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Religious cognition down-regulates sexually selected, characteristically male behaviors in men, but not in women

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Abstract

Men are typically stronger, riskier, "showier," and more impulsive than women. According to sexual selection theory, such behaviors may have enhanced reproductive fitness for ancestral human males. However, such behaviors are facultative, and the mechanisms that cause them respond to social and environmental cues that indicate whether outlays of strength, risk-taking, showing off, or impulsivity are likely to lead to payoffs in any given instance. Recent research based on the Reproductive Religiosity Model suggests that, in contemporary Western societies, religious beliefs and institutions are differentially espoused and promulgated by restricted sexual strategists (whose reproductive strategies focus on high fertility, monogamy, and high parental care) to limit the exercise of unrestricted sexuality, which threatens the viability of restricted sexual strategies (e.g., by reducing paternity certainty and male parental investment). On this basis, we hypothesized that experimental manipulations of religious cognition would reduce men's impulsivity and motivation to demonstrate their physical prowess. Supporting this hypothesis, three experiments revealed that priming participants with religious concepts (i.e., participants wrote essays about religion, read an essay supporting the existence of an afterlife, or were implicitly exposed to religious words) reduced men's (but not women's) impulsivity with money and their physical endurance on a hand grip task. The primes affected men's behaviors irrespectively of men's scores on a self-report measure of religious commitment.

Keywords: Religion; Evolution; Sexual selection; Discounting; Impulsivity; Physical strength

1. Introduction

In humans and many other species, males tend to evince more impulsivity, aggression, risk-tolerance, physical strength, and motivation to signal their value as mating partners than females do (Archer, 2009; Darwin, 1952; Hawkes, 1991; Kirby & Maraković, 1996; Little & Johnson, 1986; Pawlowski, Atwal, & Dunbar, 2008; Shih, 2007; Silverman, 2003; Wilson & Daly, 2004). These sex differences may reflect sexual selection for traits that increased ancestral males' reproductive fitness—namely, traits that intensify intrasex competition and manipulate female choice (Archer, 2009; Darwin, 1952; Gangestad & Simpson, 2000; Trivers, 1972).

Although such traits are sexually dimorphic, not every man pursues his reproductive interests through competing with other men and showing off to impress women. Likewise, not every woman pursues her reproductive interests by seeking a monogamous mate who will invest high levels of parental effort. Men and women alike are sexual strategists whose minds contain evolved mechanisms that process information about their phenotype, their condition, and their life history status—as well as information about the conditions of the available mating pool and other ecological factors—to choose suitable sexual strategies (Gangestad & Simpson, 2000).

Sexual strategies can be conceptualized as points on a continuum that is anchored on one end by a desire for frequent sex with multiple uncommitted partners, low mate fidelity, and low parental investment and at the other end by

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sexual exclusivity, marital fidelity, high fertility, and high parental investment per offspring. It is important that individuals who choose strategies that focus on the high fidelity/parental investment end of the continuum situate themselves in communities of other individuals who are pursuing similar strategies. Likewise, it is important for low fidelity/parental investment strategists to situate themselves within mating pools in which others are pursuing a low fidelity/parental investment strategy. For men in particular, the high fidelity/parental investment strategy is undermined by men and women who pursue promiscuous sexual strategies because of the attendant reduction in paternity certainty, which raises the fitness-reducing prospect that faithful males are allocating parental investment to children who are not their offspring. For women, a high fidelity/parental investment strategy is undermined by men and women who pursue promiscuous sexual strategies because of the attendant increase in the risk that men will abandon their mates and withdraw parenting effort from their offspring with those mates. Therefore, natural selection likely favored the evolution of a mating psychology that causes people to enact social behaviors that put them in contact with individuals who are pursuing similar sexual strategies—as well as a psychology that motivates them to punish or ostracize individuals in their midst who appear to be pursuing rival strategies.

Data suggest that in the contemporary United States and perhaps elsewhere, high fidelity/parental investment strategists are using religious communities and their interlocking systems of beliefs and behaviors as devices for raising the social costs of sexual promiscuity for others. To wit, religious communities not only disapprove of sexual promiscuity, but also express strong condemnation of individuals who pursue promiscuous strategies. Indeed, of all of the socially conservative attitudes that characterize strong religiosity (e.g., support for capital punishment, disapproval of crime and drug use, etc.), it is the disapproval of behaviors characteristic of low fidelity/parenting effort sexual strategies (e.g., abortion, casual sex, divorce, birth control, and sexual infidelity) that bear the strongest relationships with religious attendance (Weeden, Cohen, & Kenrick, 2008). In addition, analyses of World Values Survey data indicate that independently of religious participation, beliefs in a personal (vs. impersonal) god and belief in hell are more strongly correlated with restrictive sexual attitudes (e.g., disapproval of adultery and sex under the legal age) than they are with strict morality in nonsexual domains (e.g., disapproval of lying, cheating on taxes, or buying stolen goods; Atkinson & Bourrat, 2011). Moreover, when self-reports of one's sexual attitudes are controlled, the associations of religiosity and many other moral attitudes are substantially diminished (Kurzban, Dukes, & Weeden, 2010; Weeden et al., 2008). In keeping with the hypothesis that restricted sexual strategists in contemporary society use religious involvement to support their pursuit of a monogamous, high-fertility sexual strategy, some evidence suggests that religiosity is more strongly related to sexual restrictiveness for men (Kabiru & Orpinas, 2009; Njus & Bane, 2009), whom sexual selection has left with stronger tendencies toward the unrestricted end of the sexual strategies continuum (Gangestad & Simpson, 2000)—even though women are, on average, more religious than men (Stark, 2002).

If restricted sexual strategists really do use religious communities (Weeden et al., 2008) and their interlocking system of beliefs (Atkinson & Bourrat, 2011) to deter others from pursuing promiscuous sexual strategies and to encourage them, instead, to pursue restricted sexual strategies, then experimentally activating those religious beliefs—particularly those that are strongly associated with sexual morality (beliefs about God and about the afterlife; Atkinson & Bourrat, 2011)—might be expected to down-regulate the sex-specific behaviors that are characteristic of high mating effort and low parental investment. That is, in the same way that viewing photographs of attractive opposite-sex individuals increases men's (but not women's) impulsivity (Wilson & Daly, 2004), that the presence of opposite-sex individuals is associated with increased risk-taking for men but not women (Pawlowski et al., 2008), and that activating short-term mating motives increases men's (but not women's) conspicuous consumption (Sundie et al., 2011), we predicted that experimental activation of thoughts about religion, God, and the afterlife would reduce men's impulsivity or willingness to choose immediate rewards (in this case, monetary ones) to the exclusion of larger rewards in the future (i.e., delay discounting; Kirby & Maraković, 1996; Mazur, 1987; Wilson & Daly, 2004). We also predicted that religious priming would reduce men's (but not women's) physical endurance on a hand grip task (Little & Johnson, 1986), which is a showy display of physical fortitude. We also assume that experimental primes of religious cognition of this nature would likewise influence sexually selected traits that are characteristic of restricted female sexuality (Durante, Li, & Haselton, 2008)—as well as people's sexual attitudes directly (Weeden et al., 2008), but we do not test those possibilities here.

To be clear, the claim we evaluated here was not whether religion is an adaptation (sensu Williams, 1966) whose function is to restrict men's sexuality (but not women's): In addition to other problems associated with such a claim, it might perhaps sit uneasily with the considerable evidence from many societies that women are in fact more religious than men (Stark, 2002). Instead, the claim we set out to test was simply whether religious primes reduce two characteristically male features of an unrestricted sexual strategy—much in the same way that other primes (e.g., photographs of attractive opposite-sex individuals) can increase them. For these three initial experiments, we explored the effects of three different manipulations of religious cognition (i.e., having people write about god and/or one's religion versus two control tasks; apparent scientific support for the existence of an

afterlife; and a subliminal religious prime) on three different dependent variables (impulsive choice with respect to actual monetary rewards, impulsive choice with respect to hypothetical monetary rewards, and hand grip endurance) in an attempt to map the potential scope of the phenomenon through systematic replication rather than to establish a narrow phenomenon definitively via direct replication (Aronson, Ellsworth, Carlsmith, & Gonzales, 1990).

2. Experiments 1–3

2.1. Experiment 1

2.1.1. Method

One hundred eighty participants (102 women; 78 men) with a mean age of 18.73 (S.D.=1.01) were recruited from introductory psychology courses and received a small amount of course credit for their participation plus a 25% chance of receiving 1 of the 27 monetary rewards they preferred on the Monetary Choice Questionnaire (see below). Two additional participants (both women) were run, but turned out to have participated in the experiment in the previous semester. The data from their second participation in the experiment were therefore excluded.

Several weeks before the experiment (as in Experiments 2 and 3 also), participants completed the Religious Commitment Inventory (RCI-10) in class (Worthington et al., 2003), which measures commitment to one's religious beliefs and institutions (alphas>.85 in all three experiments).

Later in the semester, participants took part in a 1-h laboratory session. In the lab, we randomly assigned participants (blocking on sex) to one of three writing conditions. In the *religious* condition, participants wrote essays about their feelings about God and their religion. This prompt apparently did not present any difficulties for nonreligious students, who either described their religious skepticism or described what they thought about religion in general while sometimes noting that they were not religious. In the *secular* condition, participants described their feelings about their countries or cultures. In the *control* condition, participants described the belongings in their homes.

After the manipulation, participants completed the Monetary Choice Questionnaire (MCQ; Kirby & Maraković, 1996), in which they made 27 choices between a small reward now (e.g., $69 today) or a larger future reward (e.g., $85 in 91 days). From these data, we estimated participants' hyperbolic discount rates or k (Mazur, 1987). Discounting of future rewards can be approximated as $f(t)=1/(1+kt)$, where k=the hyperbolic discount parameter and t=time until reward delivery (Mazur, 1987). We calculated participants' k values for small ($25–$35), medium ($50–$60), and large ($75–$85) rewards separately. Participants had a 25% chance of obtaining 1 of the 27 rewards they selected. Following the MCQ, participants completed the RCI-10 a second time (as was also the case in Experiments 2 and 3).

2.1.2. Results and discussion

Participants' two scores on the RCI-10 were highly correlated in all three experiments (rs>.74), so we used participants' means from the two administrations to measure their religiousness. In each experiment, religiousness scores were extremely right-skewed (i.e., the distribution had a long right tail) and could not be transformed to approximate normal distributions, so we split each sample at the median to create roughly equal-sized "nonreligious" and "religious" groups (in Experiment 1, the median split created two exactly equal groups of n=90). Additionally, distributions of k were extremely right-skewed (again, there was a long right tail), so we log-transformed them, which led to better approximation of normal distributions. Participants' (log-transformed) k values for large, medium, and small rewards were highly correlated, so we used their means to estimate k (we also used this method in Experiment 2; alphas>.92). The distributions of the resultant variable were reasonably symmetrical for both men (skewness=−.125; kurtosis=−.225) and women (skewness=−.603; kurtosis=.713). In addition, the variances for men and women were not substantially different (men: 1.167; women: 1.601)—all of which suggest that neither the men's nor the women's data were beset with ceiling or floor effects.

We initially analyzed the data with a three-way full-factorial analysis of variance (ANOVA) using experimental condition, religiousness group (nonreligious, religious), and sex (male, female) as the three independent variables. However, none of the terms involving religiousness in this model were statistically significant, so we deleted those terms and recalculated a condition∗sex full-factorial ANOVA (as we also did in Experiments 2 and 3). We found a significant interaction of sex and condition, $F(2,174)=3.98$, $p=.02$ (all ps two-tailed throughout the article), which we explored further with planned linear contrasts for women and men separately. As predicted, men in the religious condition ($M=-4.67$, S.D.=1.15, $n=25$) expressed significantly lower k values than did men in the secular ($M=-3.98$, S.D.=1.13, $n=27$) and control conditions ($M=-3.89$, S.D.=0.79, $n=26$) combined, $p=.004$, which did not differ from each other, $p=.75$ (Fig. 1).

Conversely, for women, the religious condition ($M=-4.73$, S.D.=1.08, $n=36$) did not affect k values relative to the secular ($M=-4.45$, S.D.=1.11, $n=33$) and control conditions ($M=-5.14$, S.D.=1.52, $n=33$) combined, $p=.81$, although the secular condition yielded higher k values than did the control condition, $p=.027$. Thus, thinking and writing about religion reduced men's impulsivity, but not women's. Indeed, men in the religious condition were not significantly more impulsive than were women overall ($M=-4.77$, S.D.=1.27), $F(1,125)=0.14$, $p=.71$, $d=.08$.

We note, too, that women were less impulsive than were men overall, $F(1,174)=11.68$, $p=.001$, $d=-0.51$, supporting previous conclusions (Silverman, 2003). The main effect for condition was not statistically significant, $F(2,174)=2.66$, $p=.073$.

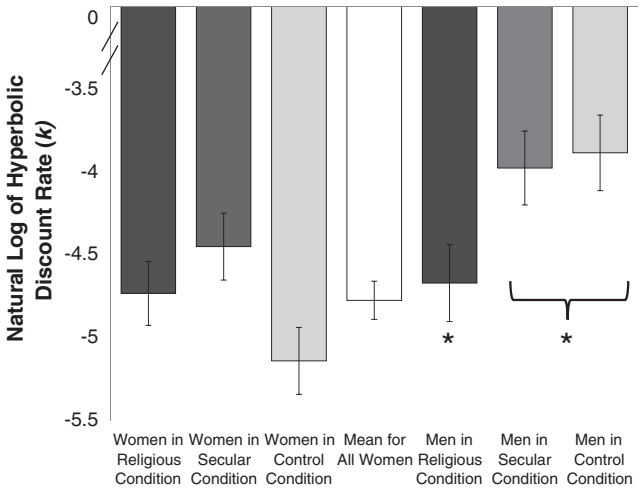

Fig. 1. Natural log of hyperbolic discount rates as a function of experimental condition and sex. The *n*s for each group are as follows: women/religious n=36, women/secular n=33, women/control n=33, men/religious n=25, men/secular n=27, men/control n=26. *The mean for men in the religious condition is significantly different (p<.05) from the mean of the men in the other two conditions and is not significantly different from the mean of the women in all three conditions combined.

2.2. Experiment 2

2.2.1. Method

One hundred seventy-one participants (97 women, 74 men; 86 "nonreligious" and 85 "religious" via a median split on the mean of their two RCI-10 scores) with a mean age of 18.86 (S.D.=1.23) were recruited using methods identical to those in Experiment 1. Two other participants (both men) were run through the experiment but were excluded prior to data analysis: One failed to follow instructions, and the other indicated that he recognized that we were using a priming method. During the same data collection effort, another 90 participants were run through a condition in which they read an article about the effect of gut worms on the human immune system. We do not consider those data here.

Experiment 2 was virtually identical to Experiment 1, except that (1) we manipulated religious cognition (blocking on sex) with essays that provided "scientific evidence" to either support or challenge belief in the existence of an afterlife (Dechesne et al., 2003) and (2) the monetary rewards were hypothetical. Discount rate estimates for hypothetical monetary rewards do not differ from estimates derived from experiments in which real money is used (Madden, Begotka, Raiff, & Kastern, 2003). The distributions of the resultant variable were reasonably symmetrical for both men (skewness=−.204; kurtosis=−.306) and women (skewness=−.377; kurtosis=.287). In addition, the variances for men and women were not substantially different (men: 2.279; women: 2.306)—all of which suggest that neither the men's nor the women's data were beset with ceiling or floor effects.

2.2.2. Results and discussion

We found a significant interaction of sex and condition, F(1,167)=4.90, p=.028, which we explored with one-way ANOVAs for women and men separately. For men, the effect for condition was significant, F(1,72)=7.08, p=.007, d=−.65. As Fig. 2 shows, men in the afterlife support condition (M=−4.85, S.D.=1.67, n=36) were less impulsive than were men in the afterlife challenge condition (M=−3.91, S.D.=1.19, n=38). For women, the condition effect was nonsignificant, F(1,95)=0.07, p=.80. Thus, manipulating belief in the afterlife reduced men's impulsivity, but not women's. Indeed, men in the afterlife support condition were not significantly more impulsive than were women overall (M=−4.64, S.D.=1.52), F(1,131)=0.46, p=.50, d=−.13.

The main effects for condition, F(1,167)=3.46, p=.064, and sex, F(1,167)=1.31, p=.25, d=−0.18, were not statistically significant.

2.3. Experiment 3

2.3.1. Method

One hundred sixty participants (82 women, 78 men; 81 "nonreligious" and 79 "religious" via a median split on the mean of their two RCI-10 scores) with a mean age of 19.27 (S.D.=1.89) were recruited from an introductory psychology course. They received a small amount of course credit for their participation, as well as $7.00. Another 10 participants (five women) were run through the protocol but were excluded prior to data analysis for various reasons: one participant reported a thumb injury that affected his performance on the maintained grip task, one participant did not complete the maintained grip task correctly, and

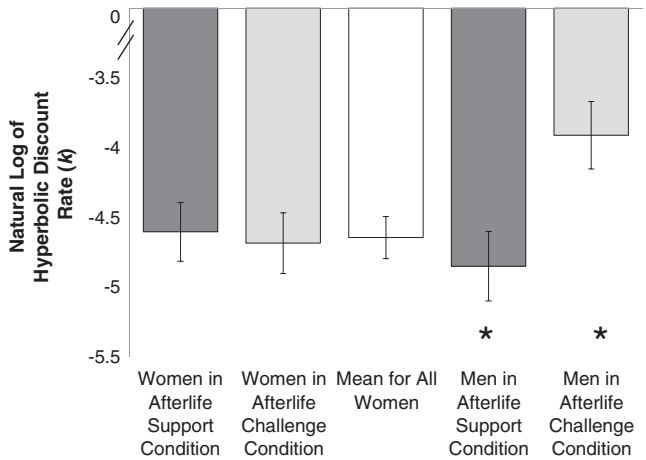

Fig. 2. Natural log of hyperbolic discount rates as a function of experimental condition and sex. The *n*s for each group are as follows: women/support n=50, women/challenge n=47, men/support n=36, men/challenge n=38. *The mean for men in the afterlife support condition is significantly different (p<.05) from the mean of the men in the afterlife challenge condition and is not significantly different from the mean of the women in the two conditions combined.

several participants reported being aware of the religious nature of the prime.

Upon arriving at the laboratory, we recorded participants' grip strength [maximum voluntary contraction (MVC)] using a handgrip dynamometer (LaFayette Instruments, Lafayette, IN, USA; model 78010). Participants were then instructed that we would presently measure how long they could maintain a force equal to 70% of their MVC [called maximum endurance time (MET); Little & Johnson, 1986]. Before measuring MET, we randomly assigned participants (blocking on sex) to one of two scrambled sentence tasks (Shariff & Norenzayan, 2007; E.L. Uhlmann, personal communication, September 25, 2008). In the religious condition, 10 of 20 scrambled sentences (which participants were asked to unscramble) contained a word related to religion (e.g., "divine," "sacred"). In the control condition, the 20 scrambled sentences did not prime any concept. After measuring MET, participants answered seven questions regarding their perceptions of task difficulty and effort allocated to the task.

2.3.2. Results and discussion

The distribution of the dependent variable, duration (in seconds) that participants could hold the handgrip dynamometer at 70% of MVC, was nonnormal, so we log-transformed the values. The distributions of the resultant variable were reasonably symmetrical for both men (skewness=−.518; kurtosis=.109) and women (skewness=−.183; kurtosis=−.629). In addition, the variances for men and women were not substantially different (men: .357; women: .309)—all of which suggest that neither the men's nor the women's data were beset with ceiling or floor effects. We found a significant interaction of sex and condition, $F(1,156)=6.60$, $p=.011$, which we explored with one-way ANOVAs for women and men separately. For men (Fig. 3), the main effect for condition was significant, $F(1,76)=6.92$, $p=.010$. The difference between men in the religious condition ($M=3.02$, S.D.=0.65, $n=39$) and the control condition ($M=3.37$, S.D.=0.50, $n=39$) yielded a medium effect size, $d=-0.60$. For women, the condition effect was not significant, $F(1,80)=0.90$, $p=.34$. Thus, the religious prime reduced men's MET, but not women's. Indeed, MET values for men in the religious condition and women overall ($M=3.04$, S.D.=0.56) were virtually identical $F(1,119)=0.03$, $p=.87$, $d=-0.03$.

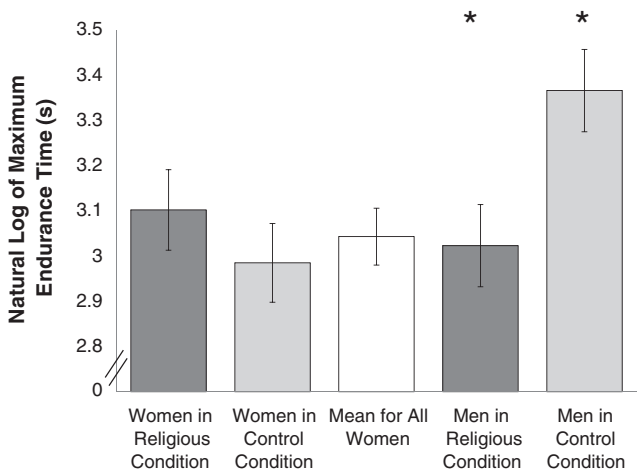

Fig. 3. Natural log of MET as a function of experimental condition and sex. The *n*s for each group are as follows: women/religious $n=40$, women/control $n=42$, men/religious $n=39$, men/control $n=39$. *The mean for men in the religious condition is significantly different ($p<.05$) from the mean of the men in the control condition and is not significantly different from the mean of the women in the two conditions combined.

The main effects for condition, $F(1,156)=1.59$, $p=.209$, and sex, $F(1,156)=2.84$, $p=.094$, $d=-0.26$, were not statistically significant.

In statistical analyses of a six-item self-report measure of subjective task difficulty (alpha=.82) and a single-item measure of how hard participants tried during the task, none of the terms were statistically significant (all *p*s>.05), indicating that perceived effort and task difficulty were not affected by condition, sex, or their interaction.

3. General discussion

Sex differences in physical strength, impulsivity, aggressiveness, and willingness to take risks are thought by many scholars to reflect the operation of sexual selection on traits that differentially improved ancestral men's reproductive success (Archer, 2009; Daly & Wilson, 2005; Darwin, 1952; Geary, 2006; Silverman, 2003; Trivers, 1972). However, not all men pursue sexual strategies that rely on impulsive choice, intrasex aggression, and advertising one's physical prowess. Instead, men and women alike adopt sexual strategies (consistent with their phenotype, their condition, their life history status, and their social environment) from a strategy space in which both restricted sexuality (characterized, for instance, by sexual exclusivity, marital fidelity, high fertility, and high parental investment per offspring) and unrestricted sexuality (characterized, conversely, by a desire for frequent sex with multiple uncommitted partners, low mate fidelity, and low parental investment) are feasible (Gangestad & Simpson, 2000). Nevertheless, the viability of a restricted sexual strategy is threatened by unrestricted sexual strategists because they undermine paternity certainty and male parental investment. Consequently, natural selection may have resulted in a mating psychology that causes people to seek social contact with individuals who are pursuing similar sexual strategies and to punish or ostracize individuals in their midst who are pursuing rival strategies (Buss & Schmitt, 1993).

Throughout history and across cultures, people have shown an uncanny tendency to use religious innovations to articulate and enforce standards that are relevant to mating, reproduction, and parenting—so much so that Reynolds & Tanner (1995) devoted 6 chapters of their 15-chapter *Social*

Ecology of Religion to issues related to mating and parenting. Correlational data suggest that in the contemporary United States, restricted sexual strategists are using religious concepts (viz., belief in a personal, moralizing god; belief in the afterlife) and institutions (e.g., as manifested in religious service attendance) to raise the social costs of sexual promiscuity for others: Sexual morality is closer to the core of religious morality than is nonsexual morality inasmuch as religious belief and behavior are more strongly correlated (and share more unique variance) with strict sexual morality than with strict nonsexual morality (Atkinson & Bourrat, 2011; Kurzban et al., 2010; Weeden et al., 2008). Additionally, the close link between religiosity and strict sexual morality may be stronger for men than for women (Kabiru & Orpinas, 2009; Njus & Bane, 2009), whom sexual selection has left with stronger tendencies toward the unrestricted end of the sexual strategies continuum (Gangestad & Simpson, 2000).

Consistent with this previous correlational evidence, our three experiments revealed that experimentally activating cognition about religion, God, and belief in the afterlife reduced men's impulsivity, or willingness to choose immediate rewards (in this case, monetary ones) to the exclusion of larger rewards in the future (i.e., delay discounting; Kirby & Maraković, 1996; Mazur, 1987; Wilson & Daly, 2004), as well as their physical endurance on a handgrip task (Jakobsen, Rask, & Kondrup, 2010; Little & Johnson, 1986), which is a display of one's physical fortitude. The effects of these religious primes were impressive inasmuch as men who received those primes evinced impulsivity and endurance scores that were statistically indistinguishable from women's. The sex differences in these manipulations could not be attributed to sex differences in ceiling or floor effects as both men and women's mean scores were far from the outer limits of human performance on all of the dependent variables we considered here.

We interpret such effects as evidence that religious concepts do indeed shift men toward more restricted sexual strategies—as would be expected if restricted sexual strategists use religious concepts to deter unrestricted sexual strategists in their mating pools (Kurzban et al., 2010). It is of interest that the effects of the religious primes uncovered here were not moderated by individual differences in religiosity. The broader literature on the effects of religious primes is ambiguous about whether the effects of such primes are moderated by individual differences in religiosity: Some studies have revealed moderation by religiosity (McKay, Efferson, Whitehouse, & Fehr, 2011; Shariff & Norenzayan, 2007, Study 2), whereas others have revealed only main effects (Randolph-Seng & Nielsen, 2007; Shariff & Norenzayan, 2007, Study 1). If our inability here to find evidence of moderation by religiosity is replicated in future work on this topic, it might have important implications for theorizing about how religious primes exert their effects on sexually selected behaviors.

Our experiments have limitations that could be addressed in future research. First, these results were obtained from undergraduate students at a university in the southern United States. Whether our results would generalize to other samples is of course an open question. Second, our experiments (and interpretations of our results) would have benefited from additional key control conditions—for example, conceptual primes of secular institutions such as courts and police that are used to regulate individual behavior (Shariff & Norenzayan, 2007), or subtle environmental cues that have been used previously to manipulate the perception of being monitored (Bateson, Nettle, & Roberts, 2006; Haley & Fessler, 2005). Third, we did not investigate dependent variables that might reflect the extent to which women are pursuing restricted versus unrestricted mating strategies (e.g., Durante, Griskevicius, Hill, Perilloux, & Li, 2011; Durante et al., 2008), although the theoretical framework used here certainly leads to the prediction that religious primes should influence women's approaches to mating as well as men's. Fourth, the theoretical framework we used here would receive additional support from evidence that religious primes have sexually dimorphic effects on behaviors that ostensibly underlie men's and women's mating strategies, while also exerting sexually monomorphic effects on behaviors that are thought not to have been sexually selected. Fifth, we assume that experimental religious primes would also influence sexual attitudes directly (Weeden et al., 2008), although we did not test that possibility here.

In summary, our results are consistent with the "Reproductive Religiosity Model" (Weeden et al., 2008)—a theoretical account that suggests that belief in religion, moralizing gods, and the afterlife is deployed by some societies (including the contemporary United States) to support restricted sexual strategies that focus on monogamy, spousal fidelity, and biparental care (Mahoney, 2010; Mahoney, Pargament, Tarakeshwar, & Swank, 2001; Weeden et al., 2008). We look forward to future experimental research that can continue to evaluate the claims of this model with additional rigor.

Acknowledgments

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