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God will forgive: reflecting on God's love decreases neurophysiological responses to errors

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In religions where God is portrayed as both loving and wrathful, religious beliefs may be a source of fear as well as comfort. Here, we consider if God's love may be more effective, relative to God's wrath, for soothing distress, but less effective for helping control behavior. Specifically, we assess whether contemplating God's love reduces our ability to detect and emotionally react to conflict between one's behavior and overarching religious standards. We do so within a neurophysiological framework, by observing the effects of exposure to concepts of God's love *vs* punishment on the error-related negativity (ERN)—a neural signal originating in the anterior cingulate cortex that is associated with performance monitoring and affective responses to errors. Participants included 123 students at Brigham Young University, who completed a Go/No-Go task where they made 'religious' errors (i.e. ostensibly exhibited pro-alcohol tendencies). Reflecting on God's love caused dampened ERNs and worse performance on the Go/No-Go task. Thinking about God's punishment did not affect performance or ERNs. Results suggest that one possible reason religiosity is generally linked to positive well-being may be because of a decreased affective response to errors that occurs when God's love is prominent in the minds of believers.

Keywords: religion; error-related negativity; control; well-being

Throughout history, God has been characterized as demonstrating benevolence and malevolence toward mortals. King David, the author of the Bible's book of Psalms, for example, wrote in chapter 94 that God '*will repay them for their sins and destroy them for their wickedness*', then goes on to describe a different God in chapter 103, who is '*slow to anger, abounding in love . . . who does not treat us as our sins deserve or repay us according to our iniquities*'. Similarly, in the 99 names of Allah described in the Qur'an, *Al-Rahim* (the exceedingly merciful) and *Al-Wadud* (the loving) are found alongside *Al-Hasib* (the bringer of judgment) and *Al-Muntaqim* (the avenger).

Religion, therefore, may offer both comfort and fear to believers. In the present study, we consider how the positive *vs* negative characteristics of God may differentially impact upon the lives of the devout. Specifically, we ask if a loving God may be good at soothing distress, but bad for helping us control behavior. We do so by observing the effects of exposure to concepts of a loving God *vs* punishing God on the error-related negativity (ERN)—a neural signal originating in the anterior cingulate cortex (ACC) that is associated with performance monitoring and affective responses to errors (Gehring *et al.*, 1993; Inzlicht and Al-Khindi, 2012).

DIVERGENT CONCEPTUALIZATIONS OF GOD, SELF-CONTROL AND WELL-BEING

Researchers have hypothesized that religion evolved because belief in supernatural punishment is an effective means of controlling antisocial behavior among large groups of people (Johnson and Krüger, 2004). Religious individuals are, on average, less likely than non-believers to engage in certain types of antisocial behavior such as crime (Baier and Wright, 2001) and substance use (Good and Willoughby, 2014), and more likely to be involved in prosocial acts such as charitable giving and volunteering (Monsma, 2007). Furthermore, priming individuals with concepts of God/religion causes them to be more generous and less dishonest in laboratory settings (Randolph-Seng and Nielson, 2007; Shariff and Norenzayan, 2007). Researchers have proposed that religion helps individuals to be well-behaved because many aspects of religious belief and practice promote 'self-control'—that is, the ability to override one's own desirable thoughts and behaviors (e.g. daydreaming, cheating on a test, eating junk food) in order to bring them into line with overarching goals (e.g. finishing an assignment, being an honest person, losing weight; Baumeister *et al.*, 2007).

Evidence for the effect of religion on self-control, however, is mixed. Fishbach *et al.* (2003) found that subconsciously priming participants with temptation-related words (drugs, premarital, etc.) led to faster recognition of religious words, indicating that people involuntarily recruit religious beliefs to help them resist temptation. Similarly, Rounding *et al.* (2012) reported that religious primes improved performance on several behavioral indices of self-control, including endurance of discomfort, delaying gratification and persisting on a task following ego depletion. Laurin *et al.* (2012), however, found that religion's impact on self-control differed depending upon which specific aspect of self-control was considered; namely, religious primes decreased goal pursuit but increased temptation resistance. Inzlicht and Tullett (2010) reported mixed findings for the effect of religion on performance on the Stroop task (a measure of executive control), with one experiment indicating religion improved control, and the other finding no effect. Some researchers have claimed that religion may actually 'decrease' control. Schjoedt *et al.* (2013), for example, hypothesized that behaviors involved in religious rituals (e.g. suppression of emotional reactions, performing obscure motor actions) leads to increased cognitive load on frontal attention networks, thereby leaving individuals with diminished executive capacities. In a study using functional magnetic resonance imaging, Schjoedt *et al.* (2011) reported that devout Christians showed less BOLD response than non-Christians in parts of the brain thought to support executive function (i.e. the medial and dorsolateral prefrontal cortex) while listening to recorded prayers of an individual with supposed healing powers. Also noteworthy is that the sole purpose of some religious experiences (e.g. speaking in tongues) is the complete loss of executive control (cf. McCullough and Willoughby, 2009).

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The conflicting evidence regarding the link between religiosity and control may be due, at least in part, to the fact that studies have not considered divergent conceptualizations of the character of God. The degree to which God's punishment *vs* love is predominant in individuals' minds may affect the extent to which religious beliefs help people recruit self-control and avoid 'sin'. Recent studies suggest that mean gods, but not nice gods, are effective at controlling antisocial impulses. Namely, DeBono *et al.* (2013) found that primes of religious forgiveness caused increased cheating in a laboratory task; Shariff and Rhemtulla (2012) found that belief in heaven robustly predicted higher crime rates cross-nationally; and Shariff and Norenzayan (2011) reported that belief in God as a more punishing figure predicted lower rates of cheating in the laboratory.

While loving gods may not be effective at improving behavior, they might be very good at making us happy. Religious individuals tend to report higher levels of life satisfaction, more happiness and fewer negative psychological consequences of traumatic life events compared with those without faith (Gartner *et al.*, 1991; Diener *et al.*, 1999). Furthermore, people who believe more strongly in God's positive qualities report more happiness and self-esteem than those who believe in the frightening aspects of God (Benson and Spilka, 1973; Shariff and Aknin, 2014). It has been thought that the mechanisms through which religion predicts well-being is through the provision of social support, feelings of purpose/meaning in life and the promotion of coping strategies and health-positive behaviors (Diener *et al.*, 2011). Each of these proposed mechanisms, while diverse, share a common function: they help soften the blows of life (Diener *et al.*, 2011). Stressful times are less painful when we have a strong network of friends in whom to confide or when we have a positive lens through which to reframe negative events (e.g. 'God still accepts me even though I failed'). Increased well-being reported by the devout—at least, those who believe in a God who is loving and forgiving—could be, therefore, the cumulative result of being less distressed when things go wrong.

It is clear that punishing and loving gods may differentially affect the lives of believers. In particular, belief in God's punishment may promote self-control and thereby help us avoid antisocial behavior, whereas belief in God's love may soothe our distress and thus promote well-being. We suggest that one possible reason for which these divergent effects may occur is because contemplating God's loving *vs* punishing nature may, respectively, increase or decrease effort allocated to 'conflict detection'.

LOVING GODS, CONFLICT DETECTION AND THE ANTERIOR CINGULATE CORTEX

In cybernetic models, self-control is signaled by conflict detection, which can be defined as a feedback-loop process that checks for discrepancies between one's current state/behavior and one's overarching goals/standards (Carver and Scheier, 1998). Critically, as outlined in the 'affect alarm model of control' (Inzlicht *et al.*, 2013; Schmeichel and Inzlicht, 2013), cognitive conflict is not affectively neutral, but aversive, and it is this aversiveness that alerts us to the presence of cognitive conflict and motivates us to enact control in order to resolve the discrepancy. It is generally thought that negative affect can expedite goal pursuit and discrepancy reduction, while positive affect can lead to diminished effort on these tasks (Carver and Scheier, 2011). Because the idea of incurring God's wrath is psychologically distressing (Weisbuch-Remington *et al.*, 2005; Shariff and Aknin, 2014), when the threat of divine punishment is prominent in believers' minds, they may be highly attuned to discrepancies between their behavior and religious standards. In contrast, when believers are focused on God's loving nature, conflict between behavior and religious standards may not arouse very much distress (because, after all, God will forgive), and thus, they may not be as attentive to the presence of conflict—which would lead to more errors, but also may result in greater feelings of happiness.

If loving Gods do, in fact, reduce the detection of conflict between one's behavior and one's religious standards, we would expect to observe this effect at the level of the brain, in particular in the anterior cingulate cortex (ACC). Neuroscientists have established that the ACC is activated in response to cognitive conflict, expectancy violations or prediction errors (Botvinick *et al.*, 2001; Holroyd and Coles, 2002). The ERN, a negative deflection in an electroencephalogram (EEG) that occurs within 100 ms after an incorrect response, has long been considered a reliable index of ACC activity (Dehaene *et al.*, 1994).Whereas there are many hypotheses about the functional significance of the ERN, one particularly well-established theory holds that it reflects a performance monitoring system that scans for discrepancies between expected and actual outcomes, and signals the need for greater executive control when a mismatch—for instance, an error—is detected.

Consistent with the affect alarm model of control, EEG studies have found that cognitive conflict, expectancy violations or prediction errors may be motivationally salient and thus lead to negative affect (Hajcak and Foti, 2008; Proulx *et al.*, 2012). For example, studies have revealed enhanced ERN (i.e. more error-related ACC activity) in people for whom errors are more aversive—for example, individuals with mood disorders such as depression (Chiu and Deldin, 2007) or OCD (Hajcak and Simons, 2002); or high in negative affect (Hajcak *et al.*, 2004). Furthermore, some studies have reported that dampened ERN is associated with positive emotions, such as increased life satisfaction (Larson *et al.*, 2010b). In short, although the ERN is an index of neural systems involved in the detection of an error, it may also reflect the accompanying aversive affect (see Shackman *et al.*, 2011).

In a series of studies, Inzlicht and colleagues (Inzlicht *et al.*, 2009; Inzlicht and Tullett, 2010) reported that priming participants with God/religion was linked with decreased ERN amplitudes, suggesting that religion caused people to care less about making errors. However, because general primes were used (i.e. God's loving and punishing qualities were not primed separately), it is not known whether (as the affect alarm model would predict) this effect is specific to God's love. Also noteworthy is that Inzlicht and Tullett (2010) found mixed results for the effect of religion on Stroop task errors (from which the ERN was generated), with one experiment finding religion improved executive control, while the other experiment found no effect. Given that ERN results suggested people monitored and cared 'less' about their errors after being primed with religion, it may have been expected that religion would cause 'more' Stroop errors. This inconsistency may have been related to the use of general religious primes, which means that there may have been a great deal of variability in terms of the specific aspect of God/religion that participants were contemplating. Also complicating the interpretation of these studies is, as Harmon-Jones and Harmon-Jones (2011) point out, errors on the Stroop task used to index ACC activity were not 'religious' errors (i.e. 'sins'). It is not known whether religion would still be associated with lower ACC activity if the error involved violations of a religious nature, and/or whether the effect of religion on the ACC in response to religious errors would differ depending upon whether primes of God's love *vs* punishment were used.

In short, our understanding of the effect of religion on neurophysiological and cognitive control could be clarified in a study where: (i) conceptions of religious punishment and love are separated, and (ii) reaction to 'religion-specific' errors is observed. In order to most appropriately address these issues, it is ideal to use a homogenous, highly religious sample, with uniform beliefs about what behaviors are considered 'sinful', and for whom the concepts of religious love and punishment would be meaningful and therefore expected to

impact behavior and neural systems in predictable ways. Prior studies have primarily used participants with wide variability in religious commitment, which makes it difficult to understand what religious primes mean to participants and why they affect behavior (Randolph-Seng and Nielsen, 2008).

OVERVIEW OF THE EXPERIMENT

The goal of the present study was to more fully understand the ways in which conceptions of religious love *vs* punishment differentially impact neural systems involved in conflict detection. Our sample consisted of students at Brigham Young University (BYU), a university owned by the Church of Jesus Christ of Latter-Day Saints (LDS, or the 'Mormon' church) wherein most students are members of the LDS church. The characteristics of the BYU sample reported in Table 1 indicate that participants were highly religious, and believed that God was both loving and punishing but endorsed God's love and forgiveness much more strongly than wrath and punishment. These statistics are consistent with the characterization of God in LDS theology, as one who is loving and forgiving, yet holds clear-cut standards for behavior and consequences for non-compliance.

Participants were primed with reminders of God's love, punishment or a comparison condition that activated the idea that religion offers peace from worry. The comparison condition highlighted religion's anxiolytic properties in order to isolate the 'specific effects' of God's love/forgiveness, as compared with other positive/soothing aspects of religion. More specifically, we felt it was important to separate the effect of being reminded of God's love/forgiveness from the effect of being reminded of the peace from worry that religion offers. By using a 'peaceful God' comparison group, we could be more confident that if we observed dampened ERN in the love/forgiveness condition, it would not simply represent the effect of lessened anxiety. We subsequently recorded EEG signals while participants completed a Go/No-Go task where they were instructed to inhibit responses to pictures of alcoholic drinks, and were told that failure to inhibit indicated pro-alcohol tendencies. Because BYU students follow an honor code that prohibits the use of alcohol, ERNs observed in response to the errors on this task represented electrophysiological responses to 'religious errors'.

The experiment, therefore, offered a reasonably ecologically valid test of how concepts of God's punishment *vs* love affected individuals' control of and affective response to behaviors perceived as sinful. We tested if God's love/forgiveness decreased the amplitude of the ERN, and God's punishment increased the amplitude of the ERN. In addition, observing the error rate on the Go/No-Go task allowed us to test the effect of punishment *vs* love on executive control. Given the literature reviewed above, we expected loving God primes to decrease the ERN and increase the number of errors, and punishing God primes to increase ERN and decrease errors.

METHOD

Participants

Participants included 123 undergraduate psychology students (75 female) enrolled at BYU. Fourteen participants were excluded due to either fewer than six error trials/excessive EEG noise ($n = 7$; Olvet and Hajcak, 2009; Larson *et al.*, 2010a) or computer malfunction leading to an absence of EEG file ($n = 7$). One participant was also excluded for reporting current alcohol consumption. Final study enrollment, therefore, included 108 participants. All participants indicated they were members of the LDS church, denied current alcohol consumption and were native English speakers free from neurologic or psychiatric diagnosis.

Procedure

The BYU Institutional Review Board approved all procedures. Participants were told they were enrolled in a study of memory for written text. They drew a slip of paper from a cup to ostensibly determine if their memory passage would be a speech, sermon or lecture. All slips of paper in the cup indicated they would be reading a sermon, and participants were randomly assigned to read one of three short passages emphasizing either God's punishment ($n = 34$; 24 female; mean age $= 19.4 \pm 1.6$ years), love/forgiveness ($n = 40$; 23 female; mean age $= 20.5 \pm 2.2$ years) or peace from worry ($n = 34$; 20 female; mean age $= 19.7 \pm 1.8$ years). The readings were created by the authors and tested with BYU students to ensure they reflected LDS theology. The readings are included in the supplementary material.

After reading the passage, participants were told that they would wait 30 min before the memory test, and to prevent them from reflecting on the text in the meantime, they would complete another task that was being developed for a study on impulse control. Participants were told the task assessed their impulses toward alcoholic beverages, with more errors signifying increased difficulty restraining pro-alcohol tendencies. The task was a Go/No-Go (GNG) task wherein participants were presented a picture of a glass of beer or a glass of orange juice. Participants were asked to identify which picture was beer and which was juice before the task began. Pictures were presented for 100 ms with an intertrial interval that varied randomly between 300 and 800 ms. Participants were instructed to push a keypad when presented with the orange juice picture (a Go trial) and withhold their response when the beer picture was presented (a No-Go trial). The task consisted of five blocks of 50 trials, with 40 Go trials and 10 No-Go trials (250 total trials; 200 Go trials and 50 No-Go trials). From the task, we calculated the rate of No-Go errors (i.e. pressing a button during a No-Go trial).

Participants also completed a survey assessing religious characteristics. Measures included the Religious Zeal Scale, which assesses fervent devotion (McGregor *et al.*, 2008, sample item includes 'I aspire to live and act according to my religious beliefs'; $\alpha = 0.86$), frequency of

Table 1 Religious characteristics of the sample

Variable/item	Number of items	Range	Scale anchors	*M* (s.d.)
God loves us unconditionally.	1	1–5	1 (very slightly or none)–5 (extremely)	4.88 (0.49)
God is forgiving.	1	1–5	1 (very slightly or none)–5 (extremely)	4.85 (0.41)
God is wrathful.	1	1–5	1 (very slightly or none)–5 (extremely)	2.25 (1.00)
God will punish us for the sins we commit.	1	1–5	1 (very slightly or none)–5 (extremely)	3.15 (1.10)
To what extent do you believe in God?	1	1–5	1 (not at all)–5 (completely)	4.84 (0.50)
How often do you attend services or activities at a place of worship?	1	1–9	1 (never)–9 (several times per day)	6.55 (0.81)
How often do you pray?	1	1–10	1 (never)–10 (several times per day)	9.31 (1.33)
Religious zeal scale	19	1–5	1 (strongly disagree)–5 (strongly agree)	4.08 (0.49)

religious service attendance, frequency of prayer, as well as ratings of belief in God's love, forgiveness, wrath and punishment.

Electroencephalogram recording and reduction

We recorded EEG during the GNG task from 128 scalp sites using a geodesic sensor net and Electrical Geodesics, Inc. (EGI; Eugene, OR) amplifier system that has a 20 K nominal gain and a band pass of 0.10–100 Hz. EEG was referenced to the vertex electrode and digitized continuously at 250 Hz with a 24-bit analog-to-digital converter. Impedances were maintained below 50 kΩ, and data were low-pass filtered at 30 Hz. We used Joe Dien's ERP PCA Toolkit to reduce the data and remove eye blink and movement artifact using independent components analysis (ICA; Dien, 2010). Components of the ICA that correlated .9 or greater with two blink templates, one provided by the ERP PCA Toolkit author and one created using the current data, were removed (Dien, 2010). Trials were marked as unusable if >15% of channels were marked bad. Channels were marked bad if the fast average amplitude exceeded 100 μV or if the differential average amplitude exceeded 50 μV. Data were average rereferenced using the polar average reference effect correction (Junghöfer *et al.*, 1999).

We extracted response-locked epochs from 200 ms prior to participant response to 400 ms following participant response. We used the −200 to −100 ms window for baseline correction. Amplitude of the ERN and correct-response negativity were extracted at electrode FCz using the mean amplitude between 0 and 100 ms. We used the mean amplitude because it is more reliable and robust against error and bias than peak amplitude-type extraction techniques (Luck, 2005; Clayson *et al.*, 2013).

RESULTS

The effect of condition on the amplitude of the ERN difference wave (error minus correct trials) was significant, $F(2,105) = 4.46$, $P = 0.01$, see Table 2. Post-hoc *t*-tests showed that participants in the loving God condition had lower-amplitude difference waves ($M = -0.45$ μV, s.d. = 1.15) than participants in the punishing ($M = -1.15$ μV, s.d. = 1.24), $t(72) = 2.52$, $P = 0.01$, $d = 0.59$, or comparison conditions ($M = -1.18$ μV, s.d. = 1.21), $t(72) = 2.63$, $P = 0.01$, $d = 0.62$. The difference waves of participants in the punishing and comparison conditions did not significantly differ, $t(66) = -0.08$, $P = 0.94$. Therefore, reminding participants of God's love can buffer error-related ACC activity, but reminding participants of God's punishment does not amplify error-related ACC activity in response to violations of a religious nature (see Figure 1).

There was a significant effect of condition on the GNG error rate (failure to inhibit pressing a button when presented with a picture of alcohol), $F(2,105) = 3.62$, $P = 0.03$. Individuals in the loving God condition made more errors ($M = .47$, s.d. = 0.13) than participants in the control condition ($M = 0.38$, s.d. = 0.13), $t(72) = 2.76$, $P = 0.01$, $d = 0.65$. The rate of errors among loving God participants was not significantly different from those in the punishing condition ($M = 0.45$, s.d. = 0.15), $t(72) = 0.62$, $P = 0.54$, and the punishing and comparison conditions also did not differ, $t(72) = -1.83$, $P = 0.07$, although we noted a marginal effect such that the punishing God surprisingly produced higher error rates than the comparison condition. Reflecting on God's loving/forgiving qualities, therefore, may cause reduced executive control. The punishing God prime, in contrast, did not improve control. Finally, because differences in executive control can pose a confound when comparing ERN across conditions (Yeung, 2004), the difference wave data were re-analyzed with error rate as a covariate and the effect did not change ($P < 0.03$). Finally, there were no significant correlations between either outcome variable (GNG errors; ERN) and the religiosity variables listed in Table 1, all rs < 0.17, all Ps > 0.07.

Table 2 Descriptive statistics for study variables

Variable	Loving God *M* (s.d.)	Punishing God *M* (s.d.)	Control *M* (s.d.)
ERP amplitude: correct trials	0.32_a (1.22)	0.46_a (1.67)	0.89_a (1.28)
ERP amplitude: incorrect trials	-0.58_a (2.17)	-1.85_b (2.31)	-1.47_{ab} (2.45)
Amplitude of difference wave	-0.45_a (1.15)	-1.15_b (1.24)	-1.18_b (1.21)
No-Go error rate	0.47_a (0.13)	0.45_{ab} (0.15)	0.38_b (0.13)

Note: Means sharing a common subscript are not statistically different at $P < 0.05$.

DISCUSSION

This study explored the effect of priming individuals with God's forgiving *vs* punishing qualities on electrophysiological responses to religion-specific errors and executive control in a sample of devout believers. We found a causal link between thinking about God's forgiveness and reduced control in terms of a higher GNG error rate than the comparison group and dampened ERN difference waves. Thinking about God's punishing qualities, however, did not affect either the ERN or GNG errors. These findings may inform our understanding of possible mechanisms through which divergent conceptualizations of God impact upon self-control and well-being.

These results suggest that reminders of God's forgiveness may cause us to care less about, and engage in less monitoring for conflict between one's behavior and religions standards. This is consistent with Inzlicht and Tullett (2010), where general religious primes led to dampened ERN, but also suggest that this effect may be specific to the contemplation of God's love and forgiveness. The fact that the present study demonstrated God's love decreased ACC activity for 'religion-specific' errors is noteworthy because such errors are likely more personally meaningful and strongly tied to well-being than generic errors, particularly among devout believers. Whereas diminished conflict detection may lead to the commission of more religious errors, then, it may also lead to heightened well-being, as reductions in affective response to personally meaningful errors may help soften the blows of life on a day-to-day basis (cf. Inzlicht *et al.*, 2011).

There are two implications of the finding that the punishing God prime did not affect either the ERN or GNG errors. First, it is possible that threat of supernatural punishment was not sufficiently distressing to cause participants to more carefully monitor for discrepancies and enact self-control. Because participants in the punishing God condition did not differ in amplitude of the ERN difference wave from the control condition (where participants were reminded of the peace religion offers from anxiety), it is unlikely that punishment caused increased distress in response to, or motivational salience of, religious errors. Reminders of supernatural punishment may not have affected participants because they were thoroughly convinced of their own forgiveness and thus small religious violations were not experienced as distressing. Future studies should consider the possibility that the threat of God's punishment may increase distress in response to and motivational salience of religious errors only among populations who are insecure about their own salvation. However, given that an accumulating body of evidence that American Christians perceive God as an unconditionally loving being who wants to befriend humans (Luhrmann, 2012), and, cross-nationally, people believe much more strongly in God's loving than punishing qualities (Shariff and Norenzayan, 2011), our sample may actually be quite representative in that respect.

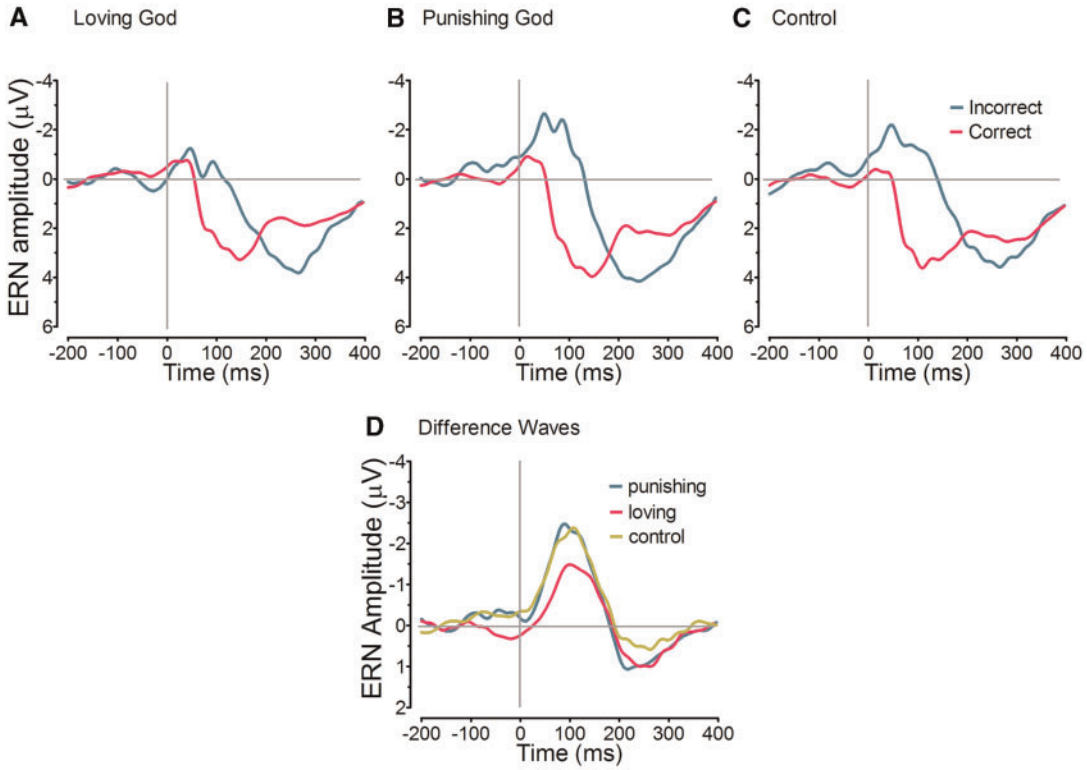

Fig. 1 Event-related potentials (ERPs) for incorrect and correct trials at electrode FCz in the (**A**) loving God condition; (**B**) punishing God condition; and (**C**) control condition. Panel (**D**) illustrates difference wave (incorrect minus correct trials) amplitude for punishing, loving and control conditions.

Second, if, as our results suggest, the threat of God's punishment does not motivate people to care more about their errors, conflict detection and/or executive control may not be important mechanisms through which religion promotes self-control and/or decreases antisocial behavior. Rather, it may be that, when exposure to religious ideas makes people more self-controlled and better behaved, it is simply because 'religion' is linked with concepts of 'conscientiousness' and 'morality'. This may be why some studies have found that religious primes seem to affect everyone uniformly, regardless of level of religiosity (e.g. Shariff and Norenzayan, 2007; Rounding *et al.*, 2011).

Limitations

Whereas using a sample of BYU students was ideal for observing the impact of meaningful religious beliefs (i.e. God's love and punishment) on the cognitive/neural experience of making personally relevant religious errors, this sample introduces some limitations with regard to interpretation and generalization—particularly with regard to the effectiveness of the punishing prime. This sample had an extremely high baseline level for belief in God's love, which means that the relatively mild punishment prime (reading a passage) may not have been able to sway their beliefs, even temporarily. It may have been necessary to use a stronger prime in order to truly understand how their behavior was affected by the threat of God's punishment. It is also possible that this sample had a high baseline level of self-control (although no research exists comparing levels of control between this sample and other populations), and, thus, a ceiling effect may have precluded the punishment prime from increasing conflict monitoring or decreasing Go/No-Go errors (which may also help explain why we observed a marginally significant higher rate of errors on the Go/No-Go task for the punishing as compared to the comparison group). Third, BYU students may not have seen alcohol as bothersome, because they have rejected it so often. We may have found different results if we had targeted a sin which BYU participants had more trouble avoiding and may have seen as a potential threat to their good standing with God (e.g. sexual intimacy with a boy/girlfriend or less formally enforced sins such as gossiping). Fourth, using a homogenous population precludes the examination of whether these effects differ by individual religious characteristics that may offer insight into what may be driving these results. For example, if the threat of God's punishment was motivating control, one would expect the devout to respond differently (i.e. more strongly) to religious primes (e.g. Inzlicht and Tullett, 2010). Because all participants in the current study were extremely devout, it was not possible to investigate such questions. Indeed, no significant correlations emerged between religious characteristics listed in Table 1 and either the ERN or GNG errors, which was likely a result of extremely low variability. To avoid limitations associated with using religiously homogenous populations but also capitalize upon the many benefits, future research may consider comparing multiple groups of homogenous religious samples within the same study (e.g. see Hommel *et al.*, 2011).

Conclusion and directions for future research

These results suggest that God's love and punishment may have divergent effects on our affective response to errors and ability to detect conflict between our behavior and our broader religious standards, with both positive and negative implications for individuals and society.

On the positive side, religion—in particular, a focus on God's love and forgiveness—may foster well-being due to the cumulative result of being less distressed when things go wrong. On the negative side, in populations where belief in God's love and forgiveness is extremely

high, religion may be ineffective at controlling our impulses because God's punishment may not be seen as a plausible threat.

It will be important for future research to identify the precise mechanisms through which thinking about God's love impacts upon errors and affective response to conflict. For example, one key feature may be the imagined social support conferred by a loving God, and, if so, similar results should be found when reminding individuals about the unconditional love of another significant individual (for example, a parent). It could also be that reminding people that a powerful God loves and forgives them increases self-confidence. Future studies may also consider exploring whether, and under what conditions, contemplating God's love ever increases control. Here, it may be useful to incorporate ideas from parenting research, where researchers have found that avoidance of antisocial behavior in adolescence is driven more by loving parent-child relationships than harsh punishment and control (Soenens *et al.*, 2006). Given that God may sometimes operate as an attachment figure (Kirkpatrick, 1998), it may be interesting to consider whether the processes through which loving parents enforce desired behavior in their children may sometimes apply to the devout's adherence to religious standards.

SUPPLEMENTARY DATA

Supplementary data are available at *SCAN* online.

Conflict of Interest

None declared.

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