Religion, Brain & Behavior
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/rrbb20

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Available online: 17 Aug 2011

To cite this article: Pierrick Bourrat, Quentin D. Atkinson & Robin I.M. Dunbar (2011): Supernatural punishment and individual social compliance across cultures, Religion, Brain & Behavior, DOI:10.1080/2153599X.2011.598325

To link to this article: http://dx.doi.org/10.1080/2153599X.2011.598325

Religion, Brain & Behavior
2011, 1–16, iFirst article

Supernatural punishment and individual social compliance across cultures

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Cooperation for the public good is vulnerable to exploitation by free-riders because it always pays individuals to exploit the social contract for their own benefit. This problem can be resolved if free-riders are punished, but punishment is itself a public good subject to free-riding. The fear of supernatural punishment hypothesis (FSPH) proposes that belief in supernatural punishment might offer a solution to this problem by deflecting the cost of punishment onto supernatural forces and thereby incentivizing cooperation. FSPH is supported empirically by ethnographic data, but this work has so far focused on (1) institutional cooperative traits which may not reflect individual choices on how to behave in everyday social interactions and (2) threat of punishment from all-powerful moralizing high gods rather than other agents capable of supernatural punishment. Here, we consider the FSPH using variables which are linked to individual interaction and expand the number of variables measuring belief in different forms of supernatural punishment. Our findings do not fit these more general FSPH predictions. We suggest there may be something special about the link between moralizing high gods and institutional enforcement of cooperation that is not captured by these other variables.

Keywords: religion; supernatural beliefs; prosociality; cooperation; supernatural punishment; SCCS

Introduction

Recently, there has been increasing interest in the role played by religion in the origin and evolution of human cooperation and prosociality (Alcorta & Sosis, 2005; Atkinson & Bourrat, 2011; Dunbar, 2009; Johnson, 2005; Johnson & Bering, 2009; Johnson & Krüger, 2004; Monsma, 2007; Norenzayan & Shariff, 2008; Pyysiäinen & Hauser, 2010; Richerson & Boyd, 1998; Roes & Raymond, 2003; Rossano, 2007; Ruffle & Sosis, 2007; Snarey, 1996; Sosis & Alcorta, 2003; Wilson, 2002). While some theories argue that religion is simply a cultural parasite (Blackmore, 1999; Dawkins, 1976; Dennett, 2006) or evolutionary by-product of other adaptive processes (Atran, 2002; Barrett, 2000; Boyer, 2001; Guthrie, 1993; Pyysiäinen & Hauser, 2010), others see it as providing individual fitness advantages by guarding against free-riding and facilitating group cohesion, cooperation, and trust (Alcorta & Sosis, 2005; Atkinson & Bourrat, 2011; Dunbar, 2008, 2009; Johnson, 2005; Johnson & Bering, 2009;

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ISSN 2153-599X print/ISSN 2153-5981 online

DOI: 10.1080/2153599X.2011.598325
http://www.tandfonline.com

Johnson & Krüger, 2004; Richerson & Boyd, 1998; Sosis & Alcorta, 2003; Sosis, Kress, & Boster, 2007; Wilson, 2002).

The fear of supernatural punishment hypothesis (FSPH) is one of the latter theories and is the focus of the present article. This theory, defended by Bering, Johnson, and Krüger (Johnson, 2005; Johnson & Bering, 2009; Johnson & Krüger, 2004), proposes that belief in supernatural agents could be adaptive at the individual level and promote cooperation. The FSPH as presented by Johnson and Bering (Johnson, 2005; Johnson & Bering, 2009) is proposed to arise from two cognitive mechanisms: a "Hypersensitive Agency Detection Device" (HADD) (Barrett, 2000, 2004) and a "Theory of Mind" module (ToM) (Premack & Woodruff, 1978). These two mechanisms are proposed to be responsible for widespread belief in supernatural invisible agents (Boyer, 2001). To these mechanisms, Johnson and Bering add a reputation-management dimension arising as a result of human language, which makes beliefs in supernatural punishing agents possibly evolutionarily advantageous.

The idea of HADD derives from Guthrie's argument according to which humans have a bias towards detecting human-like agency which might not actually exist (Guthrie, 1993). According to Guthrie, such a biased perceptual device would have been quite adaptive in our evolutionary past (Barrett, 2000): for example, failing to notice the presence of an enemy nearby may lead to death, whereas wrongly detecting one when none is present would have only a limited cost. Hence, there is an asymmetric cost in failing to detect an agent (false negative) as opposed to mistakenly detecting an agent when there is none (false positive). Selective pressures are thus expected to be stronger in reducing false negatives compared to false positives. Theory of Mind (ToM) is defined as the capacity of an individual to impute mental states in others (Premack & Woodruff, 1978). Once an agent is detected, an individual will incur a selective advantage if he is able to simulate mental states in this agent, and so predict the agent's future behavior. As a result of natural selection, humans possess what Bering calls an "intentionality system" (Bering, 2002). As a by-product of our cognitive capacities, the same phenomenon appears when supernatural agents are detected by HADD: once they are identified, an individual will assign mental states and intentionality to them. Language, the third ingredient in the FSPH, is critical in human cooperation and social life for facilitating the spread of reputational information. In an environment where there is no means of communicating information of the type "who did what," the existence of reputation is limited to directly observed behaviors. Language makes reputational information available indirectly to future potential cooperators. The importance of maintaining a good reputation makes free-riding less advantageous. As a result, a "new" selection pressure emerges that makes cooperation evolutionarily advantageous as the balance between the cost and benefit of cooperation becomes positive.

Invisible supernatural agents (e.g., ghosts, ancestors, deities) can be thought of as HADD's "false positives" and, by virtue of being detected as agents, as having minds and mental states due to ToM stimulation. FSPH predicts that individuals who believe that supernatural agents are willing to punish individuals who break moral norms or do not cooperate will gain a less damaged reputation over time than individuals who do not. The reason is that, being afraid of potential punishment, these individuals will have a stronger incentive not to break prosocial norms, especially if the norms are established by the supernatural agent itself. FSPH is also a solution to the problem of "second-order" free-riding in the group. As cooperation is vulnerable to exploitation by free-riders, a way of dealing with this vulnerability is to

punish free-riders. However, punishing is itself both a cost that must be borne by members of the group and a public good subject to exploitation, resulting in the problem of "second-order" free-riding. Johnson and Bering propose that belief in supernatural punishment might be a solution to these two problems by deflecting the cost of punishment onto supernatural agents.

FSPH finds some empirical support from ethnographic data (Johnson, 2005). Johnson has shown that the presence of moralizing "high gods" – defined as active in human affairs and specifically supportive of human morality (see Table 1) – is associated with various indices of societal cooperation such as taxation, policing, and some (but not all) measures of norm compliance, although only two of these relationships remain significant after controlling for regional effects and influence of classical religions (i.e., the main "world" religions) in general. To the extent that supernatural policing can promote prosocial behavior, belief in a morally concerned deity should be selected for or stabilized in societies where free-riding is more likely to be a problem. Again, cross-cultural evidence is consistent with this claim, with moralizing high gods significantly more likely to occur in larger societies, where enforcement costs are likely to be high (Roes & Raymond, 2003), and in regions of water scarcity, where free-riding may be especially costly to the group (Snarey, 1996). Atkinson and Bourrat (2011), using the World Value Survey across 87 countries, have shown that beliefs in Hell, Heaven, and a personal God (as opposed to a life force or spirit) were associated with stronger self-reported moral condemnation of 14 actions that participants were asked to judge. These correlations held after controlling for region, religion, level of education, and frequency of attendance at religious services. Atkinson and Bourrat propose that FSPH (but non-specific as to agency) explains the differences observed with regards to beliefs in Hell and Heaven, while supernatural monitoring (i.e., the perception of being monitored by a supernatural agent) explains the differences between believers in a personal God as opposed to believers in a life force or spirit.

Belief in invisible supernatural agents is only one modality of the solution proposed by fear of supernatural punishment. Although the theory was developed in the framework of agency and invisibility, invisibility and agency are not, strictly speaking, necessary in the sense that individual humans (who are visible) may have supernatural powers. For instance, many cultures believe that a person with "the evil eye" can cause misfortune to others by gazing on them with feelings of envy. In some cases, they are also thought to cause misfortune involuntarily (see Bowie, 2008). Other examples of beliefs in supernatural human agents include witches and sorcerers. These examples are relevant to the FSPH: if people believe that agents with supernatural powers really exist and can punish others, they might refrain from actions which could potentially provoke individuals with supernatural powers to feel envy, anger, or any other negative emotion toward them. Being non-cooperative, selfish, or careless and breaking social or moral norms are all behaviors which could elicit such emotions. For the present article we will focus on punishments by supernatural agents, but it is possible to extend the theory to domains of supernatural punishment other than conventional god-like agency (e.g., Atkinson & Bourrat, 2011; Johnson & Krüger, 2004).

In the present article, we take another look at the FSPH predictions using the Standard Cross Cultural Sample (SCCS) data. Previous work has focused mainly on large-scale societal measures of collective action (e.g., compliance with social norms, centrally enforced sanctions, willingness to pay taxes) and has not distinguished

Table 1. The different SCCS variables used for testing the three FSPH hypotheses.

Label	Variable	No. SCCS	*n*	Recoded?/structure of recoding	New name	Definition
	High gods	238	168	No		High god: spiritual being who is believed to have created all reality and/or to be its ultimate governor, even though his/her sole act was to create other spirits who, in turn, created or control the natural world.
	Theories of spirit aggression	654	131	No		Spirit aggression: the attribution of illness to the direct hostile, arbitrary, or punitive action of some malevolent or affronted supernatural being.
Fears of punishment by supernatural invisible agents (FPSIA)	Warning: Early boys	449	98	Yes/average between the four variables	Warning	Warning: threats of punishment by supernatural beings or strangers.
	Warning: Early girls	450				
	Warning: Late boys	451				
	Warning: Late girls	452				
	Theories of sorcery	655	130	No		Sorcery: the ascription of the impairment of health to the aggressive use of magical techniques by a human being, either independently or with the assistance of a specialized magician or shaman.

Table 1 (*Continued*)

Label	Variable	No. SCCS	*n*	Recoded?/structure of recoding	New name	Definition
Fears of punishment by supernatural visible agents (FPSVA)	Theories of witchcraft	656	130	No		Witchcraft: the ascription of the impairment of health to the suspected voluntary or involuntary aggressive action of a member of a special class of human beings believed to be endowed with a special power and propensity for evil.
	Evil-eye scaled rating	1188	186	No		Owning the "evil eye" can cause misfortune to others by a gaze.
	Generosity	334	58	Yes/mean of the three variables	Prosocial education	Inculcation of specific traits by parents.
	Trust	335				
	Honesty	336				
	Compliance of individuals with community norms	775	74	Yes/binary: high-moderate		
Individual cooperation (IC)	Loyalty to the local community	778	85	Yes/inverted		
	Loyalty to the wider society	779	84	Yes/inverted		

Table 1 (*Continued*)

Label	Variable	No. SCCS	*n*	Recoded?/structure of recoding	New name	Definition
	Individual aggression – homicide	1665	91	Yes/mean of the three variables	Individual aggression	Aggression: attempts to hurt or injure others within the community or local group. Individual aggression refers to aggression perpetrated by an individual, or several individuals, who do not constitute a formally organized social group (a group of friends is not a formally organized social group).
	Individual aggression – assault	1666				
	Individual aggression – theft	1667				
Community size (CS)	Community size	63	148	Yes/mean of the two variables	Community size	
	Mean size of local communities	235				
	Contact with other societies	787	87	Yes/inverted		
Control variables (CV)	Religion	713REV	186	No		
	Region	200	186	No		

between measures of cooperation at the group level and individual level. Individual cooperation can be measured in any situation where an individual is able to choose whether or not to act in a prosocial way. The presence of money in a society, for example, may reflect large-scale cooperative institutions, but it is not necessarily a measure of an individual's cooperation "on the ground," because it is not clear how individuals born into a society using money could choose whether or not to adopt the institution or, indeed, how they could free-ride on it. We view this as an important distinction because the collective represented by social institutions may not be the same thing as individuals' propensities to behave prosocially. Social institutions represent societies' collective attempts to counteract their members' inevitable predispositions to free-ride on social contracts in order to benefit their own personal self-interests, for all the reasons widely recognized by the Prisoner's Dilemma and selfish gene literatures. Societal-level institutions may thus be essential for social cohesion to be maintained by enforcing enough compliance within society to make the social contract work. In the SCCS, a number of variables give an indication of individual prosocial behavior, such as explicit individual antisocial behaviors (homicide, theft, assault, etc.) or the level of importance that parents attach to education in prosocial behavior. These behaviors have consequences for social cohesion that can, in many respects, be just as socially destabilizing as more explicit forms of free-riding. More importantly, in these cases, individuals have some real choice about whether to behave in a prosocial manner.

In addition to the issue of individual versus societal action, Johnson (2005) focused on supernatural punishment as measured by beliefs in "high gods" (see Table 1 for a definition of this variable), but there are a number of other variables in the SCCS not used by Johnson that seem to be good proxies for different types of punishment threats from supernatural agents (Johnson & Krüger, 2004). In addition to the variable "high gods," the SCCS variables "theories of spirit aggression" (as an explanation of a cause of disease) and "warning" (which measures the level of threat of being punished by strangers or supernatural agents instilled into children) are good proxies for the domain of invisible agents. In the domain of visible agents we also can find good proxies in the SCCS. The variables "theories of witchcraft" and "theories of sorceries" or "evil-eye scaled rating" are examples which, directly for the latter and indirectly for the former, imply the presence of humans who can act supernaturally. Here, we examine the FSPH predictions focusing on variables measuring individual propensities to cooperate and using a wider range of potential proxies for fear of supernatural punishment than have been used previously. While we are aware that we cannot directly measure "fear of supernatural punishment," the variables used to measure fear in supernatural punishment should be thought of as proxies for such parameters. This point was previously made by Johnson (2005) concerning the variable "high gods" (see Table 1).

We test the following three predictions using the SCCS: (i) there is a positive correlation between indices of individual cooperation and prevalence in the society of beliefs in invisible supernatural agents; (ii) there is a positive correlation between these indices and prevalence in the society of beliefs in supernatural visible agents, such as alleged witches, sorcerers, etc.; and (iii) there is a positive correlation between the size of community and the prevalence of beliefs in different types of supernatural punishment. To check that these relations are not confounded by cultural relatedness or the impact of the major world religions, we reran the analyses for each region and religion category separately. We also controlled for level of competition between

societies, since it is important to ensure that the relations we measure at not due to within- rather than between-group interactions.

Materials and methods

Data

The SCCS is composed of 186 human societies, each with about 2000 ordinal and categorical variables. These variables describe a large number of societal characteristics which have been recorded in primary ethnographic research. This database is now a well-established resource for testing hypotheses about human behavior and ecology across different cultures (e.g., Johnson, 2005; Roes & Raymond, 2003; Snarey, 1996). The 186 societies are a subset of a larger database on 1267 societies, the Ethnographic Atlas (Murdock, 1967). The variety of societies chosen for the SCCS has been carefully selected in order to be a representative subset of different societies all around the world. Moreover, all have been sampled in order to reduce "Galton's problem," which results in spurious correlations between societies due to common ancestry (Murdock & White, 1969). Galton's problem is simply evolutionary anthropology's version of the problem of not correcting for non-independence due to relatedness in comparative studies. To account for this, societies that have descended recently (less than 1000 years ago) from a common ancestor were excluded. Finally, SCCS data, where possible, have been chosen from the earliest descriptions of societies in order to reduce the likelihood of colonial influence.

Variables used

We distributed the variables in different categories in relation to the predictions of FSPH. The different categories are "community size" (CS), "fear of punishment by invisible supernatural agents" (FPISA), "fear of punishment by visible supernatural agents" (FPVSA), and "individual cooperation" (IC). The variables "region," "religion," and "contact with other society" were regrouped under the label "control variables" (CV). Finally, the "FPISA" and "FPVSA" variables have been collapsed to create a single index, "fear of punishment by supernatural agents" (FPSA).

Table 1 summarizes all the variables used. Variables were coded in order to make results positive when they meet the FSPH predictions.

Individual-level prosociality (IC)

We used a number of variables to measure IC. First of these was "compliance of individuals with community norms," excluding those societies coded as "highly variable" for this trait. Second, "prosocial education" is a composite variable derived by taking the mean of three other variables measuring the level of importance of three characteristics ("trust," "honesty," and "generosity") given in children's education. We think this variable is relevant for measuring IC because parents must choose whether and to what extent to invest time in educating their children about prosocial norms. Two other proxy measures of IC were used: "loyalty to the local community" and "loyalty to the wider society," with coding reversed. The variables "compliance of individuals with community norms," "loyalty to the local community," and "loyalty to the wider society" were all also examined in Johnson (2005). Finally, the variable

"mean of individual aggression" was used as a composite variable measuring the level of three types of individual aggression ("homicide," "theft," and "assault").

Fear of punishment by invisible supernatural agents (FPISA)

FPISA variables were used as follows. The variable "high gods" was not recoded and is composed of four states: "1) Absent or not reported;" "2) Present but not active in human affairs;" "3) Present and active in human affairs;" and "4) Present, active, and specifically supportive of human morality." With this coding, the higher the score the higher the likelihood for individuals in the society to be afraid of supernatural punishment by high gods. The variable "theories of spirit aggression" was not recoded and is composed of four states reporting the prevalence of beliefs in spirits' aggression as a cause of illness. Finally, the variable "warning" is a composite variable of four variables that measure the level of threat to children, as conveyed to them by adults, of being punished by strangers or supernatural beings.

Fear of punishment by visible supernatural agents (FPVSA)

FPVSA variables were used as follows (see Table 1). The variables "theories of sorcery" and "theories of witchcraft" were used in the same way as the variable "theory of spirit aggression." They represent, respectively, the prevalence of beliefs in sorcery (and hence of beliefs in sorcerers) and of beliefs in witchcraft (and hence spirit witches) as causes of illness. The variable "evil-eye-scaled rating" was used unchanged and represents the prevalence of degrees of certainty about belief in the evil eye.

Community size (CS)

The variable measuring the community size (see Table 1) is a composite variable obtained by averaging the variables "community size" and "mean size of local communities." Since these two variables measure the same parameter but with some disagreement, we opted to average them rather than arbitrarily choose one. Roes and Raymond (2003) claim to measure the size of societies using the SCCS variable 237: "jurisdictional hierarchy beyond local community." We preferred the variables measuring the size of communities to the variable 237 for two reasons. First, we believe that the basic unit of potential group interactions and competitions is the community level. Second, variable 237 reflects the political complexity of a society, and is thus not necessarily any kind of guide to its size.

Control variables (CV)

The variable "region" and "religion" were used unchanged. The variable "contact with other societies" was recoded by inverting the three original coding values.

Statistics

Following the same method as Roes and Raymond (2003) and Johnson (2005), we used Kendall's tau statistics to measure the association between two variables, since this is more appropriate for ordinal data and small sample sizes than Spearman's rank correlation. To control for the influence of a third variable, we used Kendall's

Table 2. Tests of FSPH using the SCCS database without controls.

				Hypotheses tested/Variables					
				(i), (ii)/(IC)					(iii)/(CS)
				Prosocial education	Compliance of individuals with community norms and decisions	Loyalty to the local community	Loyalty to the wider society	Individual aggression	Community size
Hypotheses tested/ Variables	(i), (iii)/ (FPISA)	High gods	Kendall's tau-*b*	–0.084	0.002	0.028	–0.067	–0.056	0.166*
			p-value	0.441	0.984	0.775	0.489	0.507	0.013
			n	53	69	78	79	85	139
		Theories of spirit aggression	Kendall's tau-*b*	–0.026	0.137	0.052	0.051	–0.110	0.057
			p-value	0.842	0.327	0.639	0.644	0.273	0.471
			n	40	55	64	65	66	107
		Warning	Kendall's tau-*b*	–0.371**	–0.032	0.068	–0.088	0.036	0.055
			p-value	0.009	0.825	0.578	0.472	0.735	0.533
			n	31	43	49	49	51	75
	(ii), (iii)/ (FPVSA)	Theories of sorcery	Kendall's tau-*b*	–0.045	0.107	0 .123	0.070	0.055	–0.050
			p-value	0.722	0.399	0.261	0.513	0.568	0.515
			n	39	55	64	65	66	106
		Theories of witchcraft	Kendall's tau-*b*	–0.106	–0.031	0.037	0.075	0.120	0.224**
			p-value	0.407	0.812	0.738	0.493	0.229	0.004
			n	40	55	64	65	66	107

Table 2 (*Continued*)

			Hypotheses tested/Variables					
			(i), (ii)/(IC)					(iii)/(CS)
			Prosocial education	Compliance of individuals with community norms and decisions	Loyalty to the local community	Loyalty to the wider society	Individual aggression	Community size
	Evil-eye scaled rating	Kendall's tau-*b*	–0.181	–0.219*	–0.043	0.004	0.092	0.216**
		p-value	0.067	0.034	0.635	0.960	0.243	0.001
		n	58	74	83	84	91	148

*Significant at the 0.05 level; **significant at the 0.01 level. Tests are two-tailed.
The cases filled in gray are significant results.
FPISA, fears of punishment by invisible supernatural agents; FPVSA, fears of punishment by visible supernatural agents; CS, community size; IC, individual cooperation.

Table 3. Correlations between "community size" and the three FSPH variables ("high gods," "theories of witchcraft," and "evil-eye scaled rating") for individual "region" and "religion" categories. A partial correlation with the variable "contact with other societies" is also given.

		Correlating community size with:		
Controlling for:		High gods	Theories of witchcraft	Evil-eye scaled rating
	Kendall's tau-*b*	–0.244	0.034	0.182
Africa	*p*-value	0.184	0.874	0.286
	n	21	16	22
	Kendall's tau-*b*	–0.359*	–0.047	–0.307
Circum-Mediterranean	*p*-value	0.048	0.810	0.080
	n	23	18	23
	Kendall's tau-*b*	0.055	0.226	0.149
East Eurasia	*p*-value	0.724	0.265	0.293
	n	27	19	30
	Kendall's tau-*b*	–0.142	–0.187	–0.094
Insular Pacific	*p*-value	0.468	0.370	0.578
	n	21	18	24
	Kendall's tau-*b*	0.443*	0.197	–0.017
North America	*p*-value	0.014	0.338	0.917
	n	23	18	24
	Kendall's tau-*b*	0.244	0.127	0.162
South America	*p*-value	.153	0.550	0.335
	n	24	18	25
	Kendall's tau-*b*	0.126	0.169	0.227**
Classical religions	*p*-value	0.155	0.093	0.005
	n	86	67	92
	Kendall's tau-*b*	0.017	0.100	–0.068
Mixture of classical and preclassical religions	*p*-value	0.923	0.647	0.681
	n	21	17	23
	Kendall's tau-*b*	–0.104	0.072	–0.007
Preclassical religion	*p*-value	0.481	0.674	0.961
	n	32	23	33
	Kendall's partial tau-*b*	–0.038*	0.032	0.042
Contact with other societies	*p*-value	0.050	0.071	0.565
	n	82	64	87

*Significant at the 0.05 level; **significant at the 0.01 level. Tests are two-tailed. The cases filled in gray are significant results.

partial correlation where appropriate. In all other cases (e.g., for the "region" and "religion" variables), we reran the analyses separately for each category. All our computations were performed using the software SPSS version 16.0 for Windows and R for Windows. All *p*-values are two-tailed. We recoded variables so that correlations were positive when they met the expectations of the hypotheses. When results were found to be significant after having controlled for confounding variables, we used the same sequential Bonferroni technique as Rice (1989) and Johnson (2005, p. 422) to control for multiple comparisons.

Results

Results are reported in Table 2 and Table 3.

In our tests of hypothesis (i), i.e., that there is a positive relation between the different FPISA variables and the different IC variables, the variables "high moralizing gods" and "theories of spirit aggression" were not correlated with any of the IC variables. The variable "warning" was negatively correlated with the variable "prosocial education" (Kendall's tau-b = –0.371, p = 0.009, n = 31). However, this correlation did not remain significant when controlling for "region," "religion," or "contact with other societies." None of the 15 correlations we computed supported the fear-of-supernatural-punishments hypothesis.

In our tests of hypothesis (ii), i.e., that there is a positive relation between the FPVSA variables and the IC variables, only one of the 15 correlations was significant (between "compliance of individuals with community norms and decisions" and the "evil-eye-scaled rating"), but this was in the wrong direction (Kendall's tau-b = –0.219, p = 0.034, n = 74; Table 2). This correlation did not remain significant when controlling for region (except for the region "Insular Pacific:" Kendall's tau-b = –0.793, p = 0.001, n = 14), "religion," or "contact with other societies." This relation also became non-significant when the sequential Bonferroni correction for 36 tests was applied. In sum, none of the tests we conducted supported the FSPH.

We tested hypothesis (iii), i.e., that there is a positive relation between the FPISA and FPVSA variables and the variable "community size." We found significant relationships in the predicted direction for the variables "high gods" (tau-b = 0.213, p = 0.003, n = 139), "theories of witchcraft" (tau-b = 0.391, p = 0.005, n = 38), and "evil-eye-scaled rating" (tau-b = 0.216, p = 0.001, n = 148) (see Table 2). However, overall these three correlations did not remain significant when controlling for "region," "religion," and "contact with other societies" (see Table 3). The correlation with "high gods" did remain significant for some regions (circum-Mediterranean and North America), while the correlation with "evil eye" remained significant for societies with "classical religions." These three correlations also became non-significant when the sequential Bonferroni correction for 36 tests was applied.

Finally we correlated the variable FPSA with the IC and CS variables. One of six relationships was significant in the predicted direction with the variable "community size" (tau-b = 0.245, p = 0.015, n = 53), but not when the sequential Bonferroni correction for six tests was applied.

Discussion

The correlations we tested do not support FSPH with respect to hypotheses (i) and (ii) after controlling for region and religion. Although previous analyses have found significant correlations between the variable "high gods" and different variables measuring institutional or societal-level cooperation (Johnson, 2005), our findings suggest this may not apply to other supernatural agent concepts or to individual-level cooperation as measured by our IC variables. Together with previous work, our findings suggest that high gods may be unusual among supernatural agents in functioning effectively to promote cooperative institutions in human groups. Further, while high gods may act to endorse and indirectly enforce institutional societal-level rules of conduct among believers, the relationship with individual cooperation is less

clear. This may be due to variation within societies in commitment to supernatural beliefs, meaning that, even in societies with "high gods," some individuals do not comply with prosocial norms, especially when community size increases and it is easier for free-riders to benefit (Dunbar, 1999). Atkinson and Bourrat (2011) have shown that within societies individual variation in beliefs about god and the afterlife is an important predictor of prosocial attitudes. This individual variation is lost in the SCCS database when information is converted to a single metric of cooperation for each society.

One alternative explanation is that FSPH provides a good explanation for the emergence or early evolution of religions, but may not be appropriate for explaining subsequent cross-cultural differences that arise through cultural evolution or similar processes. In other words, the theory could explain the selective advantage incurred by populations with such beliefs shortly after the emergence of religion, but might be of poor utility in explaining why we find cross-cultural differences nowadays. This might be because, once societies acquire large-scale communities, cultural evolutionary and institutional processes take over and these variables become divorced from the original adaptive function of maintaining social cohesion in small-scale traditional societies. However, this seems an unlikely explanation because, if it were true, we might expect to see correlations surviving in the Americas (where the samples consist almost entirely of traditional small-scale societies); in fact, the only regions where the correlations survive are the Mediterranean region (an early locus of the Neolithic transition to settled communities) and North (but not South) America.

Our results concerning possible relationships between the community size and the fear of supernatural punishment variables (hypothesis (iii)) suggest that the FSPH is unlikely to provide the sole explanation for the cultural differences in religious and supernatural beliefs at the level of individual behavior (as opposed to societal norms). We had hypothesized, following Roes and Raymond (2003) and Alexander (1987), that the number of individuals in a society might have an impact when a society is in competition with other societies. However, we found that the significant positive relation between the variables "high gods" and "community size" was no longer significant (and was, in any case, negative) when societal competition was partialled out. This suggests that the relationship is not with community size *per se*, but rather with the level of inter-community competition, as originally suggested by Alexander (1987).

One other relation that survives controlling for "region" and "religion" is that between community size and "evil eye," albeit only in those societies that have "classical religions" (i.e., the major world religions). This suggests that the concept of the evil eye may be a peculiarity of these religions (many of them have common roots in western Asia), although these do also tend to be those most closely associated with large polities. We cannot determine whether this is peculiar to one of the constituent religions (say, the Abrahamic religions), but it appears not to be specific to any particular region (Table 3). In other words, if it were peculiar to one specific religion, we might expect to find it reappearing as a local correlation in the region where that religion has its roots or is dominant.

In summary, when looking at a broader range of supernatural punishment and cooperation variables than previous work and after controlling for other important factors, we do not find clear support for the FSPH at the level of individual behavior (as opposed to the societal-level norms that have been the focus of previous analyses

using SCCS). This suggests that religious beliefs (and especially beliefs in high gods) may be more effective at promoting the establishment of social institutions capable of enforcing cooperation than at counteracting inevitable tendencies for individuals to free-ride on social contracts, to the ultimate detriment of the community (Dunbar, 1999). The point may be that, precisely because of this, societal-level institutions are essential to enforce sufficient compliance within society as a whole for social cohesion to be maintained.

Acknowledgements

We thank Justin Barrett, Daniel Darg, Maryna Katynia, Richard Sosis, and an anonymous reviewer for their comments and suggestions on a previous version of this article. PB's work was supported by one grant from the John Templeton Foundation-funded Cognition, Religion and Theology Project at the University of Oxford. QA's work was supported by the EC-FP6 EXREL project grant 43225 and two grants from the John Templeton Foundation-funded Cognition, Religion and Theology Project at the University of Oxford. RD's research was supported by the British Academy Centenary Research Project.

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