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# Religion and expanding the cooperative sphere in *Kastom* and Christian villages on Tanna, Vanuatu

Quentin D. Atkinson 

School of Psychology, University of Auckland, Auckland, New Zealand

## ABSTRACT

The coexistence of Christian and traditional “*Kastom*” beliefs on the island of Tanna in Vanuatu provides an especially interesting environment in which to investigate the association between religion and cooperation. Here I use an experimental economic game together with ethnographic and survey data to compare religious beliefs and practices and their association with cooperative behavior across two communities – one predominantly Christian and one predominantly *Kastom*. Results show some evidence of bias in favor of the self in the *Kastom* but not the Christian village, although the overall allocations are not significantly different between villages. Allocations to self or own village were generally lower for those who professed belief in a more omniscient and rewarding supernatural agent and for those who engaged in ritual acts of devotion more frequently, although the relationship with ritual devotion and local garden spirit beliefs varied across sites. These findings highlight intriguing differences between the two sites and provide some support for the hypothesis that elements of religion may function to facilitate the expansion of cooperation to co-religionists beyond the local community.

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## 1. Introduction

The nature and scale of human cooperation is often taken as an evolutionary puzzle. Kin selection (Hamilton, 1964) and reciprocity (Trivers, 1971) can explain cooperation between close relatives or within small groups, but are seen as insufficient to explain human cooperation in larger groups of non-kin (Boyd & Richerson, 2005). There are a range of potential solutions to this puzzle, including that human cooperation is an evolutionary by-product, that it derives from our unique capacity for language and reputation monitoring, or that it is the product of cultural norms and institutions that have been shaped by cultural group selection to promote the interests of the group (Boyd & Richerson, 2005). It is this latter possibility that motivates the work presented here, but it is worth noting that the various explanations are not mutually exclusive and may apply in varying degrees to different aspects of human prosociality.

This article addresses the hypothesis that the forms of religion we see in the world today have been favored by cultural group selection for their ability to reduce selfish behavior and expand the sphere of cooperative interactions between individuals (Henrich, 2009; Norenzayan, 2013; Norenzayan, Henrich, & Slingerland, 2013; Norenzayan & Shariff, 2008). Functionalist explanations of religion have long appealed to its ability to galvanize groups and promote group over selfish interests (Durkheim & Swain, 1915; Norenzayan & Shariff, 2008; Wilson, 2002). One of the most well-developed of

**CONTACT** Quentin D. Atkinson  [q.atkinson@auckland.ac.nz](mailto:q.atkinson@auckland.ac.nz)

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these theories holds that belief in a powerful, morally concerned deity can promote prosociality by activating reputation-monitoring psychology and by providing a perceived threat of punishment for moral transgressions – a kind of supernatural monitoring and police force that can discourage selfishness (Bering & Johnson, 2005) and expand cooperative networks beyond close kin (Shariff & Norenzayan, 2007). The theory predicts that powerful, omniscient, morally concerned “big gods” should be particularly effective at enhancing cooperation because they are perceived as knowing and caring how people behave towards one another and as punishing immorality and rewarding virtue. These features are suggested to have contributed to the success of major world religions like Christianity, Islam, and Hinduism (Norenzayan, 2013). The hypothesis is supported by experimental and survey evidence linking belief in (or priming the concept of) a moralizing god to increased prosociality (Norenzayan et al., 2013; Shariff & Norenzayan, 2007, 2011) and cross-cultural evidence for an association between moralizing gods and social complexity (Norenzayan, 2013; Roes & Raymond, 2003; although cf. Atkinson, Latham, & Watts, 2014 and Watts et al., 2015). Religious rituals are also argued to have prosocial effects (Atkinson & Whitehouse, 2011; Henrich, 2009; Norenzayan et al., 2013; Norenzayan & Shariff, 2008; Sosis & Ruffle, 2003). Frequent, painful, or risky rituals may act as costly signals of group commitment (Sosis & Bressler, 2003; Sosis, Kress, & Boster, 2007) and/or credible displays of commitment to the group’s belief system (Henrich, 2009; Lanman, 2012), thereby building trust and bolstering belief within a society.

Establishing whether and how religion promotes prosociality and the generality of any proposed effects requires testing these hypotheses across diverse cultural backgrounds. Here I test several predictions using data collected on Tanna in Vanuatu. The island of Tanna is a kaleidoscope of religious variation. Facets of Christian missionary influence interact with a revival of indigenous, or “*Kastom*,” religious beliefs, as well as more recent “cargo cults” (themselves a mix of *Kastom*, Christian, and nationalist ideas). This affords a unique opportunity to compare the psychological effects of a recently expanded world religion (Christianity), and indigenous religious beliefs and practices in a common cultural setting.

The current research compares results from a Random Allocation Game (RAG; Hruschka et al., 2014) conducted across two sites on the western side of Tanna – a coastal village near the town of Lenakel, and a cluster of three inland hamlets. The coastal village is predominantly Christian while the inland hamlets are predominantly *Kastom*, but both locations maintain a mix of traditions and there is considerable movement and intermarriage between the locations. The RAG was used to measure participants’ willingness at each site to violate an impartial resource allocation rule to favor themselves (SELF) or their village (LOCAL) versus a member of their religious tradition from another village (DISTANT). RAG allocations were combined with survey data on participants’ religious beliefs and practices. Survey questions asked about participants’ commitment to and conception of two supernatural agents at each site – a powerful “big god” (the Christian god at the coastal Christian site and *Kalpapen* at the *Kastom* site) and a local garden spiritual force (*tupunus*) associated with garden magicians. This included questions on the omniscient, punitive, and rewarding nature of each agent. Participants were also asked to estimate their frequency of participation in important rituals in the villages.

Here, I use the survey and RAG data to answer three broad questions. First, I examine differences in participants’ stated level of commitment to the supernatural agents and beliefs about the properties of the agents relevant to supernatural policing. In line with the proposal that the Christian god has spread partly by virtue of its role as a supernatural police force, the Christian god is expected to be rated as more omniscient, punitive, and rewarding, and to induce the greatest level of commitment. Christianity is also expected to undermine the legitimacy of local spirits, hence the effect of belief in and commitment to the local spirit force should be lower in the Christian village.

Second, I compare bias in RAG allocations towards self or own village at the Christian coastal site and *Kastom* inland site. To the extent that the success of Christianity can be attributed to prosocial effects of belief in a Christian god and participation in Christian rituals, we would predict that, all other things being equal, RAG allocations to the co-religionist should be greater in the Christian

village. It is worth noting that while “Christian” and “*Kastom*” serve as useful labels, the sites maintain a mix of religious traditions and there are other differences between them. Compared to the *Kastom* hamlets, the Christian village is larger, and its inhabitants are wealthier, more likely to have attended formal schooling, and have more interaction with a market economy. With only two locations and no matched controls, it is not possible to isolate the causes of any differences between sites. Nevertheless, we can ask, does willingness to allocate impartially to co-religionists in the RAG differ between people living in a large Christian village with formal schooling and considerable market contact and people living in a cluster of small traditional hamlets where *Kastom* religion still holds sway?

Third, I investigate whether individual differences in religious beliefs and participation predict allocation to SELF/LOCAL in the RAG, and whether such effects differ between Christian and *Kastom* contexts. Individuals who are more committed to a supernatural agent and who believe in a more omniscient, punitive, and rewarding supernatural agent are expected to be less likely to cheat in their own favor and so allocate more to co-religionists. To the extent that the Christian god is a more effective motivator of expanded cooperative networks, commitment to and beliefs about the Christian big god (in the Christian village) are expected to have a greater effect on allocation to self/ingroup versus co-religionists than commitment to and beliefs about the indigenous big god (at the *Kastom* site) or local spirit (at both sites). Higher rates of ritual participation are expected to indicate greater commitment to the broader group identity and hence to predict decreased allocations to SELF/LOCAL over DISTANT.

Finally, previous work has shown that, at the population level, measures of material security are associated with a reduced tendency to favor self/ingroup over outgroup in the RAG (Hruschka et al., 2014); in insecure environments, individuals will be motivated to buffer risk by investing in self and immediate ingroup. I therefore examine whether the effect of religious beliefs on cooperation is moderated by individual differences in food security and income.

## 2. Ethnographic background

Tanna is one of approximately 80 (65 inhabited) volcanic islands that make up the Melanesian archipelago of Vanuatu. The island itself is of volcanic origin, covering 550 km<sup>2</sup>, with coral reefs and narrow coastal flats surrounding a mostly forested central highland region. Melanesian seafarers first settled Tanna some 2500 years ago. Today, the island’s 29,000 indigenous inhabitants speak five to six distinct but closely related languages from the Oceanic branch of the Austronesian language family (Lewis, 2009). Inhabitants of two smaller neighboring islands, Aniwa and Futuna, were later colonized by Polynesian-speaking groups and resulted in exposure of Tannese to Polynesian culture, however the islands were not politically unified. The main settlements are the market town and port of Lenakel (pop. ~1800) on the west coast of the island, and neighboring Isangel (pop. 1200), the administrative center of TAFEA province.

Following European contact in the eighteenth century, Tanna experienced a profound period of social, economic, and religious change driven by missionary activity, trade, and an awkward period of joint British-French colonial rule. In the mid-twentieth century, a Vanuatu nationalist movement emerged with strong support on Tanna, ultimately leading to independence in 1980. Nationalism was associated with a revival of indigenous traditions or “*Kastom*” that slowed (or even reversed) some change. Modern Tanna is a mixture of these new and old systems, often with blurred lines. This is reflected in the island’s religious diversity (discussed below), but also its linguistic diversity. As well as being home to five or six indigenous languages, many Tannese also speak *Bislama*, an English-based creole used across Vanuatu, and those whose parents can afford school fees learn French or English.

Cultural and social structures are broadly similar across the island (Lindstrom, 1982). Traditional Tannese communities are organized into small hamlets of several households, each linked to a *nakamal* where the community holds ceremonies and men assemble daily to drink kava. Unlike

Melanesian societies further north, Tannese societies comprise a hereditary chieftainship, likely the result of Polynesian influence. The kinship system is Dravidian Iroquois with cross-cousin marriage between the resulting moieties (Casson & Gregory, 1976), although this is not strictly observed across the island today. Inheritance is patrilineal (Brunton, 1979) with land tenure determined by a system of recycled namesets and heredity (Lindstrom, 1985). Only indigenous *Ni-Vanuatu* and the government can own land and customary titles cannot generally be sold. Traditional chiefly authority and inheritance systems still hold sway across Tanna, but, particularly in the larger Christian settlements on the coast, they have had to accommodate the influence of the church, tourism, trade, and centrally administered systems of ownership and commerce. Most coastal and some inland villages have Protestant or Catholic schools, but high school fees mean the majority only receive a few years of formal education, if any.

The Tannese are swidden horticulturalists. Yam and taro are grown as staples across the island and are important crops in rituals organized around the harvest cycle. Kava is another important ritual crop, used to make an intoxicating beverage that Tannese men drink together each evening. Other fruits and vegetables are also grown throughout the year. Most households keep several pigs and fowl and occasionally cattle, and coastal villagers supplement their diet with some fish and shellfish. Traditionally, both men and women worked in the gardens, with men doing the heavier tasks and women attending to day-to-day upkeep. Despite rapid population growth over the last century (the population has more than quadrupled in size since 1920), the fertile volcanic soil still provides surplus production. Nevertheless, most Tannese are subsistence farmers with annual cash incomes of less than US\$600 per year. Some *Kastom* communities regard money as in opposition to *Kastom* exchange of goods and markets may be considered not *Kastom* (Lindstrom, 1982). The main cash crops sold at the market in Lenakel or shipped to Port Vila (Vanuatu's capital) are coconuts, kava, and coffee. Incomes are considerably higher in and around the villages of Lenakel and Isangel where wage labor is available for provincial offices and basic service providers. Some Tannese also work in a handful of tourist resorts, mostly on the west coast of the island, and many now take advantage of seasonal agricultural work programs in Australia and New Zealand.

Religion on Tanna is a mix of traditions. The revitalized indigenous "*Kastom*" religion reflects a combination of Melanesian and Polynesian mythology, gods, and sorcery, brought to the islands by its pre-European colonists. Following European contact, Christian missions indoctrinated much of the population and severely eroded the indigenous traditions. By the beginning of the twentieth century, many predicted the indigenous religion would be wiped out entirely (Bonnemaison, 1991; Guiart, 1956). However, a rebellion against Christian and colonial strictures that began before World War II saw a revival of these traditions under the *Kastom* banner and their reinvention alongside nationalist political sentiment in the form of millenarian movements or "cargo cults" (Guiart, 1956).

*Kastom* religion comprises an elaborate mythology and pantheon. Despite missionary zeal, the island remains replete with indigenous spirits, gods, and cultural heroes. Among the most widely known are *Kalpapen*, a god or cultural hero who features in many stories and is sometimes given creator status, and *Mwatiktik*, a Polynesian name for the god of food or the garden (Bonnemaison, 1991). Magic stones (or *kapiel*) represent another class of supernatural entity and there are hundreds spread across the island. The *kapiel* are sometimes claimed to have given life to "Man Tanna," shaped the landscape of Tanna, and created special sacred roads linking together the people of the island (Bonnemaison, 1985, 1991, 1997). Some stones are referred to as ancestors, but this is not necessarily genealogical – rather, certain families may be imbued with the spirit of a particular stone (Bonnemaison, 1985). Stones and their associated garden spiritual forces (*tupunus*) are important for the success of the gardens and specially appointed magic stone keepers must "work the stones" to ensure a good harvest (Bonnemaison, 1991). Other local spirits can be called upon to cause harm to enemies (usually sickness or death) or to protect the village from outsiders.

*Kastom* rituals on the island revolve around gardens and the strategic exchange of seasonal production. Traditional gardens are sacred places with a prescribed layout of different crops, strict

harvest protocols, and restricted access at certain points in the growing cycle (Bonnemaison, 1991). Care must be taken to avoid violating these rules and offending the *tupunus*. A major focus of garden production remains the accumulation of food for ceremonial purposes. Rituals, like the *Toka*, *Niel*, and circumcision ceremonies, involve feasting, dancing, and the exchange of vast amounts of yams, taro, and pigs. These events require months or even years of planning and are attended by hundreds or (in the case of the *Toka* festivities) thousands of individuals.

Overlaying these long-term ritual cycles is the daily rhythm of ceremonial kava drinking. Every evening at sunset, men from each village prepare and drink kava together in the “*nakamal*.” Ideally only married men drink. Boys in the villages prepare the kava for the older men by stripping the roots, chewing them to release the active compounds and regurgitating the mix as a thick paste that is combined with water and strained to drink. Women are prohibited from entering the *nakamal* area from the moment the kava preparation begins. Once the kava is ready, men come up one at a time or in small groups to receive their first “shell” (a coconut half-shell used as a cup). Upon finishing, it is good form to spit the last drops exuberantly into the air and say a *temavah*. The *temavah* is something like a short prayer, often used to ask for protection or for blessing the garden. In the main towns kava is usually drunk in bars with less ceremony and mechanized preparation.

Following decades of unsuccessful (often fatal) attempts to establish missions on the island, the first successful missionary settlements were established in 1869 (Guiart, 1956). It took another 30 years for Christianity to gain a foothold, but by 1920, at the height of the mission’s influence, there were an estimated 4000 converts among a total population of approximately 6500 (Guiart, 1956). Missionary influence was greatest along the east and west coasts with indigenous strongholds in the central “Middle Bush” area and the north. At this time, indigenous rituals and kava drinking were prohibited among converts and the missions did their best to dismantle the traditional belief system, including destroying or hiding many of the sacred *kapiel* stones. This attack on the traditional way of life caused many to leave the churches and fueled nationalist sentiment and nostalgia for *Kastom* living across Vanuatu. On Tanna, these conditions gave rise to several millenarian cargo cults, including the famous John Frum cult.

Tanna produced a number of political and religious movements that have been labeled “cargo cults.” These include the Prince Phillip cult, the Tom Navy cult, and the John Frum cult, all of which still have followers on the island today. The cults are understood to have arisen due to dissatisfaction with the church and colonial rule, and exposure to Western technology and affluent American troops during and after World War II (Guiart, 1956). Like cargo cults elsewhere in Melanesia, they combined elements of Christianity and indigenous religion with millenarian prophecies of catastrophe and salvation. Tanna’s John Frum cult, for example, prophesized the return of John Frum (usually understood as a World War II serviceman or as a local mountain god) who would eject the whites, leaving their “cargo” and other forms of wealth behind. Lindstrom (1993) points out that Western interest in the movements has focused on their bizarre cult-like features, but they have also served important social and political functions. The John Frum movement, for example, was instrumental in the Vanuatu independence movement and the *Kastom* renaissance.

Today, *Kastom* beliefs, Christianity, and the cargo cults coexist on Tanna relatively peacefully. In the 2009 census, over 20% of people listed customary beliefs as their religion. This likely includes some elements of the John Frum and other cargo cult movements – a handful of communities on the island are known as cult villages but aspects of the belief system have spread more widely. Despite its shaky history on the island, Christianity has had a pervasive impact. Seventy-two percent of Tannese named a Christian church as their religion in the 2009 census, including Protestant (20%), Catholic (10%), and Seventh Day Adventist (9%) as well as many smaller churches, some local to Tanna. Christianity predominates in coastal communities (where most of the churches are) but can be found across the island. Many now combine church attendance with daily kava drinking and participation in major *Kastom* rituals.

### 3. Methods

#### 3.1. Study sites and design

RAG and survey data were collected at two study sites from July to August 2013. The research was carried out with the permission and support of the Vanuatu Cultural Centre and the TAFEA Cultural Centre and was approved by the University of Auckland Human Participants Ethics Committee.

The first study site is a typical Christian coastal village with an adult population of approximately 200. The village is well connected, on the main road between Lenakel and the airport at Whitegrass. Residents are relatively affluent, with several owning vans or trucks. Houses are a mix of traditional thatched dwellings and more modern concrete block units. A number of the residents work in wage labor or trade in Lenakel, which is less than an hour away on foot. As well as a traditional *nakamal*, the village has its own Presbyterian church and primary school and many of the residents have a few years of formal education. All describe themselves as Christian, but Christianity exists alongside *Kastom* beliefs and practices.

The second study site comprises a cluster of three *Kastom* rural hamlets of about 30 adults each. The hamlets are situated in the hills inland from Lenakel, all within about 30 minutes' walk from each other along winding forest tracks. While Lenakel is only a morning's walk away or a 40-minute truck ride along rutted roads, the area is much less affected by modernity and Christian beliefs, instead favoring a *Kastom* lifestyle. This includes *Kastom* religious beliefs and practices, as well as ideas from the John Frum and Prince Phillip cults. Nevertheless, adults will have also had some degree of exposure to Christianity. Almost all adults are engaged in subsistence farming, making sporadic trips to market to sell produce if they need to buy tools. Many do spend longer periods in the town and, for most, *Kastom* dress is mainly used for special occasions or when film crews (or anthropologists) visit. Nevertheless, few have any formal education, incomes are low, and many laughed when asked if they own a vehicle or attend church.

Data were collected in three phases at each site. First, participants were recruited for the RAG, plus a post-RAG interview and demographic survey. Second, a week later, 20 individuals from each location took part in a semi-structured interview to help identify salient supernatural agents and rituals in each community. The results from these interviews were used to construct the third phase, a survey of religious beliefs and practices administered to everyone who had participated in the RAG.

Fluent local research assistants (three at each location) translated and independently back-translated to correct for errors and potential misunderstandings all materials for both locations. Local research assistants also helped administer the games and surveys. They were recruited from outside the study communities, although some were known to members of the communities. At the coastal Christian site, the research was conducted in *Bislama* rather than the indigenous *Nituar* language because it was the most widely understood – we found younger members of the community, particularly women who had married in, struggled with *Nituar*. In the rural *Kastom* hamlets, the native *Navhal* dialect was used – *Bislama* was not understood sufficiently well in the inland groups, particularly among older women. Four graduate research assistants helped run the games and record data.

#### 3.2. Random Allocation Game

Across both sites, 126 participants in total were recruited to play the RAG. Recruitment followed an initial community meeting to explain our wish to run the game and interviews as part of a research project about life on Tanna and how people make decisions about money. We explained that participation was completely voluntary and that those selected would receive a small payment for their participation. At the coastal Christian site, since it was not feasible to sample the whole community, we attempted to recruit participants using cluster sampling of households from a village

census. A completely random sample of households was not possible due to some villagers not showing up on the game days. At the Christian site, the game was played over two days by 44 adults (20 male) aged between 18 and 75 years ( $M = 35.0$  years,  $SD = 14.1$  years). At the *Kastom* site, we sought to recruit as many people from each of the three hamlets as wanted to participate. The game was played over four days – roughly one day per hamlet with a fourth day for people we had missed who wanted to participate. In total, 82 adults were recruited to play the RAG from the *Kastom* hamlets. Six individuals were excluded after failing the comprehension test, leaving 76 adults (38 male) from the *Kastom* hamlets who completed the game – between 80% and 90% of the resident adult population. Participants at the inland site were aged between 18 and 75 years ( $M = 37.0$  years,  $SD = 16.2$  years).

On the morning of each game day, participants for that day were gathered in an open area where we explained the basic procedure. This included a reminder about the aim of the project and that participation was voluntary and anyone could leave at any time. Everyone who came to participate received a 300-vatu show-up fee (roughly 25% of the wage for a day's manual labor). Subjects were asked not to discuss the game while they waited or after they had finished with those who had not yet played. These requests appeared to be followed conscientiously. The waiting area was monitored throughout the day by a local research assistant who managed the list of participants, provided information to any late arrivals, and organized food and drink for those waiting (see Purzycki et al. in this volume for further details).

Participants were called up in random order from the waiting area to play the game. We ran two to three game sessions concurrently to limit the time taken for everyone to play in order to reduce the risk of collusion. Game areas were set up outside, out of earshot of the waiting and interview areas, using existing barriers together with portable screens for privacy (Supplementary Figure S1). Participants were seated next to the game apparatus and opposite a local research assistant/translator who explained the rules. I (or a graduate research assistant) recorded data and monitored the administration of the game protocol to ensure consistency across participants.

The game procedure was explained according to the protocol (Purzycki et al., this volume). Participants were presented with two cups, thirty 20-vatu coins and a die with three black and three white sides. Each participant played two versions of the game – their order determined randomly. In the *Local Co-Religionist Game*, one cup was assigned to “someone from your village” (LOCAL) and the other to either “someone from another Christian village,” at the coastal Christian site, or “someone from another *Kastom* village,” at the inland *Kastom* site (DISTANT). In the *Self Game*, the first cup was replaced with a cup assigned to the participant (SELF), the contents of which, it was explained, the participant would get to keep. In each game, participants were asked to choose one of the cups in their minds and then roll the die. If the die came up black, they were to put a coin in the cup they chose in their mind. If the die came up white, they were to put a coin in the cup they did not choose. The total stakes for both versions of the game were 1200 vatu, equivalent to the wage for a day's manual labor. Daily income at the *Kastom* site was much lower than this because most did not work at all, but 1200–1500 vatu was still the going rate for a day's work. Wages in the coastal Christian village were generally higher than 1200 vatu, but this was deemed acceptable since the game took less than half a day and was generally viewed as an interesting experience.

After explaining the rules of the game, four comprehension questions were asked to check whether participants understood how the die determined where to put the coin, the number of die rolls required, and who the money would be going to. Only those who could correctly answer the questions were allowed to go on to play the game. It often took several attempts to explain the rules before the questions could be answered convincingly – the number of attempts was recorded. Many participants, particularly among the rural communities, found it helpful to play out some examples with verbal coaching. Six individuals, all from the *Kastom* site, were excluded from the study at this point because they could not pass the comprehension questions.

### 3.3. Measures of religious beliefs and practices

Religion survey data were collected from RAG participants over the three to four weeks following the RAG. First, a sample of community members was interviewed to help determine the salient supernatural agents and rituals in each community. Twenty individuals from each location were asked to free-list, describe, and rank the importance of up to five supernatural agents, five community rituals, and five private acts of ritual devotion. Using this information, together with informal discussions with community members and local research assistants, a “big god,” local spirit, private ritual, and two community rituals were selected from each site for inclusion in the religion survey.

From the religion surveys, the Christian god was selected as the big god in the Christian village (all respondents ranked the Christian god as the most important supernatural agent/god). In the *Kastom* village, *Kalpapen* was selected as the big god (other candidate big gods in the *Kastom* village included *Mwatiktik* and Jon Frum; only three people explicitly mentioned the Christian god). *Kalpapen* features extensively in mythology across Tanna, is variously understood as a creator god, the master of Mount Tukosmera (Tanna’s highest peak), the son of *Mwatiktik* or the divine *Yani* (chief) with *Mwatiktik* as his deputy (Bonnetmaison, 1997). At both the Christian and *Kastom* locations, the local spirit or spiritual force *tupunus* was chosen as the most widely known local supernatural force and an interesting contrast to the big gods questions. *Tupunus* refers to the spirit or spiritual forces surrounding the garden and by extension the magician in charge of this spirit force (Bonnetmaison, 1991). At the Christian village, church service and *Nakul* (the circumcision ritual) were selected as the two community rituals. The private ritual was prayer. At the *Kastom* village, the community rituals selected were *Toka* and *Niel* (both held every few years and involving dancing, the exchange of pigs and yams, and a large feast). The *Kastom* private ritual selected was *temavah*, a prayer said after drinking kava. While women do not drink kava in the *Kastom* villages and so do not say *temavah* themselves, they insisted that by sending food to the men in the *nakamal* they were participating in the act of devotion (to avoid the taboo against women entering the *nakamal*, young boys deliver the food to the *nakamal* at the appropriate time).

All those who participated in the RAG were invited to take part in the religion survey. In total, 42 participants from the Christian village and 76 from the *Kastom* hamlets completed the religion survey. Here I consider four scales used to measure beliefs about the big god and local spirit: a commitment scale, asking about participants’ commitment to the supernatural agent; a punishment scale, asking the extent to which the participant thought the supernatural agent cared about and engaged in punishment of stealing, lying, and murder; an omniscience scale, asking whether participants thought the supernatural agent could see faraway places and know people’s thoughts and feelings; and a reward item, asking whether participants thought the supernatural agent rewarded people in their lives. For each of the multi-item scales, Cronbach’s alpha was greater than 0.7. In addition to the belief questions, subjects were also asked how often they participated in the community and private devotion rituals selected for their site. All the scales are standardized to a range from 0 (lowest) to 1 (highest). Scale items and the response scoring are summarized in Supplementary Table S1.

### 3.4. Material security data

I also consider the effects of two individual-level measures of material security: (1) logged annual income; and (2) following Hruschka et al. (2014), a four-item food security scale asking participants, “Do you worry that in the next [month, six months, year or five years] your household will have a time when it is not able to buy or produce enough food to eat?” (1 = yes, 0 = no). Responses to the food security items were summed across the four time periods to produce an overall food security metric. Cronbach’s alpha across the four food security items was 0.89.

### 3.5. Analysis

Tests of differences in SELF/LOCAL cup allocations across locations and between games were conducted using the non-parametric Wilcoxon rank-sum test. Wilcoxon rank-sum tests were also used to compare religion measures between locations.

In order to evaluate whether individual religion measures predicted variation in game allocations, a series of logistic hierarchical linear models were run, predicting individual coin allocations to SELF/LOCAL (0) versus DISTANT (1) from each religion measure. Each analysis controlled for the effect of location (Christian or *Kastom*), game (*Local Co-Religionist Game* or *Self Game*), game order, sex, age, years of formal education, and native language ability (measured on a five-item scale from no ability [−2] to fluent [2]) and included participants as a random effect. These models included interaction effects between religion measures and location, religion measures and game, game and location, and a three-way interaction effect between religion measures, game, and location. In order to break down game-specific effects, a further set of regressions was also run on each game (*Local Co-Religionist Game* or *Self Game*) separately. To test whether material security moderated any relationship between religion measures and game allocations, the above regressions that included significant religion predictors were repeated, including the effect of food security or logged annual income, plus an interaction term with religion measures. To check for participant order effects (e.g., due to collusion after discussing the game), we also reran all analyses including participant order at each site as a predictor. Age, years of formal education, native language ability, food security, and logged annual income were centered at the mean. Reference groups were *Kastom* (location), *Local Co-Religionist Game* (game), *Local Co-Religionist Game* first (order) and female (sex).

Three of the community rituals (*Nakul* in the Christian village, and *Toka* and *Niel* in the *Kastom* village) occurred at very low frequencies and it became apparent that variation in stated levels of participation was capturing individuals' ability to estimate the time between rituals, rather than their relative likelihood of participating. The remaining community ritual at the Christian site – church attendance – did not have an analogue at the *Kastom* site and so only includes data from one site.

Data from the three hamlets at the *Kastom* location were treated as one population after Kruskal-Wallis tests revealed no significant differences between the hamlets on any of the variables considered here. Including hamlet as a random effect in the logistic hierarchical models indicated that there were no differences between the groups (variance was zero) and did not affect the conclusions presented here.

## 4. Results

### 4.1. Site demographics

Table 1 shows a comparison of basic socio-demographic information for the Christian and *Kastom* sites. Compared to participants from the Christian village, participants from the *Kastom* hamlets had smaller household sizes, much less formal education and much lower annual income. There was no significant difference across sites in gender distribution, average age, and food security scores.

**Table 1.** Socio-demographic profile showing mean values (and standard deviations) for descriptives at the *Kastom* and Christian sites and non-parametric Wilcoxon rank-sum test of difference between groups.

	Christian	<i>Kastom</i>	Test for difference
n	44	76	–
Gender	52.2% female	50.0% female	$\chi^2 = 0.0026, p = 0.960$
Age	35.02 (14.1)	37.00 (16.2)	$W = 1737, p = 0.725$
Household size	6.86 (1.7)	6.09 (1.9)	$W = 1314, p = 0.048$
Years formal ed.	8.2 (3.5)	0.63 (2.1)	$W = 166, p < 0.001$
Food security score	3.11 (1.4)	2.97 (1.5)	$W = 1738, p = 0.682$
Annual income (US\$)	7676.26 (10266.7)	531.61 (1011.7)	$W = 250, p < 0.001$

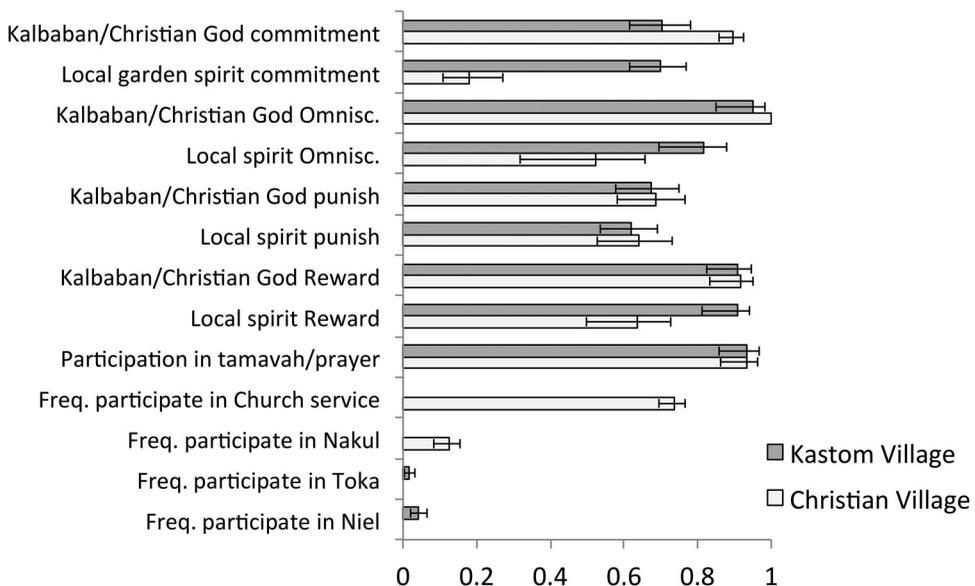
## 4.2. Religion measures

Figure 1 and Table 2 show mean and bootstrapped 95% confidence intervals for all religion measures across the two sites. Comparing religion measures within the two locations, in the Christian village, as expected, the Christian god showed significantly higher ratings of commitment (paired Wilcoxon rank-sum  $V = 903$ ,  $p < 0.001$ ), omniscience ( $V = 120$ ,  $p < 0.001$ ), punishment ( $V = 80$ ,  $p = 0.08$ ), and reward ( $V = 66$ ,  $p < 0.01$ ) than *tupunus*. However, in the *Kastom* hamlets, *tupunus* and *Kalpapen* showed no significant difference in ratings of commitment ( $V = 422.5$ ,  $p = 0.923$ ), punishment ( $V = 289.5$ ,  $p = 0.244$ ), or reward ( $V = 7.5$ ,  $p = 1.0$ ). *Kalpapen* was rated as significantly more omniscient than *tupunus* ( $V = 52$ ,  $p = 0.012$ ).

The statistical tests in Table 2 compare equivalent religion measures across the Christian and *Kastom* sites. Table 2 shows that, comparing responses about the Christian god in the Christian village to responses about *Kalpapen* in the *Kastom* hamlets, there were no significant differences in level of commitment or the extent to which the gods were viewed as omniscient, punitive, or rewarding – both the Christian God and *Kalpapen* scored relatively highly on these scales. Conversely, participants in the *Kastom* hamlets were significantly more committed to the local spirit *tupunus* and rated it as significantly more omniscient, and more rewarding, than did participants in the Christian village. *Tupunus* was also rated as more punitive in the *Kastom* hamlets, although this relationship was not significant at the 0.05 level.

One possible explanation for the between-site differences in the beliefs about *tupunus* is that some of those at the Christian site interpreted the question as relating to the garden magician rather than the spirit force he represents. However, free-list responses about what *tupunus* likes and dislikes indicate a general awareness among participants of the distinction between the spirit and the person (e.g., “*Tupunus* also cares for the *nakamal* and also the garden. If a person stands for *tupunus*, he is also called *tupunus*.”). In addition, all participant responses regarding the kinds of punishment *tupunus* imposes are supernatural in nature (i.e., *tupunus* will cause death, sickness or crops failing) suggesting a spirit interpretation.

Regarding ritual participation, frequencies of participation in acts of devotion (prayer in the Christian village and *temavah* in the *Kastom* hamlets) were identical. In the Christian village, people



**Figure 1.** Bar graph showing comparison of mean and bootstrapped 95% confidence intervals for the religion measures across the *Kastom* and Christian locations. All scales are standardized to a range from 0 (lowest) to 1 (highest).

**Table 2.** Religion comparison showing mean (and bootstrapped 95% confidence intervals) for religion measures at the Christian and *Kastom* sites and non-parametric Wilcoxon rank-sum test of difference between groups.

	Christian	<i>Kastom</i>	Wilcoxon rank-sum test for difference
Kalbaban/Christian God religious commitment	0.897 (0.86–0.925)	0.704 (0.617–0.781)	$W = 1313.5, p = 0.178$
Local garden spirit religious commitment	0.181 (0.108–0.271)	0.699 (0.615–0.769)	$W = 2657, p < 0.001$
Kalbaban/Christian God omniscience	1 (1–1)	0.949 (0.848–0.983)	$W = 1176, p = 0.143$
Local garden omniscience	0.523 (0.318–0.659)	0.815 (0.695–0.879)	$W = 967, p < 0.001$
Kalbaban/Christian God punishment	0.685 (0.582–0.766)	0.673 (0.578–0.75)	$W = 1207, p = 0.946$
Local garden punishment	0.64 (0.527–0.731)	0.618 (0.535–0.691)	$W = 685, p = 0.939$
Kalbaban/Christian God reward	0.917 (0.833–0.952)	0.907 (0.823–0.946)	$W = 1232, p = 0.945$
Local garden reward	0.636 (0.5–0.727)	0.908 (0.814–0.941)	$W = 1082.5, p < 0.001$
Participation in <i>temavah</i> /prayer	0.935 (0.863–0.964)	0.932 (0.860–0.969)	$W = 1694, p = 0.129$
Frequency of participation in church service	0.738 (0.696–0.768)		
Frequency of participation in <i>Nakul</i> (circumcision)	0.125 (0.083–0.155)		
Frequency of participation in <i>Toka</i> ceremony		0.018 (0.004–0.032)	
Frequency of participation in <i>Niel</i>		0.041 (0.021–0.065)	

attended church on average a few times per month and participated in circumcision ceremonies somewhere between a few times a year and less than once per year. In the *Kastom* village, people participated in the *Toka* and *Niel* ceremonies less than once per year.

#### 4.3. Comparison of RAG allocations across sites

Figure 2 shows the distribution of coin allocations to the DISTANT cup in the *Local Co-Religionist Game* and the *Self Game* at each site compared to the expected binomial distribution. The distributions show considerable overlap with the binomial distribution, suggesting that most participants at both locations were following the impartial allocation rule. Nevertheless, at both sites there are more than expected roughly equal allocations and, particularly at the *Kastom* site, more offers than expected that favor the LOCAL/SELF cup over the DISTANT cup.

Table 3 shows a comparison of mean allocations and bootstrapped 95% confidence intervals across games and locations. Confidence intervals for allocation to the DISTANT cup in the *Local Co-Religionist Game* overlap the expected 15-coin (50%) allocation at both the Christian and *Kastom* sites. In the *Self Game*, confidence intervals for allocation to the DISTANT cup overlap the 15 coin (50%) null expectation at the Christian site but are below 15 coins at the *Kastom* site (95% conf. int. = 13.11–14.81). Neither the *Local Co-Religionist Game* nor the *Self Game* shows a significant difference in allocations to the DISTANT cup between Christian and *Kastom* sites. However, the difference is in the expected direction, with allocations to the DISTANT cup greater at the Christian location.

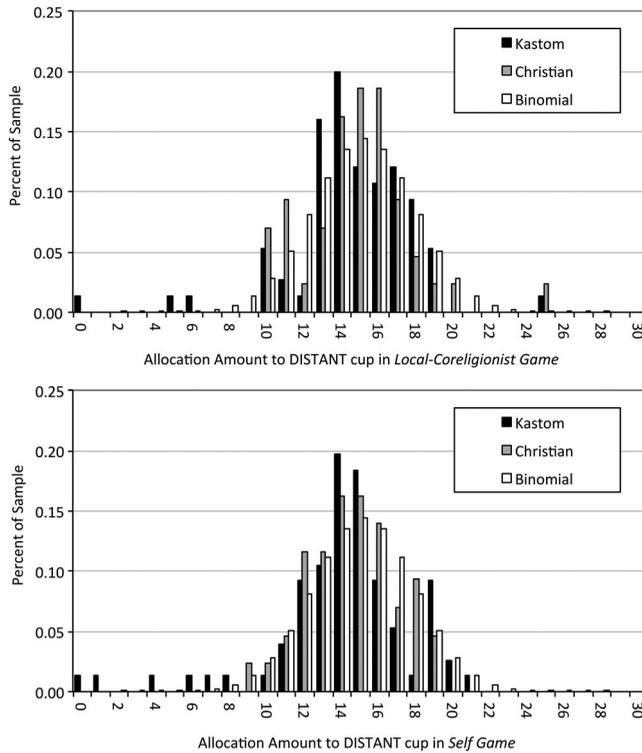
#### 4.4. Within-subjects comparison of allocations to ingroup (RAG 1) and self (RAG 2)

Table 3 also reveals that there are no significant differences between allocations to co-religionists in the *Local Co-Religionist Game* or *Self Game* at either the Christian site or the *Kastom* site. However,

**Table 3.** Comparison of mean (and bootstrapped 95% confidence intervals) for allocations to the DISTANT cup across *Kastom* and Christian villages in the *Local Co-Religionist Game* and the *Self Game*.

	Christian	<i>Kastom</i>	Wilcoxon rank-sum test for difference between locations
DISTANT allocation for <i>Local Co-Religionist Game</i>	14.86 (14.05–15.77)	14.59 (13.71–15.25)	$W = 1630.5, p = 0.921$
DISTANT allocation for <i>Self Game</i>	14.56 (13.81–15.26)	14.07 (13.11–14.81)*	$W = 1693.5, p = 0.742$
Within-subjects Wilcoxon rank-sum test for difference between <i>Local Co-Religionist Game</i> and <i>Self Game</i>	$V = 316.5, p = 0.750$	$V = 1124, p = 0.427$	

\* = 95% confidence interval outside binomial expectation of 15 coins.



**Figure 2.** Distribution of allocations to the DISTANT cup across the *Kastom* and Christian villages for: (a) the *Local Co-Religionist Game*; and (b) the *Self Game*. The expected binomial distribution is shown for comparison.

across both sites, the *Self Game* allocations to the DISTANT cup are significantly lower than 50% (15 coins) (bootstrapped 95% CI = 13.61–14.79). Allocations to the DISTANT cup in the *Local Co-Religionist Game* are not significantly different from 15 coins (95% CI = 14.02–15.21).

Across both sites, there is a significant positive correlation between allocations to the DISTANT cup in the *Local Co-Religionist Game* and *Self Game* (Spearman's  $\rho = 0.221$ ,  $p = 0.017$ ). This relationship is mainly driven by the *Kastom* site ( $\rho = 0.246$ ,  $p = 0.033$ ). The correlation between DISTANT cup allocations is positive but not significant at the Christian site ( $\rho = 0.175$ ,  $p = 0.268$ ).

#### 4.5. Predicting individual-level variation in game allocations

Table 4 shows the results of the hierarchical logistic regressions predicting game allocations to the DISTANT cup from religion measures, location, and game, controlling for demographic variables. Supplementary Table S2 shows the same analysis broken down by game for those predictors for which the full analysis indicated a significant (or borderline significant) two- or three-way interaction effect with game. The regressions did not reveal a significant relationship between game allocations and big god or local spirit commitment or punishment scores, nor was there an effect of frequency of church attendance. However, the other five religion measures did show a significant relationship with game allocations in the predicted direction.

Belief in a more omniscient big god (Christian/*Kalpapen*) was associated with increased allocation (indicating greater prosociality) to the DISTANT cup ( $B = 0.621$ ; OR = 1.861,  $p < 0.05$ ). The location by religion measure interaction effect was not fitted because all participants at the coastal site scored the Christian god a maximum two on this scale. Belief in a more rewarding big god was also associated with an increase in allocation (greater prosociality) to the DISTANT cup ( $B = 0.577$ ; OR = 1.781,  $p < 0.05$ ). There was no significant location or game interaction.

**Table 4.** Results from binomial generalized linear models of allocation to DISTANT cup (dependent variable) versus SELF/LOCAL in the allocation games for each of the religion predictors.

Predictor variables	Models (named according to religion variables included)										
	None Coef (S.E.)	Big god Omnisc. Coef (S.E.)	Big god Punish Coef (S.E.)	Big god Reward Coef (S.E.)	Big god Commit. Coef (S.E.)	Local spirit Omnisc. Coef (S.E.)	Local spirit Punish Coef (S.E.)	Local spirit Reward Coef (S.E.)	Local spirit Commit. Coef (S.E.)	Prayer/ <i>Temavah</i> Coef (S.E.)	Church service Coef (S.E.)
Game ( <i>Self Game</i> )	0.071 (0.06)	0.087 (0.068)	0.105 (0.069)	0.097 (0.068)	0.077 (0.062)	0.08 (0.068)	0.092 (0.066)	0.076 (0.068)	0.017 (0.070)	0.057 (0.061)	0.353 (0.308)
Location (Christian)	0.155 (0.135)	0.098 (0.141)	0.121 (0.152)	0.121 (0.148)	0.191 (0.156)	0.174 (0.190)	0.137 (0.191)	0.277 (0.202)	0.125 (0.171)	0.183 (0.131)	–
Religion measure	–	0.621 (0.269)*	0.174 (0.180)	0.577 (0.274)*	–0.206 (0.149)	0.366 (0.164)*	0.086 (0.178)	0.483 (0.258)†	–0.068 (0.157)	0.467 (0.220)*	–0.178 (0.485)
Game x Location	–0.032 (0.099)	–0.024 (0.107)	–0.053 (0.107)	–0.042 (0.106)	–0.064 (0.133)	–0.052 (0.144)	0.035 (0.129)	–0.130 (0.154)	0.109 (0.148)	0.019 (0.102)	–
Game x Religion	–	–0.310 (0.319)	–0.015 (0.212)	–0.091 (0.322)	0.283 (0.168)†	0.149 (0.193)	0.081 (0.194)	0.057 (0.286)	0.213 (0.180)	0.267 (0.272)	–0.658 (0.658)
Location x Religion	–	–	–0.303 (0.302)	–0.499 (0.457)	0.033 (0.622)	–0.087 (0.297)	–0.592 (0.486)	–0.201 (0.445)	0.046 (0.318)	–0.547 (0.510)	–
Game x Location x Religion	–	–	1.66 (0.356)	–0.337 (0.537)	0.054 (0.723)	–0.650 (0.347)†	0.459 (0.498)	–0.996 (0.502)*	0.010 (0.362)	–1.329 (0.786)†	–
Random effect (ID)	0.062	0.050	0.057	0.053	0.062	0.055	0.078	0.071	0.062	0.048	0.00
Constant	–0.112 (0.069)	–0.129 (0.077)†	–0.149 (0.081)†	–0.121 (0.079)	–0.136 (0.074)†	–0.196 (0.087)*	–0.171 (0.093)†	–0.161 (0.089)†	–0.097 (0.077)	0.105 (0.068)	0.124 (0.272)
N	120	101	99	101	115	84	85	87	115	115	42
BIC	9892.49	8373.06	8226.30	8389.36	9548.92	7045.85	7123.36	7283.43	9550.12	9537.29	3481.29

Note: These models include five additional control variables (sex, age, years of education, native language competence, and game order). Coefficients (and standard errors) are listed for each predictor.

† $p < 0.1$ .

\* $p < 0.05$ .

\*\* $p < 0.01$ .

\*\*\* $p < 0.001$ .

The relationships between the local garden spirit beliefs and DISTANT cup allocation amount were more complex. Belief in a more omniscient local garden spirit showed a main effect of increased allocation to the DISTANT cup ( $B = 0.366$ ;  $OR = 1.442$ ,  $p < 0.05$ ) and a borderline significant three-way interaction with location and game ( $p < 0.1$ ; Supplementary Figure S2). Belief in a more rewarding local garden spirit showed a borderline significant main effect of increased allocation to the DISTANT cup ( $B = 0.483$ ;  $OR = 1.621$ ,  $p < 0.10$ ) and a significant three-way interaction with location and game ( $p < 0.05$ ; Supplementary Figure S3).

Supplementary Figures S2 and S3 show the three-way interaction effects for local spirit omniscient and reward beliefs respectively. The positive slope of three of the four lines in the figures reflects the fact that belief in a more omniscient local spirit or more rewarding local spirit is associated with increased allocation to the DISTANT cup in the *Self Game* at both the Christian and *Kastom* sites and increased allocation to the DISTANT cup in the *Local Co-Religionist Game* at the *Kastom* site. However, for the *Self Game* in the Christian village, the line slopes in the opposite direction, indicating that belief in a more omniscient or rewarding local spirit is associated with decreased allocations to the DISTANT cup. To investigate this pattern further, Supplementary Table S2 shows separate analysis of the *Local Co-Religionist Game* and *Self Game* data, predicting allocation to the DISTANT cup from local garden spirit omniscience and reward. For the *Self Game*, Table S2 reveals a significant positive relationship between allocations to the DISTANT cup and belief in local spirit omniscience ( $B = 0.369$ ; odds ratio = 1.446,  $p < 0.05$ ) but no significant relationship with local spirit reward ( $B = 0.419$ ; odds ratio = 1.520,  $p = 0.182$ ). For the *Local Co-Religionist Game*, at the *Kastom* location there is a significant positive relationship between allocation to the DISTANT cup and local spirit omniscience ( $B = 0.501$ ; odds ratio = 1.650,  $p < 0.01$ ) and reward ( $B = 0.578$ ; odds ratio = 1.782,  $p < 0.05$ ), and an interaction effect indicating a significantly less positive relationship at the Christian location. Repeating the analysis at only the Christian location reveals no significant effect of local spirit omniscience or reward at the Christian site.

Finally, participation in prayer/*temavah* showed a main effect of increased allocation to the DISTANT cup ( $B = 0.467$ ;  $OR = 1.595$ ,  $p < 0.05$ ), as well as a borderline significant three-way interaction with location and game ( $p < 0.1$ ; Supplementary Figure S4). Figure S4 shows the three-way interaction effects for participation in prayer/*temavah*. To investigate this pattern further, Supplementary Table S2 shows separate analysis of the *Local Co-Religionist Game* and *Self Game* data, predicting allocation to the DISTANT cup from participation in prayer/*temavah*. For the *Self Game*, participation in prayer or *temavah* is associated with increased allocation to the DISTANT cup ( $B = 0.462$ ; odds ratio = 1.587,  $p < 0.05$ ). For the *Local Co-Religionist Game*, at the *Kastom* location there is a significant positive relationship between allocation to the DISTANT cup and participation in *temavah* ( $B = 0.709$ ; odds ratio = 2.032,  $p < 0.001$ ), and an interaction effect ( $B = -2.266$ ;  $p < 0.001$ ) indicating a significantly less positive relationship between prayer and allocation to the DISTANT cup at the Christian location. Repeating the analysis at only the Christian location reveals a significant negative relationship between allocation to the DISTANT cup and prayer participation at the Christian site ( $B = -1.774$ ;  $OR = 0.170$ ,  $p < 0.01$ ).

There were no significant moderator effects of food security or income on game allocations and adding the material security measures worsened the fit of these models (all models increased in Bayesian Information Criterion by more than 12 units). There were also no significant effects of participant order.

## 5. Discussion

In what follows, I return to the three broad areas outlined in the introduction in the light of the above findings. First, I discuss evidence for variation in religious beliefs and participation at the *Kastom* and Christian sites. Second, I evaluate the evidence for differences in prosociality across the *Kastom* and Christian sites as measured by allocations to the DISTANT cup in the *Local Co-Religionist Game* and the *Self Game*. Third, I discuss the evidence for an association between religious beliefs/participation

and prosociality towards the DISTANT cup in each game. I conclude by highlighting important caveats in the interpretation of these results and offer suggestions for future research.

### 5.1. Variation in religious beliefs and participation

There were no significant differences between the Christian god (at the Christian site) and *Kalpapen* (at the *Kastom* site) in stated levels of commitment, omniscience, reward, or punishment. This could be viewed as counting against the argument that these features of the Christian god have been an important force in religious competition between Christian and indigenous belief systems. However, a couple of factors weaken support for this interpretation. First, some of the religion measures may not be sensitive enough to detect relevant differences, or may suffer from a ceiling effect. For example, the omniscience measure is at the maximum value – 1.0 – for the Christian god (everyone in the Christian village rated the Christian god as knowing what people feel in their hearts and being able to see faraway places), and near the maximum – 0.95 – for *Kalpapen* (almost everyone rated *Kalpapen* the maximum value). Second, as with any survey data, responses may reflect demand characteristics or social desirability bias – e.g., a wish to convey the importance of one’s own belief system. Third, *Kastom* beliefs on Tanna are known to have changed in response to 200 years of Christian influence (Bonnemaison, 1997; Guiart, 1956), and this may have included the adoption of a Christian supreme being concept (Humphreys, 1926). Christian notions of an omnipotent, omniscient, morally concerned creator may therefore have been incorporated into the *Kastom* tradition recently, possibly in direct response to competition – an “anything your God can do, mine can do better” effect. It is worth noting that, in this example, it is the cultural traits that are competing (belief in a more or less powerful god) rather than entire religious traditions, which can co-opt elements from other traditions.

Responses regarding the local spirit *tupunus* indicated lower commitment and less belief in omniscience, reward, and punishment at the Christian site, but not at the *Kastom* site. This pattern is particularly interesting because it may reflect competitive exclusion of local spirits in the Christian village – not only do fewer people show commitment to the spirits, but their powers are viewed as much weaker in the Christian village. To the extent that shared belief in a powerful monitoring god is important for trust and cooperation, in the context of the Christian village, the functionality of the *Kastom* gods/spirits is therefore reduced compared to the Christian god. Once initiated, this may cause a self-reinforcing feedback loop in which commitment and power accorded to the *Kastom* gods/spirits is progressively reduced. This process may be akin to the centuries-long decline in rivals to Christianity across Europe.

### 5.2. Variation in game allocations between the Christian and *Kastom* sites

The game allocations at both locations suggest most participants were following the impartial allocation rule. At the Christian site, average allocations were 49.5% to the DISTANT cup in the *Local Co-Religionist Game* and 48.5% in the *Self Game*. At the *Kastom* site, average allocations were 48.6% to the DISTANT cup in the *Local Co-Religionist Game* and 46.9% in the *Self Game*. These values are within the range observed when the same protocol was played at eight other locations around the world (Hruschka et al., 2014). This work found a strong relationship between RAG allocations to SELF/LOCAL versus outgroup and community food security across the eight locations. Interestingly, while the Tannese Christian and *Kastom* SELF/LOCAL allocations are lower than was observed in nearby Fiji (62.6% [SELF] and 59.6% [LOCAL]), they closely match allocations from communities in China with similar community-level food security scores. This supports the proposal that, at least at the community level, RAG allocations are influenced by material security. As Hruschka et al. (2014) propose, increased insecurity may motivate individuals to buffer risk by favoring the self and immediate ingroup over more distant social affiliations.

Despite generally low rates of self-serving bias in the games, allocations to the DISTANT cup in the *Self Game* were significantly below the null expectation of 50% in the *Kastom* village. While not a large effect (in the logistic regressions, the location effect was in the predicted direction but was not significant), it is worth noting that the power of the method to identify differences is limited by the inherent randomness in RAG allocations. Furthermore, at the *Kastom* site (but not the Christian site), allocations to the DISTANT cup were moderately to strongly correlated across the two games, suggesting some individuals did indeed generally favor their own interests over the interests of distant co-religionists. Together, these findings provide some support for the prediction that self-serving bias will be lower in the Christian community and are at least consistent with the proposal that a world religion like Christianity may enhance perceived social obligations to co-religionists outside the immediate ingroup.

### 5.3. Do individual differences in religion measures predict RAG allocations?

The individual-level regression results provide some support for the hypothesis that aspects of religious beliefs and participation can act to increase prosocial behavior in the *Local Co-Religionist Game* and *Self Game*. While there was no effect of church attendance or big god and local spirit commitment or punishment, the other religion measures did predict game allocations to varying degrees. Allocations to the DISTANT cup were higher, consistent with an expanded cooperative sphere, among participants who believed in a more omniscient and rewarding big god. The relationship with devotional ritual and belief in a more omniscient and rewarding local garden spirit was more complex, varying across games and locations. In the *Kastom* village (but not the Christian village), allocations to the DISTANT cup were generally higher among those who practiced *temavah* more frequently or believed in a more omniscient and rewarding local spirit (though the effect of belief in a rewarding local spirit was not significant in the *Self Game*). Interestingly, the relationship between game allocations and beliefs about the local garden spirit were clearest in the *Kastom* villages, where commitment to these spirits is stronger.

The observed relationship between game allocations and the omniscience and reward measures is consistent with the proposal that the belief in a powerful, all-seeing, morally concerned deity can expand cooperative networks beyond the immediate ingroup, perhaps by activating reputation-monitoring psychology and the perception of supernatural surveillance. Indeed, religion measures appear to be a better predictor of individual variation in game allocations than material security – individual-level material security measures did not significantly predict allocations or moderate the effect of the religion measures. While there is uncertainty in the parameter estimates, the estimated size of the effects is non-negligible. The relationship with big god omniscience is the least robust as it relies on three individuals in the *Kastom* village whose omniscience score for *Kalpapen* was zero and allocated considerably less than expected to the DISTANT cup. In addition, the reported relationships do not correct for multiple comparisons, which increases the chance of false positives. The main effects would not be significant after a Bonferroni correction. A larger sample size is therefore needed to conclusively demonstrate the hypothesized relationships.

### 5.4. Caveats and future research

There are several important points to bear in mind when interpreting these findings, which motivate future research. Most obviously, because both sites differ on a number of dimensions, it is not possible to isolate any single factor as potentially causal. In addition to being predominantly Christian, the coastal site is also larger, wealthier, more educated, and more connected with a market economy. Additional sites, ideally matched on some of these dimensions, are required to fully tease apart the relative importance of each factor.

Existing institutions and customs likely also affected the way the game was interpreted at each site. When asked what the game reminded them of in everyday life, half of participants (50%) at

the Christian village said kindness or sharing. Only 18% mentioned kindness or sharing at the *Kastom* village, where the most common response was “I don’t know” (58%). When asked who they thought they were giving to, at the Christian village a few participants said to themselves (5%) or someone from another village (7%), but many specifically mentioned giving to another Christian (29%). Conversely, most participants from the *Kastom* site said they thought about giving to someone from another village (37%) or themselves (41%).

The importance of the social context in which the game is interpreted is illustrated by an episode that occurred two weeks after playing the RAG at one of the *Kastom* hamlets. I was invited to a special *temavah* in the *nakamal* of the hamlet. Usually, these *temavah* are reserved for blessing crops from the garden, which are then distributed to all the households. The ceremony began with half a dozen of the men coming forward with their payment envelopes (some apparently unopened), which they set in the middle of the *nakamal*. A *temavah* was said over the envelopes and it was explained that they wanted to show me how they made decisions about money, since that was the purpose of the research. They said that since the money had been gifted to them like yams from the garden, they would treat the money like yams. Young boys then ran the envelopes to all the households, sharing out the “harvest” just as yams would have been. It is worth noting that there was no evidence of collusion or discussion of the RAG during the game days at either site. This is supported by the fact that participant order was not a significant predictor of allocation amounts in either RAG. Nevertheless, this treatment of the payments shows the potential impact of participants’ own interpretation of the game and warns against interpreting game behavior as tapping into a blanket tendency to cooperate. Here, evidence of private bias in favor of the SELF/LOCAL cup in the games at the *Kastom* site occurs alongside public displays of generosity to the ingroup outside the game setting. This disparity echoes Weissner’s (Weissner, 2009) discussion of “experimental games” and “games of life” among the Ju/’hoan Bushmen, in which Bushmen played a self-interested strategy in the “context-free” experimental games but demonstrated the effect of clear context-dependent cultural norms and institutions in the subsequent use (and abuse) of the game money in the local economy.

A second important feature of the context on Tanna is the circumscribed nature of a small island population. Tanna’s population of 29,000 is too large for anyone to know everyone on the island, but it is small enough that no two inhabitants are truly “strangers.” This is reinforced by a strong emphasis on kinship and marriage ties across the island such that, despite differences in language, religion, and way of life, most inhabitants are not more than two degrees of separation from anyone on the island.

In addition to providing comparisons across more sites, future work may be able to improve on the above design in several ways. First, behavioral or implicit measures of religious commitment and beliefs (such as actually measuring church attendance or using implicit association tests) avoid experimenter demand or social desirability effects – although they are more difficult to administer. Second, the signal to noise ratio in the data could be improved by employing alternative measures of prosocial behavior towards co-religionists that do not include an inherent random component – although this likely destroys the RAG’s feature of preventing the experimenter or others ever knowing whether the participant played fairly. Third, the correlational nature of the above findings means that even where covariates can be accounted for, it is not possible to establish causation. Our initial intention was to experimentally prime religion at the two sites, but this was abandoned due to problems guaranteeing adequate sample sizes at each site. By experimentally priming religion at these sites using established techniques (Gervais & Norenzayan, 2012; Shariff & Norenzayan, 2007), it should be possible to more directly test whether bringing religion to mind has an effect on prosocial behavior to co-religionists.

## 6. Conclusion

Together, the results presented here provide correlational support for the hypothesis that some elements of religiosity function to facilitate the expansion of cooperation to co-religionists beyond

the ingroup. Specifically, there is some evidence that ritual participation and belief in a more omniscient, rewarding god is associated with increased prosociality in the form of greater allocation to the DISTANT cup over the SELF/LOCAL cup. There is also some evidence for greater prosociality towards co-religionists in a Christian compared to a *Kastom* site. The effect is not large, and there are many differences between the sites, but the example is nonetheless instructive. Indeed, the scenario – a relatively wealthy, educated, and connected Christian community alongside a relatively poor, uneducated, rural non-Christian community – shares many features of the context in which world religions have been expanding for centuries.

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## ORCID

Quentin D. Atkinson  <http://orcid.org/0000-0002-8499-7535>

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