



Cognitive Science 36 (2012) 846–869

Copyright © 2012 Cognitive Science Society, Inc. All rights reserved.

ISSN: 0364-0213 print / 1551-6709 online

DOI: 10.1111/j.1551-6709.2012.01242.x

# What Does God Know? Supernatural Agents' Access to Socially Strategic and Non-Strategic Information

Benjamin G. Purzycki,<sup>a</sup> Daniel N. Finkel,<sup>a</sup> John Shaver,<sup>a</sup> Nathan Wales,<sup>a</sup>  
Adam B. Cohen,<sup>b</sup> Richard Sosis<sup>a</sup>

<sup>a</sup>*Department of Anthropology, University of Connecticut*

<sup>b</sup>*Department of Psychology, Arizona State University*

Received 5 July 2010; received in revised form 25 August 2011; accepted 26 August 2011

---

## Abstract

Current evolutionary and cognitive theories of religion posit that supernatural agent concepts emerge from cognitive systems such as theory of mind and social cognition. Some argue that these concepts evolved to maintain social order by minimizing antisocial behavior. If these theories are correct, then people should process information about supernatural agents' socially strategic knowledge more quickly than non-strategic knowledge. Furthermore, agents' knowledge of immoral and uncooperative social behaviors should be especially accessible to people. To examine these hypotheses, we measured response-times to questions about the knowledge attributed to four different agents—God, Santa Claus, a fictional surveillance government, and omniscient but non-interfering aliens—that vary in their omniscience, moral concern, ability to punish, and how supernatural they are. As anticipated, participants respond more quickly to questions about agents' socially strategic knowledge than non-strategic knowledge, but only when agents are able to punish.

*Keywords:* Cognitive science of religion; Socially strategic information; Supernatural agents; Supernatural punishment; Theory of mind

---

## 1. Introduction

Supernatural beings are culturally represented in virtually all human societies (Atran & Norenzayan, 2004; Boyer, 2001; Brown, 1991, p. 139; Guthrie, 1993). The most prominent cognitive theories of religion have argued that belief in supernatural agents represents an overuse of cognitive mechanisms devoted to everyday social processes like theory of mind and perception of agency, two processes that are critical in allowing for large-scale social

---

Correspondence should be sent to Benjamin Purzycki or Richard Sosis, Department of Anthropology, University of Connecticut, 354 Mansfield Road, Storrs, CT 06269-2176. E-mails: benjamin.purzycki@uconn.edu, richard.sosis@uconn.edu

interaction (Barrett, 2004; Boyer, 2000). People typically attribute agency to animate entities by rendering them motivated by internal mental states. Such internal mental states are detected and made possible by a suite of computational devices that comprise what Baron-Cohen (1995, pp. 31–58) calls “the mindreading system.” One component of this system is the theory of mind mechanism (ToMM), which allows humans to infer and reason about how an agent’s behavior is driven by its beliefs, desires, and perceptions (Premack & Woodruff, 1978). People are quick to over-interpret events and objects as having minds (Barrett & Johnson, 2003; Gelman, Durgin, & Kaufman, 1995; Scholl & Tremoulet, 2000), and it is theorized that supernatural agent concepts are built on this ability (Atran, 2002; Barrett, 2004; Boyer, 2001; Guthrie, 1980, 1993).

People are particularly interested in the minds of their gods rather than other features, such as whether they have hair or walk upright (Boyer, 2001, p. 144). Furthermore, some have argued that people tend to imagine that supernatural agents have particular access to information relevant to social life, what we refer to here as *socially strategic information* (Boyer, 2000, 2002). Boyer (2001) defines strategic information as “*the subset of all the information...that activates the mental systems that regulate social interaction*” (p.152). Some theorists have argued that humans throughout history have committed themselves to “the gods” rather than countless other anthropomorphized and supernatural beings (e.g., dragons, trolls, and Mickey Mouse), precisely because the gods have access to socially strategic information (Atran, 2002; Barrett, 2008; Boyer, 2001, 2002).

Socially strategic information can be positive (e.g., to know that Bill goes out of his way to help people) or negative (e.g., to know that Jane is a snoop), and the assessment of such information is dependent on context. In other words, any information can be socially strategic if it bears significant weight in social relationships. Recent evolutionary theories of religion have claimed that supernatural agents that evoke religious commitment and devotion are particularly concerned with *negative* social knowledge—namely, knowledge about breaches of prosocial responsibilities (Schloss & Murray, 2011). These theories suggest that commitment to supernatural agents and belief in their punishments may function to inhibit self-interested behavior or free-riding, and thus contribute to the evolution of human cooperation in large-scale human societies (Bering & Johnson, 2005; Johnson, 2005; Johnson & Bering, 2006; Norenzayan & Shariff, 2008). As such, supernatural agent concepts may tap into cheater-detection systems and culturally specific domains of social obligation (see Cosmides & Tooby, 1989; Sugiyama, Tooby, & Cosmides, 2002). However, remarkably few studies exist that systematically address population- and individual-level views of the nature of supernatural agents’ minds.

Recent cross-cultural experiments in developmental psychology suggest that while young children often reason about God’s knowledge as particularly different from normal humans’ knowledge (Knight, Sousa, Barrett, & Atran, 2004; Richert & Barrett, 2005), children—depending on age—reason about supernatural minds using basic intuitive psychological mechanisms (Lane, Wellman, & Evans, 2010). Ethnographic descriptions of non-Western societies, nonetheless, suggest that views on what spirits and gods know vary widely across populations. For example, the Ju/’hoansi of the Kalahari believe that the spirits of their ancestors make immoral people sick and have the ability to witness antisocial behavior

(Lee, 2003, p. 129). Chagnon (1996) reports that the Yanomamö believe in a spirit who directs those who were generous in life to the sky, and those who were not to “a place of fire” (pp. 112–113). This spirit needs to ask the recently dead if they were generous because he has no access to this information. This spirit, like Ju’hoansi ancestral spirits, may be moralistic, but he is not omniscient. Among Tyvans of southern Siberia, spirit-masters are considered neither omniscient nor moralistic but care by and large about the performance of ritual behavior and the management of local natural resources (Purzycki, 2010, 2011).

Morally concerned high gods are found primarily among state societies with higher degrees of social complexity and anonymity than non-state societies (Johnson, 2005; Lahti, 2009; Roes & Raymond, 2003; Sanderson, 2008; Stark, 2001; Swanson, 1960). The New Testament, for example, states that “the Lord disciplines those whom he loves, and chastises every child whom he accepts” (Hebrews 12:6) and that “it is indeed just of God to repay with affliction those who afflict you...those who do not know God...will suffer the punishment of eternal destruction” (Thessalonians 1:5–9). However, the possibility that the gods of monotheistic traditions are most concerned with socially strategic knowledge may seem counter to people’s deeply held convictions that certain gods are omniscient. The Christian God is typically believed to be omniscient, not just having unlimited access to socially strategic information but knowing all things, no matter how trivial. The New Testament asserts that God knows about every hair on our heads and when every sparrow dies or is sold (Matthew 10:30–31; Luke 12:4–7) and the Book of Psalms describes God’s understanding as limitless (Psalms 147:5). For centuries, philosophers and theologians have grappled with the question of omniscience and its implications on other philosophical problems (see Abbruzzese, 1997; Grim, 1983; Hughes, 1995, pp. 64–107; Kapitan, 1991; Kretzmann, 1966). However, as we show below, believers conceive of God as all-knowing, rather than more knowledgeable in some areas of life than others.

A number of cognitive studies of religious belief have examined the distinctions between what religious doctrines attribute to God, known as theological correctness, and how people actually think about God. When asked explicitly about God’s character, people tend to offer theologically correct views that God is omniscient and omnipotent. More subtle measures, however, show that people tend to implicitly attribute certain human limitations to God, such as the inability to answer prayers from two different people at once (Barrett, 1998; Barrett & Keil, 1996; Cohen, 2007, pp. 155–179; Slone, 2004). Even though God and other supernatural agents are granted omniscience or unlimited access to socially strategic information, they are still cognitively processed in real time as human social actors possessing human-like cognitive and physical limitations. Cognitive and evolutionary theories of religion predict that supernatural agents are not only conceived as anthropomorphically limited but also as possessing important social knowledge, particularly with regard to immoral or uncooperative behavior. Indeed, studies reveal that although supernatural agents are anthropomorphized, they are not processed simply as powerful humans, but rather as morally special persons with unique moral properties (Gray & Wegner, 2010).

Psychologists have used response-time exercises to understand a host of psychological phenomena ranging from accessibility of attitudes (Fazio, Chen, McDonel, & Sherman, 1982; Fazio & Williams, 1986) to how semantic memory is structured (Collins & Quillian,

1969). Previous response-time research in the psychology of religion has focused on whether belief in religious concepts affects accessibility (Cohen, Shariff, & Hill, 2008), but to date no response-time research has investigated how our minds process supernatural agents' minds and whether biases in processing violate theologically correct versions of what these agents are supposed to know. Even though agents (supernatural and non-supernatural alike) may be attributed with omniscient status, if response-times to questions about their knowledge of socially strategic information are shorter than those concerning non-strategic information, this would suggest the presence of a particular accessibility or processing bias which would run counter to the explicit (theologically correct) conceptions of deities. In other words, socially strategic domains may be more accessible to people when considering supernatural agents' knowledge breadth even though this may violate their explicit conceptions. Moreover, if in highly complex societies, supernatural agent concepts function to curb antisocial behavior, then negative socially strategic knowledge should have significantly shorter response-times than positive knowledge.

Here we detail four studies in which we measured response-times to questions about whether various agents possess socially strategic and non-strategic information. We presented subjects with agents that vary in their omniscience, moral concern, ability to punish, and how supernatural they are. This allowed us to rigorously test which aspects of supernatural agents determine how quickly people access attributed socially strategic knowledge. In Experiment 1, we predicted that God's negative socially strategic knowledge would be most cognitively accessible to our participants. If so, response-times to questions about God's negative socially strategic information would be shorter, compared to response-times to questions about God's non-socially strategic information (such as how many pickles Sarah has in her refrigerator). However, if participants' explicitly stated, theologically correct beliefs about God's omniscience are consistent across domains, then God will be perceived as being equally knowledgeable in all such domains and there should be no significant difference in response-times to any questions about God's knowledge.

In Experiments 2–4, we assessed the theoretically relevant dimensions of supernatural agents that may be responsible for the response-time patterns observed in Experiment 1. In Experiment 2 we replaced God with a fictional omniscient surveillance government (NewLand) to evaluate whether the response-time patterns observed in Experiment 1 are a consequence of God's supernatural nature. NewLand is akin to some conceptions of gods insofar as it is omniscient, moralistic, and equipped with the capacity to punish and reward people, but it is not supernatural. People regularly treat institutions as agents (e.g., “the government does not want us to commit crimes”; see Waytz and Young 2012); therefore, we anticipated response patterns in Experiment 2 to be similar to Experiment 1.

In Experiment 3, we examined response-times to questions about Santa Claus's knowledge. Santa Claus is supernatural, but he is inconsistently attributed with omniscience (see Barrett, 2008). Nevertheless, we expected Santa's strategic knowledge to be particularly accessible to people as he is depicted regularly as a moralistic supernatural agent.

In Experiment 4, we presented participants with an all-knowing alien species who, despite being aware of everything that happens on Earth, does not interfere with people in any way. If it is both the putative omniscience of agents and their capacity to mete out

rewards and punishment that determines our concern with their strategic knowledge, then response-times for socially strategic and non-strategic information should not differ in this study, as we predicted they would in Experiments 1–3.

## 2. Experiment 1

### 2.1. Method

#### 2.1.1. Participants

Participants took part in only one of the four studies. Participants in all studies were recruited from anthropology courses at the University of Connecticut and were given extra credit for participation. Participants in Experiment 1 ( $n = 74$ ; 39 females; age  $M = 20.38$ ,  $SD = 2.01$ ) were as follows: 28 Catholics, 12 Protestants, 5 Jews, 2 Buddhists, and 1 Muslim. Fifteen reported no religious affiliation and 11 reported “other.” Christianity places great emphasis on consistency in personal belief and faith over practice (Cohen & Hill, 2007; Cohen, Siegel, & Rozin, 2003); therefore, we created a dummy variable for Christians (all self-reported Catholics and Protestants;  $n = 40$ ) and non-Christians ( $n = 34$ ) to control for potential effects of religious affiliation on response-time. We also asked participants how they had thought of God while responding in the response-time task. This allowed us to assess whether explicit conceptions of God had effects on response-times. Response categories were (a) believe in God and that God is all powerful and all knowing ( $n = 47$ ), (b) do not believe in God but for this study thought of God as all powerful and all knowing ( $n = 5$ ), (c) do not believe in God and in this study answered as though there is no God ( $n = 8$ ), and (d) other ( $n = 14$ ). To measure religiosity, we modified a cross-culturally validated 8-item religiosity scale (Nicholas, 2004; Nicholas & Durrheim, 1995; Rohrbaugh & Jessor, 1975). A factor analysis showed that one factor accounted for 64% of the variance in responses to these eight questions (Cronbach’s  $\alpha = 0.92$ ). Factor scores were used as a scale to measure participants’ religiosity.

#### 2.1.2. Materials

We constructed six types of questions (Appendix S1). Three types were distractor items created to conceal the focus of the study and to evaluate whether participants were reading and accurately responding to the questions. Distractor questions consisted of logical conundrums about God ( $n = 27$ ; e.g., “Does God know how to create a triangular circle?” and “Can God make a sound so silent that he cannot hear it?”), questions about God’s non-social knowledge ( $n = 10$ ; e.g., “Does God know the number of moons around Mars?” and “Does God know the structure of plant DNA?”), and trivia questions about well-known facts not related to God ( $n = 25$ ; e.g., “Was the Declaration of Independence signed in 1622?” and “Is the Statue of Liberty located in Texas?”).

To evaluate whether the God concept primes socially strategic information compared to socially irrelevant information, we constructed *nonstrategic questions* (NSPEOP;  $n = 10$ ), which contain socially irrelevant information concerning God’s knowledge about people

(e.g., “Does God know the recipe for Alice’s cake?” and “Does God know how fast Joey’s heart beats?”) and two types of questions with socially strategic information: *positive socially strategic information* (STPOS; e.g., “Does God know that Ann gives to the homeless?” and “Does God know that Michael loves his parents?”;  $n = 10$ ) and *negative socially strategic information* (STNEG; e.g., “Does God know that John cheats on his taxes?” and “Does God know that Jen lied to her mother?”;  $n = 10$ ). We avoided using examples of extreme violence in these cases to minimize potential effects of emotional responses to extremely reprehensible behaviors.

We crafted the questions of our three focal variables to minimize question-length effects on response-time. Most of these questions were 10 syllables long. Ninety-two questions in total were digitally recorded and dead air was trimmed from each recording. Each recording was systematically measured for length using a digital audio file editor by magnifying each file 6× to maximize precision. A one-way ANOVA demonstrated that overall, the mean question lengths to the thousandths of a second of each focal category (NSPEOP, STPOS, and STNEG questions) were significantly different from each other ( $F(2, 27) = 4.68, p = .02$ ). Specifically, the strategic negative question lengths were longer than the non-strategic questions about people ( $t = -3.09$ , Bonferroni’s adjusted  $p = .01$ ).<sup>1</sup>

### 2.1.3. Procedure

The audio recordings of each question were presented to participants using the *Inquisit* program (Draine, 2006). Participants accessed the study online and were instructed to find a quiet place where they would not be distracted. The entire procedure took around 10 min to complete. Participants were guided through the instructions during a brief introduction followed by a practice run of six questions (e.g., “Does God know that Phoebe is a cheerleader?” and “Did Adam Smith write *Wealth of Nations*?”) in which they were asked to press the “L” key for “no” responses and “A” for “yes” responses. Questions during the data collection were presented in random order. To ensure that participants were paying attention to the questions, we checked the responses to the trivia questions for accuracy and examined whether anyone answered all of the questions in a pattern (e.g., “yes, no, yes, no, yes...”). While participants did make some errors on the questions, there were no patterned responses that would suggest participant negligence.

Because it was technically possible to respond to a question before it was completed, it was necessary to eliminate participants who tended to respond as soon as a question began. It was also necessary to ensure that responses which were quick—but not outliers—were not deleted. *Inquisit*’s output produces a variable (LATENCY) which is the sum of the recording length and the response-time to the question. First, we subtracted the recording length of each statement from this output in order to obtain the raw response-time. As we were to log transform all raw response-times, we added 1,000 ms to all data points in order to avoid missing values from negative raw response-times. All responses which were entered >1,000 ms before the recording finished were deleted. Participants ( $n = 6$  for this experiment) who consistently (>10 responses) answered more than 1,000 ms faster than question lengths were eliminated from the sample. Individual data points that were three standard deviations above the mean of each focal variable were also

eliminated from datasets. All analyses include the logged transformations of these data points unless otherwise noted. All tables include the absolute response-time and log-transformed data statistics.

## 2.2. Results

A repeated measures ANOVA of mean response-times to question types (NSPEOP, STNEG, and STPOS) demonstrated that participants responded to each type of question differently. Mauchly's test indicated that the assumption of sphericity was violated,  $\chi^2(2) = 9.67$ ,  $p < .01$ . We therefore corrected the degrees of freedom using Huynh-Feldt estimates of sphericity ( $\epsilon = 0.91$ ). The results showed that there were significant differences in response-time to the three focal questions ( $F(1.82, 132.71) = 42.46$ ,  $p < .001$ ). No other variables had significant effects on response-time: religiosity ( $F(1.85, 132.92) = 0.54$ ,  $p = .57$ ), belief in God ( $F(1.84, 132.69) = 0.77$ ,  $p = .45$ ), Christianity ( $F(1.84, 132.35) = 0.97$ ,  $p = .38$ ), or sex ( $F(1.84, 132.29) = 0.72$ ,  $p = .48$ ).

If people more readily conceptualize gods as having access to socially strategic information, then response-times to such information should be significantly shorter than response-times to questions regarding God's knowledge of non-strategic information. Indeed, participants responded more quickly to socially strategic questions than to non-strategic questions about people ( $F(1, 73) = 62.42$ ,  $p < .001$ ). Moreover, if the content of God's knowledge is more about breaches of social contracts than good or neutral behaviors, then response-times to questions about socially strategic knowledge of negative behaviors should be significantly shorter than response-times to questions about positive behaviors. This too was supported by our data ( $F(1, 73) = 14.23$ ,  $p < .001$ ) (Table 1, Fig. 1a).

These results also lend further support to the claim that there is a distinction between how people reason about God in real time and their theologically correct versions of God's characteristics (Barrett, 1998; Barrett & Keil, 1996). How participants thought of

Table 1  
ANOVA of response-times by agent

Variable	God	NewLand	Santa	The Ark
	F-ratio	F-ratio	F-ratio	F-ratio
Focal vars. (NSPEOP, STPOS, STNEG)	42.46***	34.35***	68.17***	6.53**
Non-strategic vs. socially strategic	62.42***	4.60*	80.41***	2.28
Strategic negative vs. positive	14.23***	10.73**	1.24	3.61
Religiosity	0.54	0.43	0.13	0.88
How thought about God during study	2.31	—	—	—
Belief in God	0.77	—	—	—
Raised to believe in Santa	—	—	0.48	—
Christian	0.97	—	—	—
Sex	0.72	0.25	1.15	1.81

Note. \*\*\* $p < .001$ ; \*\* $p < .01$ ; \* $p < .05$

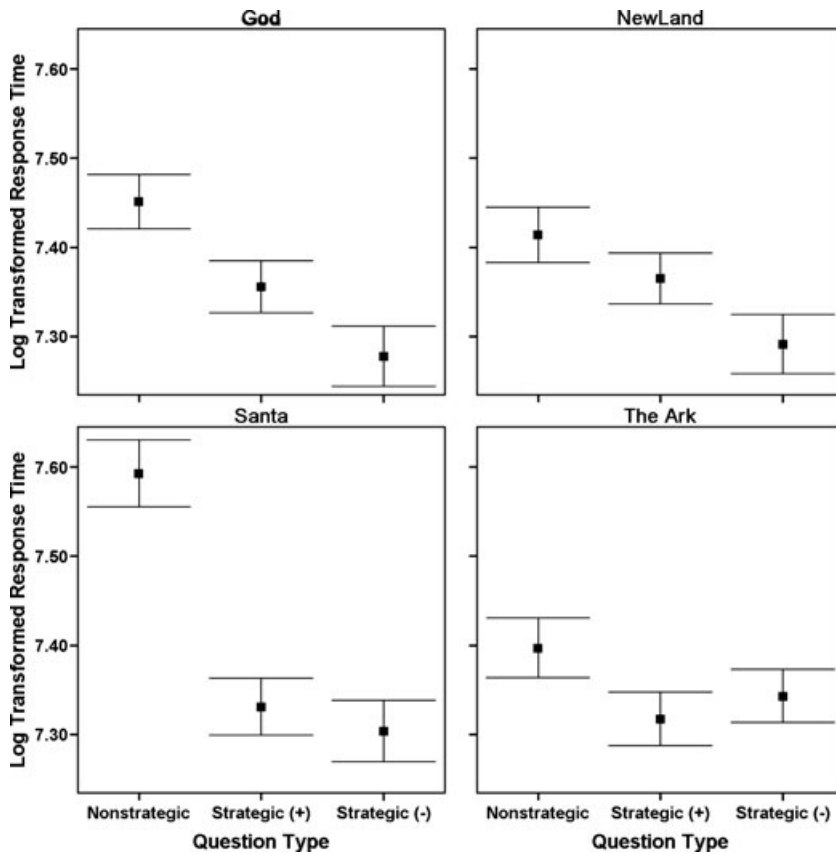


Fig. 1. Confidence intervals ( $\alpha = 0.05$ ) of log-transformed average response-times by question type for four agents: (a) God, (b) NewLand, (c) Santa Claus, and (d) the Ark.

God while responding to questions did not have a significant effect on response-time ( $F(1.87, 134.50) = 2.31, p = .11$ ). After controlling for question type, there were no significant differences between believers ( $n = 1,405, M = 7.35, SD = 0.43$ ) and non-believers ( $n = 806, M = 7.38, SD = 0.44$ ) in response-times of the three focal variables ( $F(2, 2,211) = 2.84, p = .09$ ). Moreover, controlling for effects of socially strategic content of questions, we find that explicit conceptions of God do not have significant effects on response-time ( $F(2, 2,211) = 2.92, p = .09$ ), but these results are marginal and may suggest that explicit conception of God and belief may play a mediating role in processing these concepts. Among those who specifically claimed that God is all knowing and all powerful ( $n = 47$ ), response-times to the three types of focal questions were not equal ( $F(2, 92) = 29.53, p < .001$ ). As in the overall sample, those believing in God's omniscience were quicker to respond to socially strategic than non-strategic questions ( $F(1, 46) = 29.16, p < .001$ ), and quicker to respond to questions about negative than positive behavior ( $F(1, 46) = 6.28, p = .02$ ).



Table 2 details actual responses according to question type. Clearly, participants were discriminating between the distractor and focal questions; a majority of focal question types were responded to with “yes.” A three-way log-linear analysis of the three focal variables’ (NSPEOP, STNEG, and STPOS) responses produced a final model that retained all effects. The likelihood ratio of this model was  $\chi^2(0) = 0.00, p = 1.00$ . This also indicated that the highest order interaction (NSPEOP  $\times$  STNEG  $\times$  STPOS) was non-significant,  $\chi^2(1) = 1.10, p = .30$ . Notably, when controlling for the effects of question type on these focal variables ( $F(1, 2,208) = 17.08, p < .001$ ), actual responses had a significant effect ( $F(1, 2,208) = 6.06, p = .01$ ) on response-time with participants taking significantly longer to respond “no” ( $n = 433, M = 7.41, SD = 0.46$ ) than to respond “yes” ( $n = 1,778, M = 7.35, SD = 0.43$ ). This suggests that answering with “no” required more time to process and/or violated an intuitive response to these questions.

The fact that many of the focal questions were answered with a “no” merits comment. These responses can be explained by the explicit concepts of God that participants reported having during the study. Table 3 presents the actual responses to questions by explicit conception of God. Non-believers who reported as answering as if God does not exist responded to all focal variable questions with “no.” Notice that among those who believe that God is all-knowing and all-powerful, only 6% of the non-strategic questions were answered with a negative response, whereas 3% of the strategic negative and 4% of the positive strategic questions were answered with a “no.” We created a dummy variable for explicit conceptions of God which included those whose explicit conceptions of God were reported as all-knowing and all-powerful on the one hand and the three other categories on the other (see above). A logistic regression using this dummy variable of explicit conceptions of God as the independent variable and response as the dependent variable demonstrates that explicit conception of God predicts response (Wald = 392.38,  $B = 2.98$ , odds ratio = 19.75,  $p < .001$ ).

Because “no” responses were associated with longer reaction-times, we analyzed our data further, removing all “no” responses from the data set. This reduced data set, consequently, eliminated all responses from non-believers who answered as though God did

Table 2  
Responses to questions about God’s knowledge

Question Type	<i>N</i>	<i>M</i> Response-Time in ms ( <i>SD</i> )	<i>M</i> Adj. LTime ( <i>SD</i> )	% No ( <i>n</i> )	% Yes ( <i>n</i> )
Distractor					
Trivial	1,983	804.89 (920.19)	7.40 (0.46)	63 (1,254)	37 (729)
Logical conundrums	1,836	999.03 (976.62)	7.51 (0.42)	67 (1,231)	33 (605)
Non-social knowledge	736	637.32 (789.93)	7.31 (0.42)	20 (147)	80 (589)
Focal					
Non-strategic	738	887.37 (912.64)	7.45 (0.42)	23 (168)	77 (570)
Strategic negative	739	586.66 (678.53)	7.28 (0.47)	17 (128)	83 (611)
Strategic positive	734	700.45 (822.36)	7.36 (0.40)	19 (137)	81 (597)
Total	6,766	817.39 (901.23)	7.41 (0.44)	45 (3,065)	55 (3,701)

Table 3  
Responses to questions regarding God's knowledge by explicit conception of God

Conception of God	Response	Non-strategic	Strategic (-)	Strategic (+)	Total
		% (N)	% (N)	% (N)	% (N)
God is all powerful and all knowing	Yes	94 (442)	97 (456)	96 (448)	96 (1,346)
	No	6 (27)	3 (13)	4 (19)	4 (59)
	Total	469	469	467	1,405
Non-believers	Answered as though God exists				
	Yes	80 (40)	80 (40)	81 (38)	80 (118)
	No	20 (10)	20 (10)	19 (9)	20 (29)
Answered as though there is no God	Total	50	50	47	147
	Yes	0 (0)	0 (0)	0 (0)	0 (0)
	No	100 (79)	100 (80)	100 (80)	100 (239)
Other	Total	79	80	80	239
	Yes	63 (88)	82 (115)	79 (111)	75 (314)
	No	37 (52)	18 (25)	21 (29)	25 (106)
	Total	140	140	140	420

not exist, and those who answered “no” consistently in single categories. We then ran a repeated measures ANOVA of mean log-transformed response-times to all those questions of the focal variables ( $n = 61$  each of NSPEOP:  $M = 7.43$ ,  $SD = 0.24$ , STNEG:  $M = 7.27$ ,  $SD = 0.23$ , and STPOS:  $M = 7.34$ ,  $SD = 0.22$ ). Mauchly's test indicated that the assumption of sphericity was violated,  $\chi^2(2) = 12.92$ ,  $p = .002$ . Therefore, we corrected the degrees of freedom using Huynh-Feldt estimates of sphericity ( $\epsilon = 0.86$ ). Again, there were significant differences in response times ( $F(1.71, 102.82) = 29.18$ ,  $p < .001$ ). In this case, socially strategic questions were answered significantly more quickly than non-strategic questions ( $F(1, 181) = 11.61$ ,  $p = .001$ ), and there were slight—but statistically non-significant—differences between positive and negative questions ( $F(1, 120) = 3.09$ ,  $p = .08$ ). These results, however, are likely a consequence of the far narrower sample.

In summary, these results suggest that despite theological claims concerning God's omniscience, people appear to process God's strategic knowledge more quickly than his non-strategic knowledge, and his negative strategic knowledge more quickly than his positive strategic knowledge. However, it is unclear what in particular about God concepts are driving these results. To investigate this further, in Experiments 2–4 we presented participants with scenarios about agents that vary in moral concern, how supernatural they are, and their ability to reward and punish in order to identify which aspects of these agents inform our conceptions of their knowledge.

### 3. Experiment 2

In Experiment 1, were participants' responses about God's negative socially strategic knowledge due to their beliefs that God is omniscient, morally concerned, and able to reward and punish? Or is some other aspect of thinking about God, such as his

supernatural nature, driving the pattern of results seen in Experiment 1? To isolate the effects of supernatural nature on response-times, participants in Experiment 2 are asked about the NewLand government, an entity that is not supernatural but is omniscient, and that rewards and punishes its citizens.<sup>2</sup> As people regularly conceive of institutions as agents with limited characteristics, we anticipated that an institution such as NewLand, which is similar to God in its omniscience, moral concern, and the ability to reward and punish, would elicit response-time patterns similar to those we observed in Experiment 1 where God was the focal agent.

### 3.1. Method

#### 3.1.1. Participants

Fifty participants performed the response-time task and seven did not complete the online survey ( $n = 42$ ; 28 females; age  $M = 21.49$ ,  $SD = 3.19$ ). Among those who completed the survey there were 12 Catholics, 2 Protestants, 2 Jews, and 6 Hindus. Fifteen reported no affiliation and five reported “other.”

#### 3.1.2. Materials

People are particularly adept at anthropomorphizing entire populations and institutions as though the individuals who comprise these groups have minds (e.g., the church wants everyone to be baptized, the university does not like it when students drink on campus). Experiment 2 was designed to examine response-times to questions similar to those in Experiment 1, except that God was replaced with an omniscient secular institution: NewLand. We again constructed six types of questions (Appendix S1): distractor questions of the same logical conundrums used in the previous treatment ( $n = 25$ ), trivia questions ( $n = 25$ ), non-social knowledge ( $n = 10$ ; e.g., Does NewLand know the form of plant DNA?), non-strategic questions about people ( $n = 10$ ; e.g., Does NewLand know that Alice’s shirt is red?), positive socially strategic questions ( $n = 10$ ; e.g., Does NewLand know that Pete is honest with friends?), and negative socially strategic questions ( $n = 10$ ; e.g., Does NewLand know that Donald beats up weak kids?). All of the recorded questions ( $n = 30$ ) for the three focal variables are 11 syllables long. Each question was digitally recorded, trimmed, and systematically measured for length as described above. Overall, mean question lengths were not significantly different from each other ( $F(2, 27) = 2.13$ ,  $p = .14$ ). Prior to the response-time task, participants read the following introduction:

In the year 2250, there is a country whose government is called NewLand. The government has cameras and audio recording devices everywhere including citizens’ bathrooms, on the street, at work, etc. It knows everything about each individual and records everything down to the tiniest detail. There is no privacy as NewLand keeps track of what each and every individual does at all times. NewLand punishes those who misbehave and rewards those who conduct themselves appropriately. For this study, please assume that such a government exists and answer the questions accordingly.

### 3.2. Results

Mauchly's test indicated that the assumption of sphericity was not violated,  $\chi^2(2) = 1.89, p = .87$ . The repeated measures ANOVA of mean response-times to question types (non-strategic about people, strategic positive, and strategic negative) demonstrates that participants responded to each type of question differently ( $F(3, 147) = 34.35, p < .001$ ). Again, there were significant differences between response-times to non-strategic questions and strategic questions with the latter being significantly shorter ( $F(1, 148) = 4.60, p < .05$ ). Negative socially strategic questions were responded to more quickly than the positive questions ( $F(1, 49) = 10.73, p = .002$ ) (Table 1, Fig. 1b; Table 4). Sex ( $F(3, 123) = .250, p = .861$ ) and religiosity ( $F(3, 123) = .425, p = .74$ ) had no significant effects on response-time.<sup>3</sup> A three-way log-linear analysis of the three focal variables' responses produced a final model that retained all effects. The likelihood ratio of this model was  $\chi^2(0) = 0.00, p = 1.00$ . This also indicated that the highest order interaction (NSPEOP  $\times$  STNEG  $\times$  STPOS interaction) was non-significant,  $\chi^2(1) = 0.23, p = .63$ . Again, actual response had significant effects ( $F(1, 1,522) = 20.08, p < .001$ ) on the response-times of the three focal variables after controlling for the effects of question type ( $F(1, 1522) = 3.35, p = .07$ ); 'no' responses ( $N = 207, M = 7.46, SD = 0.43$ ) took longer than 'yes' responses ( $N = 1,318, M = 7.34, SD = 0.34$ ).

Again, because 'no' responses were significantly associated with longer response-times, we removed all 'no' responses from the data set and conducted a repeated measures ANOVA of mean log-transformed response-times to all those questions of the focal variables ( $n = 44$  each of NSPEOP:  $M = 7.42, SD = 0.26$ ., STNEG:  $M = 7.28, SD = 0.21$ , and STPOS:  $M = 7.35, SD = 0.19$ ). Mauchly's test indicated that the assumption of sphericity was not violated,  $\chi^2(2) = 3.17, p = .21$ . There were significant differences in response times ( $F(2, 86) = 14.01, p < .001$ ). Socially strategic questions were answered significantly more quickly than non-strategic questions, ( $F(1, 130) = 6.55, p = .01$ ), and again there were slight differences between positive and negative questions, but they were statistically non-significant ( $F(1, 86) = 2.96, p = .09$ ).

Table 4  
Responses to questions regarding NewLand's knowledge

Question Type	<i>N</i>	<i>M</i> Response-Time in ms ( <i>SD</i> )	<i>M</i> Adj. LTime ( <i>SD</i> )	% No ( <i>n</i> )	% Yes ( <i>n</i> )
Distractor					
Trivia	1,261	990.66 (955.89)	7.51 (0.42)	63 (793)	37 (468)
Logical conundrums	1,270	859.66 (794.27)	7.46 (0.35)	95 (1,205)	5 (65)
Non-social knowledge	507	1,037.39 (970.43)	7.53 (0.42)	63 (320)	37 (187)
Focal					
Non-strategic	508	764.00 (642.10)	7.41 (0.36)	18 (90)	82 (418)
Strategic negative	509	575.20 (693.07)	7.30 (0.38)	12 (61)	88 (448)
Strategic positive	508	676.25 (654.91)	7.37 (0.33)	11 (56)	89 (452)
Total	4,563	852.72 (837.42)	7.45 (0.39)	55 (2,525)	45 (2,038)

Overall, the results of Experiment 2 indicate that the knowledge attributed to God and NewLand are processed similarly. Indeed, after controlling for question type, there were no significant differences between mean absolute response times (including both yes and no responses) between God and NewLand for the three focal variables ( $F(1, 372) = 1.45$ ,  $p = .23$ ), non-socially strategic questions about people ( $F(1, 123) = 1.69$ ,  $p = .20$ ), or for the socially strategic questions ( $F(1, 247) = 0.16$ ,  $p = .69$ ). However, people may process knowledge attributed to supernatural agents who are not omniscient differently than knowledge attributed to omniscient supernatural agents. Experiment 3 examines this possibility.

## 4. Experiment 3

Experiment 3 was designed to examine response-times to questions similar to those in Experiments 1 and 2, except that Santa Claus was the agent of interest. While Santa “knows when you are sleeping and when you are awake,” he is not consistently given the status of an all-knowing agent. Commenting on Santa’s access to strategic knowledge, Barrett (2008) notes that “information that someone is morally good or bad on balance is of minimal strategic value. What is wanted of a strategic agent is knowing whether someone has done or plans to do a particular morally bad or good act” (p. 156). In other words, socially strategic information is about specific behaviors rather than general assessments of one’s moral sense (i.e., reputation). However, the strategic significance of an act is its potential effects on reputation; if John does one bad thing, this influences our perceptions of the probability of his future misconduct. Nevertheless, Santa is acutely concerned with socially strategic behavior. If theologically correct versions of moralizing agents have little influence on how people process the knowledge of these agents, then the response-time patterns found in Experiments 1 and 2 should be observed in Experiment 3 as well. However, if differences in conception of supernatural agents are important, Santa’s perceived benevolence may result in no significant differences in response-times between *positive* and *negative* socially strategic questions.

### 4.1. Method

#### 4.1.1. Participants

Participants in Experiment 3 ( $n = 50$ ; 22 females; age  $M = 20.28$ ,  $SD = 2.02$ ) were as follows: 30 Catholics, 9 Protestants, and 1 Jew. Nine reported no religious affiliation and one reported “other.” In this study, we also included a question regarding whether participants were raised to believe in Santa Claus. Forty-five were raised with this belief and five were not.

#### 4.1.2. Materials

In this experiment, we used the same items from the previous treatment but used Santa instead of NewLand as the agent in question. Three types of questions were distractor items created in order to conceal the focus of the study and evaluate whether participants were

reading and accurately responding to questions with obvious answers. Distractor questions were again about Santa's non-social knowledge ( $n = 10$ ), logical conundrums about Santa's knowledge ( $n = 25$ ), and trivia questions about well-known facts ( $n = 25$ ). Again, we also used non-strategic questions about people, positive socially strategic questions, and negative socially strategic questions. All of the recorded questions (30) for the three focal variables (non-strategic about people, positive, and negative strategic questions) were 11 syllables long. Each question was digitally recorded, trimmed, and systematically measured for length as described above. A one-way ANOVA demonstrated that overall, the mean question lengths of these three categories were not significantly different from each other, ( $F(2, 27) = 0.96, p = .40$ ). In this study, participants read the following introduction:

Even if you were not raised to believe in Santa Claus, for the purposes of this study, please answer the following questions as though Santa Claus exists. Many children are raised to believe that Santa Claus keeps track of whether or not people have been good or bad. If they are good, children receive presents for Christmas. If children are bad, they don't receive presents.

#### 4.2. Results

A repeated measures ANOVA of response-times to question types (non-strategic about people, strategic positive, and strategic negative) demonstrated that participants responded to each type of question differently. Mauchly's test indicated that the assumption of sphericity was violated,  $\chi^2(2) = 23.73, p < .001$ . We therefore corrected the degrees of freedom using Huynh-Feldt estimates of sphericity ( $\epsilon = 0.74$ ). The results show that there were significant differences in mean response-time ( $F(1.47, 72.06) = 68.17, p < .001$ ). Neither religiosity ( $F(1.50, 72.11) = 0.13, p = .82$ ), whether participants were raised to believe in Santa ( $F(1.50, 72.04) = 0.48, p = .57$ ), nor sex ( $F(1.48, 70.98) = 1.15, p = .31$ ) had significant effects on response-time. Again, there were significant differences between response-times to non-strategic questions and strategic questions with the latter being significantly shorter ( $F(1, 49) = 80.41, p < .001$ ). However, there was no significant difference in response-times for positive or negative socially strategic knowledge ( $F(1, 49) = 1.24, p = .27$ ) (Table 5, Fig. 1c).

The equal speed at which participants responded to the positive and negative questions, which is not what we found in Experiment 1 (with regard to God) or Experiment 2 (with regard to NewLand), is consistent with our theorizing that for socially strategic negative information to be more cognitively accessible, the agent must be conceptualized as able to punish social breaches. While participants were told that Santa does not give gifts to bad children, few people have woken on Christmas morning to coal in their stocking or no presents under their tree. Santa is typically conceived as benevolent and forgiving, and not necessarily an agent who punishes. In this treatment, participants responded largely as though Santa were particularly knowledgeable about the strategic questions (Table 4). However, 40% of the responses to non-strategic questions about people were "yes" and

Table 5  
Responses to questions regarding Santa's knowledge

Question Type	<i>N</i>	<i>M</i> Response-Time in ms ( <i>SD</i> )	<i>M</i> Adj. LTime ( <i>SD</i> )	% No ( <i>n</i> )	% Yes ( <i>n</i> )
Distractor					
Trivial	1,323	1,078.79 (1,107.92)	7.54 (0.42)	62 (823)	38 (500)
Logical conundrums	1,321	1,119.82 (1,180.32)	7.56 (0.43)	66 (876)	34 (445)
Non-social knowledge	529	957.86 (1,197.33)	7.47 (0.42)	79 (419)	21 (110)
Focal					
Non-strategic	528	1,212.04 (1,271.28)	7.59 (0.44)	60 (315)	40 (213)
Strategic negative	526	617.88 (827.58)	7.30 (0.40)	3 (15)	97 (511)
Strategic positive	528	647.36 (791.85)	7.33 (0.37)	3 (16)	97 (512)
Total	4,755	992.64 (1,119.15)	7.49 (0.43)	52 (2,464)	48 (2,291)

60% were “no.” This suggests a near-split in Santa’s attributed knowledge of non-strategic information about people. A three-way log-linear analysis of our focal variables’ responses produced a final model that retained all effects. The likelihood ratio of this model was  $\chi^2(0) = 0.00$ ,  $p = 1.00$ . This also indicated that the highest order interaction (NSPEOP  $\times$  STNEG  $\times$  STPOS) was non-significant,  $\chi^2(1) = 0.26$ ,  $p = .61$ . Controlling for the effects of question type, response had no significant effects on response-time, ( $F(2, 1,582) = 1.49$ ,  $p = .22$ ). “Yes” responses ( $n = 1,236$ ,  $M = 7.38$ ,  $SD = 0.44$ ) were not answered with any different speed than “no” responses ( $n = 346$ ,  $M = 7.50$ ,  $SD = 0.37$ ). While Santa is a moralizing agent, he is not necessarily omniscient (and further study is required to see whether popular conceptions of Santa indicate whether he is perceived as all-knowing). To examine the influence of ability to punish on response-times, in Experiment 4 participants responded to questions about agents who are omniscient but not moralizing or punishing.<sup>4</sup>

## 5. Experiment 4

As demonstrated in Experiments 1–3, when supernatural agents and governments are perceived to be both omniscient (or at least morally omniscient) and moralizing, participants were quicker to attribute them with access to socially strategic knowledge. The question arises, however, whether moral concern is a default consideration when computing information about omniscient supernatural agents or governments. To address this question, we examined response-times to questions similar to those in Experiments 1–3, except that here we focused on agents who are omniscient but *non-punishing*.

### 5.1. Methods

#### 5.1.1. Participants

Seventy participants were recruited for Experiment 4 and four did not complete the follow-up survey ( $n = 66$ ; 39 females; age  $M = 20.47$ ,  $SD = 2.30$ ).

### 5.1.2. Materials

Experiment 4 followed the same structure and contained the same types of questions as the two previous conditions: distractor items which were logical conundrums ( $n = 25$ ), trivia questions ( $n = 25$ ), and non-social knowledge ( $n = 10$ ) and our focal variables which were non-strategic questions about people ( $n = 10$ ), positive socially strategic questions ( $n = 10$ ), and negative socially strategic questions ( $n = 10$ ). All of the recorded questions for the three focal variables were 11 syllables long and did not differ significantly in length ( $F(2, 27) = 1.43, p = .26$ ). In this treatment, respondents considered an omniscient but non-interfering alien species known as “The Ark.”<sup>5</sup> The following is the introduction participants read immediately before the round of practice questions:

It is the year 3025. Aliens from outer space have been peacefully observing humans for 100 years. Humans call them “The Ark.” They are super-intelligent, psychic beings and know everything that happens on Earth down to the tiniest of details that even humans find insignificant. The Ark observe and record everything that takes place but they are bound to a code: They do not and will not interact or interfere with humans in any way. For this study, please assume that The Ark exists and answer the questions accordingly.

### 5.2. Results

A repeated measures ANOVA of response-times to question types (non-strategic about people, strategic positive, and strategic negative) demonstrates that on average, participants responded to each type of question differently. Mauchly’s test indicated that the assumption of sphericity was violated,  $\chi^2(2) = 14.14, p = .001$ . We corrected the degrees of freedom using Huynh-Feldt estimates of sphericity ( $\epsilon = 0.86$ ). For the three focal variables, the results showed that there were significant differences in average response-time ( $F(1.72, 118.77) = 6.53, p = .003$ ). Neither religiosity ( $F(2, 118) = 0.88, p = .66$ ) nor sex ( $F(1.73, 110.77) = 1.81, p = .17$ ) had significant effects on response-time. In this treatment, there were no significant differences between response-times to non-strategic questions and strategic questions ( $F(1, 202) = 2.28, p = .13$ ). There were, however, near significant differences in response-times for positive or negative socially strategic knowledge, but in this experiment positive questions elicited quicker responses than the negative questions ( $F(1, 69) = 3.61, p = .06$ ) (Table 1, Fig. 1d; Table 6).

Table 5 shows that with the exception of the distractor questions, the Ark were consistently attributed with knowledge of all information equally. In this respect, the Ark are similar to God in their access to knowledge. A three-way log-linear analysis of responses to our focal questions produced a final model that retained all effects. The likelihood ratio of this model was  $\chi^2(0) = 0.00, p = 1.00$ . This analysis indicated that the highest order interaction (NSPEOP  $\times$  STNEG  $\times$  STPOS) was significant,  $\chi^2(1) = 5.79, p = .02$ . There was significantly less variance in responses to the three focal questions in the Ark treatment than in the other treatments.



Table 6  
Responses to questions regarding the Ark's knowledge

Question Type	<i>N</i>	<i>M</i> Response-Time in ms ( <i>SD</i> )	<i>M</i> Adj. LTime ( <i>SD</i> )	% No ( <i>n</i> )	% Yes ( <i>n</i> )
Distractor					
Trivial	1,711	954.02 (1,226.89)	7.37 (0.74)	64 (1,101)	36 (610)
Logical conundrums	1,724	1,253.90 (1,083.94)	7.62 (0.47)	59 (1,018)	41 (706)
Non-social knowledge	694	857.83 (854.68)	7.44 (0.42)	16 (108)	84 (586)
Focal					
Non-strategic	689	766.78 (761.43)	7.40 (0.45)	18 (124)	82 (565)
Strategic negative	691	671.98 (801.72)	7.34 (0.40)	18 (127)	82 (564)
Strategic positive	692	629.06 (773.52)	7.32 (0.40)	18 (124)	82 (568)
Total	6,201	938.13 (1,037.41)	7.44 (0.56)	42 (2,602)	58 (3,599)

When participants answered “yes” ( $N = 1,318$ ,  $M = 7.34$ ,  $SD = 0.34$ ) to questions, they were quicker in their responses than when answered “no” ( $N = 207$ ,  $M = 7.46$ ,  $SD = 0.43$ ). Responses had significant effects on response-time ( $F(1, 1,522) = 20.08$ ,  $p < .001$ ), and near-significant effects after controlling for question type ( $F(1, 1,522) = 3.35$ ,  $p = .07$ ). In contrast to Experiments 1–3, in the Ark treatment participants’ response-times did not show a bias toward answering socially strategic questions quicker than non-strategic questions. Once again, as actual responses may have affected response-time, we further analyzed all “yes” responses by removing those data points with “no” responses.

Using mean log-transformed response-times ( $n = 51$  each of NSPEOP:  $M = 7.39$ ,  $SD = 0.24$ , STNEG:  $M = 7.34$ ,  $SD = 0.24$ , and STPOS:  $M = 7.32$ ,  $SD = 0.26$ ), we conducted a repeated measures ANOVA. Mauchly’s test indicated that the assumption of sphericity was not violated,  $\chi^2(2) = 0.79$ ,  $p = .68$ , and again, there were significant differences in response-times, ( $F(2, 100) = 4.98$ ,  $p = .01$ ). However, there were no significant effects for socially strategic content ( $F(1, 151) = 1.99$ ,  $p = .16$ ) and no differences between positive and negative questions ( $F(1, 100) = 0.19$ ,  $p = .66$ ). The results suggest that an agent’s concern, and willingness or ability to act on that concern, are critical for eliciting a bias toward accessibility of strategic knowledge. We now turn to how the qualitative differences between agents affect response-time.

## 6. Between-subjects analysis

It may be that across conditions, participants are responding to agents differently due to familiarity. In order to examine whether response-times were consistent across conditions, we conducted a between-subjects analysis of the mean absolute response-times of the three focal variables: NSPEOP ( $N = 246$ ,  $M = 898.10$  ms,  $SD = 629.21$ ), STNEG ( $N = 246$ ,  $M = 612.94$  ms,  $SD = 416.94$ ), and STPOS ( $N = 246$ ,  $M = 665.46$  ms,  $SD = 455.44$ ) by agent-type. We used the raw response-times because we wished to assess whether agent-type had effects on how quickly participants were responding to questions. Controlling for the effects of question type, agent-type showed significant effects on mean absolute

response-time ( $F(1, 738) = 2.89, p < .05$ ). However, the significantly longer response-times to the non-strategic questions about people in the Santa condition are likely driving this result. Indeed, the three other treatments show no significant effects for agent-type ( $F(1, 685) = 0.62, p = .60$ ). In other words, with the exception of the Santa treatment, participants answered the questions with the same overall speeds across treatments. Nevertheless, the particular features of each agent may have an effect on response-times of specific question types.

Across all four treatments, after controlling for the effects of question type, an ANOVA indicates that supernaturalness ( $F(1, 738) = 0.14, p = .71$ ) has no significant effects on mean absolute response-times, whereas ability to punish has near-significant effects ( $F(1, 738) = 2.91, p = .09$ ). Taking a closer look at question-types using all data points reveals that supernaturalness ( $F(1, 2,447) = 13.74, p < .001$ ) and ability to punish ( $F(1, 2,447) = 17.46, p < .001$ ) have significant effects on response-times to non-strategic questions; it takes participants longer to respond to non-socially strategic questions about agents who are supernatural and able to punish people. There were no significant effects for supernaturalness ( $F(1, 2,446) = 0.10, p < .75$ ) or ability to punish ( $F(1, 2,446) = 1.33, p < .25$ ) for positive strategic questions, whereas for negative strategic questions supernaturalness ( $F(1, 2,449) = 1.73, p = .19$ ) showed no effects yet the ability to punish did ( $F(1, 2,449) = 4.98, p = .03$ ). Response-times were shorter when answering strategic negative questions about agents with the ability to punish. To summarize, supernaturalness and the ability to punish increase response-times to non-strategic questions. These features do not affect response-times to positive strategic questions, but the ability to punish shortens response-times to strategic negative questions.

## 7. Discussion

This research was designed to evaluate people's accessibility of certain types of knowledge possessed by supernatural agents. As predicted, participants responded more quickly to questions about God's knowledge of socially strategic information, particularly negative socially strategic information, than questions that contained non-strategic information about people. Even those who conceived of God as omniscient exhibited such biases in their response-times. We then sought to determine the relevant factors influencing this bias by replacing God with other agents that varied in omniscience, supernaturalness, moral concern, and ability to punish. When we replaced God with NewLand, an all-knowing government that can reward and punish, the observed response-time patterns were similar to the treatment in which God was the focal agent. These results suggest that supernaturalness is not a significant factor influencing the bias toward quicker responses to questions about negative strategic knowledge.

In the study in which Santa was the focal agent, participants responded more quickly to questions about socially strategic knowledge, but there was no difference in response-times to questions about positive and negative socially strategic knowledge. Comparisons with other treatments are difficult to assess given the fact that Santa's attributed omniscience is

less consistent among participants than the other agents. Notably, among the non-strategic questions about people 60% of the responses were “no,” whereas each of the strategic knowledge questions were answered at rates of 97% “yes.” Moreover, while Santa is morally concerned and has the ability to punish, he is generally viewed as benevolent and forgiving, suggesting that punishment may play a critical role in the accessibility of negative strategic knowledge. To examine this possibility further, we conducted an experiment in which the focal agent was an omniscient alien species that does not reward or punish. In this study we did not find significant differences in response-times between strategic and non-strategic questions or between positive and negative socially strategic questions. Overall, the results suggest that moral concern is an important feature for understanding the difference between response-times to questions about strategic and non-strategic information, and that ability to punish is an important feature for understanding the difference between positive and negative information.

Our findings are consistent with claims by cognitive scientists of religion that supernatural agent beliefs emerge from the same cognitive mechanisms that produce all social cognition (Atran, 2002; Barrett, 2004; Boyer, 2001; Pyysiäinen, 2009). While supernaturalness is often regarded as an extraordinary yet defining characteristic of gods and spirits, supernaturalness does not appear to be important for understanding their minds, even when their minds possess unlimited knowledge. Participants exhibited the same patterns of response-time biases whether the agent was supernatural (God) or not (NewLand).

Our results are also consistent with previous work that distinguishes between theologically correct and incorrect beliefs (Slone, 2004). Pioneering studies by Barrett (1998; Barrett & Keil, 1996) have shown that while people claim to believe in an omniscient and omnipotent supernatural agent, such as God, in real time they often maintain theologically incorrect versions of belief that place anthropomorphic limits on these agents. In our study, participants assumed that God knew everything (focal questions were answered consistently with “yes” responses), yet response-times indicated that some types of God’s knowledge, specifically his social knowledge, was more accessible than other types of knowledge. Not only is this consistent with the claim that the ToMM is the primary cognitive mechanism producing theologically incorrect versions of God (Atran, 2002; Boyer, 2001), but these results also emphasize the relationships between supernatural minds, their attributed contents, and accessibility biases. Even though participants claimed that God in particular has knowledge of all human affairs, response-times reflect a bias in knowledge attribution; God’s negative socially strategic knowledge seems to be most accessible. Belief in God and whether one was raised to believe in Santa showed no effects on response-time in their respective treatments. This particular parallel in processing suggests an underlying similarity in implicit conceptions of these agents. Moreover, this lends further support to the claim that our explicit (theologically correct) conceptions of supernatural agents run counter to the way our minds typically process agents.

A closer look at our qualitative data provides further insight into how participants view God’s access to social knowledge. When asked how they thought of God while responding to response-time questions, some participants chose the “Other” option and made clarifying comments. One participant responded that he thought that “god [sic] knows whatever he

wants to know,” suggesting that God’s knowledge is only limited by his *desire* to know things. Another participant stated, “I believe God is all knowing to the point of moral and ethical actions of people,” thereby actually limiting God’s knowledge to socially strategic information. In another case, an individual claimed that while “I believe in God...I do not think he knows of things not known to man.” Even though participants’ conceptions of God while participating in the study had no significant effect on response-time, these statements suggest that the knowledge of supernatural agents is indeed a flexible part of human cognition. More important, while the theologically correct versions of supernatural agents’ access to knowledge may be significantly different from processing them, their domains of concern should shed light on their ultimate function (Purzycki & Sosis, 2011).

While the domains of what constitutes “socially strategic” human experience may vary across populations, deities worth committing to will undoubtedly care about human behavior. As Gervais and Henrich (2010) point out, across populations there are significant context biases that can explain our commitment to supernatural agents (e.g., parents’ and peers’ influences). Future research, especially cross-cultural work, should take this into account and not lose sight of what a study population considers the “theologically correct” form of their supernatural agents’ knowledge and the social pressures involved in committing to them. Moreover, as we found marginal effects for explicit conception of God, more direct tests of effects of explicit conceptions of supernatural agents will likely yield significant results, particularly if coupling anger and punishment with god concepts inhibits the breaching of social contracts (Shariff & Norenzayan, 2011).

Our results also contribute to recent discussions on the relationship between human prosociality and religious cognition. Most notably, our results are consistent with the “supernatural punishment hypothesis,” which maintains that belief in supernatural sanctions evolved to promote cooperation and inhibit impulsive self-interested behavior. One version of the supernatural punishment hypothesis suggests that a psychological commitment to punishing deities evolved (Bering & Johnson, 2005; Johnson, 2005), whereas another suggests that because of the prosocial effects of punishing supernatural agent concepts, such concepts are more prevalent in populations (Shariff & Norenzayan, 2007). These approaches are not mutually exclusive and our results are consistent with both. Nonetheless, future research should aim to distinguish between these approaches and assess whether there are pan-human mechanisms for the moral attribution of supernatural agents.

Future replications of our experiments should also diversify the types of agents involved. Different supernatural agents have different specialized domains of attributed knowledge. Patron saints, for example, may be conceived of as all-knowing, but with a particular domain of attributed concern. Moreover, our participants were all students at an American university and thus our results may be culturally specific to Western conceptions of God and other supernatural agents. While God is omniscient and moralizing, not all supernatural agents are both or either of these. If the ancestors, spirits, or deities of other cultures possess socially strategic information, we speculate that individuals within these populations would also exhibit shorter response-times to questions about the socially strategic knowledge of these agents, but only if the agents are moralizing. Stark (2001) demonstrates that moralizing gods are found primarily among large societies with higher degrees of economic

specialization. The more complex a society is, the more likely a population worships a high, moralizing deity (Johnson, 2005; Lahti, 2009; Roes & Raymond, 2003; Sanderson, 2008; Swanson, 1960). Religious cognition in societies with non-Western conceptions of their supernatural agents, including those without omniscient moralizing gods, would be expected to exhibit different response patterns than we observed here.

In conclusion, our experiments offer the first experimental study that explicitly examines how people process the content of supernatural agents' minds. Although these minds can be extraordinary because of their omniscience and supernaturalness, people seem to process them using the same cognitive mechanisms, such as theory of mind, as they would use to process the minds of human agents. Our findings also indicate, however, that an agent's ability and willingness to punish makes knowledge about moral infractions particularly salient and accessible to people. It remains for future work to determine whether our findings are robust to other cultures. If the results are robust, it will be important to explore how this cognitive bias for accessing negative strategic knowledge possessed by moralistic punishing agents influences human behaviors.

## Acknowledgments

The authors would like to thank Justin Barrett, Jesse Bering, Susie DiVietro, Dominic Johnson, Jordan Kiper, Ara Norenzayan, Rod Rinell, Dianne Schindler, Paul Swartwout, and the anonymous reviewers for helpful comments on previous drafts of this paper. Sosis thanks the Templeton Foundation and Sosis, Purzycki, and Shaver thank the Cognition, Religion, and Theology Project at Oxford University for generous support of this research.

## Notes

1. As reported below, we find that response-times to strategic negative questions are significantly shorter than strategic positive or non-strategic questions, even though strategic negative questions were slightly longer.
2. Rather than use Orwell's (2003 [1949]) notion of "Big Brother," a reference that may carry a very negative connotation for those familiar with it, or no connotation for those unfamiliar with it, we created a surveillance government that both rewarded and punished.
3. Table 4 suggests that participants in this treatment responded to non-strategic questions that were not about people differently than in Experiment 1; NewLand does not know about insignificant information concerning non-human affairs.
4. Even though there was no significant difference in response-times for "yes" and "no" responses, for the sake of consistency and curiosity, we deleted all "no" responses from the data set and conducted a repeated measures ANOVA of mean log-transformed response-times ( $n = 42$  each of NSPEOP:  $M = 7.68$ ,  $SD = 0.41$ , STNEG:  $M = 7.33$ ,  $SD = 0.29$ , and STPOS:  $M = 7.33$ ,  $SD = 0.27$ ). Mauchly's test

indicated that the assumption of sphericity was violated,  $\chi^2(2) = 31.41, p < .001$ , so we corrected for this using the Huynh-Feldt estimates of sphericity ( $\epsilon = 0.66$ ). There were significant differences in response times ( $F(2, 82) = 41.30, p < .001$ ). Socially strategic questions were answered significantly quicker than non-strategic questions ( $F(1, 124) = 32.06, p < .001$ ), and again there were no differences between positive and negative questions ( $F(1, 82) = 0.004, p = .95$ ).

5. The Ark was the name of the human-operated spaceship from a Canadian science fiction serial called *The Starlost*, which aired in the early 1970s. We chose the name of “the Ark” because it is short, which maximized synonymy in terms of length between the names of the agents used in the other studies. While there are Biblical connotations to the word “ark,” the introduction is entirely secular and makes no indication that humans have ever witnessed one of its members. Moreover, subjects would be unlikely to make this connection because they were not exposed to “God questions” and were unaware that the study was about how people understand supernatural agent concepts.

## References

- Abbruzzese, J. E. (1997). The coherence of omniscience: A defense. *International Journal for Philosophy of Religion*, 41(1), 25–34.
- Atran, S. (2002). *In gods we trust: The evolutionary landscape of religion*. Oxford, England: Oxford University Press.
- Atran, S., & Norenzayan, A. (2004). Religion’s evolutionary landscape: Counterintuition commitment, compassion, communion. *Behavioral and Brain Sciences*, 27, 713–770.
- Baron-Cohen, S. (1995). *Mindblindness: An essay on autism and theory of mind*. Cambridge, MA: MIT Press.
- Barrett, J. L. (1998). Cognitive constraints on Hindu concepts of the divine. *Journal for the Scientific Study of Religion*, 37, 608–619.
- Barrett, J. L. (2004). *Why would anyone believe in God?* New York: AltaMira Press.
- Barrett, J. L. (2008). Why Santa Claus is not a god. *Journal of Cognition and Culture*, 8(1–2), 149–161.
- Barrett, J. L., & Johnson, A. H. (2003). The role of control in attributing intentional agency to inanimate objects. *Journal of Cognition & Culture*, 3(3), 208–217.
- Barrett, J. L., & Keil, F. C. (1996). Conceptualizing a nonnatural entity: Anthropomorphism in God concepts. *Cognitive Psychology*, 31, 219–247.
- Bering, J. M., & Johnson, D. D. P. (2005). “O Lord...you perceive my thoughts from afar”: Recursiveness and the evolution of supernatural agency. *Journal of Cognition and Culture*, 5, 118–142.
- Boyer, P. (2000). Functional origins of religious concepts: Ontological and strategic selection in evolved minds. *The Journal of the Royal Anthropological Institute*, 6, 195–214.
- Boyer, P. (2001). *Religion explained: The evolutionary origins of religious thought*. New York: Basic Books.
- Boyer, P. (2002). Why go gods and spirits matter at all? In I. Pyysiäinen & A. Veikko (Eds.), *Current approaches in the cognitive science of religion* (pp. 68–92). New York: Continuum.
- Brown, D. E. (1991). *Human universals*. Boston: McGraw Hill.
- Chagnon, N. A. (1996). *The Yanomamo*. Belmont, CA: Wadsworth Publishing.
- Cohen, E. (2007). *The mind possessed: The cognition of spirit possession in an Afro-Brazilian religious tradition*. New York: Oxford University Press.
- Cohen, A. B., & Hill, P. C. (2007). Religion as culture: Religious individualism and collectivism among American Catholics, Jews, and Protestants. *Journal of Personality*, 75, 709–742.

- Cohen, A. B., Shariff, A. F., & Hill, P. C. (2008). The accessibility of religious beliefs. *Journal of Research in Personality*, 42(6), 1408–1417.
- Cohen, A. B., Siegel, J. I., & Rozin, P. (2003). Faith versus practice: Different bases for religiosity judgments by Jews and Protestants. *European Journal of Social Psychology*, 33, 287–295.
- Collins, A. M., & Quillian, M. R. (1969). Retrieval time from semantic memory. *Journal of Verbal Learning and Verbal Behavior*, 8(2), 240–247.
- Cosmides, L., & Tooby, J. (1989). Evolutionary psychology and the generation of culture, Part II. Case study: A computational theory of social exchange. *Ethology & Sociobiology*, 10, 51–97.
- Draine, S. (2006). *Inquisit 2.0 [Computer software]*. Seattle, WA: Millisecond Software.
- Fazio, R. H., Chen, J., McDonel, E. C., & Sherman, S. J. (1982). Attitude accessibility, attitude-behavior consistency, and the strength of the object-evaluation association. *Journal of Experimental Social Psychology*, 18(4), 339–357.
- Fazio, R. H., & Williams, C. J. (1986). Attitude accessibility as a moderator of the attitude-perception and attitude-behavior relations: An investigation of the 1984 presidential election. *Journal of Personality and Social Psychology*, 51(3), 505–514.
- Gelman, R., Durgin, F., & Kaufman, L. (1995). Distinguishing between animates and inanimates: Not by motion alone. In D. Sperber, D. Premack & A. Premack (Eds.). *Causal cognition: A multidisciplinary debate* (pp. 150–184). Oxford, England: Plenum Press.
- Gervais, W., & Henrich, J. (2010). The Zeus problem: Why representational content biases cannot explain faith in gods. *Journal of Cognition and Culture*, 10, 383–389.
- Gray, K., & Wegner, D.M. (2010). Blaming God for our pain: Suffering and the divine mind. *Personality and Social Psychology Review*, 14, 7–16.
- Grim, P. (1983). Some neglected problems of omniscience. *American Philosophical Quarterly*, 20(3), 265–276.
- Guthrie, S. E. (1980). A cognitive theory of religion. *Current Anthropology*, 21, 181–203.
- Guthrie, S. E. (1993). *Faces in the clouds: A new theory of religion*. New York: Oxford University Press.
- Hughes, G. (1995). *The Nature of God: An introduction to the philosophy of religion*. New York: Routledge.
- Johnson, D. D. P. (2005). God's punishment and public goods: A test of the supernatural punishment hypothesis in 186 world cultures. *Human Nature*, 16, 410–446.
- Johnson, D. D. P., & Bering, J. (2006). Hand of God, mind of man: Punishment and cognition in the evolution of cooperation. *Evolutionary Psychology*, 4, 219–233.
- Kapitan, T. (1991). Agency and omniscience. *Religious Studies*, 27(1), 105–120.
- Knight, N., Sousa, P., Barrett, J. L., & Atran, S. (2004). Children's attributions of beliefs to humans and God: Cross-cultural evidence. *Cognitive Science*, 28, 117–126.
- Kretzmann, N. (1966). Omniscience and immutability. *The Journal of Philosophy*, 63(14), 409–421.
- Lahti, D. C. (2009). The correlated history of social organization, morality, and religion. In E. Voland & W. Schiefelhövel (Eds.), *The evolution of religious mind and behavior* (pp. 67–88). New York: Springer.
- Lane, J. D., Wellman, H. M., & Evans, E. M. (2010). Children's understanding of ordinary and extraordinary minds. *Child Development*, 81(5), 1475–1489.
- Lee, R. B. (2003). *The Dobe Ju/'Hoansi*. Belmont, CA: Wadsworth Publishing.
- Nicholas, L. J. (2004). The association between religiosity, sexual fantasy, participation in sexual acts, sexual enjoyment, exposure, and reaction to sexual materials among Black South Africans. *Journal of Sex & Marital Therapy*, 30, 37–42.
- Nicholas, L. J., & Durrheim, K. (1995). Religiosity, aids, and sexuality knowledge, attitudes, beliefs, and practices of black South-African first-year university students. *Psychological Reports*, 77, 1328–1330.
- Norenzayan, A., & Shariff, A.F. (2008). The origin and evolution of religious prosociality. *Science*, 322, 58–62.
- Orwell, G. (2003 [1949]). *Nineteen eighty-four*. New York: Plume.
- Premack, D., & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences*, 1(4), 515–526.
- Purzycki, B. G. (2010). Spirit masters, ritual cairns, and the adaptive religious system in Tyva. *Sibirica*, 9(2), 21–47.

- Purzycki, B. G. (2011). Tyvan *cher eezi* and the socioecological constraints of supernatural agents' minds. *Religion, Brain and Behavior*, 1(1), 31–45.
- Purzycki, B. G., & Sosis, R. (2011). Our gods: Variation in supernatural minds. In Ulrich Frey (Ed.), *Essential blocks of human nature* (pp. 77–93). New York: Springer.
- Pyysiäinen, I. (2009). *Supernatural agents: Why we believe in souls, gods, and buddhas*. New York: Oxford University Press.
- Richert, R. A., & Barrett, J. L. (2005). Do you see what I see? Young children's assumptions about God's perceptual abilities. *The International Journal for the Psychology of Religion*, 15(4), 283–295.
- Roes, F., & Raymond, M. (2003). Belief in moralizing gods. *Evolution and Human Behavior*, 24, 126–135.
- Rohrbaugh, J., & Jessor, R. (1975). Religiosity in youth: A personal control against deviant behavior. *Journal of Personality*, 43(1), 136–155.
- Sanderson, S. K. (2008). Religious attachment theory and the biosocial evolution of the major world religions. In J. Bulbulia, R. Sosis, E. Harris, R. Genet, C. Genet, & K. Wyman (Eds.), *The evolution of religion: Studies, theories, and critiques* (pp. 67–72). Santa Margarita, CA: Collins Foundation Press.
- Schloss, J. P., & Murray, M. J. (2011). Evolutionary accounts of belief in supernatural punishment: A critical review. *Religion, Brain and Behavior*, 1(1), 46–99.
- Scholl, B.J., & Tremoulet, P.D. (2000). Perceptual causality and animacy. *Trends in Cognitive Sciences*, 4, 299–308.
- Shariff, A. F., & Norenzayan, A. (2007). God is watching you: Priming god concepts increases prosocial behavior in an anonymous economic game. *Psychological Science*, 18, 803–809.
- Shariff, A. F., & Norenzayan, A. (2011). Mean gods make good people: Different views of God predict cheating behavior. *The International Journal for the Psychology of Religion*, 21, 85–96.
- Slone, D. J. (2004). *Theological incorrectness: Why religious people believe what they shouldn't*. New York: Oxford University Press.
- Stark, R. (2001). Gods, rituals, and the moral order. *Journal for the Scientific Study of Religion*, 40(4), 619–636.
- Sugiyama, L. S., Tooby, J., & Cosmides, L. (2002). Cross-cultural evidence of cognitive adaptations for social exchange among the Shiwiar of Ecuadorian Amazonia. *Proceedings of the National Academy of Sciences of the United States of America*, 99(17), 11537–11542.
- Swanson, G. E. (1960). *The birth of the gods: The origin of primitive beliefs*. Ann Arbor: University of Michigan Press.
- Waytz, A., & Young, L. (2012). The group-member mind trade-off. *Psychological Science*, 23(1), 77–85.

### Supporting Information

Additional Supporting Information may be found in the online version of this article on Wiley Online Library:

#### Appendix S1. Response-Time Questions.

Please note: Wiley-Blackwell is not responsible for the content or functionality of any supporting materials supplied by the authors. Any queries (other than missing material) should be directed to the corresponding author for the article.