

RESEARCH ARTICLE

Religious costly signal induces more trustworthiness than secular costly signal: A study of pilgrimage to Santiago de Compostela

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Funding information

Masaryk University, Grant/Award Number: MUNI/A/1396/2022; Czech Ministry of Education, Youth, and Sports, Grant/Award Number: CZ.02.2.69/0.0/0.0/19_074/0012727; Spanish Ministry of Science and Innovation, Grant/Award Number: RT12018-093550-B-100

Abstract

Research suggests that costly displays of commitment increase trust and cooperation. In five studies (total $n > 1,700$), we investigated whether costly behaviours are more effective in promoting trust when integrated within a religious rather than secular context using the pilgrimage to Santiago de Compostela as a costly display of commitment. First, we show that pilgrims base their pilgrim identity on physical effort (Studies 1A and 1B). Next, in three pre-registered experiments (Studies 2–4) with the Spanish population, we compared the trustworthiness of people posting on Facebook about their participation in a religious pilgrimage and a secular pilgrimage/hike with various control posts. The results showed that pilgrims/hikers are perceived as more trustworthy than non-pilgrims and that long-distance pilgrims are perceived as more trustworthy than short-distance pilgrims. Moreover, these effects are stronger when the pilgrimage is framed in a religious context compared to a secular context. Our research highlights the key role of religion in the costly signalling of commitment.

KEYWORDS

costly signalling, pilgrimage, religion, Santiago de Compostela, trustworthiness

1 | INTRODUCTION

Humans are reasoned to possess evolved psychological mechanisms allowing them to select trustworthy partners based on partners' facial cues (Krumhuber et al., 2007), emotional expressions (Todorov et al., 2015), or reputation (Barclay, 2010; Bereczkei et al., 2010). However, inferences from faces are not perfectly accurate and might be misleading (Rule et al., 2013); and while reputational information is relatively sound, it is not easily accessible in large and anonymous societies (e.g., McCullough, 2020).

The lingering uncertainty can be dispelled by a reliable communication of commitment to cooperative conduct through a costly display. Inspired by a model of animal communication (Zahavi, 1975; Zahavi & Zahavi, 1997), various researchers proposed that humans can honestly communicate their hidden cooperative intentions by performing ostensibly costly (in terms of energy, time, and resources) behaviour that

receivers of the signal associate with the signalled quality (Barker et al., 2019; Stibbard-Hawkes, 2019). As formalized in costly signalling theory (Sosis, 2003), commitment to cooperative norms is a hidden quality that can be reliably communicated by a public performance of costly actions that other group members associate with norm compliance (Lang et al., 2022).

During the last two decades, costly signals of commitment have been studied separately within religious contexts (e.g., Sosis & Ruffle, 2003) as well as within secular contexts (Shaver, Divietro, et al., 2018). These studies indirectly suggested that costly signals may be more effective in raising trust when they are enveloped in religious traditions compared to secular traditions. However, none of the studies conducted to date has compared the effects of the same costly signal within religious and secular groups, which prevents us from knowing if religion plays a key role in costly signalling of commitment. The present research aims to address this issue.

1.1 | Costly signalling in religious and secular contexts

Religious rituals are a cross-culturally widespread activity that is arguably costly in terms of energy, time, and resources (Irons, 2001; Sosis, 2003). To find a plausible explanation for the endurance of rituals, social scientists starting with Durkheim (2011/1912) sought to identify social benefits of ritual participation (e.g., Whitehouse & Lanman, 2014). One fruitful research line argues that rituals function as costly signals that facilitate cooperation and coordination within religious groups, leading to individual cooperative benefits that offset these costs (Bulbulia, 2004; Irons, 2001; Lang et al., 2022; Sosis, 2003).

There is evidence showing that specific religious rituals facilitate reliable communication of cooperative commitment in particular communities. For example, Israeli kibbutz members who participated more frequently in religious rituals were more cooperative in economic games compared to members of secular kibbutzim who did not engage in such rituals (Sosis & Ruffle, 2003). Similarly, Hindus participating in the extreme ritual of *Thaipoozam Kavadi* in Mauritius donated a higher portion of their monetary endowment to the local temple compared to participants who just prayed (Xygalatas et al., 2021). Several studies also showed that engaging in increasingly costly religious rituals augments perceived trustworthiness of the performer, and correlates with helping community members and with a higher probability of building positive reciprocal relationships with neighbours (Hall et al., 2015; Power, 2017, 2018; Power & Ready, 2018; Purzycki & Arakchaa, 2013; Soler, 2012).

The reviewed evidence suggests that costly religious signals reliably communicate trustworthiness to other co-religionists, and that people can use this group-specific form of communication to sustain cooperation and reciprocity with other members of religious communities. Interestingly, despite some supportive evidence from laboratory experiments (Lang et al., 2022), the sparse research conducted outside religious traditions suggests that costly commitment signalling may not be effective in real-world secular contexts. First, using archival data on the survival of US 19th-century utopian communes, Sosis and Bressler (2003) showed that while the frequency of costly group practices (taboos, collective rituals) was associated with commune longevity (presumably due to increased intra-group trust and cooperation), this effect was higher in religious communes compared to secular communes. Similarly, a study conducted by Shaver, Divietro, et al. (2018) showed that members of Greek fraternities (with high-cost initiation rituals) and university secular social clubs (with low-cost initiation rituals) did not differ in their level of cooperation in an economic game.

1.2 | Why does costly signalling work in religious but not in secular contexts?

To illuminate the discrepancies found between the effects of secular and religious costly signals in the cooperative domain, we suggest that religious signalling is a prime example of adaptive interaction between

human psychology and cultural practices related to communicating trustworthiness. The historical confluence of costly ritualized displays and belief in supernatural agents is central to our argument as this confluence interlocks costly signals and supernatural moral orders in religious traditions, affording the particular effects of religious signalling (Alcorta & Sosis, 2005; Bulbulia, 2004; Chvaja & Řezníček, 2019; Sosis, 2003, 2005). There are at least three mechanisms through which this confluence can operate.

First, in many religious traditions, supernatural agents act as guarantors of cooperative norms. At the same time, gods also mandate public expression of devotion through rituals that, by extension, serve as an expression of commitment to the sacred norms of the group. That is, by regularly expressing commitment to a supernatural deity, religious adherents simultaneously express their commitment to the associated sacred norms (Rappaport, 1999). Another person's commitment to a supernatural deity may therefore serve as an indicator of their trustworthiness in several cooperative domains to other co-religionists without requiring any further communication of cooperative intent (Bulbulia, 2004).

Second, unlike secular institutions and the norms they stipulate, the existence of supernatural agents and related sacred norms is imperious to empirical verification (Rappaport, 1999). And while secular values may and do change, sacred norms are perceived as eternal and absolute (Chvaja et al., 2022; Sarkissian & Phelan, 2019; Tetlock et al., 2000). Thus, committed religious individuals might be strongly motivated to regularly perform mandated rituals at their own costs, whereas such rituals could be easily called into question within secular contexts and not endure.

Third, in many religious traditions, gods' minds are believed to have extraordinary abilities such as omniscience and omnipresence (Purzycki et al., 2022). Such gods often care about human inter-personal conduct and govern that conduct by demanding adherence to sacred norms and punishing norm transgressions (Johnson, 2016; Norenzayan et al., 2016). Indeed, it has been found that believing in monitoring and punitive moralizing gods positively predicts moral and cooperative behaviour in various large-scale (Shariff & Norenzayan, 2011) and small-scale societies (Lang et al., 2019; Purzycki et al., 2016). It follows that if religious commitment signals provide information about the belief in sacred norms, supernatural agents, and their punishments, religious commitment signals should be more functional in increasing trustworthiness between co-religionists compared to secular commitment signals in secular communities (Xygalatas et al., 2021). The alignment of signaller and receiver identity is crucial for our argument, because signals are group-specific codes meant to affect other group members who understand that code.

Although the idea that costly religious signals differ from costly secular signals in some of these critical respects has been previously discussed, it has never been experimentally tested. Previous studies on costly signalling tested the theory either in religious (Sosis & Ruffle, 2003)¹ or in non-religious (Shaver, Divietro, et al., 2018) contexts,

¹ The authors of this study recruited participants from secular kibbutzim but the difference between their levels of cooperation and the cooperation levels of religious kibbutzim members

without comparing what happens in both types of contexts. The only exception is the work by Sosis and Bressler (2003) on historical records from 19th-century US communes, but this study did not test the causal direction between religious signals and increased cooperativeness. A proper causal test needs to compare the effects of the same costly signal on trustworthiness within religious and secular communities, which is the main goal of the present research.

1.3 | The present research

We conducted five studies using the specific context of the pilgrimage to Santiago de Compostela where pilgrims walk a variety of distances to reach the grave of the apostle James (Frey, 1998). Walking this pilgrimage is a costly behaviour in terms of time, energy, and sometimes even psychological discomfort (e.g., walking ten days in a row during constant rain) and physical pain (e.g., most pilgrims suffer from blisters). While there may be some personal benefits following the pilgrimage (e.g., health benefits due to walking), these benefits could be usually obtained via much less costly means (e.g., regular exercise in the gym). Furthermore, although the pilgrimage has obvious Christian undertones, pilgrims to Santiago are often not affiliated with any Christian denomination and undertake the pilgrimage for various reasons, including secular reasons (Amaro et al., 2018; Farias et al., 2018). Thus, the setting of the Santiago de Compostela pilgrimage provides a natural opportunity to test the effects of the same costly signal on trustworthiness within religious and secular contexts.

We first conducted two survey investigations in the field to examine the empirical adequacy of the manipulation that we aimed to use in the following experiments. In Study 1A, we asked pilgrims alongside the trail what qualities are essential to be a real pilgrim. In Study 1B, we obtained self-report data for the most salient answer from Study 1A (kilometres walked) and used this variable as a predictor of the perceived saliency of pilgrim identity.

Subsequently, we conducted three pre-registered, high-powered online experiments (Studies 2–4) where we manipulated the type and costliness of the signal (pilgrimage vs. non-pilgrimage; short pilgrimage vs. long pilgrimage) and its context (religious vs. secular) using fake Facebook profiles. Our main hypotheses were that pilgrims will be rated as more trustworthy than non-pilgrims and long-distance pilgrims will be rated as more trustworthy than short-distance pilgrims. Moreover, we predicted that these effects will be stronger in the religious compared to the secular context.

2 | STUDY 1

To test our assumption that physical effort is seen as an essential characteristic of the pilgrim identity by Santiago pilgrims, we conducted a two-step (Studies 1A and 1B) field investigation with members of

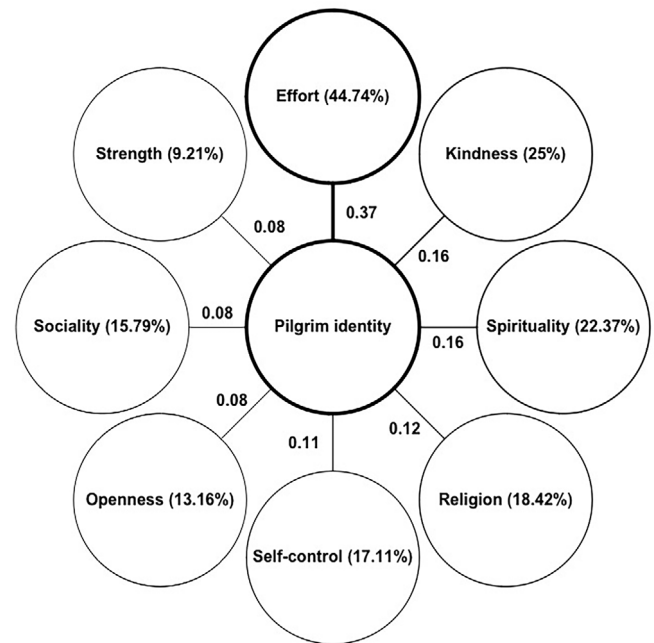


FIGURE 1 The saliency of individual categories (Smith's S) constituting a pilgrim identity is displayed alongside the lines—and is represented also by the boldness of the lines. The most salient category is effort related to the arduous journey on foot. Percentages indicate the portion of pilgrims who mentioned the corresponding category

this community. We expected that pilgrims would frequently mention effort as a key aspect of the pilgrimage and that endured effort will be positively correlated with the saliency of pilgrim identity. Both studies were administered in English and participants verbally indicated English fluency and agreement with participation. Participants were not rewarded for their participation (in any of the five reported studies).

2.1 | Study 1A: Methods and results

We asked pilgrims on the road to Santiago to list up to five traits that, according to them, constitute a real pilgrim (and to order the traits according to their importance). The data were collected in Saint-Jean-Pied-de-Port and Santiago de Compostela. In total, 76 pilgrims ($M_{age} = 36$, $SD_{age} = 14$; 57% female; 36% affiliated to a religious institution) provided at least one answer.

The free-list data were coded by two independent coders, and their disagreements (interrater reliability: Cohen's $\kappa = 0.61$, 95% CI = [0.54, 0.69]) were resolved by the last author of this article. Using the *AnthroTools* package (Purzycki & Jamieson-Lane, 2017)², we calculated the saliency of each category. The results plotted in Figure 1 reveal that physical effort (i.e., walking) is the most salient category reported by

resulted from the absence of collective rituals in the secular kibbutzim, not from the interaction between ritual frequency and the type of ideology (secular/religious).

² All analyses in this article were conducted in R (R Core Team, 2020).

pilgrims, followed by kindness, spirituality, religion, and self-control. See Section 1 in SM³ for details on coding and saliency calculation.

2.2 | Study 1B: Methods and results

We tested the hypothesis that the more kilometres pilgrims walk, the more they would feel they were real pilgrims. Fully completed questionnaires were obtained from 312 pilgrims in Santiago de Compostela who just finished the pilgrimage ($M_{age} = 35.43$, $SD_{age} = 13.79$; 55% female; 42% affiliated to a church).

We measured the pilgrim identity by the item 'I feel like a real pilgrim' (7-point Likert scale). We also asked participants how many kilometres they walked and about religious motives for the pilgrimage. Religious motives were measured using 5 items (with 7-point Likert scales) averaged to form a latent construct (e.g., 'to grow in religious faith'; $\alpha = .86$; the measure was adapted from Amaro et al., 2018 and Oviedo et al., 2014). Finally, questions on age, income, and education were included as potentially important confounds to control for.

We built a linear regression model to explain the variation in pilgrim identity with the number of kilometres walked as the main predictor and the demographic variables as controls. All continuous variables were entered in our model as z-scores. On average, participants walked 486 kilometres ($SD = 373$). We found a positive association between kilometres walked and pilgrim identity ($\beta = 0.16$, 95% CI = [0.05, 0.26], $p = .005$). Importantly, the model revealed that religious motivation is positively associated with pilgrim identity ($\beta = 0.26$, 95% CI = [0.15, 0.37], $p < .001$). See Section 2 in SM for details on Study 1B.

2.3 | Discussion

These results support the assumption that pilgrimage costs operationalized as kilometres walked are important elements of the pilgrimage to Santiago de Compostela. Besides kilometres walked, religious motivation to undertake the pilgrimage also matters for pilgrim identity, suggesting that despite the decreasing trend in religious motivation among pilgrims (Fernandes et al., 2012; Gomes et al., 2019; Kim et al., 2016; Lopez et al., 2017), religion is still important among the pilgrims on the road. However, these results must be taken with caution and interpreted only in relation to this study. Its purpose was to lend support to the idea that pilgrimage to Santiago is a suitable costly signal. Due to two limitations, we refrain from making any further generalizations based on these surveys. First, the pilgrims who completed our surveys were selected based on their fluency in English. Second, we only measured religious motivation in the study (due to the space limits of our survey in the field). Therefore, we do not know if secular motives also relate to pilgrim identity, or whether the positive associ-

ation between religious motivation and pilgrim identity that we found might be confounded by non-religious extraneous variables.

3 | STUDY 2

Study 2 tested whether the costliness and the context (religious vs. secular) of the activity affect how trustworthy the signallers are perceived to be by the receivers of the signal.

3.1 | Method

3.1.1 | Participants

An a priori power analysis (see Section 3.1 in SM) suggested a sample of 351 participants to detect effects sizes from previous literature (Hall et al., 2015). We recruited 582 participants from a pool of psychology students at the National Distance Education University and from the general Spanish population using a snowball sampling strategy. After excluding those who did not answer the questions on trust ($n = 20$), we decided also to exclude those who spent less than five minutes or more than an hour filling out the survey ($n = 41$). Since not all participants completed all questions ($n = 48$), the final sample for main analyses consisted of 473 participants ($M_{age} = 38$, $SD_{age} = 13$; 54% female; 53% Christian; 47% atheist/agnostic). All participants knew what the pilgrimage to Santiago is, and no participant guessed the hypotheses.

3.1.2 | Materials

Each participant rated three Facebook (hereafter FB) posts in counter-balanced order for the trustworthiness of their authors. We used a 3 (signal factor; within-subjects) \times 2 (distance factor; between-subjects) \times 2 (context factor; between-subjects) mixed design.

The signal factor manipulated the presence of a signal using different FB posts. The first FB post contained a costly signal (pilgrimage), the second FB post contained a subtle signals (church visit/gym visit), and the third FB post contained an activity serving as a baseline (spending time at a Formula 1 race and having a tasty dinner).

The distance factor further manipulated the cost of the pilgrimage by using different distances that the authors of the respective FB posts allegedly walked on foot. In the short-distance condition, the pilgrim walked 115 km in 4 days and in the long-distance condition 800 km in 35 days. Note that we checked whether participants perceived the pilgrimage in the long-distance condition as more difficult compared to participants in the short-distance condition.

The context factor framed the pilgrimage FB post either in religious or in secular terms. The pilgrim in the religious FB post explicitly stated a religious identity and religious motivation as well as God's guidance during the trip. In contrast, the secular pilgrim explicitly claimed to be a non-believer and conducting the pilgrimage for secular reasons

³ Electronic Supplementary material (SM) includes additional Figures (S1–S13), Tables (S1–S21), and materials organized in six sections.

(testing themselves). As a consequence of this manipulation, we also used different subtle signal FB posts for the two contexts (Christian mass in the religious context and gym in the secular context) to control for the effects of religiosity on the ratings of the FB posts authors' trustworthiness. That is, we aimed to show that costly religious pilgrimage increases trustworthiness beyond displaying religiosity through ordinary low-cost activity (attending a mass). Importantly, for the context factor, we assumed that for the religious signal to function, it needs to be understood by religious receivers. Thus, religious FB posts were matched with Christian participants and secular FB posts with non-believers. See Figure 2 for an overview of our design; and for the details on all individual FB posts, see Section 3.2 in SM.

We hid all faces and names of the purported authors of the manipulated FB posts, eliminating the possibility that the tested effects might be caused by an interaction of face and condition rather than by the manipulation itself. This step also eliminated possible gender effects since the gender of the FB profile owner was not specified.

3.1.3 | Measures

To ensure that participants in the role of signal receivers were matched with their group-appropriate signal, participants were pre-screened based on their self-reported religious status. Self-proclaimed Christians were assigned to the religious context condition and non-believers to the secular context condition. We evaluated the perceived trustworthiness of FB post authors by averaging five items measured on a 7-point scale (e.g., 'The person has integrity'; $\alpha = .86$) taken from Hall et al. (2015). We also measured perceived difficulty of the pilgrimage and perceived commitment to God ('The person is highly committed to God') using single items with 7-point Likert scales as a manipulation check.

Finally, we assessed a series of control variables: age, sex, participant's religiosity (e.g., 'I believe in the existence of God/God-like creature', 7-point Likert scale, six items, $\alpha = .76$), participant's passion for hiking (single item, 7-point Likert scale), whether participants had been on the pilgrimage to Santiago in the past, and whether participants knew what the pilgrimage to Santiago is. For details on the measures, see Section 3.3 in SM.

3.1.4 | Procedure

The study was conducted online, via *Qualtrics*. First, participants were asked whether they were Christians or Atheists/Agnostics, and the whole sample was divided into two groups (the between-subjects context factor). Then, participants were randomly assigned to the long-distance or short-distance condition (the between-subjects distance factor), and introduced to three FB posts in a randomized order (the within-subjects signal factor).

Participants learned that the study assessed how people express their personalities on social media like FB and how others perceive those expressions. Participants were told that random participants

sent us their FB posts that (according to those random participants) best represent their personalities. The participant's task was to rate those people based only on the information derived from a single FB post on several 'personality' indicators that we split into individual and social characteristics. Although we were interested only in the characteristics that we labelled as 'social', we also included individual characteristics (e.g., skilfulness and creativity) as filler items to support the cover story. Social characteristics consisted of the questions on trustworthiness described in the previous section. To make the cover story coherent, we told participants that our aim was to match their answers with the personal characteristics of the FB post authors and then assess whether participants' evaluations were close to the real characteristics. As such, the point of the cover story was to persuade participants that we were interested in whether people advertise their personality characteristics on social media honestly.

3.1.5 | Predictions and analyses

Together with the assumption checks (religious participants will be more religious than non-believers; the pilgrims in the religious context will be perceived as more religious than the pilgrims in the secular context; the longer pilgrimage will be perceived as more difficult than the shorter pilgrimage; and the religious and secular pilgrimages will be perceived as comparably difficult), we pre-registered (accessible from <https://doi.org/10.17605/OSF.IO/V65KT>) the following predictions:

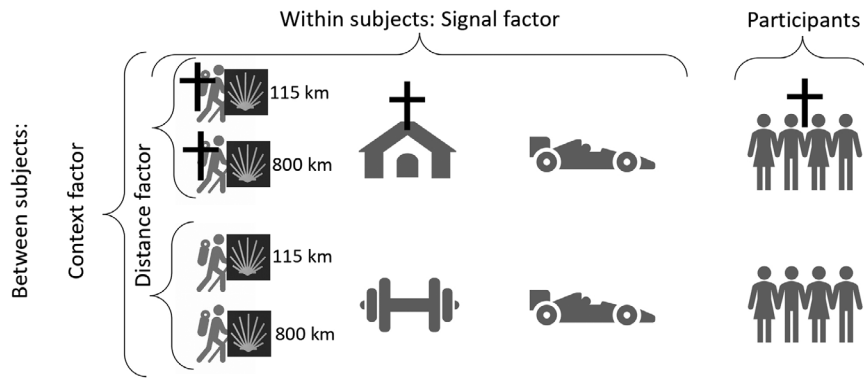
Prediction P1: The trustworthiness of the authors of the pilgrimage FB posts will be higher compared to the authors of the baseline and subtle signal FB posts. This effect will be larger in the religious compared to the secular context.

Prediction P2: The trustworthiness of the long-distance pilgrims will be higher than the trustworthiness of the short-distance pilgrims. This effect will be larger in the religious compared to the secular context.

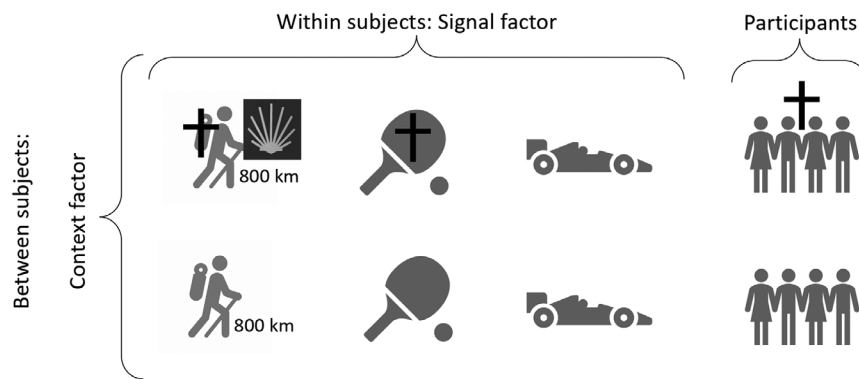
We also planned to test whether the purported effects (P1 and P2) would be mediated by perceptions of profile author's adherence to prosocial norms and commitment to God (only in the religious context) and, in the case of P2, also by the perceived costs of pilgrimage. All mediation models were pre-registered, but after we conducted the main interaction analyses, we decided to adapt our mediations to better reflect the obtained results. Thus, although the logic behind our mediations—investigating the mechanism of religious costly signalling—is congruent with pre-registered mediation predictions, we consider the mediation analyses that we eventually conducted to be only exploratory and report them in SM (Sections 3.4.3 for Study 2, 4.4.3 for Study 3, and 5.4.3 for Study 4).

As a general modelling strategy, we used linear regressions with dummy coded conditions where the reference category was the pilgrimage FB post. Note, however, that for easier interpretation

Study 2: 3 (Signal factor) x 2 (Context factor) x 2 (Distance factor, only for the pilgrimage FB post)



Study 3: 3 (Signal factor) x 2 (Context factor)



Study 4: 3 (Distance factor) x 2 (Context factor)

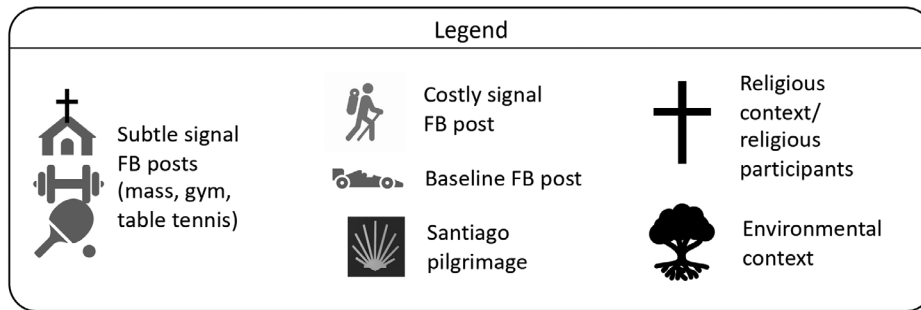
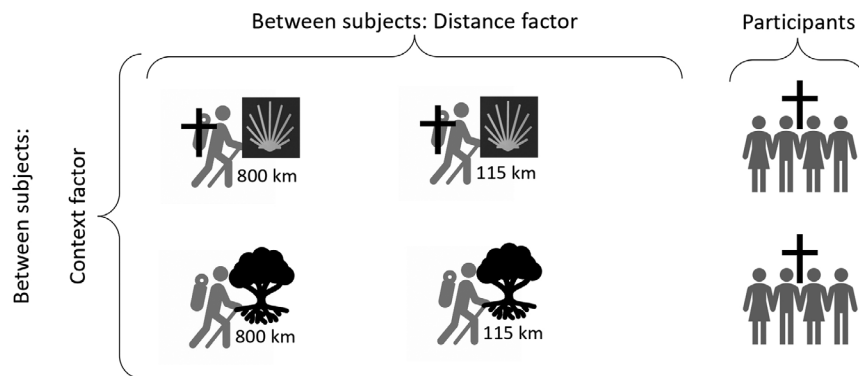


FIGURE 2 Overview of experimental designs. The 'Design' column describes the design we used in each individual study. The 'Participants' column displays the samples. Note that in Studies 2 and 3, participants saw all the FB posts in a row; in Study 4, participants saw only one FB post out of all four displayed

of the results, we reversed the coefficients of the signal factor such that positive coefficients mean that the pilgrimage FB post is higher on the respective variable than the subtle/baseline FB posts (in all Tables in SM, we report the non-reversed coefficients). For within-subjects data, we let the intercepts vary by participants using linear mixed models (*lme4*; Bates et al., 2015) to account for the repeated measures on one participant. All continuous variables were entered in our models as z-scores. The models are adjusted for control variables. This applies to all studies if not specified otherwise.

3.2 | Results

In the religious context, 124 participants were in the long-distance condition, and 125 were in the short-distance condition. In the secular context, 106 participants were in the long-distance condition, and 118 were in the short-distance condition. The results of all assumption checks were as expected. See Section 3.4.1 in SM.

Prediction P1. Across the religious and secular contexts, the authors of the pilgrimage FB posts were rated as more trustworthy than the authors of the baseline FB posts ($\beta = 0.38$, 95% CI = [0.29, 0.44], $p < .001$) and the subtle signal FB posts ($\beta = 0.20$, 95% CI = [0.13, 0.28], $p < .001$). In the religious context, the authors of the pilgrim FB posts were rated as more trustworthy than authors of the baseline ($\beta = 0.46$, 95% CI = [0.35, 0.56], $p < .001$) and subtle signal ($\beta = 0.14$, 95% CI = [0.03, 0.24], $p = .012$) FB posts. In the secular condition, the estimated increase in trustworthiness from the baseline to the pilgrim FB post was smaller than in the religious context condition ($\beta_{\text{interaction for baseline}} = -0.20$, 95% CI = [-0.35, -0.04], $p = .013$); but the increase from the subtle FB post (gym) to the pilgrim FB post was not different from the religious condition ($\beta_{\text{interaction for subtle}} = 0.15$, 95% CI = [-0.01, 0.30], $p = .064$).

Prediction P2. The long pilgrimage was associated with higher trustworthiness than the short pilgrimage ($\beta = 0.24$, 95% CI = [0.05, 0.42], $p = .012$). Interaction models revealed that religious pilgrims embarking on the long pilgrimage were trusted more than religious pilgrims undertaking the short pilgrimage ($\beta = 0.31$, 95% CI = [0.05, 0.56], $p = .018$), though this effect was not significantly different in the secular context ($\beta_{\text{interaction}} = -0.17$, 95% CI = [-0.53, 0.20], $p = .362$).

See Figure 3 for plotted differences across conditions and Section 3.4.2 in SM for details on all models in this section.

3.3 | Discussion

Study 2 found that authors of pilgrimage FB posts were rated as more trustworthy than authors of FB posts informing about less demanding activities. Moreover, pilgrims who undertook a long pilgrimage (800 km) were rated as more trustworthy than pilgrims who undertook a short pilgrimage (115 km). However, contrary to our prediction,

we did not find that the effects of pilgrimage and length of the pilgrimage were stronger in the religious context compared to the secular context.

We offer two possible explanations. First, the pilgrimage is historically interwoven with religion regardless of individual motives and religiosity. This effect might have masked our manipulation, causing higher trustworthiness of secular pilgrims. Moreover, in our design, the religious and secular contexts contained a cathedral on the pilgrimage FB post, further exacerbating this potentially confounding issue. Second, the effects of the pilgrimage FB post and long-distance pilgrimage might have been caused by participants' perception of the authors of these FB posts as having more self-control, which is associated with trustworthiness (Righetti & Finkenauer, 2011). Study 1A suggested that self-control is one of the constitutive factors of pilgrim identity. It could be speculated that pilgrimage, whether religious or secular, is a clear and strong demonstration of pilgrims' self-control rather than a signal of norm commitment. Indeed, observers may easily differentiate between pilgrims with less and more self-control based on how many days (and kilometres) the pilgrims walked.

4 | STUDY 3

Study 3 compared the perceived trustworthiness of Santiago pilgrims with the trustworthiness of hikers who walked the same distance without doing a pilgrimage. We reasoned that if religious pilgrims would be seen as more trustworthy than subtle signallers and, at the same time, hikers would not be seen as more trustworthy compared to subtle signallers, the overall effects of pilgrimage costs (its length) that we observed in Study 2 could be attributed to factors inherent to the Santiago pilgrimage. We also reasoned that if there would be no difference in the trustworthiness of pilgrims and hikers (as in Study 2), a general mechanism related to pilgrimage, such as perceived self-control, could be responsible for the effects on trustworthiness.

4.1 | Method

4.1.1 | Participants

The sample size necessary to detect the expected effects was set to 500, based on simulations of the effect sizes from Study 2 (see Section 4.1 in SM). We sampled 530 Spaniards using a snowball sampling procedure wherein students from an open university invited their acquaintances to volunteer. After excluding 30 participants who spent less than five or more than 60 min on the survey and two participants who did not answer their age, the final sample included 498 participants ($M_{\text{age}} = 37$, $SD_{\text{age}} = 15$; 61% female; 58% Christian; 42% atheist/agnostic).

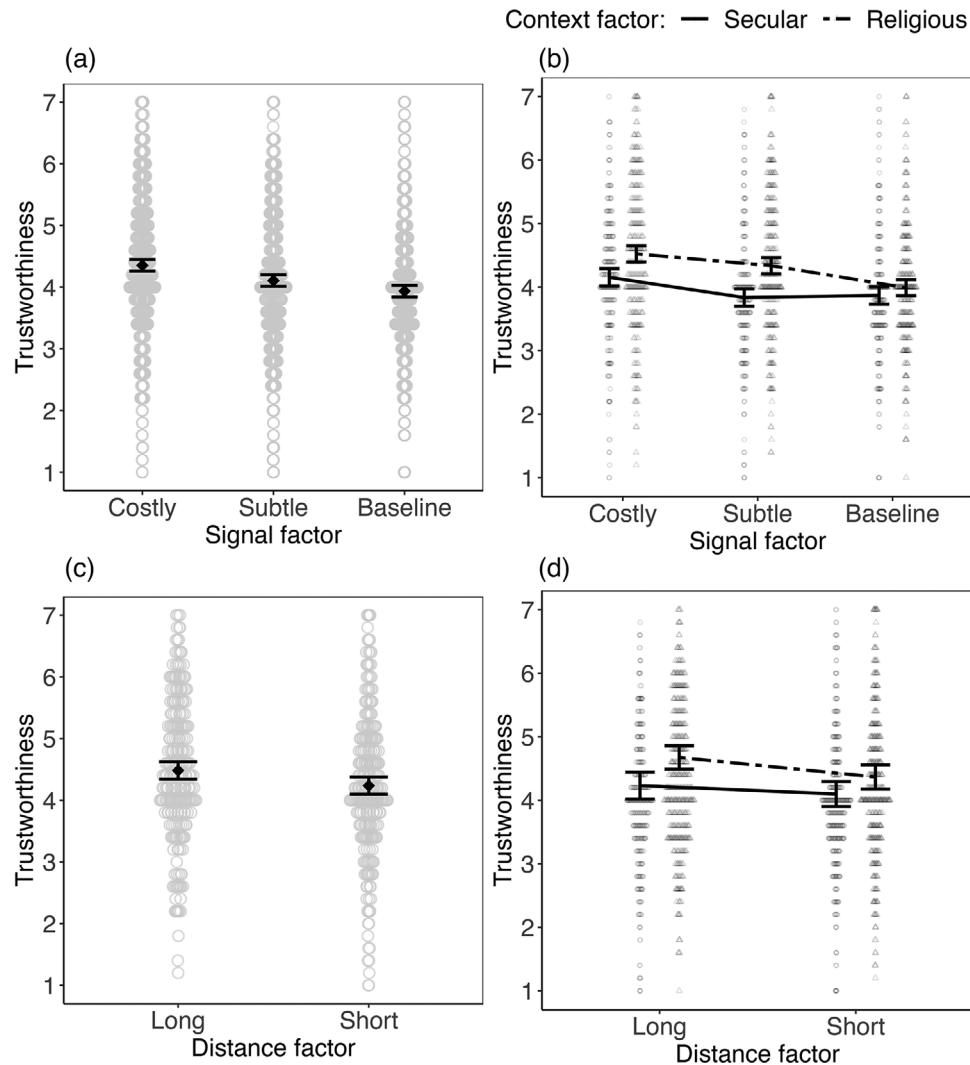


FIGURE 3 Plots represent the effects of the signal factor and the distance factor on the perceived trustworthiness of the FB post author across contexts (A, C) and in interaction with the context factor (B, D). Error bars denote 95% confidence intervals

4.1.2 | Materials

We utilized a 3 (signal factor; within-subjects) \times 2 (context factor; between-subjects) mixed design, with the signal factor (hike/pilgrimage) set at long-distance to increase the studied contrast. We used slightly modified stimuli from Study 2. For the religious costly signal, we used the FB post portraying the long religious pilgrimage to Santiago (800 km) from Study 2; and for the secular costly signal, we used a FB post about a foot trip of the same length from Cáceres (in Extremadura, close to Portugal) to Valencia (on the Mediterranean coast). Instead of using different activities as subtle signals as in Study 2, we decided to use a FB post depicting the same activity in both contexts (playing table tennis) and only manipulated its setting (a tournament organized by the local church vs. the neighbourhood for the religious and secular context, respectively). The baseline FB post was from Study 2. See Section 4.2 in SM for details.

4.1.3 | Measures

We measured trustworthiness ($\alpha = .87$), perceived difficulty of the trip, participants' religiosity ($\alpha = .85$), church affiliation, sex, age, whether participants like hiking, and perceived commitment to God using the same scales as in Study 2. To measure self-control, we used the *Brief Self Control* scale (9 items, 7-point Likert scale) adapted from Tangney et al. (2004; e.g., 'The person has self-discipline'; $\alpha = .82$). The procedure was identical to that of Study 2 (filler items were supplied by the items of self-control). See Section 4.3 in SM for details.

4.1.4 | Predictions and analyses

Apart from some assumption checks (religiosity and perceived commitment to God will be higher in the religious than in the secular context; the perceived difficulty of the pilgrimage will not differ by context),

we pre-registered (accessible from <https://doi.org/10.17605/OSF.IO/DSQKZ>, Section 4) the following prediction:

Prediction P3: Participants will perceive the pilgrim/hiker as more trustworthy compared to the table tennis player and baseline FB post author; and this effect will be larger in the religious context than in the secular context.

4.2 | Results

The sample included 288 participants in the religious context condition and 210 in the secular context condition. Assumption checks supported the soundness of our manipulation. Participants in the religious context perceived the trip as more difficult than participants in the secular context ($\beta = 1.30$, 95% CI = [1.13, 1.48], $p < .001$), but this finding should not affect the results of our main analysis as there was no indirect effect of perceived difficulty on trustworthiness (see SM Section 4.4.1 for details on assumption check analyses).

Prediction P3. Overall, pilgrims/hikers were rated as more trustworthy than table tennis players ($\beta = 0.34$, 95% CI = [0.25, 0.42], $p < .001$) and baseline FB post authors ($\beta = 0.61$, 95% CI = [0.53, 0.69], $p < .001$). In the religious context, pilgrims were rated as more trustworthy than both table tennis players ($\beta = 0.40$, 95% CI = [0.29, 0.50], $p < .001$) and baseline FB post authors ($\beta = 0.65$, 95% CI = [0.54, 0.75], $p < .001$). In the secular context, the difference between the table tennis and hiker FB posts was smaller than in the religious context ($\beta_{\text{interaction}} = -0.14$, 95% CI = [-0.31, 0.02], $p = .093$), though the effect was not statistically significant. The difference between the baseline and pilgrim FB posts in the secular context was not different from the religious context ($\beta_{\text{interaction}} = -0.10$, 95% CI = [-0.26, 0.07], $p = .257$). Adjusting these estimates for perceived self-control changed the results considerably. Pilgrims were rated as non-significantly more trustworthy than table tennis players ($\beta = 0.09$, 95% CI = [-0.01, 0.19], $p = .067$) and baseline FB post authors ($\beta = 0.13$, 95% CI = [0.02, 0.23], $p = .017$) in the religious context. In the secular context, the difference in trustworthiness between hikers and table tennis players was smaller than the difference between pilgrims and table tennis players in the religious context ($\beta_{\text{interaction for subtle}} = -0.22$, 95% CI = [-0.36, -0.08], $p = .002$). The same was true for the difference between hikers and the baseline FB post authors ($\beta_{\text{interaction for baseline}} = -0.24$, 95% CI = [-0.38, -0.09], $p = .002$). The model revealed a strong positive association between perceived self-control and trustworthiness ($\beta = 0.47$, 95% CI = [0.43, 0.52], $p < .001$). See Figure 4 for the differences across conditions. Section 4.4.2 in SM provides details on all models.

4.3 | Discussion

Effortful trips, whether motivated by a religious or secular reason, increase the perceived trustworthiness of the person who embarked on them compared to less time-consuming and less physically costly activities. This evidence is in line with the hypothesis that obviously

costly activities signal personal qualities that enhance a person's trustworthiness in the eyes of observers. Crucially, while self-control explained the variation in the ratings of trustworthiness in the secular context, this was not true for the religious context, where the differences between FB post ratings remained after adding self-control to the model.

However, it could be argued that this effect is driven by the fact that compared to agnostics/atheists, religious people may generally be more sensitive to costly displays of commitment. Moreover, the secular context did not include any indices of norm commitment while the religious context included these indices implicitly; and this implicit association between signal and norms might have driven the effect as well. We tested these alternative explanations in Study 4.

5 | STUDY 4

Study 4, conducted on religious participants only, compared the effects of religious costly signalling with non-religious but normative signalling. For the secular context, we used a pro-environmental context because it contains prosocial norms (e.g., limiting one's consumption; Kaiser & Byrka, 2011). Moreover, people actually undertake pilgrimages and hikes for environmental reasons (see Section 5.2 in SM), so the manipulation was ecologically valid. Since our previous studies showed that pilgrims were always rated as more trustworthy than the authors of the subtle and baseline posts, we focused only on the difference in trustworthiness between pilgrims/hikers. That is, we tested the interaction effect of the context factor and the distance factor on perceived trustworthiness of pilgrims/hikers.

5.1 | Method

5.1.1 | Participants

On the basis of simulations of the effect sizes from Study 2 (see Section 5.1 in SM), we recruited 417 Spanish Christians from the same population and using the same method as in Studies 2 and 3. As in the previous studies, we removed participants based on the duration criterion first ($n = 30$). As two participants did not report age, the final sample consisted of 385 participants ($M_{\text{age}} = 35.50$, $SD_{\text{age}} = 13.72$; 60% female).

5.1.2 | Materials

We used modified materials from previous studies. This study used a 2 (distance factor) \times 2 (context factor: religious vs. environmental) between-subjects design; and all participants saw only one post. The context factor was manipulated using different captions for the same picture. A pilgrim reported undertaking the pilgrimage to Santiago de Compostela to demonstrate religious conviction in the religious condition. In the environmental condition, a non-pilgrim walker reported making the trip to demonstrate pro-environmental convictions. The

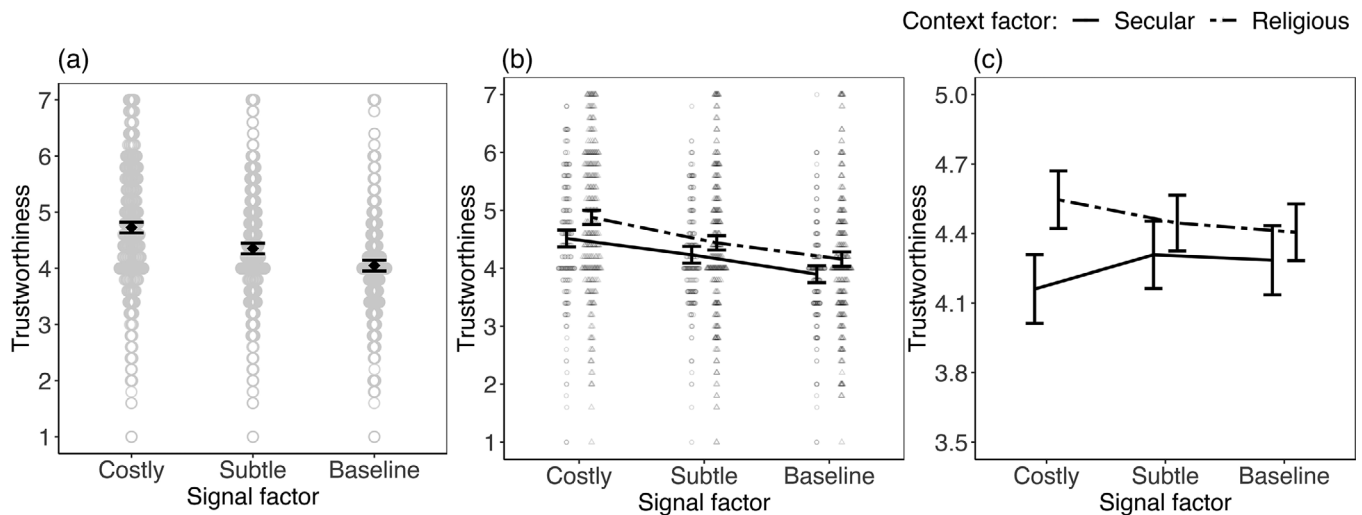


FIGURE 4 Plot A shows the differences in trustworthiness between individual FB posts authors. Plot B shows the interaction between the FB post and context factors. Plot C shows the same differences as Plot B controlling for default covariates and perceived self-control (thus, individual data points are not displayed). Note that Plot C uses a zoomed view of the Y axis. Error bars represent 95% confidence intervals

distance factor manipulated the length of the trip as in Study 2 (long = 800 km, short = 115 km). For details on stimuli, see Section 5.2 in SM. Participants were randomly assigned to one of the four conditions. As an additional exploration, at the end of the experiment, participants were shown all four posts and asked to rate them on a single item of trustworthiness (we report this analysis in SM, Section 5.4.4).

5.1.3 | Measures

First, we measured participants' degree of religiosity and pro-environmentalism using single-item, 7-point Likert scales (e.g., 'To what extent do you consider yourself a religious/pro-environmentalist person?'). Then, we randomly presented one of the four possible FB posts to the participants. Afterwards, we measured perceived trustworthiness with the scale from previous studies ($\alpha = .79$). Lastly, we measured perceived commitment to God as in previous studies and overall perceived costliness of the walking trip with a three-item Likert scale developed for this study ('How hard/difficult/costly would you say the hike from the post was?'; $\alpha = .86$). The general procedure was identical to that from Studies 2 and 3. See Section 5.3 in SM for details on the measures.

5.1.4 | Predictions and analysis

As in previous studies, we pre-registered predictions regarding the assumptions (perceived costliness of the hike will be higher in the long-distance condition and will not differ across contexts; pilgrims will be perceived as more religious than environmental hikers; and environmental hikers will be perceived as more pro-environmental than

pilgrims) as well as our main prediction (<https://doi.org/10.17605/OSF.IO/HD8FB>, Section 5).

Prediction P4: If the religious framing of the trip is an important factor in signalling, the difference in trustworthiness between the short-distance and long-distance pilgrims in the religious context will be larger than the difference in trustworthiness between the short-distance and long-distance hikers in the environmental context. If, on the other hand, the effect of costly signals on trustworthiness is due to the presence of moral norms in general, there will be no interaction effect.

5.2 | Results

In the religious context, 92 participants were in the long-distance condition, and 91 were in the short-distance condition. In the environmental context, 96 participants were in the long-distance condition, and 106 were in the short-distance condition. Assumptions checks were supported (see Section 5.4.1 in SM).

Prediction P4. Overall, participants rated the long-distance pilgrims/hikers as being more trustworthy than the short-distance pilgrims/hikers ($\beta = 0.49$, 95% CI = [0.30, 0.68], $p < .001$). In the religious context, participants rated the long-distance pilgrims as more trustworthy than the short-distance pilgrims ($\beta = 0.87$, 95% CI = [0.60, 1.14], $p < .001$); and the effect of the distance factor on trustworthiness was smaller in the environmental context ($\beta_{\text{interaction}} = -0.73$, 95% CI = [-1.10, -0.35], $p < .001$). Specifically, there was no effect of the distance factor in the secular context ($\beta = 0.15$, 95% CI = [-0.10, 0.41]).⁴ See Figure 5 for the differences across conditions. Section 5.4.2 in SM provides details on all models.

⁴ We do not report the p -value in this analysis since we would need to correct it for multiple tests. The confidence intervals indicate clearly that the difference is not significant.

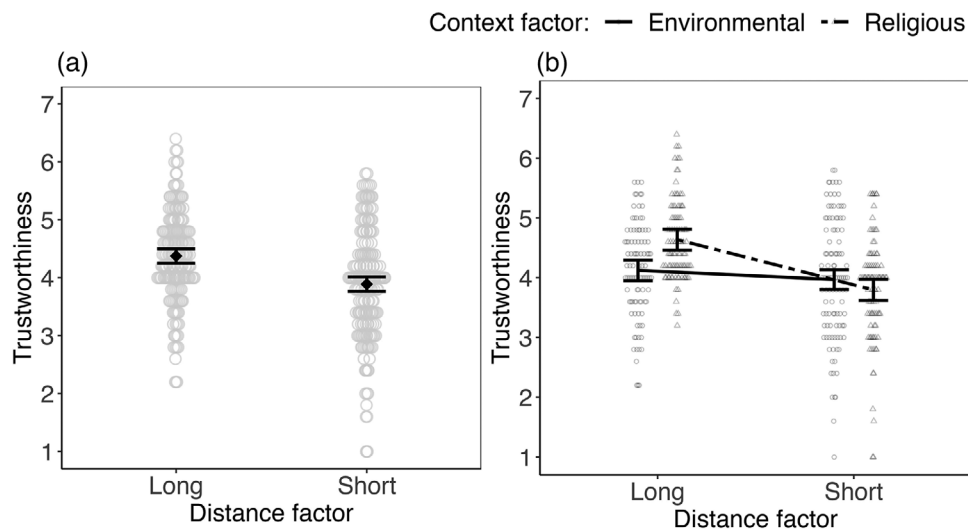


FIGURE 5 Plot A shows the differences in trustworthiness of FB posts depicting long and short trips. Plot B shows the interaction between distance and context. Error bars represent 95% confidence intervals

5.3 | Discussion

The results indicate that the costlier pilgrimage increased the perceived trustworthiness of the performer only in the religious context. People walking long distances for prosocial environmental reasons were not rated as more trustworthy when sacrificing more time and effort by religious participants. Moreover, this effect held while controlling for participants' self-reported religiosity and pro-environmentalism. Thus, we conclude that it is only the religious signal that affects religious recipients.

It can be objected that if environmentalists were sampled, the effects could be reversed; that is, that environmentally concerned people would be sensitive to costly signalling only in the environmental context. A post-hoc exploration of the data suggests that this is not a viable speculation. First, participants scored fairly high on pro-environmentalism ($M = 4.68$, median = 5, mode = 5), which was even higher than religiosity ($M = 2.75$, median = 2, mode = 1). Second, we conducted an exploratory analysis (section 5.4.2 in SM) with participants scoring high on environmentalism (>4) and low (<4) on religiosity that replicated the findings from the main analysis. This result suggests that even if we recruited secular pro-environmental participants, there would probably be no effect of the distance factor in the environmental condition. However, since the measure of environmentalism in our study allows for social desirability bias (Vesely & Klöckner, 2020), and does not measure collective identity of environmentalists, we cannot derive strong conclusions from this post-hoc exploratory analysis.

6 | GENERAL DISCUSSION

According to our two field studies, the pilgrimage to Santiago de Compostela presents a suitable ethnographical context in which costs matter (Studies 1A and 1B). The experiments suggest that, when rated

by a religious audience, religious pilgrims were evaluated as more trustworthy if they undertook a long pilgrimage for religious reasons compared to a short pilgrimage or other low-cost religious and non-religious activities. However, similar effects were found when non-believers rated other non-believers walking the same pilgrimage for secular reasons, suggesting that even a secular motivation for engaging in a costly religious ritual may boost trustworthiness (Study 2). When we compared the effects of the religious pilgrimage on a religious audience with the effects of a secular hiking trip of the same length on a secular audience, we found that the religious pilgrimage had stronger effects than the secular hike after controlling for perceived self-control of the FB post author (Study 3). Importantly, Study 4 showed that the effects of costly signalling on trustworthiness in the religious context were not driven by a general tendency of religious people to be sensitive to costs or by the implicit presence of prosocial norms in religious ideology.

6.1 | Theoretical implications

Our findings have three important implications for the debate about the relationship between religion and morality, which, according to several systematic reviews, seems to be still undecided (Bloom, 2012; Oviedo, 2016; Preston et al., 2010).

First, previous meta-analytical work on priming effects of religion suggests that religion has positive effects on prosociality when both the prime and the participants' ideology are matched (Shariff et al., 2016). And several authors have argued that religion is a group-level phenomenon evolved via cultural group selection to promote group success (Richerson et al., 2016); and that its effects on prosociality should be larger among co-religionists (Norenzayan et al., 2016; Shaver, Lang, et al., 2018). Our studies are congruent with the two previous approaches, because they show that costly signals work more effectively when the signaller, the signal, and the receiver belong to a

religious tradition. Future research can enrich our investigation by testing whether non-believers would trust more those who send religious costly signals as compared to non-costly religious signals (replication of our Study 4 with non-believers). However, note that this additional analysis is not essential for the question at hand, since secular individuals are usually not the primary intended receivers of religious signals, and, therefore, are not necessary for the functioning of the signalling system. In this respect, the religious signal would not be a signal per se but rather a cue/strategic information that the secular individuals use to their benefit (Maynard Smith & Harper, 1995)

Second, religion is not only about beliefs. Instead, religion functions as a package of diverse elements such as beliefs, norms, myths, and rituals (Sosis, 2019) that interact with each other to produce within-group trust and increase cooperation (Purzycki & Sosis, 2022). Our study is one among the first to experimentally test an interaction of some of these elements, namely beliefs and practices, suggesting that this is a potentially fruitful way to proceed in investigating religion and morality. We surmise that pilgrimages (Kantner & Vaughn, 2012), and religious practices more generally (Lang, 2019), may have evolved as key supportive elements of religious traditions promoting cooperation and trust among co-religionists.

Third, focusing on the literature on costly signalling, our research unifies disparate findings from previous studies. While studies exploring the effects of costly religious rituals on trust and cooperation reveal positive effects (Hall et al., 2015; Soler, 2012; Sosis & Ruffle, 2007), the studies conducted with secular groups and rituals do not support the positive role of costly signalling in cooperation (Cimino & Thomas, 2022; Shaver, Divietro, et al., 2018). We argue that these results are, in fact, compatible because our results show that costly signalling works better when integrated with a strong ideological substrate that includes beliefs in supernatural concepts.

6.2 | Limitations

Our research has several limitations. The first limitation is related to the absence of shared collective identity and norms in the secular context conditions compared to the religious conditions. Specifically, we used a Christian signal and Christian participants in the religious conditions, which allowed us to match the identity of signallers and receivers. However, we were not able to create secular contexts with the same level of groupness and shared identity. Agnostics and non-believers do not necessarily form cohesive groups with shared norms that could be considered a secular counterpart of Christian communities; but future research may circumvent this limitation by testing similarly costly rituals in religious groups and secular movements with shared identities. For example, religious pilgrims might be compared with secular pilgrims walking to a national monument (Gatewood & Cameron, 2004). While religious pilgrims could be evaluated on their trustworthiness by believers, such as in our study, national pilgrims could be assessed by people identifying as patriots. Since national and religious ideologies might overlap, future studies might also compare

the trustworthiness effects of rituals occurring in religious and secular congregations, such as those studied by Brown and her colleagues (2023). These studies would tell us whether collective religious identity is needed for costly signals to work or strong collective identity per se is enough.

Another important limitation is related to the fact that our studies do not answer the question of what makes religious costly signals effective in promoting trustworthiness. We suggested several reasons why signalling should be more effective when interacting with religious ideologies than within secular ideologies: namely, that in religious belief systems, gods guarantee cooperative norms and mandate participation on rituals (Rappaport, 1999); that cooperative norms of religious traditions are often sacred and non-negotiable (Tetlock, 2003); and that failure to behave in accordance with the norms of religious traditions is believed to be punished by omnipotent gods (Norenzayan, 2013). However, we were not able to test any of these hypotheses. Future research could address this issue by measuring or manipulating some of the relevant variables. For instance, future experiments could test the impact of the type of gods that are worshipped by harnessing vignettes depicting people who are doing rituals for local spirits or gods from world religions (see Lang et al., 2019). Since not all religions may enhance prosociality (Bloom, 2012; Oviedo, 2015), conducting these studies is particularly important.

7 | CONCLUSION

People often engage in costly behaviours within religious contexts, and these costs may seem baffling for outside observers. It has been argued that they serve as a signal of commitment to cooperative norms and to raise solidarity and trust between community members. Previous research has provided some evidence in support of this view, but the question about the specific role played by religion has remained unanswered. We address this issue through three experiments examining the effect of equally costly religious and secular signals on the perceived trustworthiness of the signallers. Our results reveal that costly signalling induces more trust when it is ingrained in religious traditions than when it is ingrained in secular traditions, indicating that religion might play a capital role in the process through which costly behaviours generate trust and promote cooperation. This may help us to understand the often neglected role of religious practices in promoting cooperation, and to explain the worldwide co-occurrence of costly displays and religious ideologies.

AUTHOR CONTRIBUTION

Radim Chvaja developed the idea and conducted the survey studies in the field. All authors designed the experimental studies. Juana Chinchilla and Ángel Gómez collected the data for the experimental studies. Radim Chvaja and Martin Lang analysed the data and drafted the manuscript. All authors provided comments on the manuscript.

ACKNOWLEDGMENTS

We would like to thank Jan Krátký for help with stimuli preparation, Peter Maňo, Jana Nenadalová, Dimitris Xygalatas, and John Shaver for comments on early drafts, and LEVYNA members for discussions on the early design ideas of the experiments. We also thank anonymous reviewers for important suggestions and comments.

CONFLICT OF INTEREST

The authors declare no competing interests.

ETHICS STATEMENT

All studies in this article were approved by the Research Ethics Committee at Masaryk University.

FUNDING

Radim Chvaja acknowledges support from the grant by Masaryk University, Czech Republic (MUNI/A/1396/2022). Martin Lang acknowledges support from the MSCA fellow3@MUNI project [CZ.02.2.69/0.0/0.0/19_074/0012727]. Ángel Gómez acknowledges support from RT12018-093550-B-100.

TRANSPARENCY STATEMENT

All materials necessary to replicate our findings and all the anonymized datasets and statistical codes are made public by uploading them on trusted repository (https://osf.io/fc527/?view_only=81b621f59cbf41e59818458d77566a52). Three experimental studies in this article are pre-registered.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available on Open Science Framework: https://osf.io/fc527/?view_only=81b621f59cbf41e59818458d77566a52.

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How to cite this article: Chvaja, R., Chinchilla, J., Gómez, Á., & Lang, M. (2023). Religious costly signal induces more trustworthiness than secular costly signal: A study of pilgrimage to Santiago de Compostela. *European Journal of Social Psychology*, 1–15. <https://doi.org/10.1002/ejsp.2975>