dispute reflected a failure of intragroup cooperation. The number of costly requirements did not predict these particular causes of commune dissolution, even when considering religious communes exclusively.

Sosis et al. (2007) investigated male rituals from 60 diverse societies spread across the globe. If costly rituals are an indicator of cooperative intent and/or a facilitator of intragroup cooperation, one would expect to find costlier male rites associated with these markers of cooperation. However, there was no relationship between the overall costliness of a society's male rites—as judged by a panel of graduate students—and dichotomous measures of male cooperative labor/production, the sharing of food acquired by males, or cooperation as a social value. On the other hand, male rites were costlier in societies with frequent warfare than in societies with infrequent or no warfare; this was true for external as well as internal warfare. Warfare was taken in the paper to be a cooperative endeavor, so these data partially support a link between costly rites and cooperation.

In summary, it is unclear whether or not practicing groups possess high levels of trust and prosociality. Xygalatas et al. (2013) found evidence that witnessing the costly religious behavior of others may induce generosity toward one's community. Sosis and Bressler (2003) found a

positive relationship between commune longevity and religious requirements, but it is uncertain how well commune longevity indicates intragroup cooperation. And Sosis et al. (2007) found that costly male rituals were related to the prevalence of warfare, but not to seemingly more direct measures of cooperation.

### 2.1.5. Conclusion

Does religious practice enhance trust and prosociality? Considering the empirical literature on the whole, we would answer with a tentative and qualified "yes". Research suggests that religious actors are believed to be especially trustworthy by ingroup members. In our view, this claim enjoys the strongest evidential support. In accordance, empirical findings also suggest that religious actors are especially likely to receive help and cooperation from, and to be trusted by, ingroup members. Despite this, it is unclear whether or not religious actors actually *are* trustworthy and generous, due to mixed findings. Finally, empirical investigations of intragroup cooperation are currently too few in number and have obtained results too inconsistent to draw any conclusions.

## 2.2. Does religious practice signal ingroup commitment?

We have so far discussed evidence relating to the effect of religious practice on trust and prosociality within and between groups. However, costly religious behaviors, badges, and bans were theorized to enhance trust and prosociality *within groups*, as they are proposed to signal commitment to the *ingroup* (E. Berman, 2000; Irons, 1996a, 1996c, 2001; Sosis, 2000; Sosis & Alcorta, 2003) and the *ingroup's* moral code (Irons, 1996a, 1996c, 2001). Discussing his experience with the Yomut Turkmen, Irons stated,

One conspicuous message about social behavior conveyed by these numerous signals was a division of the human world into an in-group and an out-group, and a message of commitment to cooperation to the in-group. Most world religions send a message of the sort. (2001, p. 300).

Some studies suggest, however, that religious practice may enhance trust and prosociality between groups (e.g., Hall et al., 2015), so we address this issue here.

### 2.2.1. Are religious actors committed to their Ingroup?

If costly religious behaviors, badges, and bans signal ingroup commitment, predictions can be made about the attitudes and behaviors of religious actors. Compared to nonpracticing individuals, religious actors should behave more trustworthily and prosocially when interacting with ingroup members. In our judgment, the evidence on this is currently inconclusive. However, for the sake of argument, let us suppose it is true that religious actors are particularly trustworthy and prosocial when dealing with members of their group. Does this mean they are committed to their ingroup? Maybe. Or maybe this indicates that religious actors are trustworthy and prosocial with people generally.

If costly religious practice signals commitment specifically to the ingroup, and not commitment to people generally, one would expect religious actors' increased trustworthiness and prosociality to be particular to or greater for their ingroup. Religious actors should show ingroup favoritism by being more trustworthy and prosocial with ingroup members than with outgroup members, and by indicating more positive attitudes toward ingroup members than toward outgroup members.

Unfortunately, we know of little research comparing the prosocial behavior of religious actors toward ingroup versus outgroup members. The limited available evidence, however, suggests that religious actors may favor ingroup members.

Orbell et al. (1992) compared cooperation among residents of Logan, Utah with cooperation among residents of Eugene-Springfield, Oregon, using the prisoner's dilemma game. Frequency of church attendance was positively correlated with cooperation, but only for Mormons in Logan.

(Mormons in Logan:  $r = 0.27, 0.15,$  and  $0.16$ . Non-Mormons in Logan:  $r = -0.02, -0.10,$  and  $-0.00$ . Participants in Eugene-Springfield:  $r = -0.09, 0.05,$  and  $-0.17$ .) Mormon participants in Logan probably figured they were playing with members of their church, because they knew they were playing with locals, and about 75% of locals were Mormons. This suggests that religious actors (e.g., those who attend church frequently) are more cooperative than nonpracticing individuals with ingroup members, but not necessarily with outgroup members. However, it is also possible that the Mormon participants would have been cooperative even if they had played with non-Mormons; the data collected cannot rule this out.

In the study by Shaver, Lang, et al. (2018) in which Christian and Hindu Mauritian participants played a trust investment game, those who reported a higher frequency of temple/church attendance<sup>6</sup> sent significantly more money to targets of ingroup ancestry displaying an ingroup religious badge and significantly less money to targets of outgroup ancestry displaying an outgroup religious badge. This suggests that religious actors trust other religious actors from their ingroup but distrust religious actors from outgroups.

We are primarily interested in how religious practice relates to prosociality toward ingroups versus outgroups, but having found only two empirical studies of this sort, let us also consider the relationship of religious practice to group identity. Research suggests that participating in massive religious group events can strengthen participants' religious identity (Alnabulsi, Drury, Vignoles, & Oogink, 2020; Khan et al., 2016). One might therefore expect the participants to show less tolerance for religious outgroups; some studies suggest that more religious people are less tolerant of religious outgroups (Hunsberger & Jackson, 2005). However, high-cost collective religious rituals are associated with more tolerance for religious outgroups.

Xygalatas et al. (2013) investigated identity in the context of the Hindu festival of Thaipusam. Hindu Mauritian participants indicated their identity on a sliding scale with 'Hindu' on one end and 'Mauritian' on the other. 'Hindu' is a parochial identity, taken by Mauritians to mean *Hindu Mauritian*, whereas 'Mauritian' is a broader identity encompassing 'Hindu', as well as some other religious groups (D. Xygalatas, personal communication, August 26, 2018). Participants who were tested after observing the high-ordeal kavadi ritual identified themselves more broadly (i.e., more 'Mauritian') than participants who were tested after completing a low-ordeal ritual; participants who were tested after performing the high-ordeal kavadi ritual identified themselves more broadly still. The authors argued that ordeal intensity increased feelings of social inclusiveness.

Researchers have obtained similar results among Muslim pilgrims. Muslims are generally expected to make a pilgrimage to Mecca, Saudi Arabia at least once during their lifetime if they are able to (Tarsin, 2015). This pilgrimage, known as the Hajj, takes place over the course of five days every year.

Saudi Arabia caps the number of visas available for pilgrims from each Islamic country. Clingingsmith et al. (2009) surveyed 1605 Pakistanis who had applied for visas for the 2006 Hajj. Because more people applied than could receive Hajj visas, the Pakistani government utilized a lottery. The researchers compared survey responses for individuals who won the lottery and made the Hajj (from now on, "Hajjis") to responses for individuals who lost the lottery and did not make the Hajj. Surveys were completed five to eight months after the Hajj. Hajjis reported less belief and participation in parochial Muslim practices, such as visiting shrines and using amulets, but greater participation in universal Muslim practices, such as fasting and ritual prayer. In other words, the Hajjis' religious practices aligned more closely with those widely accepted in the greater Islamic world, while moving away from

those particular to their local area. Additionally, Hajjis were significantly more likely to say they frequently prayed in the mosque of a different *maslak* (school of thought) than their own. Intriguingly, Hajjis were also more likely to indicate that non-Muslims were equal to Muslims.

Alexseev and Zhemukhov (2015) similarly reported that Russian Hajjis ( $n = 12$ ) expressed a more tolerant and inclusive view of Islam than non-Hajjis ( $n = 16$ ). For example, Hajjis said it was okay for Muslims from one school of thought to perform the Hajj using the rules from another school of thought. Hajjis also expressed more tolerance for outgroup religions.

Alnabulsi et al. (2020) surveyed 1176 Muslim pilgrims from 72 different countries as they were in Mecca participating in the Hajj. Hajjis generally indicated increased Muslim identification since beginning the Hajj, as well as increased positive attitudes toward outgroups (i.e., people from different religions and cultures). These two variables—increase in Muslim identification and increase in positive attitudes toward outgroups—were positively correlated. They even seemingly resulted from the same processes: The Hajjis' perceptions of the crowd as cooperative (i.e., supportive, respectful, and helpful), the Hajjis' positive feelings about being in the crowd, and the Hajjis' perceptions of the crowd as united were all related to both increased Muslim identification and increased positive outgroup attitudes, and these relationships were all mediated by the Hajjis' identification with the crowd (i.e., feeling a sense of unity with the crowd).

We may also consider how ritual frequency and arousal, which are negatively correlated (Atkinson & Whitehouse, 2011), relate to social identity. Whitehouse (2023) has argued that rituals lead to group bonding, and that they do so via two major pathways. The *doctrinal pathway* is that of frequent, routine, low-arousal rituals. Religious actors tend to remember the procedure for these rituals rather than individual episodes of performing these rituals. The doctrinal pathway leads to a form of social bonding called *social identification* in which thinking about one's social role reduces one's thoughts of the self. It may lead to ingroup favoritism and derogation of outgroups. The *imagistic pathway* is that of infrequent, emotionally intense, high-arousal, dysphoric group rituals. Religious actors create episodic memories of particular ritual performances. The imagistic pathway leads to a form of social bonding called *identity fusion*. As the name suggests, the religious actor's identity becomes a fusion of his or her personal self and the group. Identity fusion is stronger than social identification and may lead to extreme behavior for the sake of the group, such as violence or risking one's life.

Alexseev and Zhemukhov (2015) made some intriguing observations which may illustrate the difference between group identity derived from Whitehouse's (2023) doctrinal pathway, and group identity derived from massive collective religious events. Four groups of Russian Muslims—two groups of Hajjis and two groups of non-Hajjis who wanted to perform the Hajj but had not yet been able to—discussed topics introduced by the researchers. The non-Hajjis expressed an exclusive and strict view of their religion. One of them stated the following: "The world is divided into two parts—pure Muslims worshipping only the Almighty Allah and the rest—Shiites, Jews, and whatever...If even one word someone believes in contradicts the Quran, they are not Muslims" (p. 385). According to the authors, the other non-Hajji participants in their discussion group agreed. Non-Hajjis also expressed the opinion that missed daily prayers could not be made up for with extra prayers later. Furthermore, non-Hajjis strictly adhered to rules about Islamic badges: All non-Hajji men had beards, and all non-Hajji women completely covered their hair.

In contrast, the Hajjis talked about the ways in which different Islamic schools of thought were the same, and expressed the opinion that missed prayers could be made up for. Furthermore, they did not strictly adhere to Islamic badge rules: A few of the Hajji women showed some hair, and most of the Hajji men did not have beards, explaining that the Hajj made them realize that a beard did not necessarily make someone a better Muslim.

<sup>6</sup> The paper states this as "frequency of ritual behavior", but participants were asked specifically about temple/church attendance (J. Shaver, personal communication, January 21, 2024).

The religious experiences of the non-Hajjis (Alexseev & Zhemukhov, 2015) were probably dominated by frequent, routine, low-arousal rituals (e.g., five-times-daily prayer). Their outgroup derogation may have thus been produced via the doctrinal pathway. It is not clear how this kind of outgroup derogation relates to ingroup commitment, but we suspect the relationship is not a straightforward positive correlation. The fact that the non-Hajjis more strictly adhered to religious badges than Hajjis and expressed a stricter, less forgiving view of their religion suggests that religious actors who adhere strictly to religious rules may consider their ingroup to be quite small. Coreligionists who seek cooperation from such actors may find themselves excluded from the actor's perceived ingroup, regardless of how committed the actor is to it. However, this is mere speculation; we would like to see relevant data in the future.

In summary, two economic game studies found evidence that religious actors favor ingroup members, showing them greater trust and cooperation than outgroup members. Research on group identity furthermore suggests that religious actors who participate in costly collective rituals develop a stronger religious identity. However, this participation also seemingly leads to an expanded social identity and more positive attitudes toward religious outgroups. Although these findings are not technically mixed, they are counterintuitive: If religious practice broadens an actor's social identity, one would not expect that actor to show ingroup favoritism.

As far as we are aware, little research has investigated whether religious actors are particularly prosocial with their ingroup. This seems an important area for future research. We would particularly like to see research that measures both the inclusivity/exclusivity of social identity and behavioral ingroup favoritism (or lack thereof) in the same participants.

### 2.2.2. How do the effects of religious practice within and between groups compare?

Here we consider the effects of religious practice within groups versus between groups. Empirical findings basically fall into two categories: those that suggest that religious practice fosters trust and cooperation between groups, and those that do not.

We begin with the latter category. In four studies, religious practice seemingly increased trust and cooperation within but not between religious groups.

In the Widman et al. (2009) study, targets were rated as kinder and more moral when they wore a Christian badge, but only by participants with high scores on a doctrinal orthodoxy scale.

In an experimental study of religious badges, Muslim ( $n = 372$ ) and non-Muslim ( $n = 410$ ) women living in the United States rated the trustworthiness of Muslim target women (Northover et al., 2017). Each participant rated a target woman who was wearing a headscarf (a Muslim religious badge) and a target woman who was not wearing a headscarf. Targets with headscarves were rated as significantly more trustworthy than targets without headscarves, but only by Muslim participants.

In the study conducted by Chia and Jih (1994), Illinois high school students associated positive traits such as trustworthiness with targets more often when the targets wore Catholic religious attire; Malaysian students associated positive traits with the targets less often when the targets wore Catholic religious attire. Most of the Illinois students were Christian, whereas the Malaysian students were Muslim. The authors suggested that the Malaysian Muslim participants may have harbored anti-Christian sentiments due to a history of Western domination and conflict.

Recall the Shaver, Lang, et al. (2018) study in which Christian and Hindu Mauritians played a trust investment game. Compared to targets of ingroup ancestry with no religious badge, targets of ingroup ancestry with an ingroup religious badge were rated as nonsignificantly more trustworthy, were significantly more likely to receive money, and received a significantly greater amount of money. On the other hand,

targets of ingroup ancestry with an outgroup religious badge were rated as significantly less trustworthy, and religious badges did not seem to influence ratings of nor investment in targets of outgroup ancestry.

On the other hand, in seven studies, religious practice apparently increased trust and generosity between religious groups—although not necessarily in the same way they did within religious groups.

In the McCullough et al. (2016) study, both Christian and non-Christian participants rated targets as more trustworthy and offered them more money in a trust game when the targets bore Christian badges.

In the study by Hall et al. (2015), Christian undergraduates rated both Christian and Muslim targets as more trustworthy when the targets practiced.

In the similar study by Ellis et al. (2018), participants rated targets as more trustworthy when the targets practiced. Less than half of the participants were Christian and less than 3% were Muslim, yet trust ratings were higher for both Muslim and Catholic practicing targets.

Northover and Cohen (2017b) conducted an experiment in which non-Hindu MTurk workers rated a Hindu target person as more trustworthy when he refrained from eating meat. This effect was retained when considering only targets who had a Hindu religious (as opposed to secular) motivation for eschewing meat. Thus, participants rated a religious outgroup member as more trustworthy when he obeyed an outgroup religious rule.

Recall the study conducted by Ruffle and Sosis (2010) in which Israeli Jews imagined they had either watched a music performance, taken a workout class, or prayed with a group of strangers. Both religious and secular participants indicated more trust and altruism toward strangers who had just participated in a religious activity than they did toward strangers who had just participated in secular activities. In the praying scenario, secular participants indicated as much altruism as religious participants, although they indicated less trust than religious participants.

Northover and Cohen (2015–2017) conducted an experiment in which Muslim university students from North America rated a target as more trustworthy when he practiced, both when the target was Catholic (a religious outgroup member) and when he was Muslim (a religious ingroup member). However, the difference between practicing and not practicing was significantly greater for the Muslim target ( $p < .001$ ). The nonpracticing Muslim target received the lowest trust ratings, and the practicing Muslim target received the highest trust ratings. It seems that the target's religious practice was more important to the participants' trust perceptions when the target was a religious ingroup member.

Finally, recall the electroencephalography study by Blais et al. (2018). The brain activity (i.e., alpha suppression) of the participants, who were Christian, varied with target signaling information, and not with target religious affiliation (i.e., Christian or Muslim).

### 2.2.3. Ingroup commitment or moral commitment?

How do we interpret these mixed results? In the case of religious participants rating or interacting with religious targets, perhaps the participants considered themselves and the targets to be members of the same large ingroup, consisting of all religious people. For example, perhaps Christian participants interpreted Muslim targets' religious practice as a signal of commitment to religious people. However, this seems unlikely considering the results of Hall et al.'s (2015) pilot study: Christian undergraduates were asked to rate several groups on a scale from 1 (*definitely an ingroup*) to 4 (*definitely an outgroup*). Participants gave Muslims a mean score of 3.12; by comparison, they rated Catholics and Non-Catholic Christians as 1.97 and 1.72, respectively. It seems likely, therefore, that religious participants in costly signaling studies consider target people from other religions to be outgroup members.

The relevant findings from these studies relate to the attitudes and behaviors of religious outgroup perceivers. Perhaps the attitudes and behaviors of an outgroup perceiver toward a religious actor depends on the outgroup perceiver's attitude toward the religious actor's group. If



the perceiver has a friendly or neutral attitude toward the actor's group, religious practice may have no effect on the perceiver. On the other hand, if the perceiver feels hostile toward the actor's group, it seems likely that religious practice will reduce trust and prosociality. However, these predictions apply if religious practice only signals ingroup commitment. If religious practice is also taken as a signal of commitment to follow moral rules, these moral signals may enhance or attenuate the effects of ingroup commitment signals or produce an effect where there otherwise would not be one. If a perceiver deems the moral values of the actor's group to be unacceptable, then religious practice is likely to reduce trust and prosociality; perceived value dissimilarity between groups is associated with prejudice, discrimination, and perceptions of threat (Garcia-Retamero, Müller, & Rousseau, 2012; Neuberg et al., 2014; Schwartz, Struch, & Bilsky, 1990). If the perceiver deems the moral values of the actor's group to be good, then religious practice is likely to increase trust and prosociality. Religious practice may also increase trust and prosociality if the perceiver is not familiar with the moral values of the actor's group, as the perceiver may simply assume the moral values are good because the values are religious; religions are often associated with morality (Farkas, Johnson, Foleno, Duffett, & Foley, 2001).

Note that we are proposing that negative, positive, and null effects between groups are all theoretically consistent with the hypothesis that religious practice signals ingroup commitment, so long as it also signals moral commitment (Table 1). Therefore, this hypothesis is difficult to falsify, at least based on the research published so far, which was not designed to tease these two signals apart.

In an attempt to do so, we can imagine a study in which participants indicate how friendly (or hostile) they feel toward a certain religious group, as well as how good they find the group's moral values to be. Participants could then learn about a hypothetical target member of the religious group and, knowing only the target's religious affiliation, rate the target's trustworthiness. This would provide the participant's baseline judgment of the target's trustworthiness. Next, participants could learn about the various ways (behaviors, badges, and bans) the target practices religion; perhaps researchers could provide this information to participants with a vignette or illustrations of the target actor. Participants could then rate the target's trustworthiness a second time. If

**Table 1**

Outgroup Perceiver Judgment of the Trustworthiness and Prosociality of a Religious Actor as a Function of the Perceiver's Attitudes toward the Actor's Religious Group and its Moral Values.

		Perceiver's Attitude Toward the Moral Values of Actor's Group	
		Good or Presumed Good	Unacceptable
Perceiver's Attitude Toward Actor's Religious Group	Friendly or Neutral	Commitment to ingroup: 0	Commitment to ingroup: 0
		Commitment to moral code: +1 Both signals: +1	Commitment to moral code: -1 Both signals: -1
	Hostile	Commitment to ingroup: -1	Commitment to ingroup: -1
		Commitment to moral code: +1 Both signals: 0	Commitment to moral code: -1 Both signals: -2

*Note.* If religious practice signals commitment to one's ingroup and its moral code, an outgroup perceiver's judgment of the trustworthiness and prosociality of a religious actor is likely influenced by the perceiver's feelings about the actor's religious group and moral values. The numbers represent outgroup perceiver judgments of religious actors according to whether religious practice is interpreted as a signal of commitment to the actor's ingroup, a signal of commitment to the moral values of the actor's ingroup, or a signal of both, with positive numbers (negative numbers) indicating that judgments of trustworthiness and prosociality are increased (decreased) by religious practice, and zero indicating no effect.

the results of such a study were consistent with the hypothesis that religious practice signals both ingroup and moral commitment (or at least perceivers believe it does), we would expect them to match Table 1: Among participants who considered the moral values of the target actor's religious group to be good, those with friendly attitudes would judge the target to be more trustworthy compared to baseline, whereas judgments from those with hostile attitudes would not change much on average (Table 1). Among participants who considered the moral values of the target actor's religious group to be unacceptable, the target would receive lower trust ratings compared to baseline levels, especially from participants who felt hostility toward the target actor's religious group.

The instances of religious practice seemingly increasing trust between members of a shared group while simultaneously reducing or failing to influence trust between members of different groups are consistent with the notion of ingroup loyalty signaling; these instances can also be explained in terms of moral signaling, with the groups involved holding different moral values. However, when considering these results in combination with the ingroup favoritism apparently shown by costly actors, we believe the ingroup commitment signaling hypothesis is reasonably supported.

That being said, it seems likely that religious practice can or does signal commitment to moral values as well; outgroup members have shown trust and generosity to religious actors in multiple studies, which is hard to explain in terms of ingroup signaling alone. Indeed, early researchers on the costly signaling theory of religion noted examples of religious practice facilitating between-group trust. Frank (1988) discussed wealthy New York City families seeking Mormon nannies from Salt Lake City. He argued that Mormon church membership is a reliable signal of trustworthiness because an untrustworthy opportunist would find the Mormon experience of constant moral enculturation intolerable and leave the religion; wealthy New York couples thus prefer to hire out-of-state costly signalers over local individuals. Furthermore, Sikhs are perceived as trustworthy commercial partners by non-Sikhs, according to Sosis (2005). Sosis posited that religious behaviors can serve as signals of trustworthiness to outgroup members.

#### 2.2.4. Conclusion

Some studies found evidence that religious practice can promote trust and generosity between groups. Other studies suggest that religious practice does not promote trust, generosity, or cooperation between groups. An important future direction, then, is to figure out why results are inconsistent.

According to the costly signaling theory of religion, costly religious practice signals commitment to the ingroup and its moral values (Cronk, 1994; Irons, 1996a, 1996c, 2001; Sosis, 2000, 2006; Sosis & Alcorta, 2003). We have proposed that in the case of intergroup costly signaling, these two factors—commitment to the ingroup and commitment to moral values—may be independent of each other. Thus, the effect of religious practice may depend on the degree to which two groups share (or approve of each other's) moral values as well as the degree of peace or hostility between the groups.

An interesting finding in need of explanation is that religious practice was associated with an expanded social identity (Alexseev & Zhemukhov, 2015; Clingingsmith et al., 2009; Xygalatas et al., 2013) and greater tolerance for religious outgroups (Alexseev & Zhemukhov, 2015; Alnabulsi et al., 2020; Clingingsmith et al., 2009). It is difficult to reconcile these findings with the ingroup favoritism shown by religious actors. It is perhaps worth noting that expanded social identity was associated with forms of religious practice that are high-cost, infrequent, and highly collective (i.e., the Hajj and the kavadi ritual). Ingroup favoritism was associated with church attendance (Orbell et al., 1992; Shaver, Lang, et al., 2018) and Hindu temple attendance (Shaver, Lang, et al., 2018), which are presumably low-cost (per instance) and frequent, and generally involve smaller numbers of participants at a time. Perhaps different kinds of religious practice signal different things. We will discuss this possibility in the Future Directions section ("Type of

religious practice”).

### 2.3. Summary of empirical evidence

The body of evidence suggests that religious actors are often perceived as trustworthy and prosocial and may be more likely recipients of help and cooperation. That being said, empirical findings do not present a clear picture regarding the actual trustworthiness nor prosocial tendencies of religious actors. As for ingroup commitment, evidence does suggest that religious actors favor members of their group over outgroup members—but it is worth noting that relevant research thus far is sparse.

Most effect sizes were small to moderate. Small to moderate effect sizes over many people (the adherents of whole religions) and over generations (over the course of cultural evolution) tell us that religious practice could be very important in understanding religion. Nonetheless, these effect sizes most often not being large might suggest that there is more to understanding religious phenomena than the effects of religious behaviors, badges, and bans on trust and prosociality.

Some of the effect sizes we previously reviewed were quite large ( $k = 5$ ). Unusually large effect sizes may be explained by sampling error; however, only two of the five large effect sizes were drawn from small samples (those most likely to produce extreme statistics). The [Widman et al. \(2009\)](#) study in which psychology students rated targets on kindness and morality involved a sample of  $n = 37$ . The [Xygalatas et al. \(2013\)](#) study on the kavadi ritual in which observers donated more money to the temple also involved a relatively small number of participants,  $n = 86$  split among three groups. But three of the five large effect sizes came from studies with much larger samples. [Ruffle and Sosis's \(2010\)](#) Facebook study had an  $n$  of over 900. In this study, participants estimated that people with whom they prayed would be more likely to return their lost wallet compared to people with whom they watched a music performance. Two of the large effect sizes came from [Hall et al.'s \(2015\)](#) last study, which utilized the conjunction fallacy and showed that people strongly associate trustworthiness with religious adherence, and untrustworthiness with not adhering. This was also a large  $n$  study of about 400 people.

We are unable to discern a convincing distinguishing feature of the findings with large effect sizes. They represent various geographic locations, religious traditions, methods (e.g., self-report, conjunction fallacy), and outcome variables (e.g., hypothetical behavior, actual donations). Perhaps effects are moderated by cultural context (e.g., peace or hostility between groups, the confounding of religion and race, the degree of acceptability of being or reporting being prejudiced). Or perhaps this is just random variation, following a distribution of effect sizes that are mostly small to medium.

### 3. Future directions

Now we suggest future directions related to (1) the costs and benefits of religious practice, (2) moderators, (3) secular versus religious behaviors, badges, and bans, and (4) mediators.

#### 3.1. The costs and benefits of religious practice

There is much to consider regarding the costs and benefits of religious practice. Here we note various aspects of costs and benefits which we feel deserve more exploration in future research.

##### 3.1.1. Differential costs and benefits

Some researchers have argued that the costs and benefits of religious practice may differ systematically between individuals, such as when opportunity costs are greater for outsiders than ingroup members. We would like to see more empirical investigation of differential costs and benefits in the future. For example, to investigate whether converts receive less substantial benefits from religious practice compared to

longtime members of a religious group ([Carr & Landa, 1983](#)), researchers could ask participants to play a trust game with coreligionists, some of whom were born into the religious group, and others who had converted.

##### 3.1.2. Degree of cost

According to costly signaling theory as developed in economics and biology, signals may be of low cost (or even *no* cost) to honest signalers as long as those signals are costly (or would have been costly) for dishonest signalers ([Higham, 2014](#)). In the realm of religion, dishonest signalers are at risk of punishment, loss of reputation, and ostracism should their dishonesty be discovered ([Barker et al., 2019](#)). As we have discussed previously, religious practice may differ in cost between individuals in other situations as well. That being said, a lot of religious practice is fairly costly even for true believers. Irons stated, “Other things being equal, the costlier the signal the less likely it is to be false” (2001, p. 298). Religious actors vary in the degree of cost they pay for practice, and it is worth asking if that variability tells us something about prosociality.

Religious leaders, such as monks, nuns, and priests, often abide by costlier behaviors, badges, and bans than laypeople from the same religious group ([Singh & Henrich, 2020](#)). For example, in China, Buddhist monastics adhere to a diet without meat, eggs, and fish, whereas Buddhist laity are not obligated to ([Kieschnick, 2005](#)). Jainism provides another example. Although all Jains are expected to abide by five vows, Jain mendicants follow stricter versions of those vows than Jain laity ([Cort, 2001](#)). To give an illustration, one of those vows is *ahimsa*, or nonviolence. For Jain laity, following this vow entails avoiding harm to humans and non-human animals—including insects—and inflicting only the minimum amount of harm necessary for one's survival on plants, water, fire, earth, and air (all of which are considered to be alive); minimum force is allowed, if necessary, for defense ([Shah, 2009](#)). For Jain mendicants, however, following this vow entails avoiding all harm to all of these (i.e., humans, non-human animals, plants, water, fire, earth, and air/wind) ([Cort, 2001](#); [Shah, 2009](#)).

Monastics and priests may take religious practice to an extremely costly level, such as giving up all possessions or practicing lifelong celibacy ([Cort, 2001](#); [Herrou, 2012](#); [Olson, 2008](#); [Powers, 2008](#); [Kirko, 2002](#)). Ancient Roman priests of the Anatolian goddess Cybele even castrated themselves ([Braun, 2008](#); [Burns, 2011](#)). Like milder practice, extreme practice may be taken by perceivers as a signal of commitment to the ingroup and its values. The previously-mentioned study of Mentawai shamans also suggests that perceivers judge religious leaders who abide by restrictive and challenging practice to be powerful and to be psychologically and physiologically different from normal people ([Singh & Henrich, 2020](#)). Similarly, Buddhist monks across Asia are believed by many to possess magical power ([Powers, 2008](#)). These perceptions are probably useful to religious leaders.

Very little of the empirical research we have reviewed investigates religious leaders. The following discussion therefore mainly concerns laity. Although laypeople participate in less costly forms of religious practice on average, they may occasionally engage in extreme rituals (e.g., the kavadi), or undertake high-cost religious acts that last for a significant period of time (e.g., as part of the pilgrimage and festival Kumbh Mela, some Hindus spend a month living in ascetic conditions, eating one meal—which is vegetarian—per day, and devoting themselves to prayer and rituals; [Khan et al., 2016](#)).

We begin with the prosociality of religious actors. Just as it is unclear whether religious actors are particularly prosocial, it is unclear whether religious actors who pay higher costs are more prosocial than those who pay lower costs. In the empirical literature, religious actors who reported higher frequencies of participation in specific religious behaviors were more prosocial in about half of the cases (with both positive and null effects from each study: [Atkinson, 2018](#); [Orbell et al., 1992](#); [Sosis & Ruffle, 2003, 2004](#); [Xygalatas et al., 2018](#)). Religious actors who reported greater average participation in multiple forms of religious

practice were more prosocial in two studies (Soler, 2012; Tan & Vogel, 2008), whereas participants who reported a higher number of hours “in practice” were not (Bulbulia & Mahoney, 2008). Finally, Mauritians who had just performed or watched the high-cost kavadi ritual donated more money than participants who had just completed a low-cost ritual, and the greater the perceived pain involved in the ritual, the greater the donations (Xygalatas et al., 2013).

There is modest evidence that religious actors who pay higher costs exhibit more ingroup favoritism than those who pay lower costs. Frequency of temple/church attendance was associated with ingroup favoritism in one study (Shaver, Lang, et al., 2018) and perhaps in a second (Orbell et al., 1992, although other explanations have not been ruled out).

The relationship between cost and judgment or treatment of religious actors is perplexing. The limited available evidence suggests that cost matters, but perhaps not a great deal. The most straightforward study here is Chen (2010). Around the time of the Indonesian financial crisis, households that increased attendance at Qur’an study or increased the number of children they sent to expensive Islamic schools were less likely to be credit constrained later. This reduction in the likelihood of credit constraint was greater for households with increased practice than it was for households that held their practice steady.

The greater a South Indian villager’s frequency of participation in public rituals weighted by their cost, the more likely that villager was to be nominated as generous (Power, 2017a) and to be in a reciprocally supportive relationship (Power, 2017b). However, regular attendance at a place of worship was more strongly related to the perception of generosity and the likelihood of being in a reciprocally supportive relationship than was the degree of public ritual behavior. Public rituals among the villagers included low-cost acts such as lighting lamps and breaking coconuts, but many rituals were quite costly, such as sacrificing a goat or piercing the body with spears. Some of them required lengthy periods of fasting, risk of physical harm, and pain. Yet, the seemingly low-cost practice of attending church or temple was more closely related to good reputation and supportive relationships. Perhaps the accumulation of regular worship’s time and opportunity costs ultimately led to the perception that regular worship is costlier than the highest degree of ritual behavior. On the other hand, maybe the cost of religious behavior was less influential in the forming of the Indian villagers’ prosocial reputations than other factors. Another interpretation is that cost is more closely related to perceptions of prosociality in some categories of practice (such as church/temple attendance) than in others (such as public ritual). The data cannot speak to this interpretation, because no information on the frequency of church/temple attendance was collected—only whether villagers attended at least once a week or not.

Mentawai participants judged a shaman who abstained from extra resources to be more prosocial than a minimally abstaining shaman (Singh & Henrich, 2020). This suggests that increased costs in the form of self-denial garner religious actors greater reputations for prosociality. However, it made no difference whether the increased self-denial consisted of celibacy every day—seemingly very costly—or the eschewing of meat from three hunted animals—seemingly *not* very costly, given that Mentawai have several sources of meat, such as farmed pigs and chickens and several hunted animals. This might be explained, however, by the forced-choice experimental design: Given the choice of two target shamans, the target who obeyed the required taboos and abstained from additional resources beyond those required was judged by most participants to be more prosocial than the target who obeyed the required taboos but did not abstain from additional resources. Whether the extra restraint was higher in cost (celibacy) or lower in cost (abstention from some kinds of meat), it was still the case that mandatory restraint plus optional restraint was certainly costlier than mandatory restraint alone. Participants were never asked to choose between the extra-abstaining target who avoided meat from three animals (lower in cost) and the extra-abstaining target who was celibate (higher in cost); if they had,

perhaps they would have chosen the celibate shaman.

Northover et al. (2016) conducted two experiments in which high-cost practice did not produce significantly larger effect sizes than low-cost practice. US MTurk workers were randomly assigned to read one of three vignettes about Samir, a Muslim university student. In the costly obedience condition, Samir obeyed Islamic dietary laws, and it was costly for him to do so—it was time-consuming, financially expensive, and required some effort. In the uncostly obedience condition, Samir obeyed the same Islamic dietary laws, but it was easy for him to do so. In the disobedience condition, Samir disobeyed the Islamic dietary laws. The exact costs are worth consideration. The relevant portion of the vignette for the costly obedience condition is as follows:

Samir is a Muslim. According to Islamic law, Muslims must only eat Halal food. Therefore, Samir only eats Halal food. There are no Halal grocery stores or restaurants in town. The closest place to obtain Halal products is a grocery store far from Samir’s apartment. Once a week, Samir takes the bus to this grocery store. He buys enough food for the week and then takes the bus home. It takes about an hour to reach the grocery store and another hour to return home. This grocery store is somewhat expensive for Samir; he would buy less expensive Halal food if he could. Every evening before school, he prepares his lunch for the next day because there is no Halal food on campus. He eats his lunch in the cafeteria with his friends.

In the uncostly obedience condition, the grocery store is just five minutes away, the grocery store is inexpensive, and Samir does not need to prepare his lunch the night before school because he has access to halal food on campus. Samir is following the same religious dietary rules, but it is less costly for him to do so.

Samir received slightly higher trustworthiness ratings in the costly obedience condition compared to the uncostly obedience condition (Cohen’s  $d = 0.10$ ), but not significantly so (Dunnett’s T3:  $p = .72$ ). Northover et al. (2016) replicated this experiment with a second sample and obtained the same pattern of results (Cohen’s  $d = 0.15$ ; Dunnett’s T3:  $p = .41$ ). (Trust ratings in the disobedience condition were significantly lower than trust ratings for both the uncostly and costly obedience conditions.)

These studies suggest that costlier practice does not always produce larger effects. Furthermore, multiple studies found that mere religious badges were associated with significant effects on how the badge-wearers were perceived and treated by others. Irons (1996b) noted that less costly forms of behavior, such as religious garb, can be taken as signs of commitment, “even if less costly and hence less reliable” (p. 20). Religious badges consisted of Catholic nun and Catholic brother clothing (Chia & Jih, 1994), Christian cross necklaces (McCullough et al., 2016; Shaver, Lang, et al., 2018; Widman et al., 2009), a Christian cross of ashes on the forehead (McCullough et al., 2016), Hindu prayer ashes on the forehead (Shaver, Lang, et al., 2018), and Islamic headscarves (Northover et al., 2017). With the exception of headscarves,<sup>7</sup> religious badges such as these do not seem particularly costly. Despite apparently being of low cost, it seems that religious badges relate to the way badge-bearers are perceived and treated. Perhaps perceivers assume badge-wearers perform costly acts, even if the perceivers have not observed those costly acts. For example, a perceiver may assume an individual wearing a cross necklace also attends church regularly. This explanation seems quite likely in the case of Catholic nun and brother clothing; perceivers probably assume a woman dressed as a nun performs many costly religious acts and follows many costly religious rules. On the other hand, perhaps cost is not a greatly impactful factor when perceivers judge religious actors.

<sup>7</sup> Headscarves can reduce a woman’s attractiveness (Jordan et al., 2020; Mahmud & Swami, 2010; Pazhoohi & Hosseinchari, 2014; Swami, 2013), cause headaches (Ansari & Solomon, 2015), and provoke discrimination and abuse (Villa, 2020).



As for the role of cost within practicing groups, the empirical data are again quite sparse. We could mention the positive correlation between religious commune longevity and the number of its obligatory practices (Sosis, 2000; Sosis & Bressler, 2003), but the number of practices does not necessarily equate to degree of cost (Potz, 2023).

Research findings do not paint a clear picture of how variability of practice cost relates to prosociality. We do have some thoughts about this topic, however.

First, we think that the way cost relates to prosociality depends on factors such as the form of religious practice, the religious/cultural context, and some other moderators discussed below (see “Moderators”). For example, Power’s (2015) South Indian participants trusted ordinary routine worship as a signal of generosity, but questioned the motives of those who performed grand public rituals:

While undertaking religious acts, particularly the dramatic and attention-grabbing ones, is seen as admirable and driven by personal devotion and conviction, villagers remain somewhat skeptical of people’s motivations for undertaking the acts. The general recognition that one can build *perumai* (reputation, bigness) through such acts means that people are on the look out for those who seem to be more interested in personal aggrandizement than in enacting their selfless devotion to the deity. Those people who worship regularly, though, whether at a church or temple, are not similarly doubted. The less spectacular, routine act of worship is not plagued by similar accusations of ostentation. (p. 82).

Religious actors who attended a church or temple weekly earned reputations for generosity (Power, 2017a), which seemingly increased their chances of forming cooperative relationships (Power, 2017b). The costlier performance of public rituals was another path to generous reputations, but a less certain one. For grand rituals, the higher the cost, the more skeptical perceivers may be.

Second, perceivers may be using a rule of thumb whereby the number and frequency of behaviors, badges, and bans—more than their cost—indicates a religious actor’s prosociality. When investigating the perceived prosociality of religious actors, we would like perceivers to be presented with targets whose practice varies in degrees; that is, rather than comparing a target who practices with one who does not, comparing a target who practices a little bit to one who practices a lot. An interesting follow up to the Samir experiment would be a comparison of four targets based on a two-by-two design with the independent variables practice count (low or high)—i.e., the number of behaviors, badges, and bans, and their frequencies—and total cost (low or high). We would expect the targets with a high practice count to get higher prosociality ratings than the targets with a low practice count, regardless of cost; even the target who pays a low cost for a lot of practice would get higher ratings than the target whose small amount of practice is overall more costly. Although cost should be positively correlated with practice count in the real world, these results would suggest, as the Samir study and perhaps the Mentawai study suggest, that perceiver judgments about prosociality are affected more by the number and frequency of behaviors, badges, and bans than they are by overall degree of cost.

Third, we expect cost to be a more useful indicator of prosociality when considering all of a religious actor’s behaviors, badges, and bans combined. Doing this may even out the idiosyncrasies of individual forms of practice, such as their slight differences in signal meaning. It should also provide a more accurate assessment of the degree of cost paid by individual religious actors. For example, Actor A may spend more time praying than Actor B, and yet Actor B could pay greater costs in total religious practice. When investigating the prosociality of religious actors, we would like to see composite measures of practice, such as Soler’s (2012) Candomblé Religious Signaling Scale, which measures a variety of behaviors, badges, and bans. For researchers interested in how variability of cost relates to prosociality, accounting for all of the sampled religious actors’ practice should provide a more accurate assessment. (Researchers should also take into account the ways in

which moderating variables, such as gender and social capital, affect a religious actor’s practice choices. We discuss this below in the “Moderators” section.)

### 3.1.3. Relative cost

Those witnessing religious practice may place more value on the *relative cost* than the *absolute cost* to the religious actor. For example, if two people each donate \$100 to a religious charity, the less wealthy of the two pays a greater relative cost. We would like future research to explore perceiver judgment of religious practice when relative costs differ, or appear to differ, between religious actors. Research could consider, for instance, whether physically attractive women are judged to pay greater costs than unattractive women by concealing their bodies and hair (as women are encouraged to do in some religious traditions such as Islam, Orthodox Judaism, and Sikhism); whether elderly people are judged to pay greater costs than young fit individuals by completing a physically demanding pilgrimage; whether individuals raising young children and working full time jobs are judged to pay greater costs than retired individuals with adult children by spending time proselytizing door-to-door; and so on.

### 3.1.4. Type of religious practice

Different types of religious practice may relate to prosociality in different ways. For example, if religious practice signals commitment to the ingroup and its moral rules, we should consider the possibility that some types of religious practice are better indicators of one than of the other.

Perhaps prayer is an especially good signal of commitment to moral rules; maybe people who frequently talk to their gods also frequently think about their gods, and maybe thinking about gods leads to thinking about supernatural observation, which in turn deters rule breaking (Johnson & Krüger, 2004).

Badges may be a good indicator of commitment to the ingroup because they are likely the most consistently visible form of religious practice to outgroup members. Whereas many religious *behaviors* are performed in homes or religious buildings typically frequented only by religious ingroup members, and religious *bans* are often invisible because they are defined by a lack of certain behaviors, religious *badges* are often worn in public spaces shared with outgroup members. For example, Muslim women are more likely to cover their hair outside of their homes than within their homes. Badges thus put religious actors at risk of stigma among outgroups (Iannaccone, 1992; Sosis, 2006; Sosis & Alcorta, 2003; Strabac, Aalberg, Jenssen, & Valenta, 2016). Because badge-wearers accept the risk of outgroup stigma and apparently do not care about ‘fitting in’ with outgroup members, religious badges may be stronger signals of ingroup loyalty than behaviors and bans, at least in locations where the badge-wearer’s group is a minority.

Perhaps religious service attendance is another good signal of commitment to the ingroup, because those who frequently attend religious services spend a great deal of time socializing and bonding with fellow ingroup members. Religious service attendance may furthermore include collective rituals. In their Israeli kibbutzim study, Sosis and Ruffle (2003, 2004) found a relationship between cooperation and synagogue attendance among religious men, but not among religious women. Sosis and Ruffle suggested that ritual is associated with increased cooperativeness when the ritual is collective, but not when the ritual is private. The men living in religious kibbutzim participated in far more collective rituals, such as group prayer, than the women. Among the secular kibbutzim, where collective rituals were uncommon, men and women were equally cooperative. Sosis and Ruffle’s hypothesis seems testable, although we suggest a distinction between *collective* and *public* rituals might be useful.

## 3.2. Moderators

Suppose an individual wishes to practice religion. The specific



behaviors, badges, and bans available to the individual depend on several factors such as the individual's resources (material capital, embodied capital, and social capital), gender, and socioeconomic status, as well as the specific religious tradition they affiliate with. The costs and benefits the individual can expect from their religious practice, as well as the interpretation of and response to their religious practice, also differ according to moderating factors such as these. Here we will discuss social status, gender, and religious group.

### 3.2.1. Social status

In a recent study of the Mauritian kavadi ritual, participants of lower social class paid greater somatic and opportunity costs than participants of higher social class (Xygalatas et al., 2021). On the other hand, high-status participants built larger (and likely more financially expensive) kavadi structures than low-status participants. Thus, the degree to which individuals paid different types of cost—somatic, opportunity, or money—was related to their social standing.

Concordantly, anthropological research conducted in South India suggests that the costs and benefits of religious practice may differ as a function of reputational status and social capital (Power, 2015). Most individuals who performed intense rituals at a festival for the goddess Mariyamman enjoyed a reputation boost, but the boost was greater for those with better pre-festival reputations. Social capital may have even turned one person's failed religious ritual—which would have usually resulted in harmful gossip—into a status boost: Power compared two women who fell while crossing a bed of hot coals during the festival. One woman had a large number of social ties, whereas the other woman had few. When the woman with few social ties fell, members of the village attributed her fall to rejection by the goddess Mariyamman due to her family's wrongdoing (such as her husband drinking too much). She suffered reputational loss, with the village distancing itself (further) from her and her family. However, when the woman with many social ties fell, members of her village attributed the fall to the woman's devotion to the goddess Mariyamman, and she attained a status boost rather than a status loss.

Power (2015) also reported that in a South Indian village festival, individuals from *Dalit* ("oppressed") castes were not permitted to perform certain rituals. Villagers believed that *Dalit* individuals were ritually impure and would therefore put the whole village in danger if they were to participate. Villagers told Power that if a *Dalit* individual were to take part in any impermissible rituals, violence would break out, as had already happened in other villages. Thus, the ability of *Dalit* religious actors to accrue benefits from religious practice was limited.

Dumas, Barker, and Power (2021) developed a mathematical model exploring how and why social status (i.e., social capital, prestige, etc.) interacts with the dynamics of costly signaling. Their model features a standard costly signaling mechanism (i.e., individuals differ in quality, and the cost of signaling is larger for low-quality individuals) but also incorporates individual differences in social status. When individuals signal, they broadcast information about their social status (in addition to their quality). For example, other people can see the number of friends that come to support an individual that performs a difficult ritual. Individuals with higher social status might suffer lower costs from signaling (for example, they may be buffered by support from their allies), and get larger benefits (for example, the status boost they get from successful ritual performance may be widely amplified by their social network).

Dumas et al. (2021) found that, under these assumptions, costly signaling provides biased information about an individual's underlying quality. Individuals with high social status can enjoy a 'reputational shield' if observers make inferences about quality from their social status; thus, even low-quality individuals can pass as high-quality if they have high social status and engage in signaling. Conversely, high-quality individuals can be stuck in 'reputational poverty traps': It is difficult for them to broadcast their quality because signaling is too costly for them, or their signal would not be broadly observed anyway. In sum, social

status lowers the correlation between quality and decision to signal, and therefore lowers the potential for costly signaling to accurately convey information about quality.

Future research could explore the cross-cultural prevalence of such interactions between social status and religious signaling, and test the empirical predictions made by Dumas et al.'s (2021) model. An intriguing possibility is that high-status individuals might have incentives to support the existence of costly rituals that disproportionately favor them (and conversely, low-status individuals might want to change these rituals), and status concerns could therefore influence the form of religious institutions.

### 3.2.2. Gender

The South Indian women studied by Power (2015) were expected to behave with modesty and self-restraint. Therefore, women who performed grand rituals for large festival crowds were likely to be accused of exhibitionism. Although this accusation could also be levied against young men for performing grand rituals, the young men's behavior was shrugged off as *boys will be boys*. According to Power, women did not enjoy the same leniency. Thus, eye-catching public rituals were reputationally hazardous for women.

We can think of additional religious traditions in which men have access to more visible and public religious practice than women do. Orthodox Jewish traditions tend to require men to perform more collective and public rituals than women (S. J. Berman, 1973; Lax, 2015; Sosis & Ruffle, 2003, 2004). Recalling her 30 years as a Hasidic Jew, Leah Lax (2015) criticized the limited forms of practice available to women from her community:

We were told that we women were "spiritually stronger" than men and so had less need for the constant renewal of formal rituals. [For women, there was no] taking part in daily services or binding phylacteries and donning prayer shawls or ascending to the Torah... "less need" for ritual translated into active exclusion from all of public and most private ritual and any leadership role or public voice, thus keeping the great heart of the religion reserved for men. (p. 345).

Certain Islamic traditions enjoin similar restrictions on women. Muslim men (with some exceptions) are typically required to attend Friday congregational prayer, whereas Muslim women are not (Tarsin, 2015). In 30 countries out of 38 surveyed, a higher percentage of Muslim women than men indicated never attending mosque, despite Muslim men and women reporting similar levels of religious practice generally (Pew Research Center, 2012). Within certain Islamic traditions, it is impermissible for women to enter the prayer area of a mosque when they are menstruating or experiencing postpartum bleeding (Corbin & White, 2018; Tarsin, 2015). Women's access to the most public form of Islamic practice, the Hajj, has also been hindered; in some Islamic traditions, a woman may not perform the Hajj without being escorted by her husband or certain male family members (Islam Question & Answer, 2005). On the other hand, many Muslims believe that Muslim women—but not men—are obligated to conceal their hair, a requirement satisfied with the headscarf, a very conspicuous religious badge (Corbin & White, 2018; Tarsin, 2015).<sup>8</sup>

It seems gender is an important moderator in at least some religious traditions. We would like to see cross-cultural studies investigating whether the effect of religious practice is moderated by gender in universal ways. For example, are men cross-culturally more likely than

<sup>8</sup> Islamic traditions commonly instruct women to cover their hair and most of their body (all but their face, hands, and, in some traditions, feet) (Corbin & White, 2018; Tarsin, 2015). Many Muslim women use headscarves to cover their hair, neck, and ears, and a subset of these women also use it to cover their chest, but other garments also exist for this purpose, many of which are designed to cover both hair and body. These garments are usually even more conspicuous than headscarves.

women to participate in dramatic, eye-catching rituals? Are women cross-culturally expected to participate in fewer public rituals than men? We expect to find smaller gender differences in religious practice within more egalitarian groups.

### 3.2.3. Religious group

Religious affiliation or tradition could be another interesting variable to consider, because religious practice may signal, or be inferred to signal, different things in different groups.

For example, some Jewish traditions expect members to practice regardless of their beliefs, and people from those traditions may not make as much of an effort to figure out if an actor truly believes (Silverman, Johnson, & Cohen, 2016). In such groups, behaviors might not be taken as indications of internal beliefs; members may draw other inferences from religious behaviors, such as commitment to the religious coalition, as these practice-oriented groups could be more collectivistic and coalitional (Cohen & Hill, 2007). On the other hand, Protestant Christian groups seem to be more concerned that one's behavior matches one's beliefs (Cohen, Hall, Koenig, & Meador, 2005; Cohen, Siegel, & Rozin, 2003). Thus, some Protestant Christians may believe that behaviors are a reflection of internal beliefs, or they may be vexed if a religious actor is shown to be acting inconsistently with internal beliefs. These differing religious expectations could affect how religious behaviors are interpreted, as well as how they function and evolve within groups.

We would like to see future research compare the effects of religious practice that take the same or very similar forms across religious groups, like bans on pork consumption among Jews versus Muslims, or prayer among Christians versus Hindus, so that the form of religious practice is not confounded with the religious group or tradition.

### 3.3. Secular versus religious behaviors, badges, and bans

We have been referring to this paper's topic as the costly signaling theory of religion and focusing on religious behaviors, badges, and bans. However, researchers have alternatively referred to the costly signaling theory of ritual (e.g., Sosis, 2003) and have not always made a distinction between religious and secular rituals. Indeed, no distinction is made between the religious and secular in certain cultures (Boyer, 2001; McCutcheon, 1995). However, as a distinction is often made, it is worth asking if costly behaviors, badges, and bans are more effective signals when they are religious.<sup>9</sup>

Irons (2001) argued that although certain secular ideologies (e.g., Marxism) can produce strong commitments, the most potent cultural commitment signals are religious. He reasoned that

commitment to a particular way of life and to a community is much more believable if it is grounded in a strong belief that the moral code is somehow dictated by the basic nature of the universe, commanded by God, or in some other way seen as more than simply an agreement among people. (1996a, p. 60).

Likewise, Sosis and Bressler (2003) suggested that an essential difference between religious and secular rituals is that religious rituals refer to a supernatural being. Because religious rituals refer to the supernatural and the sacred, they produce a sense of numinosity. This 'religious experience' makes whatever claims are communicated by the rituals feel true. Although secular rituals may produce emotions, they may not feel sacred and numinous like those produced by religious rituals.

Furthermore, many (perhaps most) religious claims are unfalsifiable (Rappaport, 1979, 1999), whereas secular claims generally can be proven wrong (Sosis & Bressler, 2003). The untestable claims of

religions are therefore stabler; from the perspective of the religious adherents, religious claims may be true for all time. (For a more in-depth discussion of secular versus religious rituals, refer to Potz, 2023, and Sosis & Bressler, 2003.)

These are speculative arguments for why behaviors, badges, and bans may be more effective signals when they are religious, but what does the evidence say? Unfortunately, we know of only a few relevant empirical studies, and they do not present a clear picture.

Shaver, DiVietro, Lang, and Sosis (2018) were interested in whether costly requirements increase trust and trustworthiness within secular groups. The researchers recruited members of 11 secular US college groups to participate in a study. The groups consisted of four fraternities, four student clubs, and three introductory anthropology classes; the classes served as a control.

The participants played a trust game with members of their group. The amount of money (provided by the researchers) sent by trustors may indicate the extent to which they trusted members of their group, with greater amounts indicating greater trust. The amount of money returned by trustees may be taken as a measure of trustworthiness. After the trust game, participants reported, on a Likert scale, how much trust they had in members of their group.

The researchers investigated the relationship of these measures of trust and trustworthiness to group costs. Group costs consisted of participation costs and, when applicable, pledging costs. The researchers created a *participation cost scale* which included items about the number of group functions participants attended per week, the number of favors participants did for other members per week, and how many meals participants ate with other members per week. The researchers also created a *pledge cost scale*, which included items about the length and difficulty of the pledge period and whether it included a hell week. Three of the fraternities and one of the clubs had pledge periods.

The fraternities imposed greater costs on their members than the clubs. Was this related to greater trust and trustworthiness? The results were mixed. Fraternity trustees returned a significantly greater proportion of money (that is, they were more trustworthy) than club trustees. Fraternity trustors also sent a greater proportion of money (that is, they were more trusting) than club trustors, but the difference was not statistically significant. As for self-reported trust, fraternity members and club members did not differ.

Considering only fraternities, group participation costs did not have a significant relationship with self-reported trust, trusting behavior (i.e., trustor decisions), or trustworthy behavior (i.e., trustee decisions). In fact, members of fraternities with costlier pledge periods reported having less trust in their fellow members.

Overall, Shaver, DiVietro, et al. (2018) did not find compelling evidence that group participation costs were associated with trust or trustworthiness among fraternities. Interestingly, they furthermore found a significant *negative relationship* between pledge costs and self-reported trust among members. These results are similar to those of the previously discussed American commune study (Sosis & Bressler, 2003). Among religious communes, there was a positive correlation between the number of costly requirements and commune longevity, but this relationship was not found among secular communes. These two field studies suggest that costly requirements do not increase intragroup trust and cooperation within secular groups.

Two studies, however, suggest that secular bans may promote trust among individuals. In Ellis et al.'s (2018) final experiment, MTurk workers rated a vegetarian target person as significantly more trustworthy when he abstained from eating meat. Participants also rated a Muslim version of the target as significantly more trustworthy when he abstained from eating meat, but the effect was larger in the secular (i.e., vegetarian) context than in the religious (i.e., Muslim) context.

It is possible that the effect size was larger for the secular target because participants assumed the vegetarian target's forbearance was indicative of frequent repeated acts of forbearance, whereas the Muslim target's forbearance was indicative of occasional acts of forbearance. The

<sup>9</sup> We leave it to future researchers to clarify the distinctions between secular and religious signals, which are quite fuzzy categories.

vegetarian target avoided eating meat in a particular instance; if he is a ‘perfect’ vegetarian, he avoids eating meat all the time. The Muslim target also avoided eating meat in a particular instance, but if he is a ‘perfect’ Muslim, he need only avoid eating meat that is not halal. Assuming both targets follow their respective dietary rules perfectly, the vegetarian pays a greater cost in the long run.

Northover and Cohen (2017b) conducted an experiment (mentioned briefly above) to compare a secular ban with a religious ban without implying that the secular actor paid greater long-run costs than the religious actor. MTurk workers read a vignette about a target person named Deepak who was a Hindu and a vegetarian. For half of the participants, Deepak was a vegetarian for religious reasons: He came from a religious tradition in which eating meat was not allowed, and he believed that eating meat violated the Hindu religious moral rule “do no harm”. For the other half of the participants, Deepak was a vegetarian for secular reasons: He came from a religious tradition in which eating meat, other than beef, was allowed, and although he believed that eating meat violated the same moral rule “do no harm”, it was described as simply a *moral rule* rather than a *Hindu religious moral rule*. Thus, although Deepak was always Hindu and always vegetarian, and always believed eating meat violated the moral rule “do no harm”, the rationale for the moral rule was either secular or religious.

According to the vignettes, Deepak attended a coworker’s birthday celebration at a Korean barbecue restaurant, where none of the food was vegetarian. For half of the participants, Deepak ordered a large portion of chicken, thus violating his moral rule, and for the other half, he did not order anything, thus following his moral rule.

After reading the vignettes, participants rated Deepak’s trustworthiness. Not surprisingly, participants gave Deepak lower trustworthiness ratings when he violated the moral rule than when he followed it (partial  $\eta^2 = 0.11$ ). Notably, however, this was the case both when the rule was secular and when it was religious. Furthermore, there was no significant interaction between Deepak’s behavior (following versus breaking the rule) and the rationale for the moral rule (secular versus religious) (partial  $\eta^2 = 0.00$ ). Thus, it seems that Deepak’s behavior was perceived as a signal of trustworthiness both when the behavior was religious and when it was secular.

In summary, the evidence for secular behaviors and bans is mixed. Two field studies suggest that costly group requirements do not increase cooperation, trust, or trustworthiness in secular groups, but two questionnaire experiments suggest that costly secular bans obeyed by individuals can increase their perceived trustworthiness. Future research should delve into this apparent discrepancy.

### 3.3.1. Moral versus religious signals

Perhaps secular behaviors, badges, and bans are more likely to facilitate trust and prosociality across groups—and within groups—when they appear to rest on a moral foundation. Religions are often associated with morality (Farkas et al., 2001). The two studies in which secular bans apparently facilitated trust involved vegetarian target people eschewing meat. In one of these studies (Northover and Cohen, 2017b), participants were informed that the target person avoided meat for moral reasons. Participants in the other study (Ellis et al., 2018) may have interpreted their vegetarian target person’s behavior as moral, too. Considering the two field studies for which costly secular behaviors seemingly did *not* facilitate trust, generosity, or cooperation, it is unclear the extent to which costly secular behaviors in these studies rested on a moral foundation. One study (Shaver, DiVietro, et al., 2018) involved members of college fraternities and the other (Sosis & Bressler, 2003) involved communes. According to Sosis and Bressler, most of the secular communes in their study were founded on secular ideologies, usually socialism. It is not clear to what extent these secular ideologies or the rules and restrictions of the communes were perceived by members as being moral.

Future research may wish to compare the perceived trustworthiness of a vegetarian target person who is vegetarian for a moral reason (e.g.,

to alleviate animal suffering) with another version of the target who is vegetarian for an amoral reason (e.g., health) to further disentangle religious, moral, and secular reasons for the behavior.<sup>10</sup>

It would seem like a fruitful area for future research to determine whether religious practice sends a signal about religion or about morality. One might imagine that moral practice (perhaps, not stealing) is interpreted differently than religious practice (perhaps, circumcision). We feel this will be a complicated issue to nail down, though. Moral practice may often be interpreted as religious as well. While theft is almost universally condemned across cultures (Curry, Mullins, & Whitehouse, 2019), theft is also often prohibited by religions. So, when one does not steal, one abides by a moral code, as well as by a religious code. Furthermore, religious practice—even forms that do not on the face of them seem moral—can be interpreted to have moral import. For example, the Jewish and Muslim practice of circumcision is not on the face of it a moral commandment. However, people may feel that others have a moral obligation to adhere to their religions, making circumcision a moral issue (a sort of second order morality if you will). To add complication, observers sometimes morally discount behaviors ostensibly done for religious reasons (Gervais, 2014). All this is to say that distinguishing moral signals and religious signals might end up being quite interesting and challenging.

### 3.4. Mediators

As discussed previously, the empirical literature suggests that religious actors are perceived as especially trustworthy by ingroup members, and sometimes by outgroup members as well. When religious actors are perceived as highly trustworthy, what mediates the relationship between the observed practice and perceptions of the actors’ trustworthiness?

Researchers have generally argued that costly religious practice is a signal of commitment to the ingroup *and its moral code*. Religion is often associated with morality (Farkas et al., 2001). If religious practice is perceived as a signal of commitment to a religion’s moral code, then religious practice should promote trust, at least among perceivers who approve of the moral code. This may work both within and between groups, if outgroup religions are believed to promote good moral values. If religious practice signals commitment to a moral code, perceivers may trust religious actors because the perceivers believe the actors intend to behave fairly and kindly toward them.

One reason religious actors may be committed to a moral code is out of fear of supernatural punishment (Bering & Johnson, 2005; Johnson, 2015; Johnson & Krüger, 2004). Thus, religious practice may signal commitment to moralizing supernatural agents (Bulbulia, 2004b). If religious practice signals belief in and commitment to supernatural agents who punish people for moral violations (e.g., harming others), religious actors may be perceived as unlikely to violate moral rules, and as therefore trustworthy. Indeed, in a recent study (Shariff & Clark, 2018), Christian MTurk workers indicated that a Muslim (outgroup) target who believed in God was more trustworthy than a Christian (ingroup) target who did not believe in God. However, this hypothesis does not explain the cases in which secular behaviors facilitate trust.

Other possible mediators were investigated by Ellis et al. (2018). The potential mediators were derived from Mayer, Davis, and Schoorman’s (1995) model of trust, which proposes three components of perceived trustworthiness. First is the trustee’s *ability* to successfully complete a task relevant to the trusting situation. For example, one may trust a surgeon to remove an appendix but a plumber to repair a leaky pipe. Second is the trustee’s *benevolence* toward the trustor. Will the trustee try to help the trustor? Does the trustee care about the trustor’s wellbeing? Third is the trustee’s *integrity*. A trustor will see the trustee as having integrity to the extent the trustee follows a set of moral rules which the

<sup>10</sup> We thank a reviewer for suggesting this.



trustor deems acceptable. A trustee may be perceived as having integrity even if the trustor does not follow the same set of moral rules if the trustor thinks the moral rules are acceptable for the trustee and the trustee follows the rules consistently.

Recall that Ellis et al. (2018) conducted a series of experiments in which participants rated the trustworthiness of a prospective painter, Isa. Participants also rated Isa's ability, benevolence, and integrity. Recall that in Experiment 1 and Experiment 2, Isa was rated as significantly more trustworthy when he practiced than when he did not. However, when the authors included ability, benevolence, and integrity in their statistical models, the effect of religious practice on trust was eliminated. Further analyses were consistent with integrity as an important mediator for the relationship between religious practice and perceived trustworthiness.

The third experiment was much like the second, with an additional manipulation. Participants were shown a testimonial from 'a friend'. In the high integrity condition, the friend stated that Isa had high integrity; in the low integrity condition, the friend stated that Isa lacked integrity. Isa was rated as significantly more trustworthy in the high integrity condition than he was in the low integrity condition, partial  $\eta^2 = 0.26$ . Importantly, practicing had no significant effect on trustworthiness above and beyond the effect of integrity (partial  $\eta^2 = 0.00$ ). Ellis et al.'s (2018) study thus supports the hypothesis that integrity best mediates the relationship between religious practice and trust.

The issue of mediation has been given little direct empirical attention so far. Further research in this area may clarify the intrapersonal processes involved when perceivers judge and react to religious actors. Perceivers may believe that religious actors are committed to punishing supernatural agents, or that religious actors follow a moral code, or that religious actors have integrity. If any of these beliefs about religious actors are true, perceivers will likely conclude that religious actors will behave honestly toward them. The result should be enhanced trust.

Note that these proposed mediators are not mutually exclusive, and plausibly go together. An individual is judged to have integrity if he/she consistently follows a moral code which is deemed appropriate for that individual (Mayer et al., 1995), and an individual may consistently follow such a moral code out of fear of supernatural punishment.

Furthermore, some of these mechanisms are not specifically religious, so perhaps they could be leveraged to help ameliorate atheist prejudice. People are often mistrustful of atheists (Gervais, Shariff, & Norenzayan, 2011), even across cultures (Gervais et al., 2017), though with some poorly understood cultural variation (Cohen & Moon, 2017). If fear of supernatural punishment is an important part of the effect of religious practice on trust, atheists might be out of luck. But if people look at some kinds of religious practice as clues of integrity or a slow life history strategy (characterized by fewer sexual partners, greater investment in parenting and education, and less aggression and risk-taking), atheists could potentially defuse prejudice by showing signs of those, even in nonreligious ways (Moon, Krems, & Cohen, 2018; Moon, Krems, Cohen, & Kenrick, 2019).

Similarly, there may be secular reasons or non-religious processes that explain why religious people are trusted. Religious people are more likely to smile and seem energetic (Naumann, Vazire, Rentfrow, & Gosling, 2009), and people generally think that religious people are agreeable (trustworthiness is a facet of agreeableness; Gebauer et al., 2015).

#### 4. General conclusion

The costly signaling theory of religion views religious behaviors, badges, and bans as signals of a religious actor's commitment and loyalty to their ingroup and the ingroup's moral values. Religious practice entails time, financial, and other kinds of costs. This costliness is proposed to play a key role in the utility of religious practice as a commitment signal. Religious signaling is expected to steer individuals toward trustworthy and prosocial partners (who signal prosocial

intentions with religious practice), to benefit religious actors (who gain the trust and respect of their peers), and to increase intragroup trust and cooperation by keeping free-riders out of the group. We reviewed the empirical literature to investigate whether religious practice enhances trust and prosociality, and to see if religious practice signals ingroup commitment.

Overall, empirical findings suggest that religious actors are believed to be especially trustworthy and generous and may be more likely recipients of help and cooperation. However, research does not consistently show that religious actors actually are especially prosocial. We feel this issue deserves the most attention from future research. Mixed research findings suggest either a lack of effect (i.e., religious actors are not particularly prosocial), or the presence of poorly understood moderating factors. If religious actors are not especially prosocial, this raises the interesting question of why they are perceived to be.

There is little research to bear on the question of ingroup commitment, but evidence does suggest that routine forms of religious behavior (such as religious service attendance) are associated with ingroup favoritism. High-cost, infrequent, highly social forms of religious practice are associated with an increase in religious identity, but also an expanded social identity and greater tolerance for outgroup members. We find this counterintuitive combination intriguing and would therefore like to see research that measures both the inclusivity/exclusivity of social identity and behavioral ingroup favoritism (or lack thereof) in the same participants.

We would also like to see more research investigating various aspects of the costs and benefits of religious practice, such as degree of cost; moderators, such as social status, gender, and religious group; how secular and religious practice compares; and mediators, such as integrity. When it comes to religious signaling, there are a few uncertainties moving forward, but nothing that cannot be resolved with a little commitment.

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**Stefanie B. Northover:** Conceptualization, Writing – original draft, Writing – review & editing. **Tadeg Quillien:** Writing – original draft, Writing – review & editing. **Daniel Conroy-Beam:** Writing – original draft, Writing – review & editing. **Adam B. Cohen:** Conceptualization, Funding acquisition, Writing – original draft, Writing – review & editing.

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#### References

- Alcorta, C., & Sosis, R. (2005). Ritual, emotion, and sacred symbols. *Human Nature*, 16(4), 323–359. <https://doi.org/10.1007/s12110-005-1014-3>
- Alexseev, M. A., & Zhemukhov, S. N. (2015). From Mecca with tolerance: Religion, social recategorisation and social capital. *Religion, State & Society*, 43(4), 371–391. <https://doi.org/10.1080/09637494.2015.1127672>
- Allison, P. D. (1992). The cultural evolution of beneficent norms. *Social Forces*, 71(2), 279–301. <https://doi.org/10.1093/sf/71.2.279>
- Alnabulsi, H., Drury, J., Vignoles, V. L., & Oogink, S. (2020). Understanding the impact of the hajj: Explaining experiences of self-change at a religious mass gathering. *European Journal of Social Psychology*, 50, 292–308. <https://doi.org/10.1002/ejsp.2623>
- Ansari, H. N., & Solomon, G. D. (2015). Hijab (headscarf) headache. *Headache*, 55(3), 437–438. <https://doi.org/10.1111/head.12507>
- Atkinson, Q. D. (2018). Religion and expanding the cooperative sphere in *Kastom* and Christian villages on Tanna, Vanuatu. *Religion, Brain & Behavior*, 8(2), 149–167. <https://doi.org/10.1080/2153599X.2016.1267028>



- Atkinson, Q. D., & Whitehouse, H. (2011). The cultural morphospace of ritual form: Examining modes of religiosity cross-culturally. *Evolution and Human Behavior*, 32(1), 50–62. <https://doi.org/10.1016/j.evolhumbehav.2010.09.002>
- Atran, S., & Ginges, J. (2012). Religious and sacred imperatives in human conflict. *Science*, 336, 855–857. <https://doi.org/10.1126/science.1216902>
- Barclay, P. (2013). Strategies for cooperation in biological markets, especially for humans. *Evolution and Human Behavior*, 34(3), 164–175. <https://doi.org/10.1016/j.evolhumbehav.2013.02.002>
- Barker, J. L., Power, E. A., Heap, S., Puurtinen, M., & Sosis, R. (2019). Content, cost, and context: A framework for understanding human signaling systems. *Evolutionary Anthropology*, 28, 86–99. <https://doi.org/10.1002/evan.21768>
- Barlev, M., Mermelstein, S., & German, T. C. (2017). Core intuitions about persons coexist and interfere with acquired Christian beliefs about God. *Cognitive Science*, 41, 425–454. <https://doi.org/10.1111/cogs.12435>
- Berg, J., Dickhaut, J., & McCabe, K. (1995). Trust, reciprocity and social history. *Games and Economic Behavior*, 10, 122–142. <https://doi.org/10.1006/game.1995.1027>
- Bering, J., & Johnson, D. (2005). “O Lord...you perceive my thoughts from afar”: Recursiveness and the evolution of supernatural agency. *Journal of Cognition and Culture*, 5, 118–142. <https://doi.org/10.1163/1568537054068679>
- Berman, E. (2000). Sect, subsidy, and sacrifice: An economist’s view of ultra-orthodox Jews. *Quarterly Journal of Economics*, 115(3), 905–953. <https://doi.org/10.1162/003353500554944>
- Berman, S. J. (1973). The status of women in halakhic Judaism. *Tradition: A Journal of Orthodox Jewish Thought*, 14(2), 5–28. <https://www.jstor.org/stable/23257359>
- Blais, C., Ellis, D. M., Wingert, K. M., Cohen, A. B., & Brewer, G. A. (2018). Alpha suppression over parietal electrode sites predicts decisions to trust. *Social Neuroscience*, 14(2), 226–235. <https://doi.org/10.1080/17470919.2018.1433717>
- Bliege Bird, R., Ready, E., & Power, E. A. (2018). The social significance of subtle signals. *Nature Human Behaviour*, 2, 452–457. <https://doi.org/10.1038/s41562-018-0298-3>
- Boyer, P. (2001). *Religion explained: The evolutionary origins of religious thought*. Basic Books.
- Boyer, P. (2003). Religious thought and behaviour as by-products of brain function. *Trends in Cognitive Sciences*, 7(3), 119–124. [https://doi.org/10.1016/S1364-6613\(03\)00031-7](https://doi.org/10.1016/S1364-6613(03)00031-7)
- Braun, W. (2008). Celibacy in the Greco-Roman world. In C. Olson (Ed.), *Celibacy and religious traditions* (pp. 21–40). Oxford University Press.
- Brusse, C. (2020). Signaling theories of religion: Models and explanation. *Religion, Brain & Behavior*, 10(3), 272–291. <https://doi.org/10.1080/2153599X.2019.1678514>
- Bulbulia, J. (2004a). The cognitive and evolutionary psychology of religion. *Biology and Philosophy*, 19, 655–686. <https://doi.org/10.1007/s10539-005-5568-6>
- Bulbulia, J. (2004b). Religious costs as adaptations that signal altruistic intention. *Evolution and Cognition*, 10, 19–42.
- Bulbulia, J., & Mahoney, A. (2008). Religious solidarity: The hand grenade experiment. *Journal of Cognition and Culture*, 8, 295–320. <https://doi.org/10.1163/156853708X358191>
- Bulbulia, J., & Sosis, R. (2011). Signalling theory and the evolution of religious cooperation. *Religion*, 41(3), 363–388. <https://doi.org/10.1080/0048721x.2011.604508>
- Burns, K. (2011). Cybele and her cult at Rome: National embarrassment or benevolent savior? *Chronika*, 1, 33–37. <https://www.chronikajournal.com/resources/Burns%202011.pdf>
- Caro, T. M. (1986). The functions of stotting in Thomson’s gazelles: Some tests of the predictions. *Animal Behaviour*, 34(3), 663–684. [https://doi.org/10.1016/s0003-3472\(86\)80052-5](https://doi.org/10.1016/s0003-3472(86)80052-5)
- Carr, J. L., & Landa, J. T. (1983). The economics of symbols, clan names, and religion. *The Journal of Legal Studies*, 12, 135–156. <https://doi.org/10.1086/467717>
- Chen, D. (2010). Club goods and group identity: Evidence from Islamic resurgence during the Indonesian financial crisis. *Journal of Political Economy*, 118(2), 300–354. <https://doi.org/10.1086/652462>
- Chia, E. K. F., & Jih, C.-S. (1994). The effects of stereotyping on impression formation: Cross-cultural perspectives on viewing religious persons. *The Journal of Psychology*, 128, 559–565. <https://doi.org/10.1080/00223980.1994.9914913>
- Cimino, A., & Delton, A. W. (2010). On the perception of newcomers: Toward an evolved psychology of intergenerational coalitions. *Human Nature*, 21(2), 186–202. <https://doi.org/10.1007/s12110-010-9088-y>
- Clingingsmith, D., Khwaja, A. I., & Kremer, M. (2009). Estimating the impact of the hajj: Religion and tolerance in Islam’s global gathering. *The Quarterly Journal of Economics*, 124(3), 1133–1170. <https://doi.org/10.1162/qjec.2009.124.3.1133>
- Cohen, A. B., Gorvine, B. J., & Gorvine, H. (2013). The religion, spirituality, and psychology of Jews. In K. I. Pargament, J. J. Exline, & J. W. Jones (Eds.), *APA handbook of psychology, religion, and spirituality: Vol. 1. Context, theory, and research* (pp. 665–679). American Psychological Association.
- Cohen, A. B., Hall, D. E., Koenig, H. G., & Meador, K. G. (2005). Social versus individual motivation: Implications for normative definitions of religious orientation. *Personality and Social Psychology Review*, 9(1), 48–61. [https://doi.org/10.1207/s15327957pspr0901\\_4](https://doi.org/10.1207/s15327957pspr0901_4)
- Cohen, A. B., & Hill, P. C. (2007). Religion as culture: Religious individualism and collectivism among American Catholics, Jews, and Protestants. *Journal of Personality*, 75(4), 709–742. <https://doi.org/10.1111/j.1467-6494.2007.00454.x>
- Cohen, A. B., Johnston, R. E., & Kwon, A. (2001). How golden hamsters (*Mesocricetus auratus*) discriminate top from bottom flank scents in over-marks. *Journal of Comparative Psychology*, 115(3), 241–247. <https://doi.org/10.1037/0735-7036.115.3.241>
- Cohen, A. B., & Moon, J. W. (2017). Psychology: Atheism and moral intuitions. *Nature Human Behaviour*, 1(8). <https://doi.org/10.1038/s41562-017-0157>. Article 0157.
- Cohen, A. B., Siegel, J. I., & Rozin, P. (2003). Faith versus practice: Different bases for religiosity judgments by Jews and Protestants. *European Journal of Social Psychology*, 33(2), 287–295. <https://doi.org/10.1002/ejsp.148>
- Corbin, T., & White, K. (2018). *The new Muslim’s field guide*. CreateSpace Independent Publishing Platform.
- Cort, J. E. (2001). *Jains in the world: Religious values and ideology in India*. Oxford University Press. <https://doi.org/10.1093/0195132343.001.0001>
- Cosmides, L., Barrett, H. C., & Tooby, J. (2010). Adaptive specializations, social exchange, and the evolution of human intelligence. *Proceedings of the National Academy of Sciences*, 107(Supplement 2), 9007–9014. <https://doi.org/10.1073/pnas.0914623107>
- Cronk, L. (1994). Evolutionary theories of morality and the manipulative use of signals. *Zygon*, 29(1), 81–101. <https://doi.org/10.1111/j.1467-9744.1994.tb00651.x>
- Curry, O. S., Mullins, D. A., & Whitehouse, H. (2019). Is it good to cooperate? Testing the theory of morality-as-cooperation in 60 societies. *Current Anthropology*, 60, 47–69. <https://doi.org/10.1086/701478>
- De Jong, G., Faulkner, J., & Warland, R. (1976). Dimensions of religiosity reconsidered: evidence from a cross-cultural study. *Social Forces*, 54(4), 866–889. <https://doi.org/10.2307/2576180>
- Dengah, H. J. F. (2017). Being part of the Nação: Examining costly religious rituals in a Brazilian Neo-Pentecostal church. *Ethos*, 45(1), 48–74. <https://doi.org/10.1111/etho.12154>
- Dennett, D. C., & LaScola, L. (2015). *Caught in the pulpit: Leaving belief behind* (Expanded and Updated ed.). Pitchstone Publishing.
- Dow, J. (2008). Is religion an evolutionary adaptation? *Journal of Artificial Societies and Social Simulation*, 11(2). <http://jasss.soc.surrey.ac.uk/11/2/2.html>
- Dumas, M., Barker, J. L., & Power, E. A. (2021). When does reputation lie? Dynamic feedbacks between costly signals, social capital and social prominence. *Philosophical Transactions of the Royal Society B*, 376. <https://doi.org/10.1098/rstb.2020.0298>. Article 20200298.
- Ellis, D. M., Blais, C., Northover, S. B., Cohen, A. B., Mayer, R. C., Wingert, K., ... Brewer, G. A. (2018). *How religious (and nonreligious) behaviors influence trustworthiness: The role of integrity*. Unpublished manuscript.
- Farkas, S., Johnson, J., Folen, T., Duffett, A., & Foley, P. (2001). *For goodness’ sake: Why so many want religion to play a greater role in American life*. Public Agenda.
- Fischer, R., & Xygalatas, D. (2014). Extreme rituals as social technologies. *Journal of Cognition and Culture*, 14, 345–355. <https://doi.org/10.1163/15685373-12342130>
- Frank, R. (1988). *Passions within reason: The strategic role of the emotions*. W. W. Norton & Company.
- Garcia-Retamero, R., Müller, S. M., & Rousseau, D. L. (2012). The impact of value similarity and power on the perception of threat. *Political Psychology*, 33(2), 179–193. <https://doi.org/10.1111/j.1467-9221.2012.00869.x>
- Gebauer, J. E., Sedikides, C., Wagner, J., Bleidorn, W., Rentfrow, P. J., Potter, J., & Gosling, S. D. (2015). Cultural norm fulfillment, interpersonal belonging, or getting ahead? A large-scale cross-cultural test of three perspectives on the function of self-esteem. *Journal of Personality and Social Psychology*, 109, 526–548. <https://doi.org/10.1037/pspp0000052>
- Gervais, W. M. (2014). Good for God? Religious motivation reduces perceived responsibility for and morality of good deeds. *Journal of Experimental Psychology: General*, 143(4), 1616–1626. <https://doi.org/10.1037/a0036678>
- Gervais, W. M., Shariff, A. F., & Norenzayan, A. (2011). Do you believe in atheists? Distrust is central to anti-atheist prejudice. *Journal of Personality and Social Psychology*, 101, 1189–1206. <https://doi.org/10.1037/a0025882>
- Gervais, W. M., Xygalatas, D., McKay, R. T., van Elk, M., Buchtel, E. E., Aveyard, M., ... Bulbulia, J. (2017). Global evidence of extreme intuitive moral prejudice against atheists. *Nature Human Behaviour*, 1(8). <https://doi.org/10.1038/s41562-017-0151>
- Grafen, A. (1990). Biological signals as handicaps. *Journal of Theoretical Biology*, 144(4), 517–546. [https://doi.org/10.1016/S0022-5193\(05\)80088-8](https://doi.org/10.1016/S0022-5193(05)80088-8)
- Hall, D., Cohen, A. B., Meyer, K., Varley, A., & Brewer, G. (2015). Costly signaling increases trust, even across religious affiliations. *Psychological Science*, 26(9), 1368–1376. <https://doi.org/10.1177/0956797615576473>
- Henrich, J. (2009). The evolution of costly displays, cooperation and religion: Credibility enhancing displays and their implications for cultural evolution. *Evolution and Human Behavior*, 30, 244–260. <https://doi.org/10.1016/j.evolhumbehav.2009.03.005>
- Herrou, A. (2012). Daoist monasticism at the turn of the twenty-first century: An ethnography of a Quanzhen community in Shaanxi Province. In D. A. Palmer, & X. Liu (Eds.), *Daoism in the twentieth century: Between eternity and modernity* (pp. 82–107). University of California Press.
- Higham, J. P. (2014). How does honest costly signaling work? *Behavioral Ecology*, 25(1), 8–11. <https://doi.org/10.1093/beheco/art097>
- Hunsberger, B., & Jackson, L. M. (2005). Religion, meaning, and prejudice. *Journal of Social Issues*, 61(4), 807–826. <https://doi.org/10.1111/j.1540-4560.2005.00433.x>
- Hutterian Brethren. (n.d.). Hutterites.org. <http://www.hutterites.org/the-leut/distributon/>
- Iannaccone, L. R. (1992). Sacrifice and stigma: Reducing free-riding in cults, communes, and other collectives. *Journal of Political Economy*, 100(2), 271–291. <https://doi.org/10.1086/261818>
- Iannaccone, L. R. (1994). Why strict churches are strong. *American Journal of Sociology*, 99(5), 1180–1211. <https://doi.org/10.1086/230409>
- Inge, A. (2017). *The making of a Salafi Muslim woman: Paths to conversion*. Oxford University Press.
- Irons, W. (1996a). In our own self image: The evolution of morality, deception, and religion. *Skeptic*, 4(2), 50–61.
- Irons, W. (1996b). Morality as an evolved adaptation. In J. Hurd (Ed.), *Investigating the biological foundations of human morality* (pp. 1–34). Edwin Mellen Press.

- Irons, W. (1996c). Morality, religion, and human evolution. In W. Richardson, & W. Wildman (Eds.), *Religion and science: History, method, dialogue* (pp. 375–399). Routledge.
- Irons, W. (2001). Religion as a hard-to-fake sign of commitment. In R. Nesse (Ed.), *Evolution and the capacity for commitment* (pp. 292–309). Russell Sage Foundation.
- Islam Question & Answer. (2005, December 25). It is not permissible for a woman to travel for Hajj except with a mahram. <https://islamqa.info/en/answers/3098/it-is-not-permissible-for-a-woman-to-travel-for-hajj-except-with-a-mahram>.
- Johnson, D. (2015). Big gods, small wonder: Supernatural punishment strikes back. *Religion, Brain & Behavior*, 5, 290–298. <https://doi.org/10.1080/2153599X.2014.928356>
- Johnson, D., & Krüger, O. (2004). The good of wrath: Supernatural punishment and the evolution of cooperation. *Political Theory*, 5, 159–176. <https://doi.org/10.1558/poth.2004.5.2.159>
- Jordan, T. R., Yekani, H. A. K., & Sheen, M. (2020). Further investigation of the effects of wearing the hijab: Perception of female facial attractiveness by Emirati Muslim men living in their native Muslim country. *PLoS One*, 15(10). <https://doi.org/10.1371/journal.pone.0239419>. Article e0239419.
- Khan, S. S., Hopkins, N., Reicher, S., Tewari, S., Srinivasan, N., & Stevenson, C. (2016). How collective participation impacts social identity: A longitudinal study from India. *Political Psychology*, 37(3), 309–325. <https://doi.org/10.1111/pops.12260>
- Kieschnick, J. (2005). Buddhist vegetarianism in China. In R. Sterckx (Ed.), *Of tripod and palate: Food, politics, and religion in traditional China* (pp. 186–212). Palgrave Macmillan.
- Lang, M., Chvaja, R., Purzycki, B. G., Václavik, D., & Staněk, R. (2022). Advertising cooperative phenotype through costly signals facilitates collective action. *Royal Society Open Science*, 9(5). <https://doi.org/10.1098/rsos.202202>. Article 202202.
- Lax, L. (2015). *Uncovered: How I left Hasidic life and finally came home*. She Writes Press.
- Mahmud, Y., & Swami, V. (2010). The influence of the hijab (Islamic head-cover) on perceptions of women's attractiveness and intelligence. *Body Image*, 7, 90–93. <https://doi.org/10.1016/j.bodyim.2009.09.003>
- Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. *The Academy of Management Review*, 20(3), 709–734. <https://doi.org/10.2307/258792>
- McCullough, M. E., Swartwout, P., Shaver, J. H., Carter, E. C., & Sosis, R. (2016). Christian religious badges instill trust in Christian and non-Christian perceivers. *Psychology of Religion and Spirituality*, 8(2), 149–163. <https://doi.org/10.1037/rel0000045>
- McCutcheon, R. (1995). The category “religion” in recent publications: A critical survey. *Numen*, 42, 284–309. <https://doi.org/10.1163/1568527952598585>
- Mermelstein, S., Barlev, M., & German, T. C. (2021). She told me about a singing cactus: Counterintuitive concepts are more accurately attributed to their speakers than ordinary concepts. *Journal of Experimental Psychology: General*, 150(5), 972–982. <https://doi.org/10.1037/xge0000987>
- Moon, J. W., Krems, J. A., & Cohen, A. B. (2018). Religious people are trusted because they are viewed as slow life-history strategists. *Psychological Science*, 29, 947–960. <https://doi.org/10.1177/0956797617753606>
- Moon, J. W., Krems, J. A., Cohen, A. B., & Kenrick, D. T. (2019). Is nothing sacred? Religion, sex, and reproductive strategies. *Current Directions in Psychological Science*, 28, 361–365. <https://doi.org/10.1177/0963721419838242>
- Mukherjee, N. (1999). *Consultations with the poor in Indonesia: Country synthesis report* (Report No. 38724). Poverty Reduction and Economic Management Network, World Bank. <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/576711468042280144/consultation-with-the-poor-in-indonesia-country-synthesis-report>.
- Naumann, L. P., Vazire, S., Rentfrow, P. J., & Gosling, S. D. (2009). Personality judgments based on physical appearance. *Personality and Social Psychology Bulletin*, 35, 1661–1671. <https://doi.org/10.1177/0146167209346309>
- Nesse, R. M. (Ed.). (2001). *Evolution and the capacity for commitment*. Russell Sage Foundation.
- Neuberg, S. L., Warner, C. M., Mistler, S. A., Berlin, A., Hill, E. D., Johnson, J. D., ... Schober, J. (2014). Religion and intergroup conflict: Findings from the global group relations project. *Psychological Science*, 25(1), 198–206. <https://doi.org/10.1177/0956797613504303>
- Northover, S. B., Ayers, J., Krems, J., & Cohen, A. (2017). *Unpublished raw data on mate poaching likelihood, likability, and trustworthiness ratings of modestly- and revealingly-dressed Muslim women targets by US Muslim and non-Muslim women*. Arizona State University.
- Northover, S. B., Bigman, Y., & Cohen, A. B. (2016). *Unpublished raw data on trustworthiness ratings of Muslim targets by US MTurk workers*. Arizona State University and the Hebrew University of Jerusalem.
- Northover, S. B., & Cohen, A. B. (2015–2017). *Unpublished raw data on trustworthiness ratings of Catholic and Muslim targets by north American university students*. Arizona State University.
- Northover, S. B., & Cohen, A. B. (2017a). Understanding religion from cultural and biological perspectives. In J. Causadias, E. Telzer, & N. Gonzales (Eds.), *The handbook of culture and biology: Bridging evolutionary adaptation and development* (pp. 55–77). John Wiley & Sons. <https://doi.org/10.1002/9781119181361.ch3>.
- Northover, S. B., & Cohen, A. B. (2017b). *Unpublished raw data on trustworthiness ratings of Hindu vegetarian targets by US MTurk workers*. Arizona State University.
- Olson, C. (2008). Celibacy and the human body: An introduction. In C. Olson (Ed.), *Celibacy and religious traditions* (pp. 3–20). Oxford University Press.
- Orbell, J., Goldman, M., Mulford, M., & Dawes, R. (1992). Religion, context, and constraint toward strangers. *Rationality and Society*, 4, 291–307. <https://doi.org/10.1177/1043463192004003004>
- Pazhoohi, F., & Hosseinchari, M. (2014). Effects of religious veiling on Muslim men's attractiveness ratings of Muslim women. *Archives of Sexual Behavior*, 43, 1083–1086. <https://doi.org/10.1007/s10508-014-0259-5>
- Penn, D. J., & Számadó, S. (2020). The handicap principle: How an erroneous hypothesis became a scientific principle. *Biological Reviews*, 95, 267–290. <https://doi.org/10.1111/brv.12563>
- Pew Research Center. (2012). The world's Muslims: Unity and diversity. <http://www.pewforum.org/Muslim/the-worlds-muslims-unity-and-diversity.aspx>.
- Potz, M. (2023). Costly commitments “under his eye”: Reconceptualizing the costly signaling theory of religion. *Journal of the American Academy of Religion*, 90(3), 599–617. <https://doi.org/10.1093/jaarel/lfad001>
- Power, E. A. (2015). *Building bigness: Religious practice and social support in rural South India* [doctoral dissertation, Stanford University]. Stanford Digital Repository. <http://purl.stanford.edu/gm772dt0226>.
- Power, E. A. (2017a). Discerning devotion: Testing the signaling theory of religion. *Evolution and Human Behavior*, 38, 82–91. <https://doi.org/10.1016/j.evolhumbehav.2016.07.003>
- Power, E. A. (2017b). Social support networks and religiosity in rural South India. *Nature Human Behaviour*, 1. <https://doi.org/10.1038/s41562-017-0057>. Article 0057.
- Powers, J. (2008). Celibacy in Indian and Tibetan Buddhism. In C. Olson (Ed.), *Celibacy and religious traditions* (pp. 201–224). Oxford University Press.
- Purzycki, B. G., & Arakchaa, T. (2013). Ritual behavior and trust in the Tyva Republic. *Current Anthropology*, 54(3), 381–388. <https://doi.org/10.1086/670526>
- Qirko, H. (2002). The institutional maintenance of celibacy. *Current Anthropology*, 43(2), 321–328. <https://doi.org/10.1086/339380>
- Quillion, T. (2020). Evolution of conditional and unconditional commitment. *Journal of Theoretical Biology*, 492. <https://doi.org/10.1016/j.jtbi.2020.110204>. Article 110204.
- Rappaport, R. (1979). *Ecology, meaning, and religion*. North Atlantic Books.
- Rappaport, R. (1999). *Ritual and religion in the making of humanity*. Cambridge University Press.
- Roberts, G. (2020). Honest signaling of cooperative intentions. *Behavioral Ecology*, 31(4), 922–932. <https://doi.org/10.1093/beheco/araa035>
- Ruffle, B., & Sosis, R. (2010). Do religious contexts elicit more trust and altruism? An experiment on Facebook. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.1566123>
- Schloss, J. P. (2009). Introduction: Evolutionary theories of religion: Science unfettered or naturalism run wild? In J. Schloss, & M. Murray (Eds.), *The believing primate: Scientific, philosophical, and theological reflections on the origin of religion* (pp. 1–25). Oxford University Press.
- Schwartz, S. H., Struch, N., & Bilsky, W. (1990). Values and intergroup social motives: A study of Israeli and German students. *Social Psychology Quarterly*, 53(3), 185–198. <https://doi.org/10.2307/2786958>
- Shah, P. K. (2009). *Jainism: Religion of compassion and ecology*. JAINA Education Committee.
- Shariff, A. F., & Clark, B. (2018). *Any god is better than no god: Belief in god is a more powerful cue of trust than religious affiliation* [Unpublished manuscript]. Department of Psychology, University of Oregon
- Shariff, A. F., Willard, A. K., Andersen, T., & Norenzayan, A. (2015). Religious priming: A meta-analysis with a focus on prosociality. *Personality and Social Psychology Review*, 20, 27–48. <https://doi.org/10.1177/1088868314568811>
- Shaver, J., DiVietro, S., Lang, M., & Sosis, R. (2018). Costs do not explain trust among secular groups. *Journal of Cognition and Culture*, 18, 180–204. <https://doi.org/10.1163/15685373-12340025>
- Shaver, J., Lang, M., Krátký, J., Klocová, E., Kundt, R., & Xygalatas, D. (2018). The boundaries of trust: Cross-religious and cross-ethnic field experiments in Mauritius. *Evolutionary Psychology*, 16(4). <https://doi.org/10.1177/1474704918817644>. Article 1474704918817644.
- Silverman, G. S., Johnson, K. A., & Cohen, A. B. (2016). To believe or not to believe, that is not the question: The complexity of Jewish beliefs about god. *Psychology of Religion and Spirituality*, 8(2), 119–130. <https://doi.org/10.1037/rel0000065>
- Singh, M., & Henrich, J. (2020). Why do religious leaders observe costly prohibitions? Examining taboos on Mentawai shamans. *Evolutionary Human Sciences*, 2. <https://doi.org/10.1017/ehs.2020.32>. Article e32.
- Soler, M. (2012). Costly signaling, ritual and cooperation: Evidence from Candomblé, an Afro-Brazilian religion. *Evolution and Human Behavior*, 33, 346–356. <https://doi.org/10.1016/j.evolhumbehav.2011.11.004>
- Sosis, R. (2000). Religion and intragroup cooperation: Preliminary results of a comparative analysis of utopian communities. *Cross-Cultural Research*, 34, 70–87. <https://doi.org/10.1177/106939710003400105>
- Sosis, R. (2003). Why aren't we all Hutterites? Costly signaling theory and religious behavior. *Human Nature*, 14, 91–127. <https://doi.org/10.1007/s12110-003-1000-6>
- Sosis, R. (2004). The adaptive value of religious ritual. *American Scientist*, 92, 166–172. <https://doi.org/10.1511/2004.2.166>
- Sosis, R. (2005). Does religion promote trust? The role of signaling, reputation, and punishment. *Interdisciplinary Journal of Research on Religion*, 1, 1–30.
- Sosis, R. (2006). Religious behaviors, badges, and bans: Signaling theory and the evolution of religion. In P. McNamara (Ed.), *Where god and science meet: How brain and evolutionary studies alter our understanding of religion* (pp. 61–86). Praeger.
- Sosis, R., & Alcort, C. (2003). Signaling, solidarity, and the sacred: The evolution of religious behavior. *Evolutionary Anthropology*, 12, 264–274. <https://doi.org/10.1002/evan.10120>
- Sosis, R., & Bressler, E. R. (2003). Cooperation and commune longevity: A test of the costly signaling theory of religion. *Cross-Cultural Research*, 37, 211–239. <https://doi.org/10.1177/1069397103251426>

- Sosis, R., Kress, H. C., & Boster, J. S. (2007). Scars for war: Evaluating alternative signaling explanations for cross-cultural variance in ritual costs. *Evolution and Human Behavior*, 28, 234–247. <https://doi.org/10.1016/j.evolhumbehav.2007.02.007>
- Sosis, R., & Ruffle, B. J. (2003). Religious ritual and cooperation: Testing for a relationship on Israeli religious and secular kibbutzim. *Current Anthropology*, 44, 713–722. <https://doi.org/10.1086/379260>
- Sosis, R., & Ruffle, B. J. (2004). Ideology, religion, and the evolution of cooperation: Field experiments on Israeli kibbutzim. *Research in Economic Anthropology*, 23, 89–117. [https://doi.org/10.1016/S0190-1281\(04\)23004-9](https://doi.org/10.1016/S0190-1281(04)23004-9)
- Spence, M. (1973). Job market signaling. *The Quarterly Journal of Economics*, 87(3), 355–374. <https://doi.org/10.2307/1882010>
- Sperber, D. (1996). *Explaining culture: A naturalistic approach*. Blackwell.
- Sperber, D., Clément, F., Heintz, C., Mascaro, O., Mercier, H., Origg, G., & Wilson, D. (2010). Epistemic vigilance. *Mind & Language*, 25(4), 359–393. <https://doi.org/10.1111/j.1468-0017.2010.01394.x>
- Strabac, Z., Aalberg, T., Jensen, A. T., & Valenta, M. (2016). Wearing the veil: Hijab, Islam and job qualifications as determinants of social attitudes towards immigrant women in Norway. *Ethnic and Racial Studies*, 39(15), 2665–2682. <https://doi.org/10.1080/01419870.2016.1164878>
- Swami, V. (2013). The influence of the hijab (Islamic head-cover) on interpersonal judgments of women: Replication and extension. In J. Marich (Ed.), *The psychology of women: Diverse perspectives from the modern world* (pp. 128–140). Nova Science Publishers.
- Tan, J., & Vogel, C. (2008). Religion and trust: An experimental study. *Journal of Economic Psychology*, 29, 832–848. <https://doi.org/10.1016/j.joep.2008.03.002>
- Tarsin, A. (2015). *Being Muslim: A practical guide*. Sandala Inc.
- Tooby, J., & Cosmides, L. (1992). The psychological foundations of culture. In J. H. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture* (pp. 19–136). Oxford University Press.
- Tooby, J., & Cosmides, L. (1996). Friendship and the banker's paradox: Other pathways to the evolution of adaptations for altruism. In W. G. Runciman, J. M. Smith, & R. I. M. Dunbar (Eds.), *Proceedings of the British Academy, Vol. 88. Evolution of social behaviour patterns in primates and man* (pp. 119–143). Oxford University Press.
- Tooby, J., & Cosmides, L. (2010). Groups in mind: The coalitional roots of war and morality. In H. Høgh-Olesen (Ed.), *Human morality and sociality: Evolutionary and comparative perspectives* (pp. 191–234). Red Globe Press. [https://doi.org/10.1007/978-1-137-05001-4\\_8](https://doi.org/10.1007/978-1-137-05001-4_8)
- Tooby, J., & Cosmides, L. (2020). Natural selection and the nature of communication. In K. Floyd, & R. Weber (Eds.), *The handbook of communication science and biology* (1st ed., pp. 21–49). Taylor & Francis. <https://doi.org/10.4324/9781351235587>
- Tversky, A., & Kahneman, D. (1983). Extensional versus intuitive reasoning: The conjunction fallacy in probability judgment. *Psychological Review*, 90(4), 293–315. <https://doi.org/10.1037/0033-295X.90.4.293>
- Villa, V. (2020, December 16). *Women in many countries face harassment for clothing deemed too religious – Or too secular*. Pew Research. Retrieved February 8, 2024, from <https://www.pewresearch.org/short-reads/2020/12/16/women-in-many-countries-face-harassment-for-clothing-deemed-too-religious-or-too-secular/>.
- Wenham, G. J. (1981). The theology of unclean food. *Evangelical Quarterly*, 53, 6–15. <https://www.scribd.com/document/111990187/A-Theology-of-Unclean-Food-Wenham-Eq-81>.
- Whitehouse, H. (2023). Rethinking ritual: How rituals made our world and how they could save it. *Journal of the Royal Anthropological Institute*, 00, 1–18. <https://doi.org/10.1111/1467-9655.14048>
- Widman, D., Corcoran, K., & Nagy, R. (2009). Belonging to the same religion enhances the opinion of others' kindness and morality. *Journal of Social, Evolutionary, and Cultural Psychology*, 3(4), 281–289. <https://doi.org/10.1037/h0099316>
- Winchester, D., & Guhin, J. (2019). Praying "straight from the heart": Evangelical sincerity and the normative frames of culture in action. *Poetics*, 72, 32–42. <https://doi.org/10.1016/j.poetic.2018.10.003>
- Xygalatas, D. (2008). Firewalking and the brain: The physiology of high-arousal rituals. In J. Bulbulia, R. Sosis, E. Harris, R. Genet, C. Genet, & K. Wyman (Eds.), *The evolution of religion: Studies, theories, & critiques* (pp. 189–195). Collins Foundation Press.
- Xygalatas, D., Kotherová, S., Maño, P., Kundt, R., Cigán, J., Kundtová Klocová, E., & Lang, M. (2018). Big gods in small places: The random allocation game in Mauritius. *Religion, Brain & Behavior*, 8(2), 243–261. <https://doi.org/10.1080/2153599X.2016.1267033>
- Xygalatas, D., Maño, P., Bahna, V., Klocová, E. K., Kundt, R., Lang, M., & Shaver, J. H. (2021). Social inequality and signaling in a costly ritual. *Evolution and Human Behavior*, 42, 524–533. <https://doi.org/10.1016/j.evolhumbehav.2021.05.006>
- Xygalatas, D., Mitkidis, P., Fischer, R., Reddish, P., Skewes, J., Geertz, A., Roepstorff, A., & Bulbulia, J. (2013). Extreme rituals promote prosociality. *Psychological Science*, 24(8), 1602–1605. <https://doi.org/10.1177/0956797612472910>
- Yamaguchi, M., Smith, A., & Ohtsubo, Y. (2015). Commitment signals in friendship and romantic relationships. *Evolution and Human Behavior*, 36(6), 467–474. <https://doi.org/10.1016/j.evolhumbehav.2015.05.002>
- Zahavi, A. (1975). Mate selection – A selection for a handicap. *Journal of Theoretical Biology*, 53, 205–214. [https://doi.org/10.1016/0022-5193\(75\)90111-3](https://doi.org/10.1016/0022-5193(75)90111-3)
- Zahavi, A. (1977). The cost of honesty (further remarks on the handicap principle). *Journal of Theoretical Biology*, 67(3), 603–605. [https://doi.org/10.1016/0022-5193\(77\)90061-3](https://doi.org/10.1016/0022-5193(77)90061-3)
- Zahavi, A., & Zahavi, A. (1997). *The handicap principle: A missing piece of Darwin's puzzle*. Oxford University Press.