

Weathering the Storm: Supernatural belief and cooperation in an insecure world

Rita Anne McNamara

School of Psychology
Victoria University of Wellington
Wellington
Aotearoa New Zealand

rita.mcnamara@vuw.ac.nz

This manuscript has been accepted for publication at the Journal for the Study of Religion, Nature & Culture. This manuscript will go through changes in copy-editing through the journal's editorial office and thus this version of the article may not reflect the version that is eventually published in the journal. Please cite this paper using the following reference:

McNamara, R. A.(in press). Weathering the Storm: Supernatural belief and cooperation in an insecure world. *Journal for the Study of Religion, Nature & Culture*.

Abstract

Religious and supernatural beliefs may facilitate social life by promoting and sustaining cooperation, but the specific cooperation problems each society faces may lead to unique belief systems adapted to local socio-ecological conditions. As societies mix and belief systems spread, local and introduced belief systems may present conflicting solutions to the same social problem. How do we choose among these different solutions? The present study recruits participation from villagers living on Yasawa Island, Fiji (N=179), who espouse both Christian and traditional beliefs that promote different expectations about local and distant others. This study focuses on the relationships among existential/ resource insecurity and supernatural beliefs across these belief systems using an experimental priming procedure and a dictator game to allocate food resources. Though reminders of insecurity had no impact on allocations, the effects of being reminded of Christian or Traditional belief depended on (was moderated by) how worried participants were about resource availability and beliefs about the Christian God's tendency toward punishment or forgiveness. Analyses of interview data suggest Christian and Traditional imagery may evoke different conceptions of Gods as either supportive (Christian) or authoritarian (Traditional). Results highlight belief content as key for sustaining different social support networks and traditional belief/ knowledge systems as a source of community resilience against threats like natural disasters.

Keywords

Cooperation, Religion, Natural Disaster, Community Resilience, Food Sharing, Field Experiments, Economic Games, Fiji

Word Count: 10929

1. Introduction

Humans survive and thrive in every terrestrial environment on the planet, thanks in no small part to our ability to work with and learn from each other over generations (Mesoudi and Thornton 2018; Chudek and Henrich 2011; Henrich 2015). This study seeks to further examine the ways culture promotes cooperation in situations of environmental hazard through the avenue of religious belief. Cultural adaptations for group success include sets of religious beliefs and practices that foster group cohesion (Sosis and Alcorta 2003; Purzycki and Sosis 2013), which provide an external source of punishment to stave off free-riders (D. P. Johnson and Krüger 2004; Schloss and Murray 2011), thereby facilitating increasing political complexity and group size (Watts, Greenhill, and Lieberman 2015; Norenzayan et al. 2014; Watts et al. 2018). Harsh environments are associated with cooperation and belief in supernatural punishment (Botero et al. 2014; Snarey 1996). While the psychological evidence for the link between supernatural monitoring, punishment, and cooperation is most commonly drawn from communities with backgrounds of Abrahamic faith,¹ Non-Abrahamic traditions have also been documented to include adaptive behavioural complexes that support and sustain natural resource management (Lansing and Vet 2012; Purzycki 2010). Beyond the scope of what might be included as religion in the above studies, many Indigenous societies, traditional ecological knowledge and food sharing networks can provide the structure to facilitate resource distribution and management that mitigates risk to individuals (Nolin 2012; Aktipis, Cronk, and Aguiar 2011; Bollig 2006; R. B. Bird, Bird, and Smith 2002; Berkes, Colding, and Folke 2000; Janif et al. 2016).

While pooling resources in a local community buffers individuals, this can be resolved locally by kin groups and reputation networks – the cooperation involved in traditional methods of local resource pooling cannot explain why large-scale societies of cooperative strangers, such as those most humans live in today, might emerge (Jaeggi and Gurven 2013; Foster, Wenseleers, and Ratnieks 2006; Nowak 2006). When resources are unreliable, the cross-cultural tendency is for societies to constrict rather than expand their circles of social interaction and concern (Gelfand, Nishii, and Raver 2006; Hruschka et al. 2014; Van de Vliert 2011; Fincher and Thornhill 2012). While locally-concerned supernatural agents may motivate and sustain local cooperation systems, large-scale cooperation may be scaffolded by belief in supernatural agents that care about cooperation beyond local kith and kin (Norenzayan et al. 2014).

This study seeks to examine the dynamics between religious traditions that promote local versus universal social concerns on resource distribution under threat of resource insecurity. These relationships are explored using an experimental dictator game to allocate food resources among Indigenous iTaukei Fijians communities on Yasawa Island, Fiji.

1.1.1. Religion in Fiji

Indigenous iTaukei Fijian social organization has traditionally been built on three pillars: *vanua* (the land and its people), *matanitu* (the chiefly system), and *lotu* (the Church) (Niukula 1992; Newland 2009). While enthusiastically Christian, a number of syncretic beliefs/practices keep traditional beliefs alive (Cato 1956; Ravuvu 1983; Ryle 2010; France 1969). These beliefs are particularly evident in Fijian medicine (Katz 1999), suspected sorcery/witchcraft (Newland 2004), and in connections to chiefiness and land (Toren 2004; Gervais 2017; Kline, Boyd, and Henrich 2013; Tomlinson 2002; Baba et al. 2013).

¹ Note the harsh environment/ cooperation/ supernatural punishment effects are also highly related to traditions starting in Mesopotamia. The specific effects of Abrahamic traditions from this area versus general effects of religion are hard to dissociate.

The Christian ‘Bible God’ (*Kalou ni vola*, “God of the book” in Yasawa; elsewhere *Kalou dina* “true God”) is associated primarily with *lotu*, while the *Kalou-vu* (“root/ ancestor god,” locally concerned, less powerful, deified ancestors) is associated with *vanua*. While there is much overlap and syncretism among these belief sets, each promote different social expectations. The Bible God extends human hierarchies by having more authority over *Kalou-vu*, which then have authority over the traditional chiefly political structure. The Bible God is responsible for both redemption and punishment, though Bible God’s punishments can include the climactic/ cosmic scale as well as individual illness and death (Gillard and Paton 1999; Bryant-Tokalau and Campbell 2014). The Bible God can provide protection and forgiveness when one suspects an angry *Kalou-vu* is punishing them (Tomlinson 2004). Church attendance and regular Christian practice are frequently also cited as a primary trait of a good Fijian (Purzycki et al. 2018). *Kalou-vu* are associated with punishments of illness, misfortune, and death. *Kalou-vu* punishments are seen as both a source of discord from the devil and as a result of disrespecting the local social hierarchies (i.e. making disrespectful noise in the village that insults the chief or speaking badly about the *vanua*). These punishments can therefore be seen as a means of enforcing local village norms and supporting traditional social structures (McNamara and Henrich 2017a).²

1.1.2. Insecurity and Social Resilience Factors in Fiji

Rural iTaukei Fijian communities rely upon traditional horticultural and fishing techniques for daily subsistence. The foundation of a typical rural Fijian diet is starchy root crops like cassava and yams that are cultivated in family *teitei* gardens and marine resources gathered by reef fishing and foraging shellfish. A range of additional plants are grown or foraged seasonally, but the dry climate in the Western islands like Yasawa reduces the range available.³ Most families keep pigs, chickens, and/ or goats, though these are only eaten on special occasions. Market-purchased foods like rice, flour, sugar, and tinned meats round out the diet; most areas further from urban centres and tourist resorts gain access to market foods through money from local food and handicraft production and the tourist industry. Daily subsistence for many rural Fijian villages is therefore heavily dependent on the local ecological and climactic conditions.

Climactic shocks like *dausiga* (droughts), *vakamakama* (brushfires), and *ualuvu* (floods) seasonally impact family gardens. The Fijian *cagilaba* (cyclone, lit. “murderous winds”) season lasts from November to April. Smaller islands like Yasawa are particularly exposed to cyclones. Large cyclones causing significant structural and garden plot damage occur roughly once per decade. Importantly, the Yasawan villages participating in this study were affected by category 4 Cyclone Evan on 17 December, 2012. This cyclone destroyed many houses and most of the cassava crop.

The typical solution to dealing with these resource shocks is through reliance on family networks for support (Bryant-Tokalau and Campbell 2014; Bryant-Tokalau 2018; Gillard and Paton 1999; Sakai et al. 2014; Campbell 2009; Janif et al. 2016). As with many parts of the Pacific, kinship knowledge is a key asset for success in Fiji, with many ordinary cooperative actions structured by implicit kin relationship knowledge (McNamara and Henrich 2017b; Toren and Pauwels, n.d.; Nabobo-Baba 2006; Ravuvu 1983; Brison 2001; Brison 2007a). Such traditional values include the onus on more well-off community members giving to the

² These belief sets coexist in tension. While they are often treated as compatible in Methodism, Charismatic Christian groups are gaining popularity, partly as a way to challenge traditional hierarchies (Brison 2007b). Importantly, the spread of these charismatic Christian groups also upends the syncretism between *Kalou-vu* and Methodism by re-branding these supernatural agents as *tevoru* (demons) and witchcraft (Newland 2004).

³ Islands with more rainfall in the East often support emergency gardens of fast-growing taro, but the arid West is too dry for such crops.

needy, while those in need can expect support in times of trouble (Gervais 2017; Sahlins 1965; Brady 1972). Thus, if one has relatively secure material resources, then the proper traditional Fijian response is to give to others what they are due according to their kin relationship.

The author observed these kin networks in action while working in communities on Kadavu Island during the category 3 Cyclone Keni in April 2018. Keni was the worst storm to hit Kadavu in more than 30 years, causing extensive farm and structural damage to more than 800 homes (2018a; 2018b). In general, people return to the village from Suva⁴ when the city is too expensive. Within the village family network, one's place is assured through respect for obligations and contributions according to rank, rather than one's economic output. Sharing and caring for each other is a deeply held value. While this does make it hard for individuals to get ahead in a Western entrepreneurial sense (Farrelly and Vudiniabola 2013), it provides the community with social resources and safety nets (Schlossberg 1998). When Keni hit, those with house known to be structurally unsound to withstand the winds took cover with related neighbours and stayed as long as necessary. Once everyone was accounted for, the community bonded into the late hours over extra-long *yaqona* (kava) drinking sessions. The next day, families banded together to begin rebuilding and salvaging/processing damaged *yaqona* crops. While some cited the cyclone as a sign of God's displeasure, many instead focused on how fortunate they felt for having the land and their families to depend on. The immediate cooperative effort to rebuild far outpaced the speed of governmental aide, making the kinship networks a vital asset for their recovery and overall resilience. This episode illustrates the tension villagers face between traditional, kin-focused resilience strategies and more distal strategies that rely on nameless interactions with distant others.

1.2. Current Study

The present study tests whether prosociality, defined as generosity rather than rule following (Shariff and Norenzayan 2011; McNamara and Henrich 2017a; McNamara, Norenzayan, and Henrich 2016), may be affected by resource insecurity and religious belief systems. An experimental dictator game task used sugar resources to evoke food sharing norms and examine how reminders of resource uncertainty, crossed with Christian or Traditional belief reminders, impact giving behaviours in communities recently impacted by a large cyclone.

1.2.1. Hypotheses and Predictions

If resource insecurity preferentially directs resources to the local community (thereby restricting social networks to preference local vs. distant others), then reminders of food and resource insecurity should reduce resource allocations to distant others (Hypothesis 1). However, if belief in an all-powerful, morally-concerned supernatural agent (such as the Christian God) can encourage social networks beyond local communities, then being reminded of such agents should mitigate the social circle tightening effects of resource uncertainty (Purzycki et al. 2016; Hypothesis 2). Further, reminders of Traditional iTaukei Fijian values should activate local cooperation norms, leading others to give according to their ability. If this is the case, then those who are more secure in their resources should be more likely to give resources away and those who are more insecure should be more likely keep more for themselves (Hypothesis 3). This, however, might interact with Christian belief, such that belief in God's punishment might promote giving more away and belief in God's

⁴ The capital city, located on Viti Levu

forgiveness might promote keeping more for oneself (Shariff and Norenzayan 2011; McNamara and Henrich 2017a; Hypothesis 4).

2. Method

This study features a between-subjects 2x3 experimental design, crossing reminders of resource insecurity and religious beliefs. All study materials were translated and back-translated from English to Standard Fijian by Indigenous Fijian research assistants fluent in both languages and are available on the study OSF page ([Author] 2018).

2.1. Participants

In June and July of 2013, 179 adult (95 women; average age = 42.24 [min = 18, max = 81]; average years of formal education = 9.38 [min = 0, max = 16]) members of 3 Yasawa Island, Fiji, villages participated. Recruitment was based on participant availability.

The study's 2 (Insecurity primed or unprimed) x 3 (religion imagery prime – Christian, Traditional, neutral) design yielded 6 separate conditions, with a target sample size of 30 per condition. Given small population sizes of participating villages (approx. 70-150 adults each), this number was a balance between population size and time (see section 3.1 for power analyses).

2.1.1. Study Design and Materials

2.1.1.1. Dictator Game

Generosity toward out-group members was measured using a dictator game. Participants determined the distribution of a resource between themselves and an anonymous recipient. This was intended as a measure of preference for how much to keep for the self vs. share with another.

Recipient

The recipient is defined as “a member of a church living on another island.” Identifying them as an anonymous fellow Christian helps isolate distance effects while keeping religious and ethnic group stable (McNamara and Henrich 2017a). Game allocation cups were labelled for self and other using a label with line drawings and standard Fijian text (Figure 1).

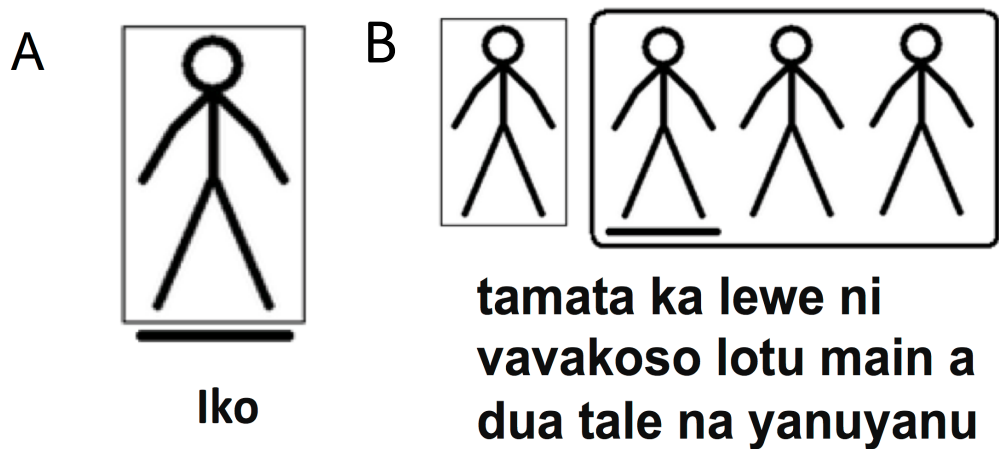


Figure 1 Line diagrams with Fijian text used to indicate cups for self (A) and Distant Co-Religionist ‘person who is a member of a church on another island.’ (B) allocations.

Stakes

Economic games typically use money to measure prosociality, and people in the participating communities have experience with games using money (Hruschka et al. 2014; McNamara, Norenzayan, and Henrich 2016; McNamara and Henrich 2017a; Henrich et al. 2010). But, money may evoke market norms and different prosocial expectations. As food sharing is a vital part of iTaukei life, this study uses sugar to evoke food sharing norms. Food resources have been used in modified games for children in this population (House et al. 2013), but rarely with adults.

The stakes of each game were set at 6 teaspoons of sugar (or about as much as might be placed in one or two cups of tea, consumed with most meals), indicated during game play by tokens consisting of local stones. Sugar is a basic staple but also acquired from the market; shortages across the island happen from time-to-time depending on how often local canteen vendors or fishermen can get to the larger markets on Viti Levu. Participants indicated their distributions by placing stones in cups marked with labels for self and recipient (

Figure 2).

2.1.1.2. Insecurity Prime

Insecurity was explicitly primed through an interview asking participants to recount memories of Cyclone Evan, a damaging storm that hit Yasawa Island and caused extensive damage in December of 2012 (~6 months before data collection). Participants’ perceived resource uncertainty was measured using a scale. Both the interview and the scale were completed either *before or after* the dictator game, making insecurity more salient during the game decisions for only half of the sample. The other half were interviewed about the cyclone after to assess cyclone experience and to measure material insecurity for analysis.

Cyclone Recollections Interview

This interview consisted of two open-ended questions:

- 1) [Happened]: “Could you please describe what happened that day?”

2) [Felt]: “What were your thoughts and feelings while the storm was going on?”

Material Resource Uncertainty Scale

Food and monetary resource uncertainty was measured using a scale adapted from Hruschka et al (Hruschka et al. 2014) and used in McNamara et al (McNamara and Henrich 2017a). This scale measures uncertainty about resource access in 1 month to 5 years (on a five point scale ranging from -2 = totally uncertain to 2 = totally certain).

2.1.1.3. Religious Belief Prime

Reminders of religious belief, even those subtly embedded in the study environment, can boost prosociality (Shariff, Willard, Anderson, & Norenzayan, 2016). In the present study, participants were reminded of Christian, Traditional, or a control neutral belief by random assignment to one of three belief imagery primes adapted from those used in McNamara et al (McNamara and Henrich 2017a). These primes were presented as *sulus* (‘cloths’) positioned as playing surfaces for the game to provide unobtrusive belief reminders (see Figure 2).

Sulus are rectangular cloths used daily for everything from clothing to cleaning to furnishing. They are commonly used as surfaces for eating or other general household activities, so their use in this (or any) context would not be out of the ordinary. All 3 *sulu* imagery primes were similar shades of dark/ navy blue and 3’x5’ in size. None include eye imagery, avoiding potential agency confounds (Bateson, Nettle, and Roberts 2006).

Prime Conditions

Christian: Christian imagery including a cross and Bible with accompanying bible verse text, “Jesus Said, ‘All things are possible to him who believes’ Mark 9:23”

Traditional: ceremonial imagery including a *tanoa* (traditional *yaqona* drinking bowl), *tabua* (sacred whale’s tooth gifted among elders, chiefs, and important guests), with accompanying text, “Fiji Islands Gift of Elders Soveniors [sic]”⁵

Neutral: a stylized flower with text, “*Bula* (“Life/ Hello”) Fiji”

⁵ Traditional Prime imagery features items associated with traditional practices and beliefs, as there was minimal visual representation of *Kalou-vu* in traditional Fijian religion (Thomson 1895; Hocart 1912). Of note, the imagery features a *tanoa*, *tabua*, and *lali*. *Tanoa* are bowls used in *yaqona* (kava) consumption, which is still believed to facilitate communication with *Kalou-vu* (Katz 1999), and are a central part of many social gatherings (Shaver 2015). *Tabua* (treasured whale’s tooth) are displayed in official buildings like churches, town halls, and chiefly houses. They are exchanged in formal ceremonies to consecrating buildings and mark social events like marriage, funerals, or compensation in apologies (Arno 2005; van der Grijp 2007; Cretton 2005). Imagery of war clubs and *lali* (drums) may evoke historical intergroup conflict, but *lali* are used today to call people to pray and to commence other everyday activities such as school, village meetings, and church.



Figure 2 Imagery Primes (A) Traditional, (B) Christian, and (C) Neutral; with dictator game set up (A). Cups for allocations marked with Self (left) and Distant Co-religionist (right). Six local stones stand in for 1 teaspoon of sugar each.

Post-Game Questions

The Dictator Game was followed by 4 open-ended questions:

- 1) “Did you hear anything about this interview and decision before actually participating? If so, what did you hear?” – assessing communication methods about the study leading to participation
- 2) [Real Life]: “What did the game remind you of in real life?” – assessing whether participants connected implications of game to other aspects of village life
- 3) [Interview]: “What were the interview questions about?” – assessing what elements of the insecurity prime interview were most salient
- 4) [Decision]: “What was the decision about?” – assessing game allocation rationale

Supernatural/ Secular Agent Negativity Beliefs

Previous research suggests that, beyond mere presence of belief, valence of belief in God as punishing or forgiving might influence whether people feel licensed to bend rules (in the presence of a forgiving God) or requirement to stick to them (in the presence of a punishing God; see: Shariff & Norenzayan, 2011). To assess whether belief valence matters, belief was measured using a 14-item scale agent negativity scale (McNamara, Norenzayan, and Henrich 2016). Participants rated how much the Bible God, *Kalou-vu*, and police (a secular control) are described by positive (forgiving, comforting, loving, compassionate, kind, gentle, peaceful) and negative (punishing, harsh, terrifying, angry, fearsome, vengeful, jealous) adjectives. Ratings are made on a 1 (completely agree) to 7 (completely disagree) scale. Negativity scores are the average of positive items subtracted from the average of negative items; higher scores indicate more negative/ punishing beliefs.

2.2. Procedure

Participants were randomly assigned to one Insecurity prime condition – before (Insecurity Salient) or after (Insecurity Not Salient) the dictator game, and one religious imagery (Christian, Traditional, or Neutral) prime.

Game play happened in private while seated on the floor, as it is typical in rural iTaukei houses to avoid using chairs or tables except in special circumstances (sitting in an elevated position is a sign of high social rank and would be construed as disrespectful). An iTaukei Fijian experimenter set out one of the three religion prime *sulus* before the game started and administered pre and post-game interviews. The other two *sulus* were hidden; no participant mentioned noticing the *sulus* as out of ordinary. Study procedures were administered in the main room of volunteer households, with sheets hung to maintain visual privacy.

For those assigned to the *Insecurity Salient* condition, participants answered interview questions about their memories of Cyclone Evan and material resource insecurity in the game play area. The experimenter then explained the game rules – once participants passed game comprehension questions, the experimenter left the room while participants made their allocations.⁶ Following their allocation, participants called the experimenter back to complete the remaining questions. Participants assigned to the *Insecurity Not Salient* condition followed an identical procedure except the dictator game took place before the insecurity interview.

⁶ The experimenter left the room to give the participant privacy to make their decision, then the interviewer recorded their allocations after the interview was finished. However, the actual expectation of anonymity in games played in these rural communities is unlikely. Other games played in these communities allowed for anonymous receipts (e.g. Hruschka et al. 2014; McNamara, Norenzayan, and Henrich 2016; McNamara and Henrich 2017a; Henrich et al. 2010), though participants would often make a point to introduce themselves to the researcher who was writing the receipts while they were recording their allocations.

After finishing, participants were thanked for their time and informed that they would receive their sugar pay-out following completion of the study. At the end of data collection, sugar packets were handed out to participants. Recipient allocations were randomly handed out to people living on the main island of Viti Levu.

3. Results

This analysis uses OLS regression models to predict allocations based on primes, agent negativity beliefs, and perceptions of uncertainty. Interview answers are then explored for further insight into participant experience of the cyclone and the game.

3.1. Regression on Allocations

In the analyses that follow, negative allocation values indicate that participants kept more sugar for themselves.⁷ To avoid overfitting the data, several models were examined and compared to the null (see Table 1), a technique which allows for a comparison of coefficient sizes with and without various other predictors and is useful in cases where collinearity or overfitting is anticipated. A total sample size of 180 would give the power to detect a regression coefficient of $\geq |0.205|$; a difference ≥ 1.78 between the intercepts (different mean allocations of ~ 2 tsp sugar) for the two insecurity conditions (groups $n = 90$); a difference of ≥ 2.19 (~ 2 tsp sugar) between the religious imagery conditions (group $n = 60$); and a change in slopes of ≥ 0.04 in the interactions between insecurity and belief within each imagery prime condition (group $n = 60$; (Faul et al. 2009).

Model 1 tests effects of demographic variables sex, age and years of formal education; demographics had no effect and do not improve model fit. Analyses therefore continue without these variables; see OSF project ([Author] 2018) for analyses with demographics.

Models 2, 3, and 4 explore whether this study can replicate previous findings that supernatural negativity beliefs are moderated by perceived uncertainty (McNamara, Norenzayan, and Henrich 2016). Models 3 and 4 also test whether the religious imagery primes have unique effects on any moderating effects between beliefs and uncertainty (which would replicate effects reported in RAG favouritism in these communities, see McNamara and Henrich 2017a). None of these models shows a significant improvement over the null, indicating that the RAG effects may not extend to this dictator game setting.

Having checked for demographic and replication effects, Model 5 tests whether Bible God negativity belief alone is moderated by perceived uncertainty differently across religious imagery primes, and keeps the negativity beliefs as covariates only – this model does present a significant improvement over the null (*adj. R*² = 0.06, model $F(13, 165) = 1.82$ $p = 0.043$).

Model 6 tests the effectiveness of the insecurity in the equation of Model 5; this addition remains a significant improvement over the null (*adj. R*² = 0.06, model $F(14, 164) = 1.86$ $p = 0.035$) but is not significantly better than model 5 ($F(1, 164) = 1.97$, $p = 0.16$). Statistically, this model represents a better explanation of the results than the null model. However, the added insecurity prime variable makes the model more complex than model 5 – as it is not significantly better than model 5, indicating that retaining the insecurity prime is not warranted by how little additional variance it explains. This is an early indication that the insecurity prime did not produce any significant overall effects.

Model 7 reduces the regression equation to keep only the interaction between religious imagery prime, Bible God negativity belief, and perceived uncertainty. This model is again

⁷ All data and study analyses can be found online at ([Author] 2018). All analysis was conducted in R (R Development Core Team 2008); missing data were imputed using Amelia II (Honaker, King, and Blackwell 2006) and pooled regression estimates run using the CAR (Fox and Weisberg 2011) and Psych (Revelle 2011) packages. Tables and graphs are plotted with stargazer (Hlavac 2018) and sjplot (Lüdtke 2018).

an improvement over the null, and it shows that the additional complexity of the other two negativity belief variables is not a significant improvement (model 7 vs. model 5 $F(2,165) = 0.72, p = 0.49$). Subsequent analyses therefore drop these belief variables.

Model 8 adds the insecurity prime to the equation from model 7; this again shows no significant improvement ($F(1,166) = 1.83, p = 0.18$), indicating no overall effect of the insecurity prime. Model 9 tests for the importance of adding a difference in effects of Bible God negativity belief and perceived uncertainty with the religious imagery primes. This model is significantly worse when this interaction is dropped (model 9 vs model 7 $F(5,167) = 3.09, p = 0.01$; model 9 vs model 8 $F(6,166) = 2.89, p = 0.01$). Further analyses therefore focus on models 7 and 8.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Age	0.01 (-0.01, 0.02)								
Years Formal Education	-0.003 (-0.12, 0.11)								
Women vs. Men	0.02 (-0.49, 0.52)								
Neutral vs. Christian			0.62 (-1.28, 2.53)	0.08 (-1.58, 1.74)	-0.01 (-1.61, 1.60)	0.17 (-1.45, 1.78)	-0.03 (-1.62, 1.55)	-0.20 (-1.77, 1.38)	-0.18 (-0.79, 0.42)
Neutral vs. Traditional			0.73 (-1.01, 2.47)	0.68 (-0.87, 2.23)	0.62 (-0.91, 2.14)	0.60 (-0.92, 2.12)	0.47 (-1.03, 1.97)	0.49 (-1.01, 1.99)	-0.06 (-0.65, 0.54)
Insecurity Unprimed vs Primed						-0.36 (-0.85, 0.12)	-0.35 (-0.84, 0.13)		-0.31 (-0.80, 0.17)
Bible God Negativity Belief		0.29 (-0.09, 0.67)	0.16 (-0.61, 0.93)	0.19 (-0.55, 0.93)	0.20 (-0.53, 0.94)	0.21 (-0.53, 0.94)	0.26 (-0.46, 0.98)	0.26 (-0.47, 0.98)	0.29 (-0.09, 0.67)
Kalou-vu Negativity Belief		0.10 (-0.06, 0.26)	0.14 (-0.12, 0.39)	0.09 (-0.07, 0.26)	0.07 (-0.05, 0.20)	0.07 (-0.05, 0.20)			
Police Negativity Belief		-0.07 (-0.33, 0.19)	0.05 (-0.34, 0.45)	-0.06 (-0.32, 0.20)	-0.08 (-0.28, 0.11)	-0.09 (-0.28, 0.11)			
Uncertainty		-0.02 (-0.14, 0.10)	0.12 (-0.14, 0.38)	0.07 (-0.17, 0.31)	0.05 (-0.18, 0.27)	0.06 (-0.16, 0.29)	0.04 (-0.18, 0.26)	0.02 (-0.20, 0.25)	-0.04 (-0.16, 0.07)
Uncertainty Moderation Effect on Bible God Negativity Belief		-0.01 (-0.08, 0.07)	0.003 (-0.15, 0.16)	-0.01 (-0.16, 0.15)	-0.01 (-0.16, 0.14)	0.001 (-0.15, 0.15)	-0.01 (-0.16, 0.14)	-0.02 (-0.17, 0.13)	-0.01 (-0.09, 0.07)
Uncertainty Moderation Effect on Kalou-vu Negativity Belief		-0.01 (-0.04, 0.02)	-0.02 (-0.08, 0.04)	-0.01 (-0.04, 0.03)					
Uncertainty Moderation Effect on Police Negativity Belief		-0.004 (-0.05, 0.05)	-0.05 (-0.13, 0.04)	-0.01 (-0.06, 0.04)					
Uncertainty Effect in Neutral vs. Christian			-0.08 (-0.42, 0.25)	0.01 (-0.29, 0.30)	0.02 (-0.27, 0.31)	-0.02 (-0.31, 0.27)	0.02 (-0.27, 0.31)	0.05 (-0.23, 0.34)	
Uncertainty Effect in Neutral vs. Traditional			-0.37* (-0.71, -0.04)	-0.31† (-0.61, -0.002)	-0.29† (-0.60, 0.01)	-0.31* (-0.61, -0.01)	-0.27† (-0.57, 0.02)	-0.26† (-0.56, 0.04)	
Bible God Negativity Belief Effect in Neutral vs. Christian			-0.75 (-2.14, 0.64)	-0.56 (-1.88, 0.77)	-0.62 (-1.91, 0.67)	-0.51 (-1.80, 0.78)	-0.65 (-1.92, 0.63)	-0.75 (-2.02, 0.52)	

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bible God Negativity Belief Effect in Neutral vs. Traditional			0.34 (-0.59, 1.26)	0.29 (-0.61, 1.19)	0.27 (-0.62, 1.16)	0.25 (-0.64, 1.13)	0.16 (-0.71, 1.04)	0.19 (-0.69, 1.06)	
Kalou-vu Negativity Belief Effect in Neutral vs. Christian			-0.23 (-0.65, 0.20)						
Kalou-vu Negativity Belief Effect in Neutral vs. Traditional			0.08 (-0.31, 0.48)						
Police Negativity Belief Effect in Neutral vs. Christian			-0.55 (-1.42, 0.32)						
Police Negativity Belief Effect in Neutral vs. Traditional			-0.17 (-0.75, 0.41)						
Uncertainty Moderation Effect on Bible God Negativity Belief in Neutral vs. Christian			0.20 [†] (-0.03, 0.43)	0.17 (-0.05, 0.40)	0.18 (-0.04, 0.40)	0.16 (-0.06, 0.38)	0.18 (-0.04, 0.40)	0.20 [†] (-0.01, 0.42)	
Uncertainty Moderation Effect on Bible God Negativity Belief in Neutral vs. Traditional			-0.19 [†] (-0.39, 0.01)	-0.17 [†] (-0.37, 0.03)	-0.17 [†] (-0.37, 0.03)	-0.18 [†] (-0.38, 0.02)	-0.16 (-0.36, 0.03)	-0.15 (-0.35, 0.05)	
Uncertainty Moderation Effect on Kalou-vu Negativity Belief in Neutral vs. Christian			0.04 (-0.05, 0.12)						
Uncertainty Moderation Effect on Kalou-vu Negativity Belief in Neutral vs. Traditional			0.004 (-0.08, 0.09)						
Uncertainty Moderation Effect on Police Negativity Belief in Neutral vs. Christian			0.11 (-0.07, 0.28)						
Uncertainty Moderation Effect on Police Negativity Belief in Neutral vs. Traditional			0.07 (-0.05, 0.18)						
Constant	0.47 (-1.19, 2.14)	1.03** (0.39, 1.67)	0.49 (-0.94, 1.92)	0.68 (-0.59, 1.95)	0.75 (-0.49, 1.98)	0.91 (-0.34, 2.16)	1.08 [†] (-0.10, 2.26)	0.92 (-0.24, 2.09)	1.38*** (0.64, 2.12)
<i>R</i> ²	0	0.03	0.16	0.13	0.13	0.14	0.13	0.12	0.03
<i>Adjusted R</i> ²	-0.01	-0.01	0.03	0.05	0.06	0.06	0.06	0.06	0
<i>F</i> Statistic	0.21	0.81	1.26	1.59 [†]	1.82*	1.86*	2*	1.99*	0.95
<i>df</i>	(3; 175)	(7; 171)	(23; 155)	(15; 163)	(13; 165)	(14; 164)	(12; 166)	(11; 167)	(6; 172)

Note:

[†]p<0.1; *p<0.05; **p<0.01; ***p<0.001

Table 1 Models comparisons; 7 & 8 are the focus of separate analyses on religious imagery primes. Estimates reported as *b* with (.95CI).

The next step in the analysis examines the interactions in models 7 and 8. Figure 3 shows the marginal means of offers made when insecurity was primed. Figure 3 further highlights that this prime did not have an overall significant impact on allocations (Hypothesis 1 is not supported in this data).

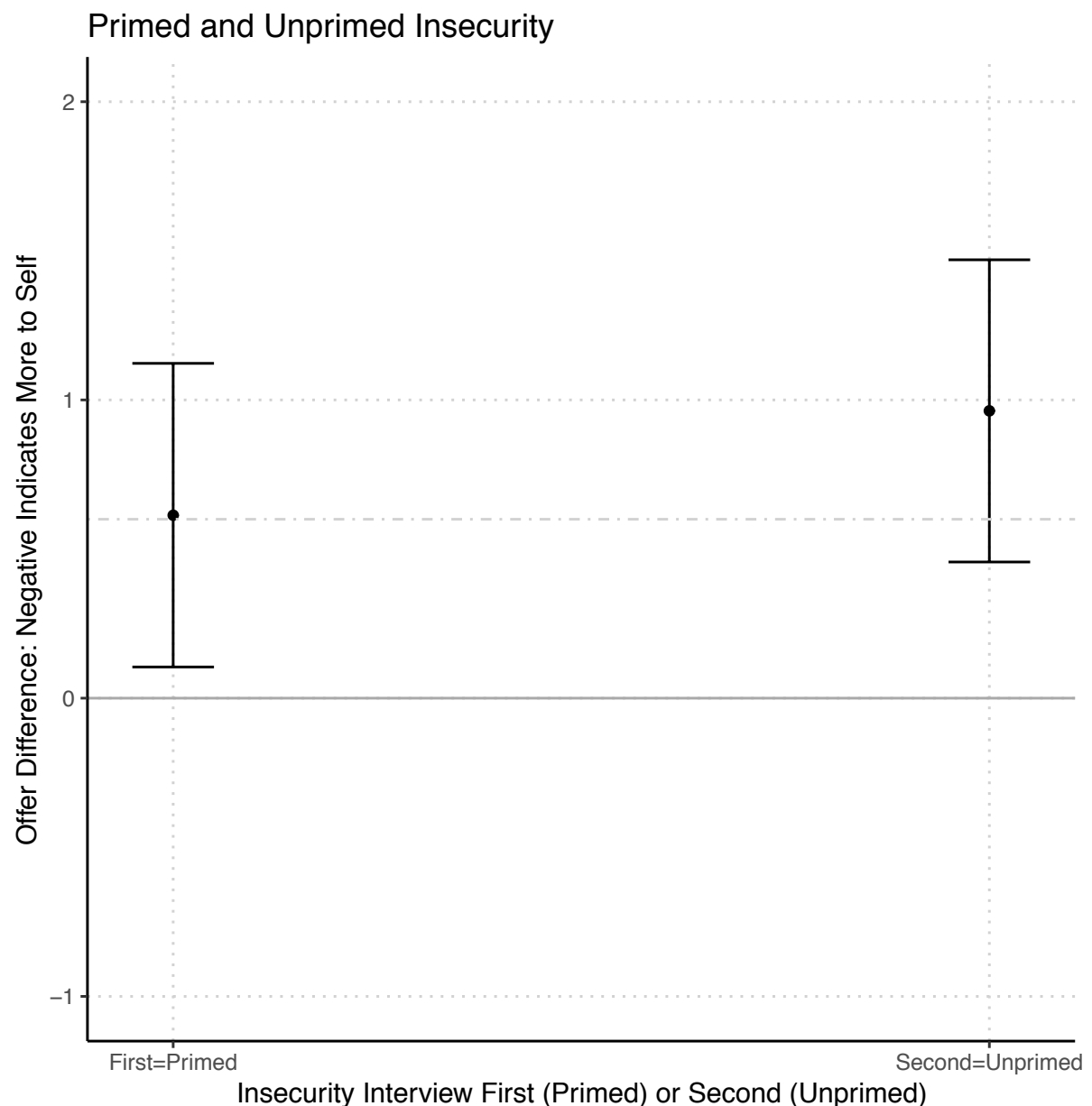


Figure 3 Marginal mean offers of Primed and Unprimed Insecurity, showing no significant effect of prime. .95CI error bars.

Figure 4 shows the interactions between Bible God negativity belief and perceived uncertainty for each religious imagery prime. This figure reveals that there was no interaction in the neutral imagery prime. But, both the Christian and Traditional prime show an interaction between Bible God negativity belief and perceived uncertainty (Hypotheses 2-4).

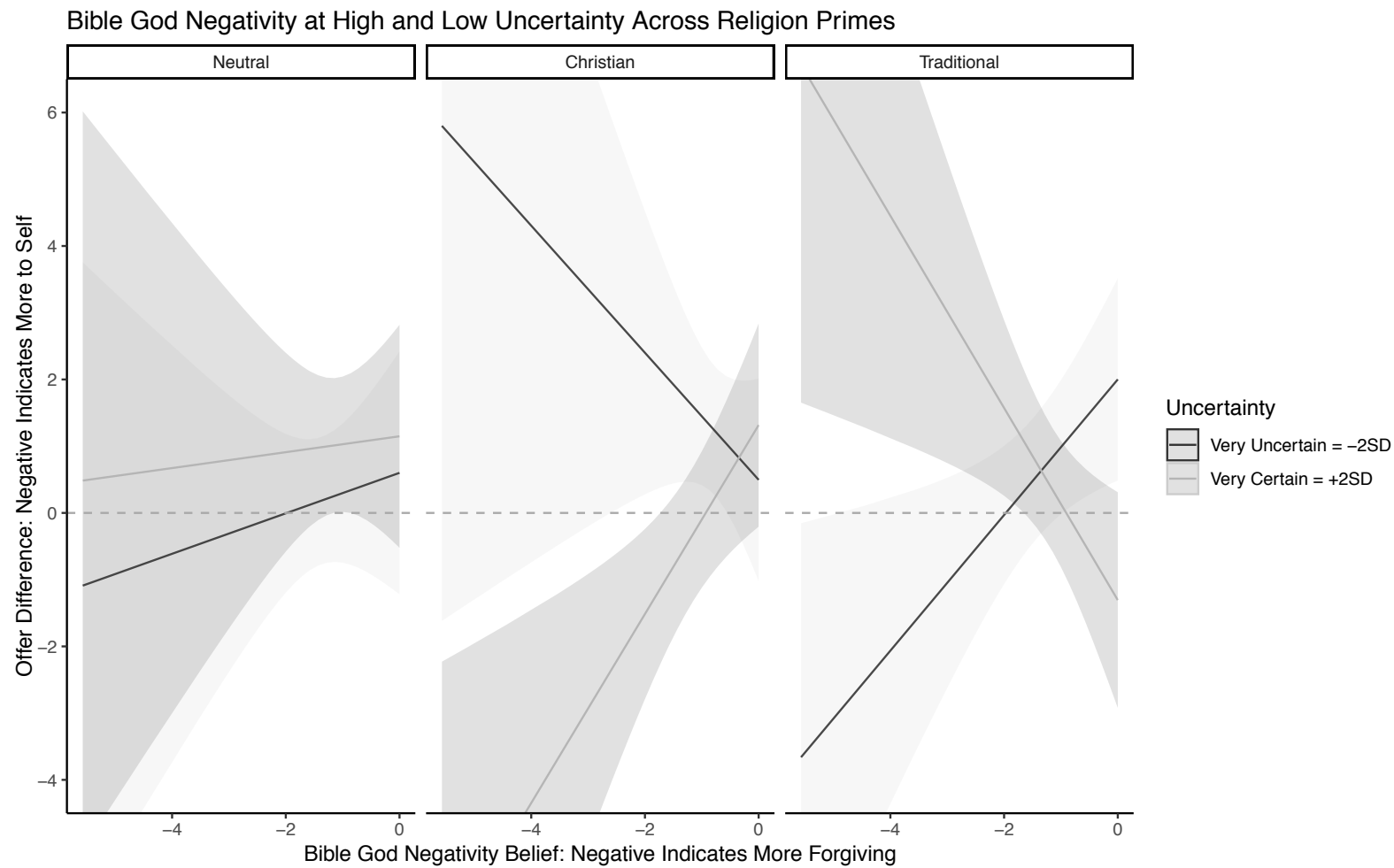


Figure 4 Interaction between Bible God negativity belief and perceived resource uncertainty for religious imagery primes. Both Christian and Traditional primes show an interaction between belief and uncertainty. Shaded areas indicate .95 CI.

Table 2 shows the results of decomposing the interactions above into their simple slopes by analysing each imagery prime separately. Belief in Bible God as a punisher predicts higher sugar allocations to distant strangers when the participant is both very certain they will have sufficient resources and primed with Christian Imagery (model 8 $b = 0.17$, CI.95[0.01, 0.32], $p = 0.049$; model 7 $b = 0.18$, CI.95[0.03, 0.33], $p = 0.029$; Hypotheses 2 & 4 are supported in this model). The Traditional imagery prime shows the opposite effect; greater belief in Bible God punishment predicts more giving to distant others when participants are highly *uncertain* about future resources (model 8 $b = -0.17$, CI.95[-0.29, -0.06], $p = 0.004$; model 7 $b = -0.17$, CI.95[-0.29, -0.06], $p = 0.004$). The Traditional prime also shows a significant effect of participants allocating less to distant others as they perceive more uncertainty about their resources, and when they believe the Bible God to be neither punishing nor forgiving (model 8 $b = -0.23$, CI.95[-0.41, -0.06], $p = 0.046$; model 7 $b = -0.24$, CI.95[-0.41, -0.06], $p = 0.046$; Hypotheses 3 and 4 are supported in this model).

	Religious Imagery Prime					
	Neutral		Christian		Traditional	
	(8)	(7)	(8)	(7)	(8)	(7)
Insecurity Unprimed vs Primed	-0.22 (-1.18, 0.74)		-0.38 (-1.23, 0.46)		-0.46 (-1.20, 0.28)	
Uncertainty	0.03 (-0.22, 0.29)	0.02 (-0.22, 0.27)	0.05 (-0.13, 0.24)	0.08 (-0.10, 0.25)	-0.23* (-0.41, -0.06)	-0.24* (-0.41, -0.06)
Bible God Negativity Belief	0.26 (-0.58, 1.10)	0.26 (-0.55, 1.07)	-0.38 (-1.42, 0.66)	-0.49 (-1.50, 0.52)	0.42 [†] (-0.03, 0.86)	0.44 [†] (-0.001, 0.89)
Uncertainty Moderation on Bible God Negativity	-0.02 (-0.19, 0.16)	-0.02 (-0.19, 0.14)	0.17* (0.01, 0.32)	0.18* (0.03, 0.33)	-0.17** (-0.29, -0.06)	-0.17** (-0.29, -0.06)
Constant	1.02 (-0.39, 2.43)	0.92 (-0.38, 2.23)	1.08 (-0.21, 2.37)	0.73 (-0.30, 1.76)	1.59*** (0.70, 2.49)	1.41** (0.56, 2.26)
<i>R</i> ²	0.02	0.02	0.2	0.19	0.16	0.14
<i>Adjusted R</i> ²	-0.05	-0.03	0.15	0.15	0.1	0.09
<i>F</i> Statistic	0.35	0.41	3.54*	4.46**	2.64*	3*
<i>df</i>	(4; 55)	(3; 56)	(4; 55)	(3; 56)	(4; 54)	(3; 55)

Note:

[†]p<0.1; *p<0.05; **p<0.01; ***p<0.001

Table 2 Models 7 & 8 on each religious imagery prime separately. Traditional Prime shows the largest effects of perceived uncertainty, with uncertainty reducing offers to distant others when the Bible God is believed to be neither punitive nor forgiving. Significant interactions in both Christian and Traditional primes show opposite effects. When making allocations around Christian imagery, those who are more certain about their future resources give more to distant others as the Bible God is seen as more punishing. When allocating around Traditional imagery, belief that Bible God is punishing predicts lower offers to distant others among those who are highly uncertain about future resources. Estimates show b with (.95CI).

3.2. Interview Analysis

Given the lack of strong effects detected in the above regression analyses, the next phase of analysis focuses on qualitative answers provided as open-ended responses following the experiment. The text analysis procedure below is used to remove researcher opinion from interpreting any patterns in the data. Instead, the goal is to allow patterns that might be present to emerge for further interpretation in the research process. Open-ended questions were explored using text mining techniques described in Silge and Robinson (2018).⁸ The goal of this analysis section is to avoid imposing expectations on what the interviews might say, instead exploring patterns that may emerge across the answers. The first look at this data focuses on finding common pairs of words across to detect any emergent themes that might be present. Table 3 shows the top 10 pairs of words used for each of the five questions – these word pair frequencies suggest that these were the most important concepts evoked in the interview. Wind strength and effects on the houses were most salient in people's retelling of the event (perhaps not surprising given the event was a cyclone), and participants reported thinking most about their family, children, and their house. Sharing equally was salient in participants' answers to what the game reminded them of in real life; when asked what stuck out to them in the interview questions, the most common answer was the salience of food insecurity/ rising cost of food; finally, when asked what the game decision means to them, the most common answers were about sharing equally, loving, and caring for each other.

The next look at this data examines whether there are qualitative differences in how people respond to these questions based upon the imagery primes or on what allocation they decided upon for self and other. If so, these differences may point to differences in how concepts are activated within these conditions of the experiment. Because Christianity is so important in daily iTaukei Fijian life, belief in the Christian God may have had a general effect regardless of imagery condition. Looking for references to God in the answers across imagery conditions might serve as a manipulation check to see whether and how thoughts of God might be activated across the imagery conditions. In recollections of the event, there were 0 references to God in the Neutral prime, 3 (5% of the sample) in Christian, and 6 (10% of the sample) in Traditional. The Christian prime answers discussed God as a source of strength. Interestingly, of the 6 references in the Traditional prime, 5 discussed God's overwhelming power and might. When describing what they felt and thought, 10 reference God in the Neutral prime, 4 in the Christian (only 1 referenced God in their event recollection), and 7 in the Traditional prime. In the Neutral prime, half referenced God's power/ need for repentance while the other half referenced God as a source of peace and protection. Three Christian prime answers cite God as a source of comfort, while the 4th indicated a reminder to worship. Five Traditional prime references discussed God as a punisher/ judge, while the remaining 2 discussed closeness to/ support from God. God is referenced 2 times in the real life implications in Neutral and only once in Christian; God is not referred to at all in subsequent answers. Finally, to hint at the possible efficacy of using sugar as the game stakes, there are also 7 references to diabetes in the real life implications and game decision questions.

One might wonder whether participants answered differently depending on the religious imagery condition they were assigned to or whether they gave more to the recipient, the self, or gave equally. To test this, analyses next looked for possible differences in word use patterns across religious imagery conditions, as well as patterns of word use across allocation distributions. Two latent Dirichlet allocation (LDA) analyses were conducted to assess

⁸ All data and study analyses can be found online at ([Author] 2018). Interviews were conducted in Standard Fijian; original Fijian answers and English translations available with study data.

whether 1) religion primes or 2) allocation distribution (defined as more to self = S, equal = E, more to other = O) led to different patterns of responses. The topic parameter k was set to 3 to model topics for the 3 primes or allocation distribution categories in either analysis. Neither of the LDA analyses indicated markedly different topics for any questions, except in the question asking participants what the game decision reminded them of in real life. Those who allocated more to themselves answered differently to those who gave away equal or more to the other. The computer-generated category was able to correctly assign more than half of those words, indicating some uniqueness to answers given by participants allocating more to themselves. Figure 5 shows the network of the Item Frequency-Inverse Document Frequency (IF-IDF, a measure of word distinctiveness within a body of text) for decision answers by allocation category. . While there is substantial overlap across these answers indicating that there are not strong differences across the conditions, there are some words that emerge in stronger association with certain allocation patterns. More-to-self allocations are more distinguished by words like “worry (*leqataka*),” “mine (*mequ*),” and “themselves (*o koya/ mena*).” This may indicate that those who were inclined to keep more for themselves also had an underlying activation of worry or sense of insecurity or scarcity. On the other hand, equal and more-to-other allocations are associated with words like “loving (*loloma*),” “care (*lomani/ nanumi/ dauqarauna* = lit “a person who is emptied out”),” “church (*lotu*),” and avoiding being “greedy (*kocokoco*).” This does provide some hint that a difference in self-reported explicit motivation might underlie different allocation patterns, though this might not track distinctly with the different imagery prime condition

Cyclone Questions

<u>Happened word pairs</u>				<u>Felt word pairs</u>			
Rank	item1	item2	n	item1	item2	n	
1	strong	wind	83	thinking	house	13	
2	house	wind	71	thinking	family	10	
3	house	cyclone	58	thinking	children	8	
4	house	strong	56	house	children	7	
5	cyclone	strong	53	house	blown	5	
6	cyclone	wind	52	thinking	god	4	
7	wind	blown	50	fear	house	4	
8	house	blown	43	fear	mind	4	
9	house	water	40	thinking	mind	4	
10	wind	water	39	house	mind	4	
Total word pairs N			12,641	Total word pairs N			1,242

Post-Game Questions

Real Life word pairs							Interview word pairs						Decision word pairs		
Rank	item1	item2	n		item1	item2	n			item1	item2	n			
1	share	equally	23		question	cyclone	50			life	sharing	14			
2	sugar	teaspoons	13		food	cyclone	46			life	caring	10			
3	shared	equally	12		cyclone	questions	36			life	loving	10			
4	sugar	equally	11		food	questions	28			sharing	equally	7			
5	sharing	equally	9		question	food	26			caring	loving	7			
6	teaspoons	two	9		food	lack	20			spirit	loving	7			
7	equally	distributed	8		sugar	cyclone	19			distribution	equally	5			
8	share	sugar	6		cyclone	lack	14			equally	distributed	5			
9	equal	distribution	6		price	increase	13			caring	spirit	5			
10	sugar	two	6		food	sugar	13			caring	heart	5			
Total word pairs N			387		Total word pairs N		454			Total word pairs N		294			

4. Discussion

The prediction that reminders of material uncertainty would reduce offers to others was not supported; if anything, the context of reminders of catastrophic storms may have activated sharing networks that villagers rely on for survival in such hard times. While it is possible that a true difference in preference for sharing in this dictator game may be smaller than the current sample size could detect, this study found no evidence for insecurity reducing offers and no evidence for sizable differences in offers based on religious imagery. The effects of religious imagery primes similarly did not seem to depend on whether insecurity was salient in the dictator game, but there is limited support for a moderation effect of individual perceptions of material uncertainty on how much beliefs about the Christian Bible God's forgiveness or punishment influence game offers. Belief in Bible God punishment predicted more giving to distant others when participants are highly *uncertain* about future resources in the Traditional imagery condition, while the Christian imagery condition showed the opposite effect. This difference in direction of Christian and Traditional belief effects has been reported in other studies with this population (McNamara and Henrich 2017a; McNamara, Norenzayan, and Henrich 2016), with implications further discussed below.

While this study was initially motivated by a set of theory-driven predictions, lack of strong support for these predictions motivated a further look at the qualitative data within this study to explore dynamics not captured in the initial theoretical approach. An analysis of interview questions perhaps shed some light into what is driving these imagery condition results: the Christian imagery condition may have evoked a comforting and supportive God, while priming Traditional concepts may evoke a more punitive and judgmental God. This authoritarian God is in line with Traditional beliefs about ancestors as harsh and potentially malevolent, while the caring/ supportive God may be a feature of modern Protestant Christianity (Exline 2008; Garcia 2015; Wright 2009; Armstrong 1993; Finke and Stark 2005).

4.1. Implications and Limitations

If any effect of the predicted patterns is present in the data, it is subtle. Given the mediocre effects shown here, these should be interpreted with caution. At the least, this may indicate that the dynamics at play are different to those that initiated the motivation for the study in the first place. The dependency between belief and uncertainty has been found in previous studies with this population (McNamara and Henrich 2017a; McNamara, Norenzayan, and Henrich 2016). In a different economic game that allowed for subtle favouritism, the Traditional imagery used in this study was associated with more giving to local than distant social others (McNamara and Henrich 2017a). This suggests traditional iTaukei beliefs are situated to sustain local rather than more distant social cooperation networks. Participants who were more uncertain about their resources and who reported more belief in God's punishment were more likely to give rather than keep sugar in this study, which may partly be explained by references to God's authoritarian nature as evidenced in the interview questions. On the other hand, the Christian imagery condition showed the opposite effect, and was also associated with more interview answers that suggested God's supportive nature. This may hint at the underlying effect of image of God evoked in the game may influence giving or holding on to resources (Shariff and Norenzayan 2011).

The rate of equal distribution between self and other is higher than previous dictator games with this population (Henrich et al. 2010), though previous games were played with money. Other games played in these communities show higher rates of allocations to self and in-group than out-group (McNamara and Henrich 2017a; McNamara, Norenzayan, and Henrich 2016). Contrary to predictions that insecurity reduces offers to distant others,

European samples have shown negative mood framing effects can increase dictator game offers (Pérez-Dueñas et al. 2018), but this finding would not explain the lack of difference between the insecurity priming conditions found in the current study.

Another shortcoming of the game may stem from using tokens instead of real items – all previous economic game studies in these populations used actual items for game allocations (Gervais 2017; Henrich et al. 2010; McNamara and Henrich 2017a; McNamara and Henrich 2017b; Hruschka et al. 2014; House et al. 2013). While the stakes in this game were not hypothetical, the use of tokens rather than discrete units of sugar may have made game play feel hypothetical; cultural differences in tendencies toward abstract thinking might make token-based allocations seem less real (Buchtel and Norenzayan 2009; Scribner and Cole 1973). However, game play with other populations does not find a difference between hypothetical and real stakes in delay discounting or risk aversion *except* when the stakes are high or there is immediate negative feedback (Locey, Jones, and Rachlin 2011; Xu et al. 2016).

Instead, using sugar as the allocated resource may be perceived as lower-stakes than money, making people less worried about giving it away. Post-game interviews referred to sugar as an unhealthy food choice that could cause or aggravate conditions like diabetes. Obesity, diabetes, heart disease, and stroke are common ailments around the Pacific; much of the mortality and morbidity of these diseases stems from increasing reliance on market-acquired foods over traditionally cultivated and prepared foods (Campbell 2014; Hughes and Lawrence 2005). Interviews revealed references to diabetes and blood pressure that indicate knowledge about good and bad food choices, but access to healthy foods may be constrained by environmental and economic issues (Tapera, Harwood, and Anderson 2017).

Alternatively, the results may be a reflection of food-sharing rather than money-sharing norms. Giving freely – especially food – may be a value that bridges ecological hazards. A common greeting around the village is: “*Mai, kana* (come eat).” Following Cyclone Evan, these communities received shipments of rice, flour, sugar, and non-perishable proteins (tinned meats, dried dahl, dried milk) from the Fijian government, Non-Governmental Organizations, and the author’s research collaborators. Game decisions made with actual parcels of flour, rice, or tinned meats might directly evoke disaster relief support, which might directly tap sharing networks beyond local kin ties. One might further speculate that slightly different food sharing norms might be evoked in a game played with allocations of kinds of food stuffs. For example, traditional starchy staples like *uvi* (yams) or *tavioka* (cassava) are commonly shared within villages, which may tap local food sharing norms. Other ceremonial foods like pig may tap yet another set of traditional networks of more distal food sharing across the archipelago. Further study is needed to determine whether this is the case, and to address additional questions regarding how different religious traditions might interact with type of food and sharing and disaster relief (Gillard and Paton 1999).

4.2. Future Directions

Though this study set out to test one set of cultural evolutionary and cognitive science of religion hypotheses, the results hint at different dynamics at play. These dynamics may be more in line with the food sharing and risk management practices common in many traditional and Indigenous communities. Future research should explore how people in communities like the participating Yasawan villages called upon religious cosmological explanatory frameworks to deal with existential shocks like natural disasters. One pattern warranting further investigation is the suggestion here that a forgiving Christian God might boost giving in the perception of uncertainty. Some psychological work suggest that, while a punishing god may promote more rule following, a forgiving god may be more inclined to boost generosity (K. A. Johnson, Cohen, and Okun. 2016; McNamara & Purzycki, in press).

Importantly, the evolutionary dynamics of these systems unfold over time. Patterns observed here in participating communities are evidence of evolution happening in real time; traditional and introduced beliefs are actively being negotiated in the brains of believers, possibly motivating opposite responses. Future research would enhance this work by adding more formal theoretical modelling using adaptive dynamical approaches to examine where equilibria exist in these actively changing environments, as it appears these communities are in the point of this flux. As communities with deep ecological traditions grow and change to be a part of the modern world, further insight into the protective and resilience factors afforded by retaining tradition as well as flexibility to adopt new practices would be of huge benefit to the world as we face an impending climate crisis (Haluza-DeLay 2014).

5. Conclusion

The current study makes preliminary steps toward examining how different belief systems might impact giving beyond local communities. It also suggests that different kinds of resources, like money or food, may have different sharing norms with different giving preferences in the structured experimental situation of an economic game. Perhaps most importantly, the high rates of sharing and qualitative results around participant's experiences of sharing in times of disaster speak to how belief systems underlie social structures leading to community resilience. The traditional social networks and beliefs in these Indigenous iTaukei communities may provide an essential asset to support their survival in an increasingly insecure climate.

References

- Aktipis, C Athena, Lee Cronk, and Rolando Aguiar. 2011. "Risk-Pooling and Herd Survival: an Agent-Based Model of a Maasai Gift-Giving System." *Human Ecology* 39 (2): 131–40. doi:10.1007/s10745-010-9364-9.
- Armstrong, Karen. 1993. *A History of God*. New York: Ballantine.
- Arno, Andrew. 2005. "'Cobo" and 'Tabua' in Fiji: Two Forms of Cultural Currency in an Economy of Sentiment." *American Ethnologist* 32 (1). American Anthropological Association: 46–62. doi:10.2307/3805149?ref=no-x-route:4dc249baabd20c39418204c223103f66.
- Baba, Tupeni L, Emitai L Boladuadua, Tevita Ba, Wasevina V Vatuloka, and Unaisi Nabobo-Baba. 2013. *Na Vuku Ni Vanua- Wisdom of the Land: Aspects of Fijian Knowledge, Culture and History*. Vol. 1. Suva, Fiji: Native Academy Publishers, Institute of Indigenous Studies.
- Bateson, M, D Nettle, and G Roberts. 2006. "Cues of Being Watched Enhance Cooperation in a Real-World Setting." *Biology Letters* 2 (3): 412–14. doi:10.1098/rsbl.2006.0509.
- Berkes, Fikret, Johan Colding, and Carl Folke. 2000. "Rediscovery of Traditional Ecological Knowledge as Adaptive Management." *Ecological Applications* 10 (5). Wiley-Blackwell: 1251–62.
- Bird, R Bliege, D W Bird, and Eric A Smith. 2002. "Risk and Reciprocity in Meriam Food Sharing." *Evolution and Human Behavior* 23: 297–321.
- Bollig, Michael. 2006. *Risk Management in a Hazardous Environment: a Comparative Study of Two Pastoral Societies*. Edited by Daniel G Bates. New York: Springer.
- Botero, Carlos A, Beth Gardner, Kathryn R Kirby, Joseph Bulbulia, Michael C Gavin, and Russell D Gray. 2014. "The Ecology of Religious Beliefs." *Proceedings of the National Academy of Sciences of the United States of America* 111 (47). National Academy of Sciences: 16784–89. doi:10.1073/pnas.1408701111.
- Brady, Ivan A. 1972. "Kinship Reciprocity in the Ellice Islands: an Evaluation of Sahlins' Model of the Sociology of Primitive Exchange." *The Journal of the Polynesian Society* 81 (3). Polynesian Society: 290–316. doi:10.2307/20704865?refreqid=search-gateway:0617392eb1f009a4baa0ea2c2a488514.
- Brison, K J. 2001. "Crafting Sociocentric Selves in Religious Discourse in Rural Fiji." *Ethos* 29 (4). Wiley Online Library: 453–74.
- Brison, Karen J. 2007a. *Our Wealth Is Loving Each Other: Self and Society in Fiji*. Lanham, MD: Lexington Books.
- Brison, Karen J. 2007b. "The Empire Strikes Back: Pentecostalism in Fiji." *Ethnology* 46 (1). University of Pittsburgh- Of the Commonwealth System of Higher Education: 21–39. doi:10.2307/20456609?ref=search-gateway:b92a740076d0eced0755432ccca09a88.
- Bryant-Tokalau, Jenny. 2018. *Indigenous Pacific Approaches to Climate Change: Pacific Island Countries*. Cham, Switzerland: Palgrave Macmillan.
- Bryant-Tokalau, Jenny, and John Campbell. 2014. "Coping with Floods in Urban Fiji." In *Disaster Relief in the Asia Pacific: Agency and Resilience*, edited by Minako Sakai, Edwin Jurriëns, Jian Zhang, and Alec Thornton, 123. New York, NY, USA.
- Buchtel, Emma E, and Ara Norenzayan. 2009. "Thinking Across Cultures: Implications for Dual Processes." In *In Two Minds: Dual Processes and Beyond*, edited by Jonathan St B T Evans and Keith Frankish, 217–38. Oxford, UK: Oxford University Press.
- Campbell, John. 2009. "Islandness: Vulnerability and Resilience in Oceania." *Shima the International Journal of Research Into Island Cultures* 3 (1).
- Campbell, John Richard. 2014. "Development, Global Change and Traditional Food Security in Pacific Island Countries." *Regional Environmental Change* 15 (7). Springer Berlin Heidelberg: 1313–24. doi:10.1007/s10113-014-0697-6.

- Chudek, Maciej, and Joseph Henrich. 2011. "Culture-Gene Coevolution, Norm-Psychology and the Emergence of Human Prosociality.." *Trends in Cognitive Sciences* 15 (5). Elsevier Ltd: 218–26. doi:10.1016/j.tics.2011.03.003.
- Cretton, Viviane. 2005. "Traditional Fijian Apology as a Political Strategy." *Oceania* 75 (4): 403–17. doi:10.1002/j.1834-4461.2005.tb02899.x.
- Exline, J J. 2008. "Beliefs About God and Forgiveness in a Baptist Church Sample.." *Journal of Psychology and Christianity*.
- Farrelly, T, and A T Vudiniabola. 2013. "Kerekere and Indigenous Social Entrepreneurship." *SITES: Journal of Social Anthropology and Cultural Studies* 10 (2): 1–29.
- Faul, Franz, Edgar Erdfelder, Axel Buchner, and Albert-Georg Lang. 2009. "Statistical Power Analyses Using G*Power 3.1: Tests for Correlation and Regression Analyses." *Behavior Research Methods* 41 (4): 1149–60. doi:10.3758/brm.41.4.1149.
- Fincher, C L, and R. Thornhill. 2012. "Parasite-Stress Promotes in-Group Assortative Sociality: the Cases of Strong Family Ties and Heightened Religiosity." *Behavioral and Brain Sciences* 39 (2-3). Behavioral and Brain Sciences: 155–60. <http://journals.cambridge.org/action/search?searchType=CITEADVANCE&journals=BB&S&volume=35&issue=02&page=61&author=Fincher&year=2012>.
- Finke, Roger, and Rodney Stark. 2005. *The Churching of America 1776-2005: Winners and Losers in Our Religious Economy*. New Brunswick, NJ: Rutgers University Press.
- Foster, Kevin R, Tom Wenseleers, and Francis L W Ratnieks. 2006. "Kin Selection Is the Key to Altruism.." *Trends in Ecology & Evolution* 21 (2): 57–60. doi:10.1016/j.tree.2005.11.020.
- Fox, John, and Harvey Sanford Weisberg. 2011. *An R Companion to Applied Regression*. 2nd ed. Thousand Oaks, CA: SAGE Publications.
- Garcia, Hector A. 2015. *Alpha God: the Psychology of Religious Violence and Oppression*. Amherst, NY: Prometheus Books.
- Gelfand, Michele J, Lisa H Nishii, and Jana L Raver. 2006. "On the Nature and Importance of Cultural Tightness-Looseness.." *The Journal of Applied Psychology* 91 (6): 1225–44. doi:10.1037/0021-9010.91.6.1225.
- Gervais, Matthew M. 2017. "RICH Economic Games for Networked Relationships and Communities: Development and Preliminary Validation in Yasawa, Fiji." *Field Methods* 29 (2): 113–29. doi:10.1177/1525822X16643709.
- Gillard, Matt, and Douglas Paton. 1999. "Disaster Stress Following a Hurricane: the Role of Religious Differences in the Fijian Islands." *Australasian Journal of Disaster and Trauma Studies* 24 (2).
- Haluza-DeLay, Randolph. 2014. "Religion and Climate Change: Varieties in Viewpoints and Practices." *Wiley Interdisciplinary Reviews: Climate Change* 5 (2): 261–79. doi:10.1002/wcc.268.
- Henrich, Joseph. 2015. *The Secret of Our Success: How Culture Is Driving Human Evolution, Domesticating Our Species, and Making Us Smarter*. Princeton, NJ: Princeton University Press.
- Henrich, Joseph, Jean Ensminger, Richard McElreath, Abigail Barr, Clark Barrett, Alexander Bolyanatz, Juan Camilo Cardenas, et al. 2010. "Markets, Religion, Community Size, and the Evolution of Fairness and Punishment." *Science* 327 (5972): 1480–84. doi:10.1126/science.1182238.
- Hlavac, M. 2018. "Stargazer: Well-Formatted Regression and Summary Statistics Tables. ." Bratislava, Slovakia. <https://CRAN.R-project.org/package=stargazer>.
- Hocart, A M. 1912. "On the Meaning of Kalou and the Origin of Fijian Temples.." *The Journal of the Royal Anthropological Institute of Great Britain and Ireland* 42 (July). Royal Anthropological Institute of Great Britain and Ireland: 437–49.

- Honaker, J, G King, and M Blackwell. 2006. "Amelia II: a Program for Missing Data."
- House, Bailey R, Joan B Silk, Joseph Henrich, H Clark Barrett, Brooke A Scelza, Adam H Boyette, Barry S Hewlett, Richard McElreath, and Stephen Laurence. 2013. "Ontogeny of Prosocial Behavior Across Diverse Societies.." *Proceedings of the National Academy of Sciences* 110 (36): 14586–91. doi:10.1073/pnas.1221217110.
- Hruschka, Daniel J, Charles Efferson, Ting Jiang, Ashlan Falletta-Cowden, Sveinn Sigurdsson, Rita A McNamara, Madeline Sands, Shirajum Munira, Edward Slingerland, and Joseph Henrich. 2014. "Impartial Institutions, Pathogen Stress and the Expanding Social Network.." *Human Nature* 25 (4): 567–79. doi:10.1007/s12110-014-9217-0.
- Hughes, Robert G, and Mark A Lawrence. 2005. "Globalisation, Food and Health in Pacific Island Countries." *Asia Pacific Journal of Clinical Nutrition* 14 (4): 298–306.
- Jaeggi, Adrian V, and Michael Gurven. 2013. "Reciprocity Explains Food Sharing in Humans and Other Primates Independent of Kin Selection and Tolerated Scrounging: a Phylogenetic Meta-Analysis.." *Proceedings of the Royal Society B: Biological Sciences* 280 (1768): 20131615–15. doi:10.1098/rspb.2013.1615.
- Janif, Shaiza Z, Patrick D Nunn, Paul Geraghty, William Aalbersberg, Frank R Thomas, and Mereoni Camailakeba. 2016. "Value of Traditional Oral Narratives in Building Climate-Change Resilience: Insights From Rural Communities in Fiji." *Ecology and Society* 21 (2): art7. doi:10.5751/es-08100-210207.
- Johnson, Dominic D P, and O Krüger. 2004. "The Good of Wrath: Supernatural Punishment and the Evolution of Cooperation." *Political Theology* 5 (2): 159–76.
- Johnson, Kathryn A, Adam B Cohen, and Morris A Okun. 2016. "God Is Watching You...but Also Watching Over You: the Influence of Benevolent God Representations on Secular Volunteerism Among Christians.." *Psychology of Religion and Spirituality* 8 (4): 363–74. doi:10.1037/rel0000040.
- Katz, Richard. 1999. *The Straight Path of the Spirit: Ancestral Wisdom and Healing Traditions in Fiji*. Rockester, VT: Park Street Press.
- Kline, Michelle A, Robert Boyd, and Joseph Henrich. 2013. "Teaching and the Life History of Cultural Transmission in Fijian Villages.." *Human Nature* 24 (4): 351–74. doi:10.1007/s12110-013-9180-1.
- Lansing, J Stephen, and Thérèse A Vet. 2012. "The Functional Role of Balinese Water Temples: a Response to Critics." *Human Ecology* 40 (3): 453–67. doi:10.1007/s10745-012-9469-4.
- Locey, Matthew L, Bryan A Jones, and Howard Rachlin. 2011. "Real and Hypothetical Rewards in Self-Control and Social Discounting." *Judgment and Decision Making* 6 (6): 552–64.
- Lüdecke, Daniel. 2018. "sjPlot - Data Visualization for Statistics in Social Science.," July. doi:10.5281/zenodo.1310947.
- McNamara, Rita A, and Joseph Henrich. 2017a. "Jesus vs. the Ancestors: How Specific Religious Beliefs Shape Prosociality on Yasawa Island, Fiji ." *Religion, Brain & Behavior* 39 (2): 1–20. doi:10.1080/2153599X.2016.1267030.
- McNamara, Rita A, and Joseph Henrich. 2017b. "Kin and Kinship Psychology Both Influence Cooperative Coordination in Yasawa, Fiji." *Evolution and Human Behavior* 38 (2): 197–207. doi:10.1016/j.evolhumbehav.2016.09.004.
- McNamara, Rita A, Ara Norenzayan, and Joseph Henrich. 2016. "Supernatural Punishment, in-Group Biases, and Material Insecurity: Experiments and Ethnography From Yasawa, Fiji." *Religion, Brain & Behavior* 6 (1): 34–55.
- McNamara, Rita A. & Benjamin G Purzycki, (in press) Minds of Gods and Human Cognitive Constraints: Socio-ecological context shapes belief. *Religion, Brain and Behavior*.

- Mesoudi, Alex, and Alex Thornton. 2018. "What Is Cumulative Cultural Evolution?." *Proceedings. Biological Sciences / the Royal Society* 285 (1880). The Royal Society: 20180712. doi:10.1098/rspb.2018.0712.
- Nabobo-Baba, Unaisi. 2006. *Knowing and Learning: an Indigenous Fijian Approach*. Suva, Fiji: Institute of Pacific Studies, University of the South Pacific.
- Newland, Lynda. 2004. "Turning the Spirits Into Witchcraft: Pentecostalism in Fijian Villages." *Oceania* 75 (1). Wiley: 1–18. doi:10.2307/40331952?ref=no-x-route:8803096ac68e19ac17557a7b1b4f42f7.
- Newland, Lynda. 2009. "9. Religion and Politics: the Christian Churches and the 2006 Coup in Fiji." In *The 2006 Military Takeover in Fiji : a Coup to End All Coups?*, edited by Jon Fraenkel, Stewart Firth, and Brij V Lal, 187–207. Canberra, Australia: ANU Press.
- Niukula, P. 1992. *The Three Pillars: the Triple Aspect of Fijian Society*. Christian Writing Project.
- Nolin, David A. 2012. "Food-Sharing Networks in Lamalera, Indonesia: Status, Sharing, and Signaling." *Evolution and Human Behavior* 33 (4). Elsevier Inc.: 1–12. doi:10.1016/j.evolhumbehav.2011.11.003.
- Norenzayan, Ara, Azim F Shariff, Aiyana K Willard, Edward Slingerland, Will M Gervais, Rita A McNamara, and Joseph Henrich. 2014. "The Cultural Evolution of Prosocial Religions." *Behavioral and Brain Sciences* 39 (December): 1–19. doi:10.1017/S0140525X14001356.
- Nowak, Martin A. 2006. "Five Rules for the Evolution of Cooperation.." *Science* 314 (5805): 1560–63. doi:10.1126/science.1133755.
- Pérez-Dueñas, Carolina, M Fernanda Rivas, Olusegun A Oyediran, and Francisco García-Torres. 2018. "Induced Negative Mood Increases Dictator Game Giving." *Frontiers in Psychology* 9 (August). Frontiers: 367. doi:10.3389/fpsyg.2018.01542.
- Purzycki, B G, and Richard H Sosis. 2013. "The Extended Religious Phenotype and the Adaptive Coupling of Ritual and Belief." *Israel Journal of Ecology & Evolution* 59 (2): 99–108. doi:10.1080/15659801.2013.825433.
- Purzycki, Benjamin Grant. 2010. "Spirit Masters, Ritual Cairns, and the Adaptive Religious System in Tyva." *Sibirica* 9 (2): 21–47. doi:10.3167/sib.2010.090202.
- Purzycki, Benjamin Grant, Anne C Pisor, Coren Apicella, Quentin Atkinson, Emma Cohen, Joseph Henrich, Richard McElreath, et al. 2018. "The Cognitive and Cultural Foundations of Moral Behavior." *Evolution and Human Behavior* 39 (5): 490–501. doi:10.1016/j.evolhumbehav.2018.04.004.
- Purzycki, Benjamin Grant, Coren Apicella, Quentin D Atkinson, Emma Cohen, Rita A McNamara, Aiyana K Willard, Dimitris Xygalatas, Ara Norenzayan, and Joseph Henrich. 2016. "Moralistic Gods, Supernatural Punishment and the Expansion of Human Sociality." *Nature* 530 (7590). Nature Research: 327–30. doi:10.1038/nature16980.
- R Development Core Team. 2008. "R: a Language and Environment for Statistical Computing." Vienna, Austria. <http://www.R-project.org>.
- Ravuvu, Asesela. 1983. *Vaka I Taukei: the Fijian Way of Life*. Suva, Fiji: Institute of Pacific Studies of the University of the South Pacific.
- Revelle, W. 2011. "Psych: Procedures for Personality and Psychological Research. ." *Personality-Project.org/R Webpage*. Evanston. November 30. http://www.google.ca/url?sa=t&rct=j&q=psych%20package%20bartlett%20scores&source=web&cd=2&ved=0CCMQFjAB&url=http%3A%2F%2Fcran.r-project.org%2Fweb%2Fpackages%2Fpsych%2Fpsych.pdf&ei=jzzYTtTkD-7RiALc4eyyCg&usq=AFQjCNGz2ilj_I_XKSAZnYeKkg2VmZcl4g&sig2=gDjxT_otpMuIDSd59puAQA.

- Sahlins, Marshal. 1965. "On the Sociology of Primitive Exchange." In, edited by Michael Banton, 139–227. New York: Routledge.
- Sakai, Minako, Edwin Jurriëns, Jian Zhang, and Alec Thornton, eds. 2014. *Disaster Relief in the Asia Pacific: Agency and Resilience*. New York, NY, USA: Routledge.
- Schloss, Jeffrey P, and Michael J Murray. 2011. "Evolutionary Accounts of Belief in Supernatural Punishment: a Critical Review." *Religion, Brain & Behavior* 1 (1): 46–99. doi:10.1080/2153599X.2011.558707.
- Schlossberg, M. 1998. "Kerekere, Hierarchy and Planning in Fiji: Why Cultural Understanding Should Be a Prerequisite to International Planning." In *City, Space and Globalization: an International Perspective*, edited by Hemalata Dandekar, 225–31. Ann Arbor: University of Michigan Press.
- Scribner, S, and M Cole. 1973. "Cognitive Consequences of Formal and Informal Education." *Science* 182 (4112): 553–59.
- Shariff, Azim F, and Ara Norenzayan. 2011. "Mean Gods Make Good People: Different Views of God Predict Cheating Behavior." *International Journal for the Psychology of Religion* 21 (2): 85–96. doi:10.1080/10508619.2011.556990.
- Shariff, Azim F., Aiyana K. Willard, T. Anderson, & Ara Norenzayan. 2016. "Religious Priming: A Meta-Analysis With a Focus on Prosociality." *Personality and Social Psychology Review* 20 (1): 27–48. doi:10.1177/1088868314568811
- Shaver, John H. 2015. "The Evolution of Stratification in Fijian Ritual Participation." *Religion, Brain & Behavior* 5 (2). Taylor & Francis: 101–17. doi:10.1080/2153599X.2014.893253.
- Silge, Julia, and David Robinson. 2018. *Text Mining with R: a Tidy Approach*. Sebastopol, CA, USA: O'Reilly.
- Snarey, John. 1996. "The Natural Environment's Impact Upon Religious Ethics: a Cross-Cultural Study." *Journal for the Scientific Study of Religion* 35 (2): 85–96. doi:10.2307/1387077.
- Sosis, Richard H, and Candace Alcorta. 2003. "Signaling, Solidarity, and the Sacred: the Evolution of Religious Behavior." *Evolutionary Anthropology: Issues, News, and Reviews* 12 (6): 264–74. doi:10.1002/evan.10120.
- Tapera, Rachel, Matire Harwood, and Anneka Anderson. 2017. "A Qualitative Kaupapa Māori Approach to Understanding Infant and Young Child Feeding Practices of Māori and Pacific Grandparents in Auckland, New Zealand." *Public Health Nutrition* 20 (6). Cambridge University Press: 1090–98. doi:10.1017/S1368980016002950.
- Thomson, BH. 1895. "The Kalou-Vu (Ancestor-Gods) of the Fijians." *The Journal O F the Anthropological Institute O F Great Britain and Ireland* 24: 340–59.
- Tomlinson, Matt. 2002. "Sacred Soil in Kadavu, Fiji." *Oceania* 72 (4): 237–57. doi:10.1002/j.1834-4461.2002.tb02794.x.
- Tomlinson, Matt. 2004. "Ritual, Risk, and Danger: Chain Prayers in Fiji." *American Anthropologist, New Series* 106 (1). American Anthropological Association: 6–16.
- Toren, Christina. 2004. "Becoming a Christian in Fiji: an Ethnographic Study of Ontogeny." *Journal of the Royal Anthropological Institute* 10 (3): 221–40.
- Toren, Christina, and Simonne Pauwels, eds. n.d. *Living Kinship in the Pacific*. New York, NY, USA: Berghahn.
- Van de Vliert, E. 2011. "Climato-Economic Origins of Variation in Ingroup Favoritism." *Journal of Cross-Cultural Psychology* 42 (3): 494–515. doi:10.1177/0022022110381120.
- van der Grijp, Paul. 2007. "Tabua Business: Re-Circulation of Whale Teeth and Bone Valuables in the Central Pacific." *The Journal of the Polynesian Society* 116 (3). The Polynesian Society: 341–56. doi:10.2307/20707401?ref=no-x-route:ce4b67be2778f5eec0f8b5e7a59bfbc.

- Watts, J, S J Greenhill, and M D Lieberman. 2015. "Broad Supernatural Punishment but Not Moralizing High Gods Precede the Evolution of Political Complexity in Austronesia." *Proceedings of the Royal Society B* 282: 1–7.
- Watts, Joseph, Oliver Sheehan, Joseph Bulbulia, Russell D Gray, and Quentin D Atkinson. 2018. "Christianity Spread Faster in Small, Politically Structured Societies." *Nature Human Behaviour* 2 (8). Nature Publishing Group: 559–64. doi:10.1038/s41562-018-0379-3.
- Wright, Robert. 2009. *The Evolution of God*. New York: Little, Brown and Company.
- Xu, Sihua, Yu Pan, You Wang, Andrea M Spaeth, Zhe Qu, and Hengyi Rao. 2016. "Real and Hypothetical Monetary Rewards Modulate Risk Taking in the Brain." *Scientific Reports* 6 (1). Nature Publishing Group: 29520. doi:10.1038/srep29520.
- 2018a. "'It Came Out of Nowhere' Cyclone Keni Wreaks Havoc on Kadavu." *Radionz.Co.Nz*. April 10. <https://www.radionz.co.nz/international/pacific-news/354717/it-came-out-of-nowhere-cyclone-keni-wreaks-havoc-on-kadavu>.
- 2018b. "NASA Finds Tropical Cyclone Keni Dropped Heavy Rain on Fiji, Direct Hit to Kadavu." *Phys.org*. April 12. <https://phys.org/news/2018-04-nasa-tropical-cyclone-keni-heavy.html>.