LETTER

Moralistic gods, supernatural punishment and the expansion of human sociality

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Since the origins of agriculture, the scale of human cooperation and societal complexity has dramatically expanded[1,2]. This fact challenges standard evolutionary explanations of prosociality because well-studied mechanisms of cooperation based on genetic relatedness, reciprocity and partner choice falter as people increasingly engage in fleeting transactions with genetically unrelated strangers in large anonymous groups. To explain this rapid expansion of prosociality, researchers have proposed several mechanisms[3,4]. Here we focus on one key hypothesis: cognitive representations of gods as increasingly knowledgeable and punitive, and who sanction violators of interpersonal social norms, foster and sustain the expansion of cooperation, trust and fairness towards co-religionist strangers[5–8]. We tested this hypothesis using extensive ethnographic interviews and two behavioural games designed to measure impartial rule-following among people ($n = 591$, observations = 35,400) from eight diverse communities from around the world: (1) inland Tanna, Vanuatu; (2) coastal Tanna, Vanuatu; (3) Yasawa, Fiji; (4) Lovu, Fiji; (5) Pesqueiro, Brazil; (6) Pointe aux Piments, Mauritius; (7) the Tyva Republic (Siberia), Russia; and (8) Hadzaland, Tanzania. Participants reported adherence to a wide array of world religious traditions including Christianity, Hinduism and Buddhism, as well as notably diverse local traditions, including animism and ancestor worship. Holding a range of relevant variables constant, the higher participants rated their moralistic gods as punitive and knowledgeable about human thoughts and actions, the more coins they allocated to geographically distant co-religionist strangers relative to both themselves and local co-religionists. Our results support the hypothesis that beliefs in moralistic, punitive and knowing gods increase impartial behaviour towards distant co-religionists, and therefore can contribute to the expansion of prosociality.

Among the other factors[2–4,7] that influence the emergence of human ultrasociality and complex societies, the diffusion of explicit beliefs in increasingly moralistic, punitive and knowledgeable gods may have played a crucial role[6,7]. People may trust in, cooperate with and interact fairly within wider social circles, partly because they believe that knowing gods will punish them if they do not. Additionally, through increased frequency and consistency in belief and behaviour sets, commitments to the same gods coordinate people's expectations about social interactions[5–9]. Moreover, the social radius within which people are willing to engage in behaviours that benefit others at a cost to themselves may enlarge as gods' powers to monitor and punish increase[10]. To account for the emergence of these patterns, some evolutionary approaches to religion have theorized that cultural evolution may have harnessed and exploited aspects of our evolved psychology, such as mentalizing abilities, dualistic tendencies and sensitivity to norm compliance, to gradually assemble configurations of supernatural beliefs that promote greater cooperation and trust within expanding groups, leading to greater success in intergroup competition. Of course, given that cultural evolution can produce self-reinforcing stable patterns of beliefs and practices, these supernatural agent concepts may also have been individually favoured within groups due to mechanisms related to signalling, reputation and punishment[5–9,11,12]. Over time, these deities spread culturally and came to dominate the modern world religions like Christianity, Islam and Hinduism. Such traditions eventually came to account for a large proportion of the world's population[6,7,13,14] (see Supplementary Information section S1). Here we directly test one specific hypothesis: conceptions of moralistic and punitive gods that know people's thoughts and behaviours promote impartiality towards distant co-religionists, and as a result contribute to the expansion of sociality.

At the societal level, several lines of converging evidence are consistent with this hypothesis. For example, after controlling for key correlates, analyses of cross-cultural data sets show that larger and more politically complex societies tend to have more supernatural punishment and moralistic deities[5,15], and historical analyses in one geographic region show that precursors to supernatural punishment beliefs precede social complexity[16]. However, this data derives from qualitative ethnographies of entire societies; a more focused, direct and systematic cross-cultural assessment of what individuals think their gods care about, and whether or not people explicitly or implicitly view their gods as concerned with norms of interpersonal social behaviour (termed here as 'morality'[17,18]; see Supplementary Information section S4.2) has only recently begun[18–20]. Analyses of cross-national databases (for example, the World Values Survey) reveal positive relationships between beliefs in hell, beliefs in gods' power to punish, and various self-reported prosocial behaviours[21,22]. Although valuable, these lines of research primarily rely on survey questions not specifically designed to address the research question we are interested in. Moreover, they rely on samples drawn broadly from nation states, thus excluding small-scale societies that are crucial for assessing questions about the expansion of prosociality.

At the individual level, two types of behavioural studies are also consistent with this hypothesis, but each has crucial limitations. First, laboratory experiments show that exposure to religious reminders increases generosity and decreases cheating among religious believers[23–25]. However, as is the case for most psychological experiments, the vast majority of these studies rely on Western, Christian-majority samples, limiting their generalizability[26]. Second, in one

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Table 1 | Site descriptive statistics

Site	Researcher	Economy	Moralistic god	Local god or spirit	n	Females	Age	Material insecurity
Coastal Tanna§	Atkinson	Horticulture	Christian god	Garden spirit (*Tupunus*)	44	23	35.02 (14.13)	0.22 (0.36)
Hadza	Apicella	Hunting	Celestial figure (*Haine*)#	Sun (*Ishoko*)#	68	31	39.82 (12.08)	0.82‡ (0.36)
Inland Tanna§	Atkinson	Horticulture	*Kalpapan* (traditional)	Garden spirit (*Tupunus*)	76	38	37.00 (16.17)	0.26 (0.38)
Lovu	Willard	Wage labour	Hindu *Bhagwan*	None available	76	52	44.56 (16.94)	0.83 (0.33)
Mauritius	Xygalatas	Wage labour and farming	Hindu Shiva	Spirit/soul/ghost (*Nam*)	94	27	36.56 (15.05)	0.39 (0.35)
Pesqueiro	Cohen	Wage labour	Christian god	Virgin Mary	77	40	34.12 (13.08)	0.86 (0.24)
Tyva Republic	Purzycki	Wage labour and herding	Buddha Burgan	Spirit-masters (*Cher eezi*)	81	58	33.53 (12.52)	0.47 (0.28)
Yasawa	McNamara	Fishing and farming	Christian god	Ancestor spirits (*Kalou-vu*)	75	41	38.04 (15.91)	0.50 (0.40)
				Grand mean	73.88	–	37.34	0.55

Means indicated (standard deviations in parentheses). See Extended Data Fig. 1 for a map of field sites.
§One individual was removed from the local co-religionist game due to coin visibility.
#These two gods closely overlap in conception.
‡Answer options were "yes", "no" or "I don't know".

field study[27] across 15 diverse societies of foragers, pastoralists and horticulturalists, adherence to Christianity or Islam predicted greater fairness in economic games relative to adherence to local/traditional religions. This study, however, lacked precise measures for our theoretically important components of beliefs about gods' minds—punishment, knowledge and moralism. Moreover, these studies did not consider the religious affiliation of the anonymous recipients of players' monetary decisions. It is therefore unclear whether these findings explain the expansion of prosociality specifically towards geographically distant co-religionists.

Addressing these limitations, we combined two behavioural experiments with detailed ethnographic interviews to assess whether participants who report that their moralistic gods are punishing and more knowledgeable about human thought and behaviour are more likely to impartially allocate money to anonymous, geographically distant co-religionists over both themselves and their local community[6,7]. In five of the sites, we also tested whether religious priming associated with moralistic gods had effects on gameplay, but these had no overall effect (see Supplementary Information sections S2.2.2 and S6.2.

We tested these predictions with a sample of 591 participants (310 females; observations = 35,400; Table 1 and Extended Data Fig. 1) from eight diverse communities, including hunter-gatherers, horticulturalists, herders and farmers, as well as fully market-integrated populations engaged in wage labour or operating small businesses. The participants adhere to a variety of world religious traditions including Christianity, Hinduism and Buddhism, and report beliefs in an immense range of local supernatural agents, including spirit-masters, saints, ancestors, animistic beings, anthropomorphic celestial deities, garden spirits, and ghosts (Supplementary Information section S3).

To measure favouritism towards oneself and local community under maximally anonymous conditions, we modified the random allocation game[9,28,29]. In this game (Fig. 1), participants play in private with 30 coins, two cups and a fair die with three sides of one colour and three sides of another colour. In the experiment, the participant's job is to allocate each coin to one of the two cups. First, they mentally choose one of the cups and then roll the die. If one coloured side comes up, players are instructed to put the coin into the cup they mentally

chose. If the die comes up the other colour, people are instructed to put the coin into the opposite cup from the one they chose. Of course, as cup selection occurs only mentally, participants can overrule the die in favour of one of the cups without anyone else observing their decision. If people play by the rules and thereby allocate the coins impartially, the mean number of coins in each cup should be 15, and the distribution around this average will be binomial. This allows us to test for systematic deviations from this distribution (Supplementary Information section S2.2).

Participants played two counterbalanced games for a total of 60 coin allocations per person (Fig. 1). In one game, the local co-religionist game, participants chose between a cup assigned to an unspecified anonymous co-religionist from their local community and a cup assigned to an anonymous co-religionist living in a geographically distant community that does not regularly interact with the player's community. In the other game, the self game, participants chose between a cup for themselves and a cup for another anonymous distant co-religionist. In order to control for any effects of ethnicity[30] and nationality, both local and distant co-religionists were of the same ethnic group and nationality as the participant.

Participants understood that money put into the cups would be given to the people they represented, including themselves, and we actually distributed allocations to participants and randomly selected people described by the cups (that is, there was no deception). After gameplay, we asked each participant a battery of questions, including a series of counterbalanced questions about two locally relevant deities (Supplementary Information section S2).

To assess the gods' relative moral concern, we conducted preliminary ethnographic interviews in each site to identify the most moralistic deities (that is, 'moralistic gods'), as well as locally salient, relatively less moralistic, 'local gods' or spirits. We verified the degree to which gods care about morality with a free-list task asking about gods' concerns[19] and scales created to measure how important participants claim punishing theft, murder and deceit are to these supernatural beings. We measured gods' punishment and knowledge, using the mean of two, two-item, easy-to-understand scales with dichotomous responses. The target gods associated with games were rated significantly more moralistic, knowledgeable and punitive than local gods (see Extended Data Figs 2 and 3; Supplementary Information section S4). We also aggregated gods' punishment and knowledge scores by averaging all four dichotomous responses, labelled 'punishment–knowledge combined' in Table 2. These measures are our key theoretical predictors for game allocations.

Figure 2 displays the effect of punishment for moralizing gods, without any controls, and reveals the impact of "I don't know" answers which were otherwise excluded from our analyses below. When people report not knowing if a god punishes, they put considerably fewer coins in the cups for distant co-religionists in both games (local co-religionist game: $M = 12.97$, s.d. $= 4.33$; self game: $M = 12.50$, s.d. $= 4.15$) than those who consistently report that their god punishes (local co-religionist game: $M = 14.58$, s.d. $= 3.24$; self game: $M = 14.53$,
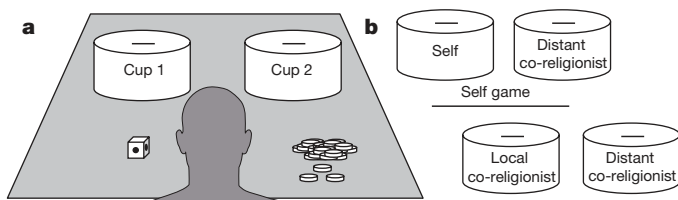
Figure 1 | The random allocation game. a, b, Generic game setup (**a**) and variants used in present work (**b**).
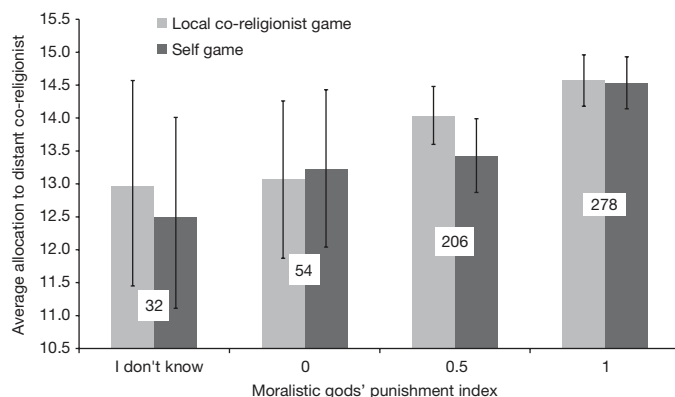
Table 2 | Log odds ratios for predicting allocations to distant co-religionists with 95% confidence intervals from our main binomial logistic regression models

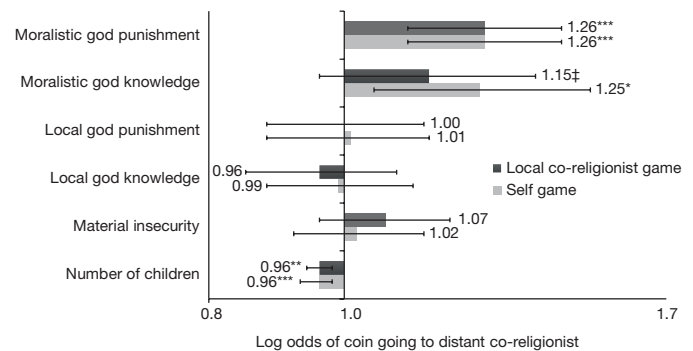| Variable	Local co-religionist game	Local co-religionist game	Self game	Self game
Moralistic gods' punishment	1.15 (1.03, 1.27)*	–	1.11 (1.00, 1.23)†	–
Moralistic gods' knowledge	1.17 (1.00, 1.36)*	–	1.22 (1.05, 1.42)*	–
Punishment–knowledge combined	–	1.20 (1.04, 1.37)*	–	1.23 (1.07, 1.41)**
Material insecurity	1.02 (0.92, 1.12)	1.01 (0.92, 1.11)	0.98 (0.89, 1.08)	0.96 (0.88, 1.06)
Number of children	0.98 (0.96, 1.00)†	0.99 (0.97, 1.01)	0.98 (0.96, 1.00)*	0.98 (0.96, 1.00)*
n	503	519	504	520
Observations	15,090	15,570	15,120	15,600

All models in this table include field site and additional control variables as fixed effects. For all punishment–knowledge aggregate models, see Extended Data Table 1 (highlights from models 1 and 4 presented here) and Supplementary Table S9. See Supplementary Tables S5 and S6 for all other models (highlights from models 1 FE presented here). Odds ratios >1 indicate greater odds in allocating a coin to the distant co-religionist. **$P \leq 0.01$, *$P \leq 0.05$, †$P \leq 0.10$.

Figure 3 | Log odds ratios with 95% confidence interval plots of the influence of key variables on the odds that a coin goes into the cup for the distant co-religionist. Odds ratios >1 indicate an increase and odds ratios <1 indicate a decrease in the odds of allocating a coin to the distant co-religionist (***$P \leq 0.001$, **$P \leq 0.01$; *$P \leq 0.05$; ‡$P \leq 0.15$). The *x* axis is on a logarithmic scale. Both models include other controls ($n = 390$). Local co-religionist and self results include sites as fixed effects. Note that Indo-Fijians are not included in these models due to the lack of data for local gods. See Supplementary Tables S5 and S6 for full models (models 2FE are presented here).

s.d. = 3.31). One way to estimate the magnitude of these effects is to calculate the quotient of deviations from the ideal impartial allocation of 15. Compared to those who don't know, claiming the moralizing god punishes increases allocations towards distant co-religionists in the self game by a factor of 4.8 and in the local co-religionist game by a factor of 5.3. Extended Data Figs 4 and 5 detail the overall allocation distributions for both games.

We explored this relationship in more detail by regressing the number of coins allocated to the distant co-religionist cup on a host of variables for each game in a large set of binomial regressions (Extended Data Table 1 and Supplementary Information section S6). Table 2 shows a subset of the key predictors for the models with the largest set of control variables, including a number of economic and demographic variables such as education, material insecurity, number of children and field site fixed effects. Using sites as fixed effects allows us to remove the variation between our sites, so the results in Table 2 only capture the differences among individuals within sites. Based on previous work[9,29], we suspected that material insecurity and number of children would increase self and local favouritism, and therefore

we include both in our model (Supplementary Information section S2.3.1). To affirm the robustness of these analyses, we estimated many alternative models, formulated mixed models, and used both alternative standard error estimates and different approaches to modelling the error (Supplementary Information section S5.4). Across a wide range of specifications and models including a host of variables (for example, divine rewards, emotional closeness to distant co-religionists, among others), both moralistic gods' punishment and knowledge, as well as our aggregate punishment–knowledge variable, are reliably associated with less bias against distant co-religionists (Supplementary Tables S5–S9).

We checked whether the effects of moralistic gods' punishment and knowledge were indeed specific to powerful, moralizing gods. We added local gods' punishment and knowledge to the models presented in Table 2. Figure 3 shows the odds ratios and confidence intervals for these coefficients. Although neither the punishing powers nor knowledge of these local deities had any association with the allocations, the odds ratios for our key predictors pertaining to moralistic gods actually increased. These overall findings are correlational and should be interpreted with caution and in combination with other evidence, also considering that religious priming did not reveal consistent effects. However, these patterns reduce concerns that omitted third variables might account for the correlations we observe. A third variable, in addition to correlating with allocations, would have to correlate only with the punishing and knowing character of moralistic and knowledgeable gods, but not with those same attributes in local gods or with the tendency of either type of deity to reward people.

These results build on previous findings and have important implications for understanding the evolution of the wide-ranging cooperation found in large-scale societies. Moreover, when people are more inclined to behave impartially towards others, they are more likely to share beliefs and behaviours that foster the development of larger-scale cooperative institutions, trade, markets and alliances with strangers. This helps to partly explain two phenomena: the evolution of large and complex human societies and the religious features of societies with greater social complexity that are heavily populated by such gods[6,7]. In addition to some forms of religious rituals and non-religious norms and institutions, such as courts, markets and police, the present results point to the role that commitment to knowledgeable, moralistic and punitive gods plays in solidifying the social bonds that create broader imagined communities[11,12,31].

Figure 2 | Allocations to distant co-religionists increase as a function of moralistic gods' punishment. Punishment indices are mean values of a two-item scale (see Supplementary Information section S2.3.2). Error bars represent bootstrapped (1,000 replications) 95% confidence intervals of the mean. Histogram labels are sample sizes per category. Note that among the 32 individuals who responded "I don't know" to the questions pertaining to moralistic gods' punishment, 17 were Hadza and 15 were inland Tannese.

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Author Contributions J.H., A.N. and B.G.P. conceived the study, prepared protocols, managed project communication and initiated manuscript preparation. C.A., Q.D.A., E.C., R.A.M., A.K.W., B.G.P. and D.X. collected data. B.G.P. conducted all analyses, made all graphs, Tables and illustrations. All authors participated in developing and refining protocols, experimental design and in manuscript preparation.

Author Information Reprints and permissions information is available at www.nature.com/reprints. The authors declare no competing financial interests. Readers are welcome to comment on the online version of the paper. Correspondence and requests for materials should be addressed to B.G.P. (bgpurzycki@alumni.ubc.ca) or J.H. (henrich@psych.ubc.ca).
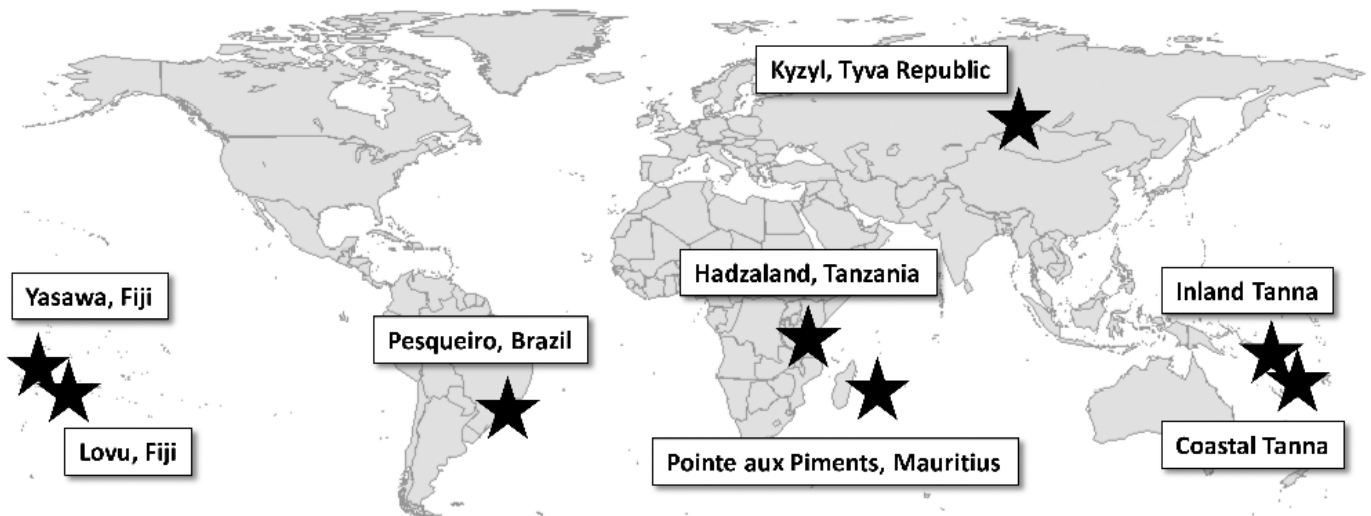
Extended Data Figure 1 | Map of the eight field site locations. Map from R package 'maps' (2015). R version by Ray Brownrigg. R package version 3.0.0-2 (http://CRAN.R-project.org/package=maps).

Gods' Dislikes

a

	Coastal Tanna	Hadza	Lovu	Inland Tanna	Mauritius	Pesqueiro	Tyva Republic	Yasawa
Moralistic God	0.76	0.47	0.81	0.32	0.82	0.70	0.70	0.90
Local God	0.14	0.47		0.19	0.14	0.38	0.08	0.05

Gods' Likes

b

|	Coastal Tanna	Hadza	Lovu	Inland Tanna	Mauritius	Pesqueiro	Tyva Republic	Yasawa
Moralistic God	0.17	0.22	0.72	0.07	0.31	0.42	0.38	0.79
Local God	0.02	0.17		0.01	0.30	0.14	0.03	0.04

Extended Data Figure 2 | Proportion of sample listing moral and virtue items for moralistic and local gods' dislikes and likes by site. a, b, We asked participants to freely list up to five things that moralistic and local gods dislike and like. These free-list items were subsequently coded by two independent coders using 12 categories (see Supplementary Information section S4.1.1 for the methods). Items listed first are the most salient items in participants' models of gods' concerns. Error bars have a total breadth of 10%. Note that Indo-Fijians (Lovu) did not answer questions about local gods.
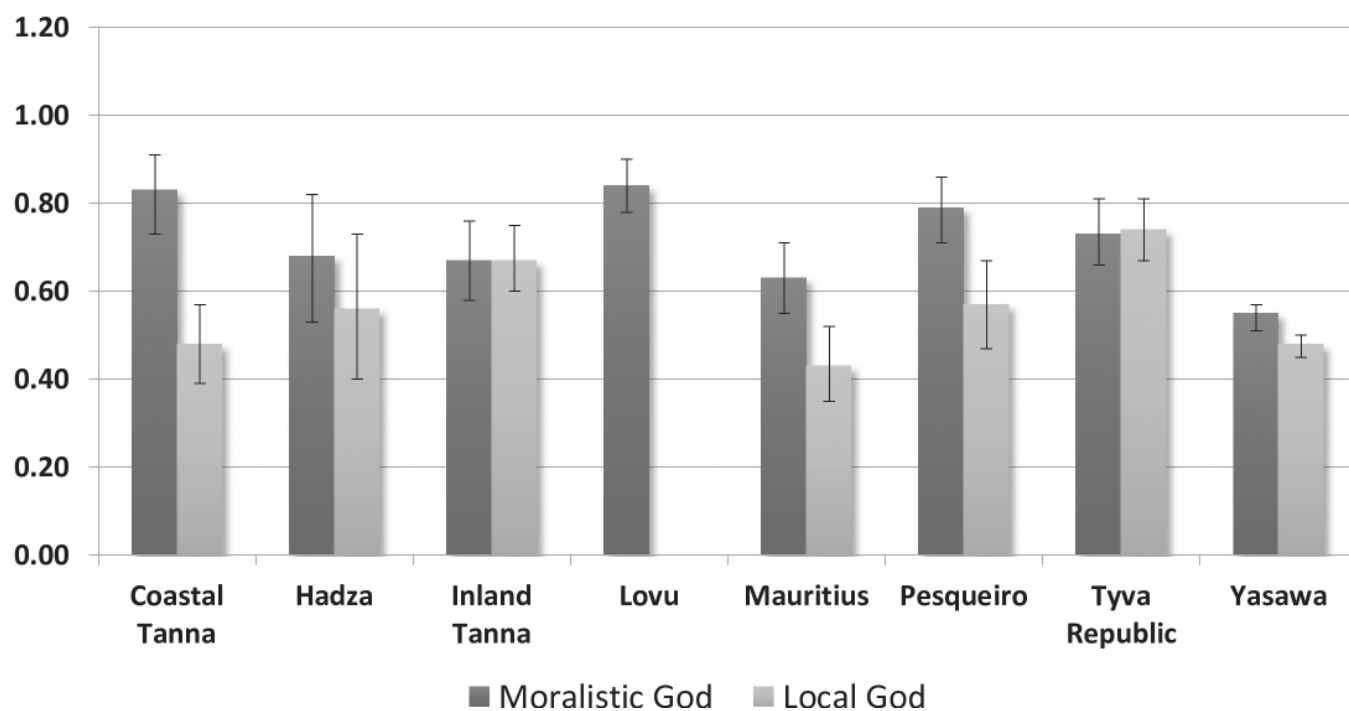
Knowledge Scale

a
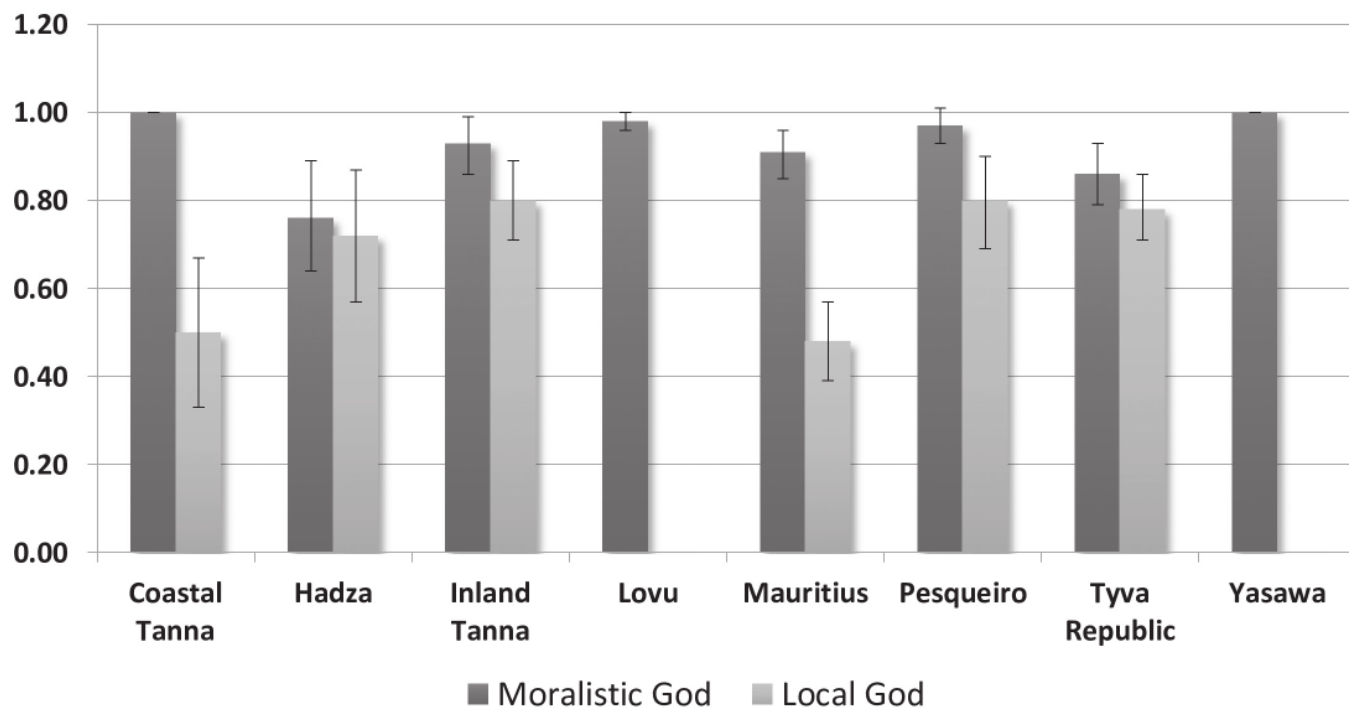
Punishment Scale

b

Extended Data Figure 3 | Mean moralistic and local gods' knowledge and punishment scales by site. a, b, Error bars represent 95% confidence intervals of the mean. Lovu (Indo-Fijians) did not answer questions about local gods, and Yasawans' (native Fijians) attributions of ancestor spirits' knowledge had a mean and standard deviation of zero. Note that local gods often punish for non-moralistic reasons. See Supplementary Information sections S4.1 and S4.2 for methods and analyses.
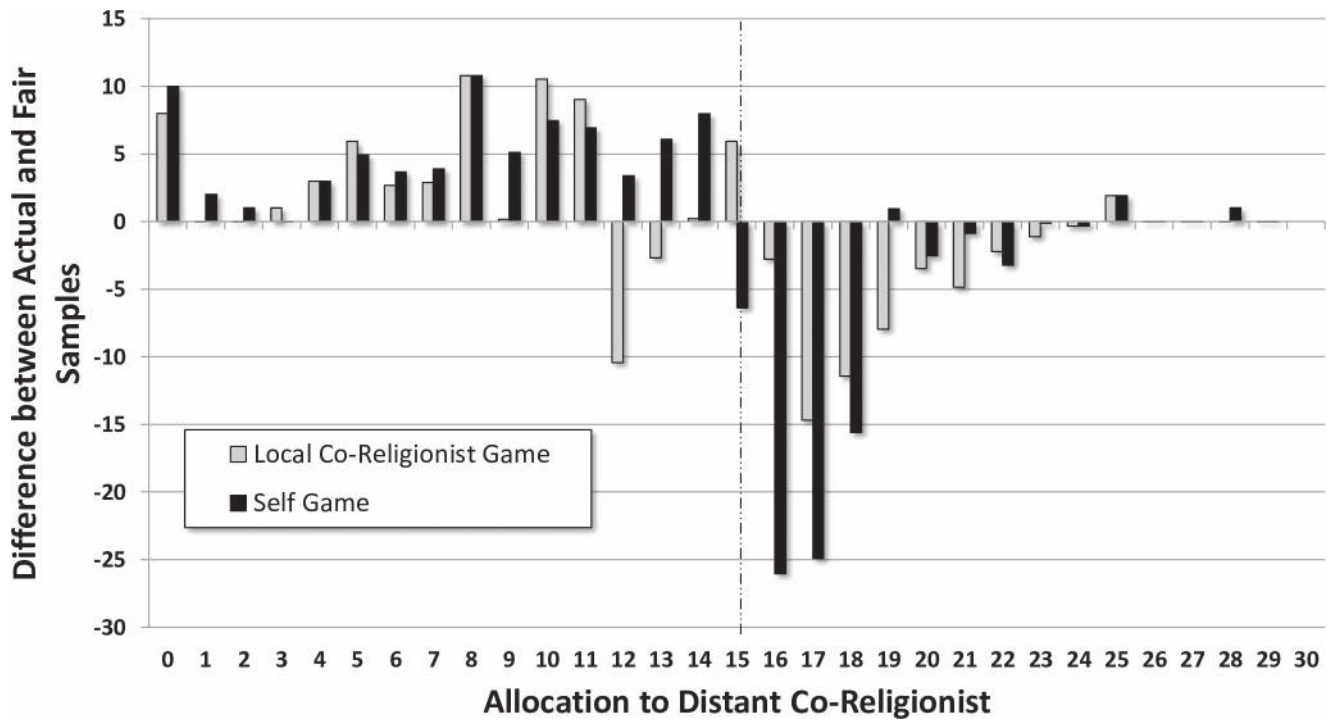
Extended Data Figure 4 | Plot of differences between size of actual allocations and allocations from binomially distributed sample of the same size. The halfway mark of 15 indicates the predicted mean of all cups. Bars above zero on the *y* axis indicate higher frequencies of allocations than predicted, and those lower indicate fewer individuals than predicted. Note the cluster of extremely lower-than-predicted values immediately after the cut-off point of 15.
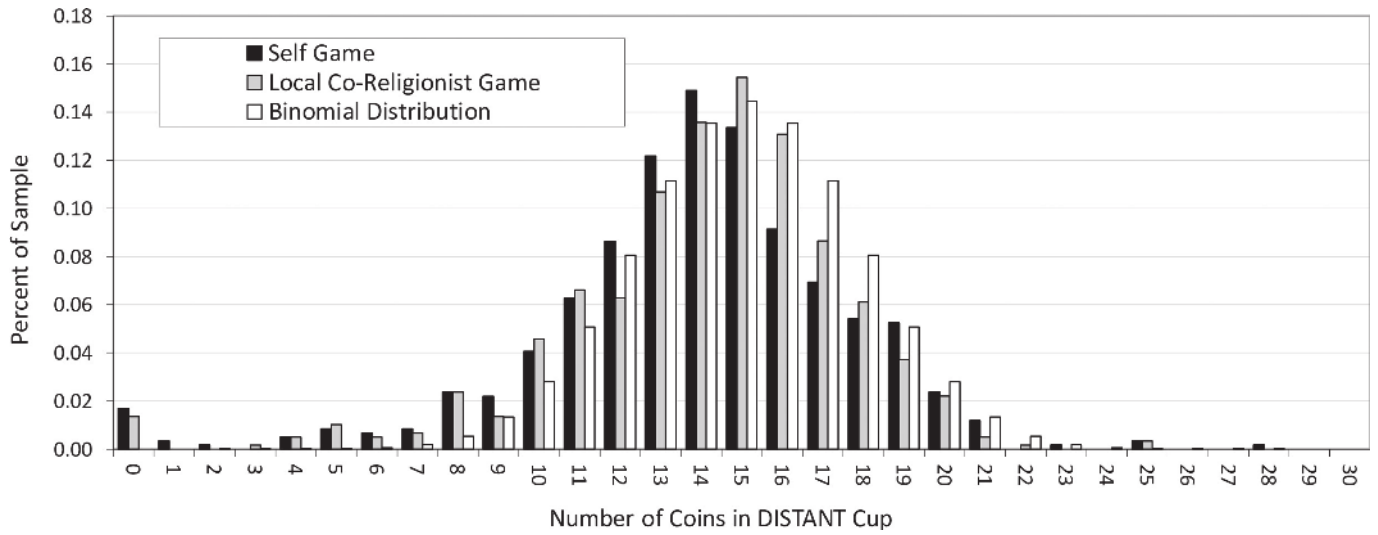
Extended Data Figure 5 | Per cent of sample by allocation amount to distant cup in local co-religionist (grey) and self games (black) as compared to binomial distribution (white). For both games, allocations lean towards the left of a theoretically ideal binomial distribution suggesting that overall, participants biased allocations towards themselves ($n = 591$) and local co-religionists ($n = 589$) at the expense of geographically distant co-religionists.

Extended Data Table 1 | Models accounting for allocations to anonymous distant co-religionists with punishment–knowledge aggregate scales

	1 *Local Co-Religionist Game*	2 *Local Co-Religionist Game*	3 *Local Co-Religionist Game*	4 *Self Game*	5 *Self Game*	6 *Self Game*
Punishment-Knowledge (MG)	1.20 [1.04, 1.37]*	1.27 [1.08, 1.50]**	1.47 [1.18, 1.83]***	1.23 [1.07, 1.41]**	1.40 [1.18, 1.65]***	1.51 [1.21, 1.88]***
Punishment-Knowledge (LG)	--	0.95 [0.83, 1.09]	0.90 [0.76, 1.07]	--	1.00 [0.88, 1.14]	1.04 [0.88, 1.23]
Reward (MG)	--	--	1.03 [0.86, 1.24]	--	--	1.10 [0.92, 1.33]
Reward (LG)	--	--	0.92 [0.79, 1.08]	--	--	0.93 [0.79, 1.09]
Moral Index (MG)	--	--	0.98 [0.93, 1.03]	--	--	1.00 [0.95, 1.05]
Moral Index (LG)	--	--	1.03 [0.98, 1.08]	--	--	0.98 [0.93, 1.03]
Age (Centered)	1.00 [1.00, 1.00]	1.00 [1.00, 1.01]*	1.01 [1.00, 1.01]**	1.00 [1.00, 1.01]*	1.01 [1.00, 1.01]***	1.01 [1.00, 1.01]***
Sex (0 = Female)	1.06 [0.99, 1.14]†	1.05 [0.97, 1.13]	1.09 [1.00, 1.19]†	1.03 [0.96, 1.10]	1.07 [0.99, 1.15]†	1.06 [0.97, 1.15]
Years of Formal Education	0.99 [0.98, 1.00]	0.99 [0.98, 1.01]	1.00 [0.98, 1.01]	1.00 [0.99, 1.01]	1.00 [0.99, 1.02]	1.01 [0.99, 1.02]
Material Insecurity	1.01 [0.92, 1.11]	1.08 [0.97, 1.20]	1.09 [0.96, 1.23]‡	0.96 [0.88, 1.06]	1.03 [0.92, 1.15]	1.01 [0.89, 1.14]
# of Children	0.99 [0.97, 1.01]	0.97 [0.95, 0.99]**	0.97 [0.94, 0.99]*	0.98 [0.96, 1.00]*	0.96 [0.94, 0.98]***	0.96 [0.93, 0.99]**
DISTANT Religious Similarity	--	--	1.01 [0.96 1.05]	--	--	1.03 [0.98, 1.08]
LOCAL Emotional Closeness	--	--	0.98 [0.94, 1.03]	--	--	1.00 [0.95, 1.04]
DISTANT Emotional Closeness	--	--	0.97 [0.94, 1.01]	--	--	1.00 [0.97, 1.04]
Police Evaluation	--	--	1.03 [0.98, 1.09]	--	--	1.03 [0.98, 1.09]
Honesty Mentioned (0 = No)	--	--	0.92 [0.76, 1.11]	--	--	1.19 [0.99, 1.44]†
Treatment (0 = Control)	1.00 [0.93, 1.08]	1.04 [0.96, 1.14]	1.05 [0.95, 1.15]	0.97 [0.90, 1.05]	0.96 [0.89, 1.05]	0.95 [0.87, 1.04]
Game Order (0 = *Self* First)	1.05 [0.99, 1.12]‡	1.08 [1.01, 1.16]*	1.12 [1.03, 1.22]**	1.03 [0.96, 1.09]	1.06 [0.98, 1.14]‡	1.11 [1.02, 1.20]*
Coastal Tanna	0.98 [0.83, 1.16]	1.06 [0.86, 1.30]	1.08 [0.86, 1.34]	0.87 [0.73, 1.02]†	0.89 [0.73, 1.10]	0.89 [0.71, 1.11]
Hadza	0.59 [0.48, 0.73]***	0.70 [0.55, 0.89]**	--	0.63 [0.51, 0.78]***	0.76 [0.59, 0.97]*	--
Inland Tanna	0.92 [0.75, 1.14]	0.98 [0.77, 1.24]	1.02 [0.77, 1.35]	0.80 [0.65, 0.99]*	0.89 [0.70, 1.12]	0.89 [0.67, 1.18]
Lovu	0.96 [0.83, 1.11]	--	--	0.91 [0.79, 1.06]	--	--
Mauritius	0.90 [0.78, 1.04]‡	0.88 [0.76, 1.03]‡	0.91 [0.75, 1.10]	0.77 [0.66, 0.88]***	0.78 [0.67, 0.91]**	0.78 [0.65, 0.94]*
Pesqueiro	0.91 [0.78, 1.06]	0.91 [0.77, 1.08]	0.89 [0.72, 1.10]	0.90 [0.77, 1.04]	0.84 [0.71, 0.99]*	0.94 [0.77, 1.16]
Yasawa	0.79 [0.69, 0.91]**	0.77 [0.66, 0.90]**	0.80 [0.60, 1.06]‡	0.62 [0.54, 0.72]***	0.63 [0.54, 0.74]***	0.64 [0.48, 0.86]**
Constant	0.88 [0.70, 1.12]	0.86 [0.66, 1.13]	0.85 [0.60, 1.22]	0.98 [0.78, 1.24]	0.81 [0.61, 1.06]†	0.68 [0.47, 0.97]*
AIC	2846.5	2224.2	1770.3	2990.4	2351.1	1920.7
Pseudo-R^2	0.19	0.18	0.19	0.23	0.26	0.31
N	519	408[a]	323[b]	520	408[g]	323[h]

Log odds ratios (and 95% CIs) for variables predicting allocations to the distant co-religionist.

[a]Lovu not included.

[b]Hadza and Lovu not included.

All models are binomial logistic regressions, backward selected for site inclusion. Models include field sites as fixed effects. Moralistic god variables are denoted as 'MG' and local god variables are denoted as 'LG'. Pseudo R^2s are Nagelkerke's R^2. ***$P \leq 0.001$, **$P \leq 0.01$, *$P \leq 0.05$, †$P \leq 0.10$, ‡$P \leq 0.15$. See Supplementary Information section S2.3 for variable definitions, Supplementary Information section S5 for discussion of analyses and Supplementary Table S9 for punishment–knowledge aggregate models with extreme values removed.