

Abstract

The propensity for religious belief and behavior is a universal feature of human societies, but religious practice often imposes substantial costs upon its practitioners. This suggests that during human cultural evolution, the costs associated with religiosity might have been traded off for psychological or social benefits that redounded to fitness on average. One possible benefit of religious belief and behavior, which virtually every world religion extols, is delay of gratification—that is, the ability to forego small rewards available immediately in the interest of obtaining larger rewards that are available only after a time delay. In this study we found that religious commitment was associated with a tendency to forego immediate rewards in order to gain larger, future rewards. We also found that this relationship was partially mediated by future time orientation, which is a subjective sense that the future is very close in time and is approaching rapidly. Although the effect sizes of these associations were relatively small in magnitude, they obtained even when controlling for sex and the Big Five personality traits (Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism).

Keywords: religion, evolution, hyperbolic discounting, delay discounting, impulsivity, delay of gratification

Religious People Discount the Future Less

1.0 Introduction

Evolutionary scientists have begun to inquire into how humans' propensity for religious belief and behavior, which can impose heavy somatic and energetic costs upon their practitioners, might have evolved (e.g., Atran & Henrich, 2010; Bering & Johnson, 2005; Irons, 2001; Norenzayan & Shariff, 2008; Sanderson & Roberts, 2008; Sosis, 2003; D. S. Wilson, 2002; Wright, 2009). Religions, in the form with which we are most familiar today, first appeared approximately 10,000 years ago, around the time when human societies were transitioning from hunter-gatherer bands to large-scale agrarian societies (Wright, 2009). We, along with other theorists (Norenzayan & Shariff, 2008; Wright, 2009; Johnson, 2005), believe that this timing was perhaps not coincidental, and that religious beliefs and practices developed as they did through cultural evolution in response to challenges that life in large-scale, sedentary, agrarian societies created—specifically, challenges related to cooperative action with large numbers of non-kin, and challenges related to agricultural food production, which traded larger outlays of initial effort for larger caloric yields (McCullough & Carter, 2011).

Several proposals focus on the notion that religious beliefs and behaviors promote generosity or cooperation among unrelated individuals, perhaps in turn yielding (a) the economic gains associated with reciprocal cooperation or the production of public goods; or (b) enhanced group cohesion that promotes effective intergroup competition (Bering & Johnson, 2005; Henrich et al., 2010; Johnson, 2005; Norenzayan & Shariff, 2008; Sosis, 2000). Supporting these proposals, experimental manipulations of religious cognition have been reported to increase generosity (Pichon, Boccato, & Saroglou, 2007; Shariff & Norenzayan, 2007), honesty (Randolph-Seng & Nielsen, 2007), and submission to authority (Saroglou, Corneille, &

Cappellen, 2009). If religious beliefs and behaviors, despite the costs they can impose, enabled humans to take advantage of life in large, agrarian societies made up primarily of non-kin, then such beliefs and behaviors might have propagated through cultural-evolutionary mechanisms (Henrich et al., 2010; Richerson & Boyd, 2005; Sanderson & Roberts, 2008; Wright, 2009).

But there are cognitive constraints on the evolution and proximal production of prosocial behaviors such as cooperation, including the ability to forego immediately available rewards in the interest of larger rewards that can be obtained only after a delay (Curry, Price, & Price, 2008; Stephens, McLinn, & Stevens, 2002; Stevens, Cushman, & Hauser, 2005; Yi, Buchhalter, Gatchalian, & Bickel, 2007). For example, Curry et al. (2008) and Yi et al. (2007) demonstrated that participants' discount rates (i.e., the rate at which the value of a reward is downgraded as a function of the time until its receipt) were negatively associated with cooperation during economic games such as the iterated prisoner's dilemma. Therefore, overcoming impulses to defect in social dilemmas to gain the longer-term benefits of mutual cooperation could be one pathway by which religious cognition promotes prosocial behavior (McCullough & Carter, 2011). On this basis, we hypothesized that religiousness is associated with a stronger preference for large rewards that can be obtained only after a delay versus small rewards that are immediately available (Kirby & Maraković, 1996; Rachlin, 2000). Reyes-García et al. (2007) made a similar argument for how delay of gratification helps people obtain the forms of human capital (e.g., formal schooling) required to transition from activities that characterize self-sufficient societies (e.g., hunting, foraging) to those that characterize market-based societies (e.g., wage-earning).

1.1 Computational Models of Intertemporal Choice

To understand how religious belief and behavior might influence delay discounting at the cognitive or computational level, it is useful to consider the cognitive processes that lead to intertemporal choice dilemmas. Researchers have discovered that people's choices between small rewards available after a short delay versus larger rewards available after a longer delay may reflect the operation of one or two distinct neural systems, although the computational tasks that these systems perform is debated. Despite disagreement, there is reasonably good consensus that intertemporal choice requires distinct computations of reward value and time to reinforcement, and that individual differences in preferences for larger-later versus smaller-sooner rewards can be traced to differences in the operation of circuits that compute reward value and wait time (Ballard & Knutson, 2009).

Therefore, if religious belief and behavior influence the operation of systems for intertemporal choice, they might do so in at least two ways. First, chronic involvement in religion, with its attendant social reinforcement of restraint and punishment of impulsivity (Kenrick, McCreath, Govern, King, & Bordin, 1990), might lead to reductions in the strength of the neural signals that represent the value of immediately available rewards, or increases in the signals that represent the value of temporally distant rewards. Second, and perhaps more plausibly, religion might influence the cognitive system or systems that compute wait time. Through development over the life course, adjusting to religious socialization (i.e., via contact with religious parents, peers, and institutions) involves learning to manage incentives to delay gratification. Learning to manage these incentives during development and adulthood might lead to changes in the cognitive system that computes and represents reward delay.

In fact, many religions teach concepts that direct people's attention to the distant future. Preoccupation with future-oriented concepts such as immortality, reincarnation, resurrection, the

slow but inexorable creep of divine justice, karma, or places one might inhabit after death such as Elysium, Gehenna, Hades, Heaven, Hell, Purgatory, Valhalla, or Sheol might cause the intermediate future (e.g., six months from now) to *feel* closer. People's subjective experiences of time are intimately related to their rates of hyperbolic discounting, and—importantly—making time salient increases the correspondence between objective time and cognitive representations of time (Zauberman, Kim, Malkoc, & Bettman, 2009). Also, people who are intrinsically religious and who indicate an interest in the afterlife tend to report that the future feels as though it is approaching quickly and that they spend a lot of time thinking about the future (Oner-Ozkan, 2007). In other words, the chronic salience of the future that religion encourages might cause religious people to experience distant rewards as subjectively closer, thereby reducing delay discounting.

1.2 Hypotheses and the Present Study

In the present work, we tested two hypotheses. First, we hypothesized that religiousness is associated with lower discounting of future awards—that is, a stronger preference for larger-later rewards over smaller-sooner rewards. Second, we hypothesized that the association of religiousness with lower rates of discounting is partially mediated by the association of religiousness with future time orientation.

We examined these ideas in a cross-sectional study evaluating whether religious university students had lower rates of hyperbolic discounting and whether that association was mediated by future time orientation (Gjesme, 1979)—a construct reflecting a preoccupation with the future and a sense that it is approaching quickly. In conducting this study, we also statistically controlled for sex differences and for differences in the “Big Five” personality traits

(John & Srivastava, 1999), several of which have been associated with both religion (Saroglou, 2010; Stark, 2002) and delay discounting (Miller, Lynam, & Jones, 2008; Silverman, 2003).

2. Method

2.1 Participants

Participants were 277 undergraduates (41% men) at the University of Miami. Their mean age was 19.08 years ($SD = 2.19$, youngest = 17, oldest = 39). Participants reported a variety of religious denominations (44.8% Christian, 10.5% Judaism, 2.5% Islam, 1.8% Buddhism, 1.8% Hinduism, 1.1% Taoism, and 3.6% other). 17.3% of the sample did not report a religious affiliation and 16.6% selected “none” for their religious denomination. Participants also reported diverse ethnicities (69.3% Caucasian, 8.7% Asian, 6.1% African American, 0.7% Native American, 7.2% other, and 7.9% more than one race). 17% considered themselves to be Hispanic. Participants were recruited from introduction to psychology courses and received a small amount of course credit for their participation plus a 25% chance of receiving one of the 27 monetary rewards they preferred on the Monetary Choice Questionnaire (see below).

2.2 Measures

2.2.1 Monetary Choice Questionnaire (MCQ). Though controversial, there is good evidence that discounting of future rewards as a function of time is reasonably well approximated as $f(t) = 1 / (1 + kt)$, where k = the hyperbolic control parameter, and t = time until reward delivery (Mazur, 1987). To estimate k , participants completed the Monetary Choice Questionnaire (MCQ; Kirby & Maraković, 1996), which involves 27 independent binary choices between either a small immediate reward (e.g., \$50 today) or a larger reward following a time delay (e.g., \$100 six months from now). From participants’ 27 choices, we calculated their k values for small (\$25-\$35), medium (\$50-\$60), and large (\$75-\$85) delayed rewards (the MCQ

estimates k for varying magnitudes of reward in order to provide a measure of the “magnitude effect,” the finding that smaller rewards are discounted more steeply; Kirby & Maraković, 1996). To improve the validity of these estimates of k , participants were informed they had a 25% chance of obtaining 1 of the 27 rewards they preferred. Values for k were non-normally distributed (skewness = $-.39$, kurtosis = $.46$), so we log-transformed them to approximate normal distributions. Measuring individual differences in discounting using the hyperbolic formula has been shown to predict self-reported impulsivity and a variety of disinhibitory disorders including alcohol and drug abuse, childhood conduct problems, and adult antisocial behavior (Bobova, Finn, Rickert, & Lucas, 2009).

2.2.2 Religious Commitment Inventory (RCI-10). The 10-item Religious Commitment Inventory (RCI) measures participants’ commitment to their religious beliefs and institutions (Worthington et al., 2003). Participants used a five-point Likert-type scale (1 = *not at all true of me*, 5 = *totally true of me*) to report the degree to which they agreed with statements such as “I spend time trying to grow in understanding of my faith.” Worthington et al. (2003) reported excellent reliability for the RCI (Cronbach’s $\alpha = .93$, and $r_s > .84$ for both three-week and five-month test-retest) as well as strong evidence for construct validity (self-rating of participation in organized religion, $r = .70$, and self-rated religious commitment, $r = .84$) and discriminant validity.

2.2.3 Future Time Orientation (FTO). Participants also completed the 14-item Future Time Orientation Scale (Gjesme, 1979), which includes items such as “I have been thinking a lot about what I am going to do in the future,” and “I reflect a great deal about the future and feel it is rapidly approaching.” Participants completed these items on a four-point Likert-type scale (1 = *is not at all true of me*, 4 = *is very true of me*). The FTO scale tends to have low reliability

(Gjesme, 1979), so we boosted its reliability to $\alpha = .73$ by removing one item (item fourteen, “Usually I feel time is going too fast”), a choice based solely on the fact that this single item brought α below an acceptable level. Gjesme (1975) reported evidence for construct validity of the FTO Scale: Students with higher FTO scores, as compared to students with lower FTO scores, reported that a future event felt nearer in time. Additionally, Oner-Ozkan (2007) reported evidence that those with higher FTO scores reported more interest in a future beyond death, suggesting that perhaps this possible future was experienced as more real.

2.2.4 The Big Five Inventory (BFI). The 44-item Big Five Inventory (BFI; John, Donahue & Kentle, 1991) measures participants’ standing on the “Big Five” personality traits (Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism). Items in this scale are used to create mean scores for these five constructs. The BFI is widely used as a measure of the Big Five and its validity is well documented (John & Srivastava, 1999).

2.3 Procedure

Participants completed the Religious Commitment Inventory in an initial mass testing session that occurred before they were brought into the laboratory. Subsequent laboratory sessions were run with one to four participants per session. During sessions with multiple people, participants were asked not to talk, and they were seated so that they could not see each other. The researcher explained to participants that they would be asked to answer questions regarding their personal preferences and beliefs. They were told that they would be asked some questions regarding their preferences for amounts of money at varying times, and that they should consider these choices carefully because they stood a one-in-four chance of receiving one of their choices. It was made clear to participants that the researcher would get contact information for each participant so that every effort could be made to deliver any reward that was to be received in the

future (rather than immediately). After participants received instructions, they completed the Monetary Choice Questionnaire, the Future Time Orientation Questionnaire, and the Big Five Inventory. When participants finished their questionnaire packets, each was given a chance to pick one of four playing cards. If a participant picked an ace, participants were then given the amount of money they had chosen for a randomly selected item. If the reward was delayed, a time was set up for participants to receive their money. All participants were then debriefed, thanked, and dismissed.

3. Results

3.1 Descriptive Statistics

Means, standard deviations, and internal consistency reliabilities are reported in Table 1. Intercorrelations among all major study variables appear in Table 2.

3.2 Statistical Modeling

Data were analyzed with structural equation modeling (SEM) in MPlus version 4.21 (Muthén & Muthén, 1998-2004). We used SEM because of the advantages it holds over other statistical techniques, namely, (1) it enables the removal of measurement error from latent variables, thereby leading to better approximation of effect sizes, (2) it provides objective measures for judging the degree of fit between hypothesized relationships and the actual data, and (3) it enables one to simultaneously test all of one's statements about the processes that are responsible for a network of relationships (Kline, 2005). Using the large- and small-magnitude scales derived from the Monetary Choice Questionnaire, we created a latent variable measuring the discounting of future rewards. Creating such a latent variable allowed us a more accurate measure of k that avoids the abovementioned "magnitude effect." Only these two scales were used because the medium-magnitude reward scale was too highly correlated with the large-

magnitude reward scale, resulting in a loading (standardized coefficient) > 1.0 with the latent variable. The latent discounting variable was then regressed on the Religious Commitment Inventory and the Future Time Orientation scale, as well as sex and the Big Five. Additionally, Future Time Orientation was regressed on the Religious Commitment Inventory. Covariances among religious commitment, future time orientation scale, sex, and the Big Five were freely estimated.

The chi-squared test of model fit was not significant ($\chi^2(7) = 14.03, p > .05$), indicating that the model fit the data. Additional fit indices also supported this conclusion: The CFI was .98, the SRMR was .01, and the RMSEA was .06, with a 90% CI for this estimate of 0.0 to .10. Taken together, these fit statistics suggest that the model provided a very close approximation to the data (Chen, Curran, Bollen, Kirby, & Paxton, 2008). For ease of interpretation, all standardized estimates are presented in Figure 1. It is of note that the direct effect of religious commitment on delay discounting, though small in terms of effect size, is statistically significant (standardized coefficient = $-.18, z = -2.62$), as are the paths from religious commitment to future time orientation (standardized coefficient = $.14, z = 2.35$) and from future time orientation to the latent discounting variable (standardized coefficient = $-.23, z = -2.91$). As Figure 1 demonstrates, the associations among religious commitment, future time orientation, and delay discounting obtained even when controlling for potential sex differences and their (generally small) associations with the Big Five personality traits (Miller et al., 2008; Saroglou, 2010; Silverman, 2003; Stark, 2002). Outside of the context of the above model, zero-order correlations between the latent variable for k and Big Five Personality traits were nearly significant for Conscientiousness only, standardized coefficient = $-.24 (z = -1.94)$.

Statisticians have recently begun reporting improved methods for testing mediation effects using Bias Corrected Bootstrapping (MacKinnon, Lockwood, & Williams, 2004; Shrout & Bolger, 2002). This option is considered to be the most accurate method for testing mediation when sample sizes are small to moderate, as is the case in the present study. Using this method, the estimated indirect effect of religious commitment on discount rates via its intermediate effect on future time orientation was significantly different from zero (95% CI = -.10 to -.01), indicating that the effect of religious commitment on discounting is partially mediated by future time orientation.

4. Discussion

Many researchers have proposed that religious beliefs and behaviors facilitate prosocial behavior (e.g., Bering & Johnson, 2005; Irons, 2001; Johnson, 2005; Norenzayan & Shariff, 2008; Sosis, 2003; D. S. Wilson, 2002; Wright, 2009) and might have been naturally (or culturally) selected for this function. However, the evolution and proximal production of cooperation rely on a more fundamental cognitive process: The ability to resist impulses to take a smaller-sooner reward so that one can pursue a larger reward that only becomes available after a delay (Stevens et al., 2005). In the present study, we evaluated the association of religious commitment with a measure of delay discounting (Kirby & Maraković, 1996; Mazur, 1987), and we tested whether the association of religious commitment with delay discounting was mediated by the association of religiousness with future time orientation (Gjesme, 1979).

Our results supported both hypotheses. More religious participants tended to exhibit a stronger preference for larger-later rewards than did their less religious counterparts—a finding that is, as far as we are aware, reported for the first time in this paper. Furthermore, the

association of religious commitment with lower discounting was partially mediated by religious participants' tendency to view the future as more salient.

We think these results can be understood in light of the fact that religious environments (e.g., religious families, peer groups, and social institutions) are ones in which people are taught (through direct instruction, social learning, and direct exposure to operant contingencies) that patience pays. Patience is a highly prized virtue in many religious systems, and self-reports of patience are positively associated with measures of religiousness (Schnitker & Emmons, 2007). We think that as a result of such a learning history in childhood or through adulthood, people with religious backgrounds may get exposed to consistent behavioral contingencies in which impulsivity is consistently discouraged, and delay of gratification is consistently rewarded (Kenrick et al., 1990; Price & Bouffard, 1974), thereby causing them to develop a more patient style of decision-making. Moreover, the emphasis of many religions on the afterlife and on future supernatural punishments and rewards may create a chronic preoccupation with the future that causes the future to feel subjectively closer in time.

From a computational point of view, learning experiences that reinforce patience, punish impatience, and cause a chronic focus on future outcomes—such as those that might occur as the result of religious socialization—might influence the cognitive systems that represent time (Ballard & Knutson, 2009). Indeed, recent experiments have demonstrated that when people actively consider (and then estimate) the lengths of time until certain future events will occur, their subjective measurements of time become more accurate representations of objective time (Zauberman et al., 2009). In other words, future-oriented religious concepts may influence the estimation of the distance between the present and the future—actually causing people to feel

that the time until the delivery of rewards is closer. We look forward to future research that might examine such speculations experimentally.

4.1 Limitations and Directions for Future Research

There are some limitations to our findings that should be noted. First, we conducted this study with U.S. university students for whom Christianity was the predominant religion, so it is unknown whether these effects would generalize to people from other parts of the world or other religious backgrounds. However, Oner-Ozkan (2007) found that Turkish (Muslim) undergraduates who are highly religious tended to report considering the future in their present decision making to a greater extent than did less religious students, and researchers have found positive relationships between religion and self-reports of self-control among, for instance, Muslim students from India (Aziz & Rehman, 1996) and Indonesia (French, Eisenberg, Vaughan, Purwono, & Suryanti, 2008). In addition, Jackson and Francis (Jackson & Francis, 2004) found negative relationships of self-reported church attendance and personal prayer with self-reported impulsivity among University students in the UK. These findings give reason to suspect that we would indeed find a negative association of religiosity with delay discounting with people from nations outside the U.S. and with non-Christians, though future research is clearly required.

Second, the associations among religious commitment, future time orientation, and delay discounting were relatively small in magnitude. Third, the correlational nature of the study makes it difficult to draw firm causal conclusions. Experimental research would help to confirm the conclusions that we have offered here. However, the fact that the associations among religiousness, future time orientation, and delay discounting obtained even when controlling for participants' sex and their standing on the Big Five personality traits suggests that the

associations are not due to sex differences or to differences in those particular personality traits, several of which are often associated (albeit relatively weakly, i.e., $r_s \approx .20$) with both religion (Saroglou, 2010; Stark, 2002) and delay discounting (Miller et al., 2008; Silverman, 2003). Fourth, the standard version of the MCQ, which we used here, adds an additional cost to the larger-later rewards by requiring participants to return to the laboratory to receive their payment (whereas the smaller-sooner rewards are delivered immediately). Although this additional cost is constant across participants, and therefore would not be expected to distort the magnitude of correlations between religiosity and delay discounting, it most likely leads to overestimates of average degree of discounting in our sample. Future work should use methodology more in line with Wilson and Daly (2004) in which both the smaller-sooner reward and the larger-later reward required that the participant return to the laboratory at a later date.

Fourth, the current model proposes that causality flows from religiousness to future discounting, but the cross-sectional nature of this study does not allow for a direct test of this particular causal ordering. It is possible that the ability to delay gratification may increase religiosity, and that the relationship between religion and self-regulatory constructs is actually one of mutual influence. Longitudinal studies have been published showing that early religious beliefs predict higher scores for personality traits related to self-regulation at a later time for women (Wink et al., 2007) and that higher ratings of personality traits linked to self-regulation at one time point predict greater religious belief and involvement at a later time point (McCullough, Tsang, & Brion, 2003; McCullough et al., 2005). Additional longitudinal studies and experimental work will help to address this issue. Research to disentangle the effects of religious upbringing during childhood from the effects of religious belief and practice during adulthood on delay discounting would also be particularly valuable.

Fifth, the self-report measure of future time orientation that we used here may have only weakly approximated the time monitoring process that underlies intertemporal choice (Ballard & Knutson, 2009; McClure, Ericson, Laibson, Loewenstein, & Cohen, 2007; McClure, Laibson, Loewenstein, & Cohen, 2004), so our references to that computational process were largely heuristic rather than something we measured directly. Examining the associations of religiousness with the cognitive processes involved in computing rewards and delays—or even behavioral measures that ostensibly track those computations (e.g., Zauberman et al., 2009) would be a valuable direction for future research on this topic.

Finally, we hypothesized that the negative association of religious behavior with temporal discounting results from domain-general cultural learning processes that religious people use to promote intra-group cooperation, but other hypotheses are available to explain our results. For example, religious people may encourage other members of their religious communities to reduce their impulsivity in order to reduce intersex competition within religious mating pools (Kurzban, Dukes, & Weeden, 2010; Li, Cohen, Weeden, & Kenrick, 2010; Weeden, Cohen, & Kenrick, 2008). On this alternate view, the negative association of religiousness with discounting is a by-product of religious individuals' broader interest in encouraging adherents to switch to mating strategies characterized by delayed reproduction, low mating effort, marital fidelity, and high parental investment. Future experiments that pitted the theoretical account we used here (i.e., that religious beliefs promote cooperation) with an account based on religious people's efforts to constrain the sexual strategies of individuals who reside in the same mating pool would be an exciting direction for evolutionarily informed research on religious behavior.

4.2 Conclusion

Research from many parts of the world and with people from many different religious groups has shown that religious people are lower in impulsivity and more willing to delay gratification than are their less religious counterparts (McCullough & Willoughby, 2009). Furthermore, evolutionary theorists have speculated that humans' propensity for religious beliefs and behaviors might have evolved by virtue of their abilities to promote cooperation (Johnson, 2005; Norenzayan & Shariff, 2008; Sosis, 2000), which itself is contingent on delay of gratification (Stevens et al., 2005). Our results contribute to this literature by demonstrating that religious people also have a stronger preference for longer-later rewards than do their less religious counterparts, and that this association is partially mediated by future time orientation.

These results might enhance our understanding of the contemporary behavioral correlates of religion (McCullough & Willoughby, 2009)—many of which are predicated upon religion's ability to foster delay of gratification, which itself is predictive of better outcomes in a large number of life domains (McCullough & Willoughby, 2009; Vohs & Baumeister, 2011). In addition, these results are potentially important for what they imply about the evolutionary forces that might have shaped religious belief and practice into the forms in which they are practiced today (Johnson, 2005; Sanderson & Roberts, 2008; Sosis, 2007).

Acknowledgements

Evan C. Carter, Michael E. McCullough, Carolina Corrales, and Adam Blake, Department of Psychology, University of Miami, Coral Gables, FL. Jungmeen Kim, Department of Psychology, Virginia Polytechnic Institute and State University, Blacksburg, VA. Correspondence regarding this article may be sent to Michael McCullough at mikem@miami.edu. This research was generously supported by grants from the John Templeton Foundation and the Fetzer Institute.

References

- Atran, S., & Henrich, J. (2010). The evolution of religion: How cognitive by-products, adaptive learning heuristics, ritual displays, and group competition generate deep commitments to prosocial religions. *Biological Theory: Integrating Development, Evolution, and Cognition*, 5, 18-30.
- Aziz, S., & Rehman, G. (1996). Self control and tolerance among low and high religious groups. *Journal of Personality and Clinical Studies*, 12, 83-85.
- Ballard, K., & Knutson, B. (2009). Dissociable neural representations of future reward magnitude and delay during temporal discounting. *NeuroImage*, 45, 143-150.
- 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.
- Bobova, L., Finn, P. R., Rickert, M. E., & Lucas, J. (2009). Disinhibitory psychopathology and delay discounting in alcohol dependence: personality and cognitive correlates. *Experimental and Clinical Psychopharmacology*, 17, 51-61.
- Chen, F., Curran, P. J., Bollen, K. A., Kirby, J., & Paxton, P. (2008). An empirical evaluation of the use of fixed cutoff points in RMSEA test statistic in structural equation models. *Sociological Methods and Research*, 36, 462-494.
- Curry, O. S., Price, M. E., & Price, J. G. (2008). Patience is a virtue: Cooperative people have lower discount rates. *Personality and Individual Differences*, 44, 780-785.
- French, D. C., Eisenberg, N., Vaughan, J., Purwono, U., & Suryanti, T. A. (2008). Religious involvement and the social competence and adjustment of Indonesian Muslim adolescents. *Developmental Psychology*, 44, 597-611.

- Gjesme, T. (1979). Future time orientation as a function of achievement motive, ability, delay of gratification and sex. *Journal of Psychology, 101*, 173-188.
- Henrich, J., Ensminger, J., McElreath, R., Barr, A., Barrett, C., Bolyanatz, A., . . . Ziker, J. (2010). Markets, religion, community size, and the evolution of fairness and punishment. *Science, 327*, 1480-1484.
- Irons, W. (2001). Religion as a hard-to-fake sign of commitment. In R. M. Nesse (Ed.), *The evolution of commitment* (pp. 292-309). New York: Russell Sage Foundation.
- Jackson, C. J., & Francis, L. J. (2004). Are interactions in Gray's Reinforcement Sensitivity Theory proximal or distal in the prediction of religiosity: A test of the joint subsystems hypothesis. *Personality and Individual Differences, 36*, 1197-1209.
- John, O. P., & Srivastava, S. (1999). The Big Five trait taxonomy: History, measurement, and theoretical perspectives. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research* (2nd ed., pp. 102-138). New York: Guilford.
- Johnson, D. D. P. (2005). God's punishment and public goods. *Human Nature, 26*, 410-446.
- Kenrick, D. T., McCreath, H. E., Govern, J., King, R., & Bordin, J. (1990). Person-environment intersections: Everyday settings and common trait dimensions. *Journal of Personality and Social Psychology, 58*, 685-698.
- Kirby, K. N., & Maraković, N. N. (1996). Delay-discounting probabilistic rewards: Rates decrease as amounts increase. *Psychonomic Bulletin and Review, 3*, 100-104.
- Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). New York: Guilford.

- Kurzban, R., Dukes, A., & Weeden, J. (2010). Sex, drugs, and moral goals: Reproductive strategies and views about recreational drugs. *Proceedings of the Royal Society B*, 277, 3501-3508.
- Li, Y. J., Cohen, A. B., Weeden, J., & Kenrick, D. T. (2010). Mating competitors increase religious beliefs. *Journal of Experimental Social Psychology*, 46, 428-431.
- MacKinnon, D. P., Lockwood, C. M., & Williams, J. (2004). Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivariate Behavioral Research*(39), 99-128.
- Mazur, J. E. (1987). An adjusting procedure for studying delayed reinforcement. In M. L. Commons, J. E. Mazur, J. A. Nevin & H. Rachlin (Eds.), *Quantitative analyses of behavior* (Vol. 5: The effect of delay and of intervening events on reinforcement value, pp. 55-73). Hillsdale, NJ: Erlbaum.
- McClure, S. M., Ericson, K. M., Laibson, D. I., Loewenstein, G., & Cohen, J. D. (2007). Time discounting for primary rewards. *Journal of Neuroscience*, 27, 5796-5804.
- McClure, S. M., Laibson, D. I., Loewenstein, G., & Cohen, J. D. (2004). Separate neural systems value immediate and delayed monetary rewards. *Science*, 306, 503-507.
- McCullough, M. E., & Carter, E. C. (2011). Religion and self-regulation. In K. D. Vohs & R. F. Baumeister (Eds.), *Handbook of self-regulation: Research, theory, and applications* (2nd ed.). New York: Guilford.
- McCullough, M. E., & Willoughby, B. L. B. (2009). Religion, self-regulation, and self-control: Associations, explanations, and implications. *Psychological Bulletin*, 135, 69-93.

- Miller, J. D., Lynam, D. R., & Jones, S. (2008). Externalizing behavior through the lens of the five-factor model: A focus on Agreeableness and Conscientiousness. *Journal of Personality Assessment, 90*, 158-164.
- Muthén, B. O., & Muthén, L. K. (1998-2004). *Mplus user's guide* (3rd ed.). Los Angeles, CA: Muthen & Muthen.
- Norenzayan, A., & Shariff, A. F. (2008). The origin and evolution of religious prosociality. *Science, 322*, 58 - 62.
- Oner-Ozkan, B. (2007). Future time orientation and religion. *Social Behavior and Personality, 35*, 51-62.
- Pichon, I., Boccato, G., & Saroglou, V. (2007). Nonconscious influences of religion on prosociality: A priming study. *European Journal of Social Psychology, 37*, 1032-1045.
- Price, R. H., & Bouffard, D. L. (1974). Behavioral appropriateness and situational constraint as dimensions of social behavior. *Journal of Personality and Social Psychology, 30*, 579-586.
- Rachlin, H. (2000). *The science of self-control*. Cambridge, MA: Harvard University Press.
- Randolph-Seng, B., & Nielsen, M. E. (2007). Honesty: One effect of primed religious representations. *International Journal for the Psychology of Religion, 17*, 303-315.
- Reyes-García, V., Godoy, R., Huanca, T., Leonard, W. R., McDade, T., Tanner, S., & Vadez, V. (2007). The origins of monetary income inequality: Patience, human capital, and division of labor. *Evolution and Human Behavior, 28*, 37-47.
- Richerson, P. J., & Boyd, R. (2005). *Not by genes alone: How culture transformed human evolution*. Chicago: University of Chicago Press.

- Sanderson, S. K., & Roberts, W. W. (2008). The evolutionary forms of the religious life: A cross-cultural, quantitative analysis. *American Anthropologist*, *110*, 454-466.
- Saroglou, V. (2010). Religiousness as a cultural adaptation of basic traits: A five-factor model perspective. *Personality and Social Psychology Review*, *14*, 108-125.
- Saroglou, V., Corneille, O., & Cappellen, V. (2009). "Speak, Lord, your servant is listening": Religious priming activates submissive thoughts and behaviors. *International Journal for the Psychology of Religion*, *19*, 143-154.
- Schnitker, S. A., & Emmons, R. A. (2007). Patience as a virtue: Religious and psychological perspectives. *Research in the Social Scientific Study of Religion*, *18*, 177-207.
- Shariff, A. F., & Norenzayan, A. (2007). God is watching you: Supernatural agent concepts increase prosocial behavior in an anonymous economic game. *Psychological Science*, *18*, 803-809.
- Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods*, *7*, 422-455.
- Silverman, I. R. (2003). Sex differences in delay of gratification: A meta-analysis. *Sex Roles*, *49*, 451-463.
- Sosis, R. (2000). Religion and intergroup cooperation: Preliminary results of a comparative analysis of utopian communities. *Cross-Cultural Research*, *34*, 70-87.
- Sosis, R. (2003). Why aren't we all Hutterites? Costly signaling theory and religious behavior. *Human Nature*, *14*, 91-127.
- Sosis, R. (2007). Does religion promote trust? The role of signaling, reputation, and punishment. *Interdisciplinary Journal of Research on Religion*, *1*, 1-30.

- Stark, R. (2002). Physiology and faith: Addressing the "universal" gender difference in religious commitment. *Journal for the Scientific Study of Religion*, *41*, 495-507.
- Stephens, D. W., McLinn, C. M., & Stevens, J. R. (2002). Discounting and reciprocity in an Iterated Prisoner's Dilemma. *Science*, *298*, 2216-2218.
- Stevens, J. R., Cushman, F. A., & Hauser, M. D. (2005). Evolving the psychological mechanisms for cooperation. *Annual Review of Ecology, Evolution, and Systematics*, *36*, 499-518.
- Vohs, K. D., & Baumeister, R. F. (Eds.). (2011). *Handbook of self-regulation: Research, theory, and applications* (2nd ed.). New York: Guilford Press.
- Weeden, J., Cohen, A. B., & Kenrick, D. T. (2008). Religious attendance as reproductive support. *Evolution and Human Behavior*, *29*, 327-334.
- Wilson, D. S. (2002). *Darwin's cathedral: Evolution, religion, and the nature of society*. Chicago: University of Chicago Press.
- Wilson, M., & Daly, M. (2004). Do pretty women inspire men to discount the future? *Proceedings of the Royal Society B*, *271*, S177-S179.
- Worthington, E. L., Wade, N. G., Hight, T. L., Ripley, J. S., McCullough, M. E., Berry, J. T., . . . O'Connor, L. E. (2003). Religious Commitment Inventory-10: Development, refinement, and validation of a brief scale for research and counseling. *Journal of Counseling Psychology*, *50*, 84-96.
- Wright, R. (2009). *The evolution of God*. New York: Little, Brown and Company.
- Yi, R., Buchhalter, A. R., Gatchalian, K. M., & Bickel, W. K. (2007). The relationship between temporal discounting and the prisoner's dilemma game in intranasal abusers of prescription opioids. *Drug and Alcohol Dependence*, *87*, 94-97.

Zauberman, G., Kim, B. K., Malkoc, S. A., & Bettman, J. R. (2009). Discounting time and time discounting: Subjective time perception and intertemporal preferences. *Journal of Marketing Research*, 46, 543-556.

Table 1

Descriptive Statistics for Major Study Variables

Variable	<i>M</i>	<i>SD</i>	<i>alpha</i>
RCI	2.02	1.04	.95
<i>k</i> for L	-5.15	1.44	*
<i>k</i> for M	-4.68	1.48	*
<i>k</i> for S	-4.05	1.28	*
Conscientiousness	3.60	0.70	.84
Extraversion	3.32	0.86	.89
Agreeableness	3.85	0.66	.78
Neuroticism	2.75	0.79	.83
Openness	3.65	0.65	.80
FTO	2.78	0.41	.73

RCI = Religious Commitment Inventory; “*k* for L” refers to the discount parameter for large rewards, whereas “M” is for medium and “S” is for small. FTO = Future Time Orientation. *Because *k* is not a linear composite of items, α cannot be calculated.

Table 2

Correlations Among Major Study Variables

Variable	1	2	3	4	5	6	7	8	9
1. RCI	--								
2. <i>k</i> for L	-0.15*	--							
3. <i>k</i> for M	-0.20**	0.86**	--						
4. <i>k</i> for S	-0.20**	0.78**	0.83**	--					
5. Conscientiousness	0.20**	-0.12*	-0.08	-0.05	--				
6. Extraversion	0.06	0.01	0.04	0.07	0.14*	--			
7. Agreeableness	0.22**	-0.06	-0.10	-0.09	0.27**	0.02	--		
8. Neuroticism	-0.01	0.07	0.04	0.11	-0.13*	-0.19**	-0.28**	--	
9. Openness	0.11	0.07	0.05	0.01	-0.06	0.19**	0.06	-0.08	--
10. FTO	0.14*	-0.21**	-0.19**	-0.18**	0.53**	0.09	0.15*	-0.10	-0.03

RCI = Religious Commitment Inventory; "*k* for L" refers to the discount parameter for large rewards, whereas "M" is for medium and "S" is for small. FTO = Future Time Orientation; * $p < .05$, ** $p < .01$.

Figure Captions

Figure 1. Structural equation model displaying the relationships among religious commitment, future time orientation, and delay discounting while controlling for sex and the Big Five personality traits. Covariances of religious commitment and future time orientation with sex and the Big Five personality traits were estimated freely. All estimates reported are standardized; a solid line indicates statistical significance. * $p < .05$; ** $p < .01$.

Figure(s)
[Click here to download high resolution image](#)

