Appealing to the minds of gods: Religious beliefs and appeals correspond to features of local social ecologies

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Abstract

How do beliefs about gods vary across populations, and what accounts for this variation? We argue that appeals to gods generally reflect prominent features of local social ecologies. We first draw from a synthesis of theoretical, experimental, and ethnographic evidence to delineate a set of predictive criteria for the kinds of contexts with which religious beliefs and behaviors will be associated. To evaluate these criteria, we examine the content of freely-listed data about gods' concerns collected from individuals across eight diverse field sites and contextualize these beliefs in their respective cultural milieus. In our analysis, we find that local deities' concerns point to costly threats to local coordination and cooperation. We conclude with a discussion of how alternative approaches to religious beliefs and appeals fare in light of our results and close by considering some key implications for the cognitive and evolutionary sciences of religion.

Keywords: cognitive anthropology, cultural evolution, free-list method, gods' minds, human behavioral ecology, religious systems

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1. Introduction

While questions of cross-cultural variation in religion have deep roots in the history of anthropological thought (e.g., Evans-Pritchard, 1965; Lang, 1909; Swanson, 1960; Tylor, 1920), the bulk of contemporary research examines gods or religious traditions that are explicitly associated with human morality (Baumard et al., 2015; Beheim et al., 2021; Botero et al., 2014; Peoples and Marlowe, 2012; Roes and Raymond, 2003; Skoggard et al., 2020; Snarey, 1996; Watts et al., 2015). These studies primarily rely on—often the same—society-level data, usually from coded ethnographies and reports from travelers and missionaries (cf., Beheim et al., 2021; Purzycki and McKay, n.d.; Purzycki and Watts, 2018). Generally, these studies seek to understand the contextual factors (e.g., social complexity or resource scarcity) that correspond to religious beliefs.

Many contemporary studies examine how individual-level beliefs contribute to the evolution of cooperation (e.g., Atkinson and Bourrat, 2011; Ge et al., 2019; Lang et al., 2019; Purzycki et al., 2016b; McNamara and Henrich, 2018; Willard et al., 2020). Yet, rather than attend to deities' concerns in their ethnographic contexts, this body of work also primarily focuses on moralistic traditions and generalized cooperation. If religion can contribute to the evolution of cooperation, we should expect that variation in religious appeals, beliefs, and practices is partly attributable to variation in local threats to coordination and cooperation (Bendixen and Purzycki, 2020; Purzycki and McNamara, 2016; Purzycki and Sosis, 2022).

However, isolated examples aside (e.g., Atran et al., 2002; McNamara et al., 2021; Purzycki, 2011, 2013, 2016; Singh et al., 2021; Shaver et al., 2017), there remains a dearth of high-resolution, directly comparable, cross-cultural data with which to examine how gods' concerns systematically vary cross-culturally. To therefore make what we see as the necessary theoretical and empirical first steps toward a systematic and predictive account of cross-cultural variation in religious beliefs and practices, we present and contextualize individual-level ethnographic free-list data about what pleases and angers deities across eight diverse field sites. We organize this report as follows.

We first review contemporary work on cross-cultural variation in gods' concerns (Section 2). Building on this, we develop a cultural evolutionary account of that variation and outline a set of predictive criteria for what gods will culturally evolve to care about given local socioecological features and constraints. We then present methods of our data collection and summarize key results (Section 3.1) followed by an assessment of how our free-list data informs our account (Section 3.2). Finally, we discuss how our results fare against alternative approaches, offer some cautionary

notes, and consider some limitations and implications of the present findings (Section 4).

2. Social life and the minds of gods

2.1. Variation in god beliefs and appeals

While the subject of gods' concerns has been central to anthropological inquiry for over a century, its focused, cross-cultural empirical assessment has only recently begun. For example, Boehm (2008) surveyed 43 ethnographies covering 18 foraging societies, and found instances of supernatural punishment of at least one behavior construed as "antisocial" and "predatory on fellow band members" among all 18 groups. Other behaviors for which traditional gods punished were violations of what Boehm calls "nonmoral taboos" which include domains such as food, ritual, animals, sex, and life stages. In a general survey of ethnographic cases, Purzycki and McNamara (2016) broke down gods' concerns into three broad categories: things people do to each other (e.g., moral conduct and virtuous qualities), toward the gods (e.g., ritual and faith), and toward nature (e.g., preservation and maintenance). Recent site-specific studies using contemporary social scientific methods corroborate these typologies and also contextualize their relevance to interpersonal relationships (see below and Atran et al., 2002; McNamara et al., 2021; Purzycki, 2011, 2013, 2016; Shaver et al., 2017; Singh et al., 2021).

Ongoing theory-building (cf., Bendixen and Purzycki, 2020; McNamara and Purzycki, 2020; Purzycki and McNamara, 2016; Purzycki and Sosis, 2011; Purzycki et al., n.d.) suggests that these concerns should point to some important roles that gods might play in local social ecologies. Yet, an encompassing theory of gods' concerns has yet to be assessed directly alongside systematically collected, detailed, individual-level ethnographic data. Assuming that religious traditions are contingent on a variety of cultural evolutionary processes (see Appendix), we build upon these previous efforts and derive a constellation of general predictive criteria for the kinds of socioecological inputs that contribute to the evolution of religion.

2.2. Cultural evolution of gods' concerns

Social life is replete with promises and perils, and the origin of cooperation and coordination on human scales is often touted as an evolutionary puzzle (Cronk and Leech, 2012; Henrich and Muthukrishna, 2021; Richerson et al., 2016). Many evolutionary mechanisms have been proposed for curbing selfishness and promoting cooperation in human societies (e.g., Henrich and Henrich, 2007) and among them

are features of religions such as supernatural punishment (Johnson, 2005) and rituals (Sosis and Bressler, 2003). Indeed, rather than being projections of individual cognition, mundane desires or self-interest, cultural models of gods' concerns appear to revolve around behaviors that correspond to locally salient threats to cooperation and coordination (Bendixen and Purzycki, 2020; Purzycki and Sosis, 2011, 2022; Rossano, 2007).

As individual acts, appeals to a watchful and punitive deity are communicative acts from a signaler to a receiver (see Cronk, 1994a,b; Rappaport, 1994). These appeals include individually costly behaviors (e.g., "the spirits get upset if you hunt in that part of forest" or "the gods demand expensive sacrifices") that—through threat of spiritual repercussions—can contribute to the reduction of defection in cooperative ventures when enacted (Johnson, 2016). Supernatural appeals are often invoked when local challenges to cooperation and coordination become salient and pressing (Purzycki et al., 2020) and can feed back as explanations of maladies and misfortune (Boyer, 2021; Fitouchi and Singh, 2022). With time, cultural models of gods' concerns should thus evolve to align themselves with particular kinds of communal problems that people face or have faced and corresponding behaviors address them (see Appendix). We refer to such problems as "god-problems".

We predict that "god-problems" have generally recurring features (cf., Bendixen and Purzycki, 2020). First and foremost, they are (a) social dilemmas that are game-theoretic in nature, including problems with cooperation, coordination and conflicts of interests (see Atran et al., 2002; Bulbulia, 2004; Irons, 2001; Lansing and Miller, 2005; Lansing et al., 2017; Lightner and Purzycki, n.d.; Purzycki and Sosis, 2022; Shariff et al., 2014). Coordination and cooperation are critical aspects of human social life, and concepts of deities that care about behaviors that address locally relevant issues may be relatively more culturally and cognitively attractive within a community (Boyer, 2000, 2001; Purzycki and Sosis, 2022). As a result, god-problems are therefore also predicted to be perceived as (b) materially and/or socially costly, and therefore (c) cognitively salient.

Further, we expect god-problems to constitute a subset of local social dilemmas that are (d) relatively difficult to police with secular means and/or (e) more convincingly enforced by appeals to supernatural monitoring and punishment (Johnson, 2016; Norenzayan et al., 2016; Rossano, 2007; Rossano and LeBlanc, 2017). Although empirical findings have been mixed, some studies have indicated that, at least under certain circumstances, cues of being watched may curb rule-breaking (Bateson et al., 2006; Dear et al., 2019; Nettle et al., 2013; Piazza et al., 2011; Northover et al., 2017a,b). Appeals to supernatural agents may function as cues of being watched and induce fear of supernatural sanctions under conditions where secular means and in-

stitutions are inefficient or unavailable (e.g., Endicott and Endicott, 2014; Leeson and Suarez, 2015; Rossano, 2010, p. 205-207) or where strict norm adherence is particularly critical for a community (Jackson et al., 2021; Roes and Raymond, 2003; Skoggard et al., 2020; Snarey, 1996). Such appeals are especially attractive both cognitively and culturally when a wide variety of frequently occurring maladies can be interpreted as supernatural sanctions, a consistent pattern across ethnographic reports (Hartberg et al., 2016). Lastly, since appeals to a deity might not be necessary, effective, or convincing if the consequences of a behavior are transparent and self-evident, god-problems likely have difficult-to-foresee consequences (f) in that the future implications of widespread defection are non-obvious to individuals.

2.3. Illustration with two ethnographic examples

To illustrate the predictive criteria, let us compare two ethnographic case studies. First, consider that in the Tyva Republic localized spiritual entities known as *spirit-masters* (*cher eezi*) are perceived to be particularly concerned with pollution, littering and over-exploitation of natural resources (Purzycki, 2011, 2016, see also below and Supplementary Section S6.1). Traditionally, there is widespread association between *spirit-masters* and natural resource preservation and management (e.g., keeping rivers, land and sacred places clean; preventing excessive hunting). Spirits are typically associated with areas rich in natural resources and specific sacred areas where *spirit-masters* reside and rituals are performed. Popular ritual participation and officiating shamans and lamas maintain these associations (Purzycki, 2016). Littering, pollution and, more broadly, resource preservation and management, constitute a set of quintessential game-theoretic dilemmas (Colyvan et al., 2011; Hardin, 1968): the collective as a whole benefits maximally when everyone cooperates (e.g., no littering, no over-exploitation) but individuals themselves are better off defecting on cooperation (e.g., littering wherever, over-exploiting public/common natural resources), when everyone else cooperates. This fulfills criterion (a). It is also a costly dilemma, criterion (b), in that everyone is worse off if resources deteriorate beyond repair. Maintaining natural resources is also a very salient problem (c) to locals (Purzycki, 2016). Furthermore, littering, pollution and over-exploitation are often anonymous acts; in many cases it is impossible to identify the perpetrator (d), and hence, appeals to supernatural monitoring is likely a more effective means than secular alternatives (e). Finally, since pollution and over-exploitation are inherently collective affairs in that the severity of the problems depend on the accumulation of litter and/or over-extraction of resources over time (i.e., any one person is unlikely to cause serious damage on their own), the pay-offs of the dilemma may be considered non-obvious for the involved individuals (f).

In contrast, consider Henrich and Henrich's (2010) study of pregnancy-related food taboos in Fiji. They found that the marine species that pregnant and breast-feeding women are not supposed to consume are those carrying the highest levels of toxins to which pregnant and lactating women and newborns are particularly vulnerable. These taboos are culturally transmitted primarily from mother to daughter. However, while these taboos appear to make adaptive sense, and food taboos in general are often supernaturally enforced (Meyer-Rochow, 2009), local Fijians do not regard the pregnancy-related taboos as something local deities are concerned with. Henrich and Henrich (2010) suggest that "this is because compliance with the taboo is pretty high (threats of social sanctions or of harm to one's infant seem sufficient to maintain them), so threats of supernatural sanctions may be unnecessary to sustain the adaptive behavior" (suppl. mat., p. 36). In other words, the costs of violating the taboo—although potentially high and salient (b and c)—are clear and unambiguous with a predictable outcome likelihood (f) and relatively easy and effective to enforce with secular social norms and stigma (d and e). Note too, that the interests of the actors involved (the women, their families, the community) are aligned around the same outcome (or are at least not in any obvious conflict), namely avoiding the consumption of toxic foods. It is therefore unclear whether the Fijian pregnancy-related food taboos represent an actual social dilemma (a). Hence, according to the criteria listed, the Fijian pregnancy-related food poisoning risk does not constitute a god-problem.

2.4. Summary

In sum, we submit that appeals to gods will primarily include behaviors that engage the kinds of challenges people face, in particular threats to coordination and cooperation[1] (Bendixen and Purzycki, 2020; McNamara and Purzycki, 2020; Purzycki and Sosis, 2022, ch. 10). These threats to coordination and cooperation are a part of a constellation of features we refer to as "god-problems". To assess the relationship between the content of religious appeals and god-problems, we conducted a two-part study. The first part (Section 3.1) assesses freely-listed beliefs about gods' concerns from individuals from eight different field sites. We expected that the most

[1]Note that our account does not assume that religious beliefs and behaviors are always beneficial for a community (see e.g., Edgerton, 1992). Just as cultural and ecological pressures can push a group to beneficial behavioral patterns, so too can cultural and ecological pressures (including time lag) push groups to sub-optimal traditions (e.g., Boyd and Richerson, 1990, 1992; Colleran, 2020; Richerson and Boyd, 2005, chapter 5; for a case study, see le Guen et al., 2013). Further, appeals to gods might point to false threats (e.g., witches), but such appeals are nevertheless framed in ways as threatening to the stability of the social status quo.

salient appeals in free-lists will include behaviors that address god-problems within their respective local social ecologies. The second part of our study (Section 3.2) follows up on these data and in consultation with our sites' corresponding ethnographic literature, we examine these social ecologies and evaluate the god-problem criteria.

3. Study

3.1. An empirical assessment of gods' concerns

3.1.1. Participants

The present data is part of the *Evolution of Religion and Morality Project*[2] (Purzycki et al., 2022a) that was designed to explore and test hypotheses pertaining to religious beliefs and cooperation. The main study consisted of a series of experimental economic games and a battery of demographic and religiosity questions conducted across eight diverse field sites from around the world (Table 1; see Lang et al., 2019; Purzycki et al., 2016b,a, 2018a, and Supplements for further details of methods and field sites).

Table 1: **Deities selected, language used in, and primary economy in each field site.** Note that no local gods were identified for the Lovu Fiji sample.

Site	Economy	Moralistic deity	Local deity	Language of study
Coastal Tanna	Hort./Hunting	Christian god	*Tupunus*	Bislama
Hadza	Hunting	*Haine*	*Ishoko*	Hadzane/Swahili
Inland Tanna	Hort./hunting	*Kalpapen*	*Tupunus*	Navhaal
Lovu, Fiji	Wage labor	Shiva	—	Fiji-Hindi/English
Mauritius	Wage labor	Shiva	spirit (*nam*)	Mauritian Creole
Marajó, Brazil	Wage labor	Christian god	St. Mary	Portuguese
Tyva Republic	Wage labor/herding	*Buddha-Burgan*	spirit-masters (*cher eezi*)	Tyvan
Yasawa, Fiji	Fishing/farming	Christian god	ancestor spirits (*kalou-vu*)	Bauan Fijian

We paid participants (Table 2) an initial fee of ∼25% of the local average daily wage, and the participants kept their earnings in the experimental economic games with a potential additional sum of ∼50% of the local average daily wage. Participation in the main study took a total of around 90 minutes.

[2]The full protocol, summary of methods, and descriptions of the cultural samples are available at: https://github.com/bgpurzycki/Evolution-of-Religion-and-Morality.

Table 2: **Summary of sample size, demographics, and items listed.** Aside from mean age and standard deviations, values reflect cross-variable sample size and, in parentheses, average number of items listed across domains. Number of individuals for which demographics are available and who completed at least one of the free-list tasks (N) and sub-sample sizes per free-list domain (MG: moralistic god, LG: local god, PO: police). Note that there are mismatches between demography and free-list data, since some participants completed the demographic survey but not the free-lists and vice versa. Some participants who completed the demographic survey did not report their age.

Site	***N***	**Age**	**Females**	**MG$_{\text{pleases}}$**	**MG$_{\text{angers}}$**	**LG$_{\text{pleases}}$**	**LG$_{\text{angers}}$**	**PO$_{\text{pleases}}$**	**PO$_{\text{angers}}$**
Coastal Tanna	42	35.3 (*14.4*)	21	42 (2.2)	42 (3.0)	41 (1.2)	37 (1.3)	42 (2.5)	41 (3.7)
Hadza	68	39.8 (*12.1*)	31	58 (1.6)	57 (1.7)	47 (1.3)	47 (1.6)	69 (1.2)	69 (1.3)
Inland Tanna	73	37.4 (*16.2*)	36	74 (1.6)	74 (1.7)	74 (1.7)	74 (1.3)	72 (1.3)	68 (2.1)
Lovu Fiji	75	44.6 (*16.9*)	52	80 (2.7)	80 (2.8)	–	–	79 (3.1)	77 (3.3)
Marajó, Brazil	73	34.5 (*13.2*)	39	73 (2.5)	76 (2.6)	58 (1.8)	60 (1.5)	68 (2.1)	65 (2.4)
Mauritius	77	36.2 (*14.9*)	26	80 (3.5)	69 (2.4)	52 (2.4)	48 (1.6)	80 (3.2)	83 (3.4)
Tyva Republic	72	34.3 (*13.0*)	52	73 (2.6)	73 (2.7)	72 (2.4)	72 (2.2)	73 (4.0)	71 (3.8)
Yasawa Fiji	67	38.4 (*16.1*)	37	105 (3.1)	105 (3.0)	105 (2.2)	105 (2.2)	105 (5.0)	105 (4.9)
Total	547	37.7 (*14.9*)	294	585 (2.6)	576 (2.5)	449 (1.9)	443 (1.8)	588 (2.9)	579 (3.2)

3.1.2. Methods

Prior to the main study, we conducted preliminary ethnographic interviews where participants listed gods and spirits that were important in their communities. For each listed deity, we asked follow-up questions about their knowledge breadth, how punitive they were, and how concerned they were with moral norms (i.e., interpersonal social behaviors that benefit or harm others). Taking these ratings, we selected one deity that was the most knowledgeable, morally concerned, and punitive (the "moralistic deity" henceforth) and another locally important deity that was relatively less associated with these qualities (the "local deity" henceforth). We used these deities to design the main project with a new sample of individuals. Table 1 details the deities we selected and the working languages across our eight field sites.

An ideal method for soliciting naturalistic, discrete, and quantifiable ethnographic data is the free-list method (Bendixen and Purzycki, n.d.b; Quinlan, 2005; Smith, 1993; Smith and Borgatti, 1997). In this task, participants list items that represent their knowledge about some topic. Compared to other social scientific instruments such as pre-fabricated item response scales, free-listing also ensures cultural relevance and validity (a particularly pressing issue in the study of "indigenous" religions; see Maarif, 2019), since the content is fully dictated by participants. As such, it is a maximally useful ethnographic tool among populations that might vary in numeracy and literacy.

Among many other questions and items (see Purzycki et al., 2016a), we asked participants to freely list items across six domains:

1. the kinds of things the moralistic deity cares about or like

2. the kinds of things the moralistic deity dislikes.
3. the kinds of things the local deity cares about or likes.
4. the kinds of things the local deity dislikes.
5. up to 5 things that the police like.
6. up to 5 things that the police dislike.

We designed these lists to be capped at five items per domain due to time, but some did offer more. We probed participants about deities in counterbalanced fashion (items 1-4), followed by questions about the police (items 5-6)[3]. In line with the prediction that some features of social life are more likely to be associated with supernatural rather than secular concern, questions about the police were included as a contrast to the two kinds of deities in order to directly compare cognitive and cultural models across secular and supernatural agents.

We coded these free-list data in two ways (see Supplementary Section S2 for further notes and procedures). The first method was general; two independent coders coded the data with the following twelve-category rubric drawn from Purzycki and McNamara (2016):

1. **Morality**: generalized behaviors that have a benefit or cost to other people (e.g., hurting, being generous, sharing, etc.)
2. **Virtue**: individual qualities that may or may not have social ramifications (e.g., hard-working, kind, bad conscience, etc.)
3. **People**: in reference to the quality, and/or the state of people (e.g., people, people stay in good health, live beings, happy, etc.)
4. **Etiquette**: conventional social behaviors that have no immediate cost or benefit to others (e.g., shaking hands, wearing the proper clothes, etc.)
5. **Substance Use/Abuse**: Items that involve the use of illicit substances
6. **Religion**: any non-ritual or non-behavioral item concerned with the supernatural (e.g., faith, devotion, loving god, etc.)
7. **Ritual**: any behavior or object used in ritual devoted to the supernatural (e.g., praying, meditation, offerings, sacrifices, not participating in ritual, etc.)
8. **Ecology**: any behavior or object affecting non-human relationships (e.g., pollution, keeping sacred places clean, gardening, etc.)
9. **Food**: food items (e.g. yam, milk, etc.)
10. **Miscellaneous**: miscellaneous items, items that cross-cut categories, etc.

[3]We also asked participants to list up to 5 behaviors that make someone a good/virtuous/moral person and up to 5 behaviors that make someone a bad/immoral person. For an empirical report on the results of these questions, see Purzycki et al. (2018b).

11. **D/K**: I don't know, not sure, etc.
12. **Specific**: Items that are specific to a culture (e.g., bel' leaf, *artysh*, etc.). These were subsequently re-coded into one of the other codes after consultation with field researchers.

Inter-coder reliability was generally quite high across domains (Supplementary Table S1). In cases of inter-coder conflicts, B.G.P. selected the one code of the two that better reflected the coding rubric (Supplementary Table S2).

The same two coders also coded the data in a more specific, bottom-up fashion. As these specific codes are by definition more subjective and unconstrained in nature, there was much variation and inconsistency in granularity, labels, and (mis)spellings across the coders. We subsequently cleaned such entries and lumped together semantically similar items (e.g., what we coded as "No stealing" was initially coded by one assistant as "No stealing – Burglers [sic]", "No stealing – Robbery", "No Stealing – Thieves"). We report the specific codes from the who developed the most fine-grained coding scheme (see Supplementary Section S2).

After processing, listed items were analyzed according to their frequency and order of mention to generate Smith's S, an index of cognitive-cultural salience. Specifically, the Smith's S of a listed item is calculated simply as $S = \frac{\Sigma \frac{(n+1-k)}{n}}{N}$, where n is the number of items an individual lists, k is the order number in which an item was listed, and N is the total sample size of the specific task. As such, the free-list method can reveal variation within and across topics, individuals and groups. As a domain-specific index of salience[4], Smith's S increases as a function of a listed item/item type's individual accessibility and population-level ubiquity. We conducted salience analyses (Supplementary Section S5) of the coded free-list data using the `AnthroTools` package (Purzycki and Jamieson-Lane, 2016) for `R` (R Core Team, 2021). Code and data to reproduce the analyses herein are available at: https://github.com/tbendixen/cross-cultural-free-list-project.

[4]Note that Smith's S scores are not standardized across domains or sites. Given variation in cross-site and domain sample size as well as the breadth of category (e.g., "Morality" encompasses more behaviors than "Ritual"), treating similar or the same values across domains or sites might be misleading. These values are therefore best appreciated relative to other coded items within their respective domains and sites. There are nevertheless global properties that become clearer by using this value, as shown in Figure 1. Since these global properties (i.e., the content of god appeals) are the focus of the present study, we refrain from pursuing any population-level inferences about the distribution of these properties, such as the probability of listing certain items as a function of some predictor(s). For suggestions on how to model free-list data more formally, see Bendixen and Purzycki (n.d.b).

3.1.3. Results

Our key findings can be summarized as follows: (1) participants systematically responded that their deities and the police are angered and pleased by human behavior; (2) the moralistic gods and the police converge on similar themes of moral concern but also diverged in predictable ways; (3) while the moralistic gods and the police are primarily and unambiguously moralistic, the local gods also consistently exhibit some salient moral concern; and (4) compared with the moralistic gods and the police, which are generally similar across cultures, the local gods are associated with unique site-specific concerns (see Section 3.2). Since much of contemporary research emphasizes the punitive aspects of deities, we focus here mainly on what angers these agents (see Supplementary Figure S2 for panels of what *pleases* these agents).

Figure 1 reports Smith's S for the general codes across sites and agents. For the sake of more compact reporting, we focus here on items with Smith's $S \geq .10$ (general codes) or $\geq .05$ (specific codes). Tables 3 and 4 report the most salient global and site-specific codes across agents (see Supplementary Section S7 for expanded salience tables). Globally, both the moralistic gods (MO) and the police (PO) converge on disliking breaches of Morality ($S_{\text{MG}} = 0.64$, $S_{\text{PO}} = 0.78$) and Virtue ($S_{\text{MG}} = 0.26$, $S_{\text{PO}} = 0.11$) and both are pleased by social harmony (People: $S_{\text{MG}} = 0.16$, $S_{\text{PO}} = 0.15$). However, there are predictable divergences; in contrast to the police, moralistic gods are pleased by religious thought (Religion: $S_{\text{MG}} = 0.11$) and behavior (Ritual: $S_{\text{MG}} = 0.30$), while the police are more often associated with disliking Substance Use/Abuse ("Drugs" in graphs and tables: $S_{\text{PO}} = 0.16$)[5]. Notably, local deities (LG) are also angered ($S_{\text{LG}} = 0.19$) and pleased ($S_{\text{LG}} = 0.11$) by (im)moral behaviors, but typically to a lesser degree than moralistic gods and the police, thus confirming our design and operationalization; according to our design and definitions, "moralistic gods" are indeed more moralistic than our "local gods".

The conceptual overlap between the moralistic deities and the police is further nuanced when examining the specific codes. Aggregated across all sites, the moralistic deities and the police share the same top four items in terms of what they are angered by: stealing, violence, lies, and disobedience (in general and toward the law) (see Table 5). These are unambiguously moral items. As was to be suspected, however, there are also some notable differences. In particular, the police are angered by concrete crimes, such as rape and murder, whereas the moralistic deities

[5]For the police, note also the high salience of "Don't know" among the Hadza and Inland Tanna, two sites that are generally unfamiliar with a formal and organized police force.

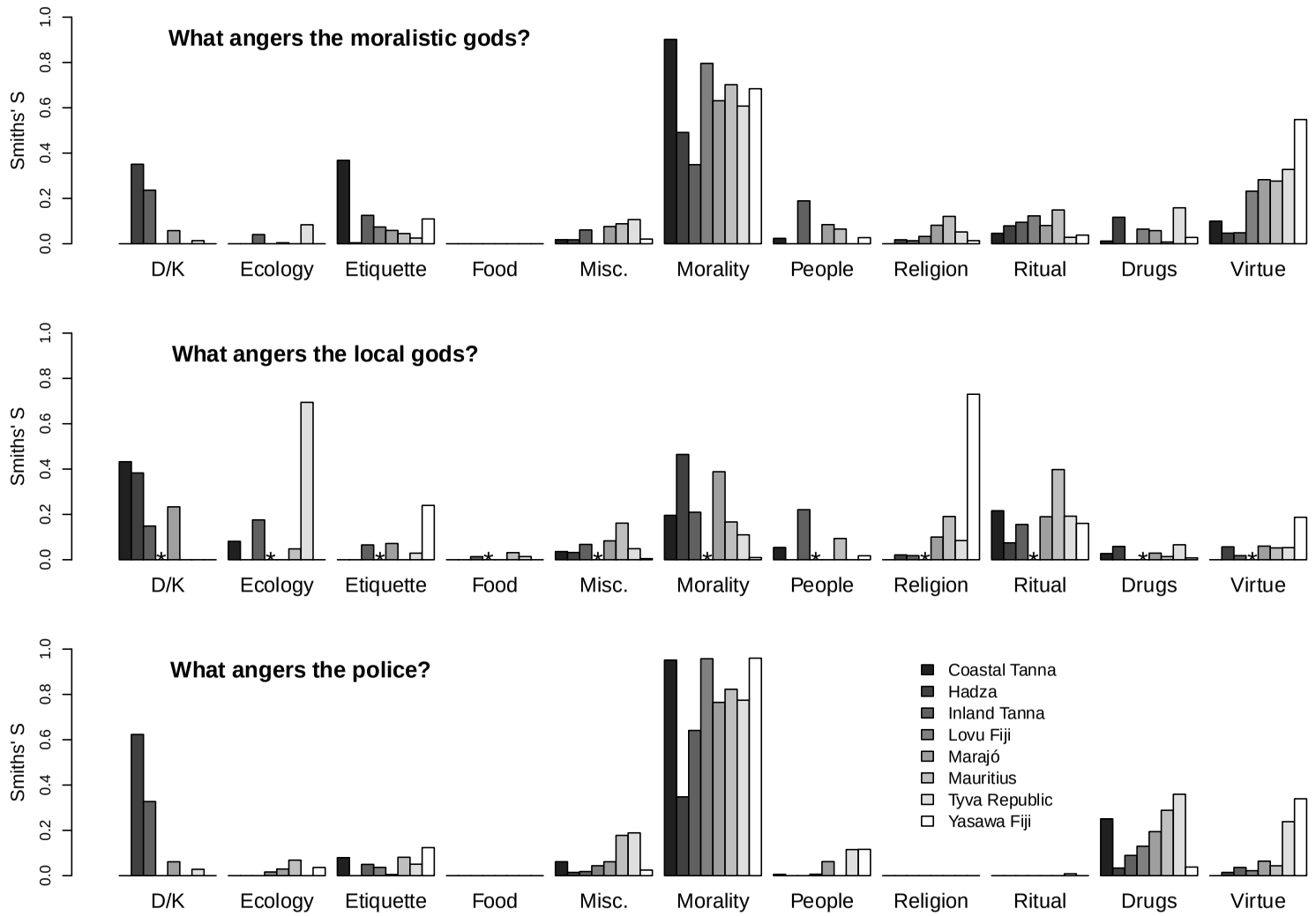

Figure 1: **Smith's *S* of general codings for what *angers* the moralistic gods, the local gods and the police**. Note that no local deities were identified for Lovu Fiji, hence the asterisks. D/K = Don't know; Misc. = Miscellaneous; Drugs = Substance Use/Abuse.

are displeased by more abstract, religious transgressions such as sin, swearing, and general "bad behavior". In terms of what pleases moralistic deities and the police, there is some, but less overlap. Among the top three specific codes, obedience is again a shared concern but the police are primarily pleased by behaviors and qualities that directly support human social interactions, including abiding by the law, not stealing, honesty, discipline, and no violence. In contrast, the moralistic deities are again associated with more general themes, usually with religious connotations, including prayer, general "good behavior", human welfare, faith, and truth.

Taken together, the specific codes support the inference from the general codes in that the moralistic deities and the police are both very similar in their moral concern but also each associated with domain-specific items, namely law and crime for the police and religious devotion for the moralistic deities. The local gods, even though they are clearly associated with moral behaviors like the other two agents, are considerably more cross-culturally diverse, exhibiting unique signatures of localized concerns (see Figure 1 and Table 4).

Table 3: **Global Smith's S of and number of participants who listed the most salient general codes of what *pleases* and *angers* the moralistic gods (MG), the local gods (LG) and the police (PO)**. Only Smith's $S \geq .10$ is reported. "Substance Use/Abuse" is abbreviated as "Drugs". "Don't know" excluded.

$\mathbf{MG_{pleases}}$	$\mathbf{MG_{angers}}$	$\mathbf{LG_{pleases}}$	$\mathbf{LG_{angers}}$	$\mathbf{PO_{pleases}}$	$\mathbf{PO_{angers}}$
Morality	Morality	Ritual	Religion	Morality	Morality
(0.31, 220)	(0.64, 413)	(0.29, 152)	(0.23, 112)	(0.55, 372)	(0.78, 484)
Ritual	Virtue	Drugs	Morality	Virtue	Drugs
(0.30, 212)	(0.26, 201)	(0.18, 91)	(0.19, 94)	(0.30, 239)	(0.16, 137)
Virtue	–	Ecology	Ritual	People	Virtue
(0.28, 218)	–	(0.12, 57)	(0.19, 101)	(0.15, 130)	(0.11, 106)
People	–	Morality	Ecology	Misc.	–
(0.16, 119)	–	(0.11, 70)	(0.15, 73)	(0.14, 107)	–
Religion	–	Food	–	–	–
(0.11, 92)	–	(0.11, 52)	–	–	–

Table 4: **Cross-cultural Smith's *S* of and number of participants who listed the most locally salient general codes of what *pleases* and *angers* the moralistic gods (MG), the local gods (LG) and the police (PO)**. "Substance Use/Abuse" is abbreviated as "Drugs". "Don't know" excluded.

Group	$\mathbf{MG_{pleases}}$	$\mathbf{MG_{angers}}$	$\mathbf{LG_{pleases}}$	$\mathbf{LG_{angers}}$	$\mathbf{PO_{pleases}}$	$\mathbf{PO_{angers}}$
Coastal Tanna	People	Morality	Ecology	Ritual	Morality	Morality
	(0.56, 25)	(0.90, 41)	(0.16, 7)	(0.22, 8)	(0.52, 25)	(0.95, 41)
Hadza	People	Morality	People	Morality	People	Morality
	(0.31, 22)	(0.49, 30)	(0.29, 15)	(0.47, 23)	(0.21, 15)	(0.35, 24)
Inland Tanna	Ecology	Morality	Food	People	Morality	Morality
	(0.34, 26)	(0.35, 29)	(0.56, 43)	(0.22, 17)	(0.22, 17)	(0.64, 45)
Lovu Fiji	Morality	Morality	–	–	Morality	Morality
	(0.57, 53)	(0.80, 68)	–	–	(0.77, 73)	(0.96, 76)
Marajó, Brazil	Virtue	Morality	Ritual	Morality	Morality	Morality
	(0.36, 32)	(0.63, 56)	(0.45, 27)	(0.39, 25)	(0.46, 35)	(0.77, 52)
Mauritius	Ritual	Morality	Morality	Ritual	Morality	Morality
	(0.68, 62)	(0.70, 51)	(0.40, 25)	(0.40, 21)	(0.61, 58)	(0.82, 75)
Tyva Republic	Morality	Morality	Ritual	Ecology	Morality	Morality
	(0.31, 29)	(0.61, 51)	(0.57, 46)	(0.69, 53)	(0.53, 50)	(0.77, 67)
Yasawa Fiji	Virtue	Morality	Drugs	Religion	Morality	Morality
	(0.58, 76)	(0.68, 87)	(0.71, 79)	(0.73, 84)	(0.90, 103)	(0.96, 104)

Table 5: **Global Smith's *S* of and number of participants who listed most salient specific codes of what *pleases* and *angers* the moralistic gods (MG) and the police (PO) (excludes "don't know")**. Only Smith's $S \geq .05$ is reported.

$\mathbf{MG_{pleases}}$	$\mathbf{MG_{angers}}$	$\mathbf{PO_{pleases}}$	$\mathbf{PO_{angers}}$
Prayer	Stealing	Law Abiding	Stealing
(0.13, 102)	(0.18, 142)	(0.15, 127)	(0.44, 315)
Obedient	Lies	No Stealing	Violence
(0.07, 55)	(0.16, 120)	(0.12, 97)	(0.22, 184)
Behaviour - Good	Violence	Obedience	Disobedience - Law
(0.06, 49)	(0.11, 89)	(0.07, 52)	(0.13, 110)
People	Disobedient	Honesty	Lies
(0.06, 36)	(0.07, 57)	(0.07, 47)	(0.11, 101)
Faith	Sin	Discipline	Murder
(0.05, 41)	(0.07, 49)	(0.06, 48)	(0.10, 92)
Truth	Swearing	No Violence	Disobedience
(0.05, 39)	(0.06, 50)	(0.05, 49)	(0.06, 48)
–	Behaviour - Bad	–	Rape
–	(0.06, 42)	–	(0.06, 62)
–	Murder	–	–
–	(0.06, 49)	–	–

3.2. Local gods in context

Once we analyzed and summarized the free-list data, we let the local gods and their most salient appeals guide us in examining each site's corresponding ethnographic literature (see Supplementary Section S6 for broader ethnographic discussions of the local spirits) and evaluated the predictive criteria for god problems at each site. Recall our account, which predicts that god-problems – the things that people associate deities with through appeals to and beliefs about the supernatural – will tend to be: (a) game-theoretic social dilemmas, that are (b) costly and/or (c) salient, (d) difficult to monitor and enforce with (appeals to) secular alternatives and/or (e) more convincingly and effectively enforced with supernatural appeals, and/or (f) where the ultimate actual consequences of norm deviation are difficult to foresee.

3.2.1. Tyva Republic

Consistent with previous research (Purzycki, 2011, 2013, 2016), *spirit-masters* of the Tyva Republic dislike pollution and destruction of the natural environment and are primarily pleased by "no pollution" (see Section 2.3) and ritual devotion (e.g., *sang salyr*/sanctification, bowing, and various food offerings). Throughout Inner Asia, people make offerings at cairns and other places of ritual significance that are strategically located in the landscape, such as at territorial borders and natural springs. Adhering to local rituals signals trustworthiness among Tyvans (Purzycki and Arakchaa, 2013) and violating ritual and resource obligations are believed to result in bad luck. Taken together, appeals to spirits and their associated behaviors are aligned with the problem of curbing territorial trespassing and over-exploitation of resources (Section 2.3) and thereby reduce costly conflict between neighboring camps (Purzycki, 2010; Purzycki and Arakchaa, 2013). The Tyvan free-list data, then, fit with the criteria for god-problems, in that territorial defense, disputes, and pollution are social dilemmas (a) with salient and real costs to people involved (b and c). Conceivably, since territories cover vast and sparsely inhabited land and pollution is typically anonymous, these dilemmas are difficult to police with secular means (d), such as patrolling, and the pay-offs are likely opaque (f) (e.g., pollution accumulates over time; not performing rituals saves time, effort and material goods, but being caught trespassing or not adhering to ritual prescripts is potentially very costly) without appeals to supernatural monitoring (e).

3.2.2. Tanna

In both of the Tanna sites, food crops, gardening, and garden rules are recurring themes of concern for *Tupunus*, the spiritual force of the local sacred garden system.

On Tanna, indigenous garden rules and taboos regulate who can enter the sacred crop gardens and what should be done in the gardens at various times of the year (Bonnemaison, 1984, 1991; Flexner et al., 2018; Kouha, 2015). Importantly, *Tupunus* is angered by garden taboo violations and punishes perpetrators with sickness and bad luck (Atkinson, 2018; Nehrbass, 2011). In line with the god-problem criteria, ethnographic sources suggest that garden taboos revolve around conceivable threats to coordination and cooperation, particularly ensuring proper cultivation and distribution of collective resources (p. 75-76, 86, Bonnemaison, 1991; p. 258, Flexner et al., 2018; see also Supplementary Section S6.2 for further ethnographic details). Resource management, exploitation, and distribution constitute a set of costly (b) and salient (c) set of game-theoretic dilemmas (a) (Hardin, 1968; Ostrom, 2009; Rogers, 2020) with opaque pay-offs (f) in that resource mismanagement is a cumulative problem (see Section 2.3). In lieu of dedicated secular institutions (d; indeed, on Tanna, the police are not thought to care about these matters; see Supplementary Tables S14-S15), it might be the case that spirit beliefs and appeals more effectively curb defection than secular alternatives (e).

3.2.3. Yasawa, Fiji

Yasawans free-list the ancestor spirits, *kalou-vu*, as primarily pleased by "kava" rituals and their own "worship". Kava is a pepper plant with sedative properties that can be prepared into a mildly narcotic substance and, according to one ethnographer, "kava stands metaphorically at the center of Fijian public life" (Tomlinson, 2007, p. 1066). Throughout Polynesia, kava is consumed at nightly drinking ceremonies traditionally associated with ancestor worship (Shaver, 2015; Shaver and Sosis, 2014; Tomlinson, 2004; Turner, 2012). In at least some cases, drinking kava alone is associated with witchcraft (Toren, 2020) and *kalou-vu* are generally thought to punish violations of local customs (McNamara et al., 2016).

Consistent with the god-problem criteria, the religious system comprising *kalou-vu* beliefs and kava drinking is directly involved in cooperative affairs (a, c); kava ceremonies are arenas for a host of salient (b) social activities, including competition for status among males (Shaver, 2015; Turner, 2012), forging social bonds and coordinating communal projects (Tomlinson, 2004), as well as dissolving disagreements and aligning economic interests (Tomlinson, 2007); activities, with inscrutable long- and short-term costs and benefits (f), where appeals to spirits (e) are perhaps particularly potent at disincentivizing defection above and beyond locally available alternatives (d).

However, interpreting the free-listed dislikes of the ancestor spirits among Yasawans is complicated by the local presence of a particular form of Christianity. The

ancestor spirits are perceived as angered by such things as "faith", the "word" and "grace" of God, and "truth", themes closely related to Christianity. As traditional ancestor worship and kava-drinking are viewed as illegitimate and sometimes associated with witchcraft from the perspective of the local Christian churches (McNamara, 2012, p. 17-18; Tomlinson, 2004; Turner, 2012), the free-list responses reveal a form of cultural competition between Christianity and traditional ancestor beliefs (McNamara and Henrich, 2018; McNamara et al., 2021) where Christian churches have successfully demonized the *kalou-vu*. We see a similar feature in Mauritian responses about *nam* spirits.

3.2.4. Mauritius

Nam spirits, the local gods of the Mauritius sample, are similar to the Western concept of the soul (Kundtóva Klocová et al., 2022; Xygalatas et al., 2018). When a person dies, the *nam* leaves the body of the deceased. If the death was undramatic and natural, and if the bereaved honor the deceased with prayer and ritual offerings, the *nam* will peacefully journey to the realm of the spirits. However, if the death was sudden, unexpected or violent, the spirit is hindered in its transition and can get trapped between the world of the living and the dead. In these cases, rituals, prayer, and offerings toward these spirits are critical lest they transform into *jab*, evil spirits that retaliate ritual neglect with misfortune, illness, or death (Colwell-Chanthaphonh and de Salle-Essoo, 2014; Sussman, 1981). Therefore, *nam* spirits, in the form of *jab*, are sometimes associated with black magic and sorcery (Kundtóva Klocová et al., 2022; Xygalatas et al., 2018). The ambivalent nature of these entities may explain why *nam* are free-listed as pleased with predominantly *immoral* things, such as "bad behavior", "fear", and "revenge". Similar to the case of Yasawan ancestor spirits, *nam* are displeased with such things as "prayer", "good people" and "God", which reflects a cultural antagonism between local religious systems, since sorcery is illegal under Mauritian law (Kundtóva Klocová et al., 2022; Xygalatas et al., 2018). However, *nam* spirits like "bad behavior" but also (the act of) "loving". Further, "prayer" is something they both like *and* dislike. These seeming contradictions may be a result of distinct and conflicting cultural models of *nam* as either a good-willed spirit or a force of evil in the form of *jab* (cf., Kundtóva Klocová et al., 2022), and, again, may reflect cultural competition between different local belief systems in that *nam* like prayer directed towards themselves but dislike prayer dedicated to other "rival" deities. Note that for these reasons this particular ethnographic context complicates assessing our predictive criteria (a through f; see Supplementary Section S6.4 for discussion).

3.2.5. Hadza

Among the Hadza, *Ishoko*, represented by the Sun, was selected as the local deity (Apicella, 2018). *Ishoko* is free-listed as primarily concerned with (im)moral deeds (e.g., insults, loving, murder, sharing, stealing, violence) and virtuous states and qualities (e.g., peace, good heart) as well as ritual acts (e.g., singing). Morality constitutes a straightforward set of god-problems inasmuch as (im)moral actions almost always involve social dilemmas (a) with substantial (b, c) cost/benefit tradeoffs (Alexander, 1987; Curry et al., 2019; Purzycki et al., 2018b) that might often be easier to coordinate with appeals to an intervening supernatural agent (e), particularly when secular institutions are weak or absent (d; note that many participants of our Hadza sample responded "Don't know" with regards to what the police dislike, indicating a general unfamiliarity with formal law-enforcement, see Figure 1). In this case, however, we see no clear indication that the most salient (im)moral acts listed have opaque payoffs (f).

The relatively high moral salience of *Ishoko* is worth highlighting. As a cultural group, the Hadza is often regarded as a prototypical hunter-gatherer society (e.g., Peoples and Marlowe, 2012; Wright, 2010), but no other site in our sample scores a higher Smith's S of Morality for something that upsets a local god than the Hadza[6] (see Figure 1). This finding supports a classic view, namely that the presence of moralistic deities are not limited to large-scale, complex societies (e.g., Evans-Pritchard, 1965; Malinowski, 1992). Complimentary analyses further indicate that the moralistic concerns of *Ishoko* (and *Haine*, the "moralistic god" of our Hadza sample) cannot be fully accounted for by external influence from moralizing world religions and missionary activities (Purzycki et al., 2022b; Stagnaro et al., 2022).

3.2.6. Marajó, Brazil

In Marajó, Brazil, St. Mary (Our Lady of Nazareth – *Nossa Senhora de Nazaré*) was the selected local deity. It is clear from the free-lists that St. Mary resembles a moralistic deity; she is first and foremost concerned with (im)moral behavior (e.g.,

[6]Note that some participants considered *Haine* and *Ishoko* to be identical entities, an observation that might account for the high moral salience of *Ishoko* as well as the general similarity between *Haine* and *Ishoko* (see e.g., Table 4). In cases where participants said that *Haine* and *Ishoko* are the same, the free-list data from *Haine* were duplicated to Ishoko, a decision made by the local field research team. However, to assess how this decision impacts the main results, in the Supplements we analyze and plot the salience of the general codes separately for those Hadza participants who said that *Ishoko* and *Haine* are "different" or the "same" (Figures S3 and S4). Analyzing these two groups of participants separately does not substantially change the main results. See Sections S3, S7, and Figures S3 and S4 for further discussion.

loving, violence, sin, murder) as well as ritual and religious acts (e.g., prayer, faith, worship) dedicated to her (see Table 4). While ethnographic details of this field site do not lend themselves to a fine-grained examination of the predictive criteria, as noted earlier, (im)moral behaviors are generally costly (b) and pertinent (c) social dilemmas (a) that often require third-party policing (d), such as appealing to a watchful and punitive deity (e). Again, just how opaque payoffs of (im)moral acts are to individuals (f) in this case remains unclear.

The moralistic deity for Marajó was the Christian God, and since St. Mary is central to Catholicism, the primary religious denomination at this field site, it is likely that the close conceptual link between St. Mary and the Christian God influences adherents' conception of the former's concerns. Indeed, other work with some of the present participants found that ratings of St. Mary as a punitive and moralistic figure predicts increased prosociality in anonymous economic games (Cohen et al., 2018), suggesting that St. Mary shares important features with moralizing deities in general (Lang et al., 2019; Purzycki et al., 2018a, 2022b). In this sample, however, the general codes suggest that St. Mary is distinct from the Christian God in at least one way, namely, that Ritual is more salient for her ($S_{\text{Likes}} = 0.45$; $S_{\text{Dislikes}} = 0.19$) than for the Christian God ($S_{\text{Likes}} = 0.27$; $S_{\text{Dislikes}} = 0.08$; see Table 4 and Supplementary Tables S4-S7). This salient association is likely due to the fact that St. Mary is the patron saint of the sampled village of Pesqueiro and residents throw religious festivals in her honor (see Cohen et al., 2018; Purzycki et al., 2016a), suggesting that the free-list data reflect a key feature of local cultural tradition.

4. Discussion

4.1. Summary

Despite a growing contemporary literature on moralizing aspects of deities, relatively few individual-level studies have systematically investigated the spectrum of concerns that deities are associated with and their ethnographic contexts. To initiate this inquiry, we first presented an account of god beliefs and appeals, which includes a set of predictions, derived from prior theoretical, experimental, and ethnographic evidence, for when we might expect people to appeal to the supernatural. We then reported individual-level free-list data on a diverse set of deities' likes and dislikes across eight societies and contextualized the cultural models of local deities' concerns in light of our account.

As noted throughout, the degree to which the free-list data and the ethnographic literature allowed a direct assessment of the predictive criteria varied across sites.

We generally found that local deities' concerns point to costly threats to local coordination and cooperation that–in lieu of well-functioning alternatives–are likely effectively enforced by appeals to the supernatural. These findings are consistent with our criteria (a) through (e). Criterion (f) was perhaps necessarily more difficult to assess, however. While threats to classic public goods dilemmas such as resource management (Tyva; Tanna) and communal work (Yasawa) are often long-term and cumulative in nature, the costs involved in outright moral offenses such as murder and violence (Hadza; Marajó) are more immediate and unambiguous than other infractions (for further discussion, see Bendixen and Purzycki, n.d.a). Whether this criterion requires revision, its relevance to moralistic traditions is unique, or whether it needs to be evaluated on a site-by-site basis requires further consideration.

More generally, several key findings are worth highlighting, which provide preliminary answers to our guiding questions: First, we show that rather than random, arbitrary, universal, or idiosyncratic, individuals' appeals to locally relevant gods' concerns are *i*) constituent parts of shared cultural models that *ii*) systematically point to *iii*) human behaviors associated with site-specific contexts that *iv*) could theoretically mediate cooperative relationships. In other words, even though gods could have cared about mythical ideas or idiosyncratic things that individuals transparently project onto the gods, appeals to gods' concerns point to behaviors that can address "god-problems". Second, by showing that some target deities were more closely aligned with the interests of the police and those interests were coded as "moral", we validated the "moralistic god" construct. Third, while the moralistic gods and the police are closely aligned in terms of general moral salience, supporting a popular notion that deities of world religions come to resemble law-enforcing entities (e.g., Johnson, 2016; Norenzayan, 2013), the specific content of their moral concerns also predictably diverge—the police are more often concerned with concrete crimes (e.g., rape and murder), whereas the moralistic gods are concerned with personal and collective displays of devotion and general "good behavior". Fourth, supporting a classical view that deities of even smaller-scale societies are often morally salient and relevant (e.g., Evans-Pritchard, 1965; Lang, 1909; Malinowski, 1936), local gods also exhibit moral concern, though not typically to the extent of moralistic gods or the police (cf., Purzycki et al., 2022b).

How do these results fare in light of alternative views of god beliefs and appeals? In the following, we turn to that question, followed by a discussion of some important limitations and implications of the present study.

4.2. Alternative accounts of variation in god beliefs and appeals

Consider first the view that god concepts are "catchy" because gods are intuitively thought to be morally interested (Boyer, 2000, 2001). This is a helpful perspective in that it predicts that gods will revolve around consequential aspects of social life, a prediction for which we found support. However, while deities might in general be *intuitively* moralistic (Purzycki, 2011; Purzycki et al., 2012, 2022b), we found that there was considerable cross-cultural variation in the *explicit* appeals people employ, suggesting that the local context might play a more important role in the evolution of god beliefs and appeals. By way of illustration, consider that gardening is a "catchy" god concern on Tanna (Section 3.2.2), but not in any other of our sites. This particularism makes sense in light of the ethnographic context but is not obviously accounted for by claims about beliefs being "catchy" for their general social or moral salience *per se*.

Other approaches (e.g., Jackson and Gray, n.d.; Johnson et al., 2015; Spiro and D'Andrade, 1958) investigate variants of the "projection hypothesis", namely that various aspects of gods are projections of believers' own concerns, temperaments, and interests. A related view emphasizes that appeals to rules–secular as well as supernatural–are shaped by individuals' self-interest (e.g., people invent or enforce rules that benefit themselves), and that rules therefore often serve the interest of the powerful (Singh et al., 2017). While these frameworks might help address some very specific aspects of god beliefs and appeals (e.g., when elites use appeals to gods as a means for social control; Ellwood, 1918; Swanson, 1960, ch. 9; Watts et al., 2016), they are limited in a few important ways (Bendixen and Purzycki, 2020). First, the many things that deities are *not* associated with are arguably as revealing as the things that they are associated with, and overall we do not find that deities care about all manner of personal whims and preferences. As we showed, representational models of deities are, overall, culturally shared rather than idiosyncratic. Second, many god-problems such as commitments to costly ritual routines and temporal or spatial prohibitions on the use of natural resources, are costly to individuals and therefore are inconsistent with immediate self-interest. Third, individuals do not simply project their own explicit moral values onto local gods; there is little overlap in what people say their deities care about and what they say make a person "good" and "bad" (see Purzycki, 2016; Purzycki et al., 2018b). Contrary to some implied variants of the projection hypothesis, then, individuals' personal concerns and whims are rather separate from those of the gods.

Many current accounts emphasize various moral aspects of deities (e.g., Johnson, 2005, 2016; Norenzayan et al., 2016; Schloss and Murray, 2011). While participants attributed all gods, "moralistic" and "local" alike, with some moral concern (see

also Purzycki et al., 2022b), they are also culturally specialized in that they are each associated with a locally limited but globally diverse set of concerns that are often not explicitly moralistic. This finding is consistent with our account that beliefs about and appeals to deities reflect locally salient challenges and dilemmas in the socioecological landscape (Purzycki and Sosis, 2022; Purzycki et al., n.d.) However, what the present work shows is that even if deities are not *explicitly concerned with* general moral prescriptions and prohibitions, they are unambiguously relevant to the costs and benefits of social life—cooperation, in short (Teehan, 2016). And so, if we are to conceive of morality *as* cooperation (Alexander, 1987; Curry et al., 2019), all of these deities could be construed as "moralistic". This too calls for a closer examination of local deities and their associations and contextual roles in mediating human relations.

4.3. Concluding remarks

While the present work shows that appeals to gods and spirits point to threats to coordination and cooperation in the local socioecological landscape, we have *not* demonstrated that these beliefs and appeals actually *motivate* corresponding behaviors that mitigate such threats. Even though particular religious systems exhibit clear features of adaptive self-organization (e.g., Bird et al., 2013; Lansing et al., 2017; Sosis and Bressler, 2003) and many other cases are interpreted as such (e.g., Angsongna et al., 2016; Connors, 2000; Leeson and Suarez, 2015; Rossano, 2007; Rappaport, 1968; Reynolds and Tanner, 1995; Strassmann et al., 2012), it remains unclear if appeals to deities actually motivate such systems (Purzycki and Sosis, 2022).[7] There is experimental evidence across 15 field sites showing that higher individual ratings of gods' *general* monitoring and punitive tendencies predict fairer and more generous behavior towards co-religionists in behavioral economic games (Lang et al., 2019). Crucially, however, this work shows no clear relationship between money allocations and *specific* moral concerns attributed to deities; people might know the locally relevant appeals to gods' concerns, but it does not neces-

[7]Caution is also generally warranted in inferring functional behavior from cultural beliefs in lieu of rigorous theory, analysis, and evidence (see Bloch, 1983; Elster, 1983, 2015; Shariff et al., 2014; Smith and Wishnie, 2000). A related methodological issue pertains to the non-trivial task of drawing rich inferences from free-list data; since free-list responses in isolation are often subject to several interpretative *etic* outcomes, insight into the local *emic* context is crucial for valid conclusions. For instance, in the Mauritius case, many participants listed food-related items (e.g., milk, bel'leaf, flowers, water) as something Shiva likes (see Supplementary Table S10), but since certain foodstuffs play a prominent role in Hindu ritualistic tradition, these responses were coded as Ritual according to the general coding rubric.

sarily mean they are motivated by living up to them. Generally, we anticipate that individuals are more inclined to act when they perceive that the costs of gods' wrath outweigh those associated with behaving consistently with gods' wishes (cf., Johnson and Bering, 2006), but this remains to be substantiated.

Nonetheless, consistent with our account, some detailed ethnographic case studies employing contemporary social scientific methods do suggest that at some level, god beliefs and appeals can in fact have tractable behavioral consequences and curb defection in cooperative dilemmas. For instance, among the Mentawai on Siberut Island, Indonesia, the local spirit, *Sikameinan*, punishes people with illness or accidents for violating meat sharing norms. *Sikameinan* can be appeased by hosting costly ceremonies, which among other elements involves sharing meat with community members. As such, beliefs about the punitive *Sikameinan* seems to motivate exactly the kind of behavior that the spirit is associated with (Singh et al., 2021). To take another example, in the Maya lowlands of Guatemala, the native Itza' Maya traditionally profess beliefs that local spirits protect the rain forest, for instance by punishing violations of the spirits' "preferences" for certain species and patches of land[8] (Atran et al., 2002). These beliefs seem to have co-evolved with the subsistence practices of the Itza', which are determined as more productive and sustainable compared to neighboring groups' across a range of physical measurements. Thus, spirit beliefs among the Itza' appear to contribute to the management of forest resources (see also Atran et al., 1999; le Guen et al., 2013). Yet another example comes from a recent experimental study with the Ik of Uganda, showing that reminding participants about supernatural punishment increases economic donations to a needy, anonymous recipient (Townsend et al., 2020).

Additionally, while our assessment strongly suggests that beliefs are tied to particular contexts, we have not captured their evolution in action. As cultural strategies that promote cooperation can co-evolve with shifting cooperative dilemmas (Bednar and Page, 2007; Smaldino and Lubell, 2014), we expect that when communities face novel threats to cooperation, appeals to gods' concerns will co-evolve with the behaviors that address these problems (cf., Jensen, 2019, ch. 7; Purzycki and Sosis, 2022; Purzycki et al., n.d.; Sørensen, 2004). Some experimental and ethnographic evidence supports this prediction. For example, believers are more likely to emphasize that greed angers God after receiving no return in a trust game (Purzycki et al.,

[8]These preferences "represent a synthesis of experience accumulated over generations. Violations of spirit preferences can lead to accidents, falling ill, or worse. It matters little if the supernatural threat is real or not: if people believe in it, the threat of punishment becomes a real deterrent" (le Guen et al., 2013, p. 781).

2020). In Tyva, alcoholism is a severe social ill, and drinking is a steady component of what displeases or angers *spirit-masters* (Purzycki, 2016) and Buddha (Purzycki and Holland, 2019)[9] (see Figure 1 and Supplementary Tables S5 and S7). In Taiwan, the traditional sea goddess, Mazu, was recently co-opted as the patron deity of the local anti-nuclear movement after an oracle of Mazu accurately "foresaw" the non-operation of a newly constructed power plant (Shih, 2012). Around the world, "eco-spiritual" movements have emerged within world religions in the wake of increased sociopolitical attention on environmentalism (e.g., Preston and Baimel, 2021; Sponsel, 2014; Taylor et al., 2016). Each of these cases offer glimpses of the various mechanisms that can ignite cultural change in response to changes in the environment. The routes behind the diffusion of these changes are manifold (see Appendix).

Additionally, when religious systems compete—such as at our field sites in Mauritius and Yasawa, where spirit worship is suppressed as illegal or illegitimate—local deities and spirits appear highly concerned with ritualized commitments to themselves and neglect of or antagonism toward rival deities (see Figure 1, Sections 3.2.3-3.2.4, and Supplementary Sections S6.3-6.4); a pattern that makes sense from a cultural evolutionary perspective, in that god concepts that did not evolve to demand constant attention, particularly when under pressure, would likely be outcompeted by more persistent strains. All of these cases provide hints of the ways in which religion evolves, but of course, we are only just beginning to make sense of these evolutionary processes (Bendixen and Purzycki, 2020). In particular, cross-cultural longitudinal studies would allow researchers to track religious appeals and behaviors across changing demographic, existential, cultural, social, and ecological circumstances and thereby disentangle the various forces at play in the evolution of religion.

Appendix: On the cultural evolutionary process

We take it as a given that the data we assessed in the present study reflect outputs of either direct or indirect social learning processes. As our goal was to examine what people culturally transmit to each other and whether or not such models are tethered to particular features of social ecologies, our present data do not allow us to make direct inferences about the particular transmission pathways. In fact, our account allows for a variety of candidate social learning processes (see Kendal et al., 2018, for

[9] Purzycki and Sosis (2022, ch. 10) frame the potential costs and benefits of social drinking as a social dilemma.

taxonomy) behind the formation of the cultural models we examine (cf., Bendixen and Purzycki, 2020, 2021, n.d.a). These include: content-based biases (e.g., deities that care about morally and socially relevant issues, can monitor and intervene in human affairs, and offer teleological explanations of threats and (mis)fortune are "cognitively attractive" and therefore more culturally retainable and transmittable; Boyer, 2000; Purzycki et al., 2012); context-based biases (e.g., people learn about and commit to gods and their postulated concerns through parents, peers, role models, and specialists via verbal, symbolic, and behavioral displays of commitment; Atran and Henrich, 2010; Henrich, 2009; Richerson and Boyd, 2005); pay-off biases (e.g., people are generally sensitive to local problems and their costs and benefits such that environments powerfully shape cultural variants; Sosis and Bulbulia, 2011; Sperber, 1996); manipulative signaling (e.g., people appeal to the supernatural in order to align other people toward some individualistic or social goal and, because of their superhuman powers, spirits and gods are both difficult to disprove and potentially very costly to ignore making them less susceptible to skepticism; Bendixen and Purzycki, 2020; Fitouchi and Singh, 2022); cultural group selection (e.g., all else being equal, behaviors that elicit supernatural intervention in locally pressing social dilemmas contribute to cooperation and thereby the longevity of the cultural system itself; Norenzayan et al., 2016; Richerson et al., 2016); as well as stochastic and historical contingencies (e.g., Sørensen, 2004). In addition to the mechanisms that attend to perturbations in cooperative relationships, sources of new information with the potential to become incorporated into cultural models might include individual projections that stem from self-interest (e.g., god wants you to send me your money) or fancy (e.g., the spirits like watching kung fu flicks), historically contingent factors (e.g., an imperialistic tradition or set of secular institutions that usurp the function of local traditions), and random variation from human creativity (e.g., god is angered by Brussels sprouts).

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University.

Author Contributions

T.B. and B.G.P led project development, data checks, analysis, and writing. B.G.P. managed the greater project of which this was a part, compiled data, and organized coding of the free-list data and T.B. led analysis and ethnographic background research. J.H., A.N., and B.G.P. designed the Evolution of Religion and Morality Project. C.A., Q.A., E.C., R.A.M., B.G.P., A.K.W., and D.X. collected data.

Data Availability

All data and code to reproduce the present study are available at: https://github.com/tbendixen/cross-cultural-free-list-project. The main project repository including raw data, full protocols, and related materials is available at: https://github.com/bgpurzycki/Evolution-of-Religion-and-Morality.

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