The Nonconscious Influence of Religious Symbols in Motivated Performance Situations

Max Weisbuch-Remington, Wendy Berry Mendes, Mark D. Seery and Jim Blascovich

Pers Soc Psychol Bull 2005; 31; 1203
DOI: 10.1177/0146167205274448

The Nonconscious Influence of Religious Symbols in Motivated Performance Situations

Max Weisbuch-Remington
Mercer University

Wendy Berry Mendes
Harvard University

Mark D. Seery
University of California–Irvine

Jim Blascovich
University of California–Santa Barbara

Anthropological, sociological, and psychological theories suggest that religious symbols should influence motivational processes during performance of goal-relevant tasks. In two experiments, positive and negative religious (Christian) symbols were presented outside of participants' conscious awareness. These symbols influenced cardiovascular responses consistent with challenge and threat states during a subsequent speech task, particularly when the speech topic concerned participants' mortality, and only for Christian participants; similar images lacking Christian meaning were not influential. Results suggested that these effects were due to the learned meaning of the symbols and point to the importance of religion as a coping resource.

Keywords: *religion; subliminal; symbols; challenge; threat; coping; automatic*

Cultural and religious icons and symbols have been examined from a variety of theoretical perspectives, including anthropological (e.g., Geertz, 1973), psychological (e.g., Jung, 1964), and sociological (e.g., Barthes, 1957). According to these perspectives, objects that represent religious concepts (henceforth, religious symbols) exert considerable influence on many social psychological processes, including those associated with coping. Some (e.g., Jung, 1964) argue that conscious awareness of a religious symbol is not necessary for it to exert an influence. Similarly, Blascovich and Mendes (2000) theorized that affective symbols influence motivational states both consciously and unconsciously during motivated performance situations.

Religion and Coping

A variety of theories within and outside of social psychology converge on the notion that religion plays an important role for people coping with the demands of uncertain or otherwise difficult situations. Existential theorists (Becker, 1973; Kierkegaard, 1844/1981; Sartre, 1956), for example, suggest that religion functions to help individuals cope with an otherwise unbearably uncertain and potentially meaningless life. Such accounts imply that religion is likely to be an especially useful coping resource when existential uncertainties (e.g., death, morality) become salient. For William James (1936/1997, Lectures 4 & 5), religion offered the individual a certain optimism about life that helps to ameliorate one's psychological and even physical problems. Similarly, Emile Durkheim (1912/1995) suggested that religious faith could restore an individual's sense of well-being during and after frustration and/or loss. Finally, numerous passages from the Bible and other religious tracts recommend reliance on God in times of despair.

Authors' Note: This research was partially supported by National Science Foundation Graduate Research Fellowships to Max Weisbuch-Remington and Mark Seery and a National Research Service Award (MH12013) to Wendy Berry Mendes. We are grateful to Christian Unkelbach, Corey Crouch, and Linda Valleni for providing assistance with data collection and administration. Correspondence concerning this article should be addressed to Max Weisbuch-Remington, Department of Psychology, Mercer University, Macon, GA 31207; e-mail: remington_m@mercer.edu.

PSPB, Vol. 31 No. 9, September 2005 1203-1216
DOI: 10.1177/0146167205274448

Other, more recent perspectives linking religion to coping largely mirror the earlier accounts. For example, in line with the existential view of religion and coping, terror management theory (TMT; Greenberg, Solomon, & Pyszczynski, 1997), "belief in a just world" theory (BJW; Lerner, 1980), as well as theories of uncertainty reduction (e.g., Kruglanski, 1989; McGregor, 2003) suggest that religious worldviews and beliefs help the individual cope with an unpredictable and potentially meaningless world by offering a structured prescription for life.

Similar to James (1936/1997) and Durkheim (1912/1995), Lazarus and Folkman (1984) have argued that religious beliefs can give rise to hope, optimism, and meaning in otherwise damaging circumstances. Such hopeful beliefs may serve to sustain coping efforts in adverse conditions. However, departing from some of the earlier theorists, Lazarus and Folkman also explicitly argued that religious belief could have negative consequences for coping, depending on the activated religious beliefs. Lazarus and Folkman (1984) noted that "a belief in a punitive God can lead a person to accept a distressing situation as punishment and to do nothing about mastering or managing the situational demands" (p. 160). Pargament (1997), echoing Lazarus and Folkman, suggested that religious coping can take either a positive or a negative form and that the active beliefs during coping determine the relevant physical and mental health outcomes.

Religious Symbols and Coping

Anthropologists and sociologists alike (e.g., Durkheim, 1912/1995; Evans-Pritchard, 1956; Geertz, 1973; Levi-Strauss, 1964) suggest that symbols are a necessary aspect of religion. Geertz (1973) argued, for instance, that religion can be defined as "a system of symbols which acts to establish powerful, pervasive, and long-lasting moods and motivations in (people)" (p. 90). The role of religious symbols in coping with difficult situations, however, is less clear than the role of religion in coping. Although the study of religious symbols in particular and cultural symbols in general has been an active area of research in other disciplines, little mainstream social psychological research has focused on such symbols (but see Greenberg, Porteus, Simon, & Pyszczinski, 1995). Given that religion plays an important role in coping processes, it seems likely that religious symbols also might play a significant role.

According to many scholars, the effects of religious symbols are likely to be almost immediate, perhaps even automatic (cf. Bargh, 1994). Consistent with Geertz (1973), scholars across disciplines suggest that cultural and religious symbols reinforce complex ideas in an immediate and emotionally powerfully way (e.g., Freud, 1938/2000; Jung, 1964; Ortner, 1973). Anthropologist Sherry Ortner (1973) argued that religious symbols such as a crucifix are of a class of "summarizing symbols" that function to make the defining points of an ideology immediately salient. Ortner (1973) argued that "the important mode of operation for summarizing symbols . . . is its focusing power, its drawing together, intensifying, catalyzing impact upon the respondent" (p. 1342). Indeed, the anthropologist Susan Langer (1942) argued that a symbol can be defined as such by its ability to automatically give rise to conceptions associated with (but not redundant with) the presented object (p. 60). For example, a cross is an object or image (i.e., two perpendicular lines) that becomes a symbol only when it evokes images of Christianity. If symbols draw together important and perhaps complex beliefs in an immediate and intense fashion, then it follows that even brief exposure to religious symbols might activate religious coping mechanisms.

Consistent with these ideas regarding the influence of religious symbols, Carl Jung (1964) argued that symbolic religious images manifested in real life (not just dreams) are likely to reflect enduring and unconscious collective representations—in other words, objects that automatically represent important religious themes. The meaning of these symbols may or may not be evident to one's conscious mind. Moreover, Jung (1964) suggested that given the limits of conscious perceptual ability, people often encounter such collective representations without any awareness that they have, in fact, been exposed to the symbol. He argued that encountering such religious symbols is likely to have profound consequences for one's experience in the world. It is hypothesized here that exposure to religious symbols outside of conscious awareness can influence one's experience, specifically in coping with potentially threatening performance situations.

The Biopsychosocial Model of Challenge and Threat

The biopsychosocial model of challenge and threat (Blascovich & Mendes, 2000; Blascovich & Tomaka, 1996) provides a means to assess coping responses during potentially threatening performance situations. In this investigation, we focus on challenge and threat coping responses within motivated performance situations. Blascovich and colleagues define motivated performance situations as goal-relevant (i.e., having implications for personal well-being) performance situations requiring instrumental (i.e., active rather than passive) cognitive responses. Examples include interviews, test taking, speeches, game playing, and interpersonal negotiations. Within such situations, challenge occurs when personal and/or situational resources (skills, knowl-

edge, abilities, social support) are evaluated as meeting or exceeding situational demands (e.g., danger, required effort). Threat occurs when resources do not meet situational demands. Although typically characterized as discrete states, challenge and threat represent endpoints of a bipolar continuum, such that individuals may be more or less challenged than others.

Blascovich and colleagues have validated cardiovascular markers of challenge and threat on the basis of patterns of neurally and hormonally controlled cardiovascular responses (for reviews, see Blascovich & Mendes, 2000; Blascovich & Tomaka, 1996). Based on Dienstbier's (1989) physiological toughness pattern, challenge includes the activation of the sympathetic-adrenal-medullary (SAM) axis, which enhances cardiac performance—particularly heart rate (HR) and left ventricular contractility (VC)—and decreases systemic vascular resistance (total peripheral resistance [TPR]), an effect mediated by the release of epinephrine at the peripheral arteries. As a result of these effects, cardiac output (CO) is increased during challenge. In contrast, threat is marked by activation not only of the SAM axis, again increasing cardiac performance (HR and VC), but also by activation of the hypothalamic-pituitary-adrenocortical (HPA; in previous work referred to as pituitary-adrenocortical or PAC) axis, which inhibits the release of epinephrine, resulting in relatively higher systemic vascular resistance (TPR) and little or no change in CO during threat.[1]

To meet the strict definition of a marker (i.e., Cacioppo & Tassinary, 1990), the challenge and threat cardiovascular indexes have been validated in more than 20 experiments. Initially, studies showed that within motivated performance situations, self-reports of challenge and threat (a) were correlated with the cardiovascular indexes, (b) were not caused by the cardiovascular patterns, and (c) increased in parallel with the cardiovascular indexes following challenging versus threatening instructional sets (Tomaka, Blascovich, & Kelsey, 1993; Tomaka, Blascovich, Kibler, & Ernst, 1997; for a review, see Blascovich & Tomaka, 1996). Because self-reports have some limitations (e.g., social desirability, order effects, failures of introspection), it also was desirable to observe whether the cardiovascular patterns of challenge and threat (sans self-report) could be predicted based on established social psychological theory. Indeed, research has shown that the cardiovascular indexes of challenge and threat have confirmed hypotheses derived from work on social comparison (e.g., Mendes, Blascovich, Major, & Seery, 2001), social facilitation (Blascovich, Mendes, Hunter, & Salomon, 1999), intergroup interaction (Blascovich, Mendes, & Seery, 2002; Mendes, Blascovich, Lickel, & Hunter, 2002), emotional disclosure (Mendes, Reis, Seery, & Blascovich, 2003), belief in a just world (Tomaka & Blascovich, 1994), social stigma (Blascovich, Mendes, Hunter, Lickel, & Kowai-Bell, 2001), self-esteem (Seery, Blascovich, Weisbuch, & Vick, 2004), and loneliness (Hawkley, Burleson, Berntson, & Cacioppo, 2003).

In the context of the current investigation, these psychophysiological markers provide several advantages. First, appraisals including resource and demand evaluations can be both conscious and nonconscious (Blascovich & Mendes, 2000; Lazarus, 1982, 1984). Lazarus (1982) has argued, for example, that responses to stimuli outside of awareness are due to preconscious evaluations of those stimuli. Indeed, research has shown that stimuli outside of conscious awareness can influence components of resource and demand evaluations (e.g., self-evaluation: Baldwin, Carrell, & Lopez, 1990; danger: LeDoux, 1996). Similarly, and as noted above, Jung (1964) suggested that responses to religious symbols may not always be consciously accessible. In fact, Baldwin et al. (1990) observed differences in self-evaluation following subliminal exposure to a religious icon (the Pope). Thus, the predictions noted below, derived from the literature review above, should hold for nonconscious as well as conscious processes. Methods that require conscious self-reflection (i.e., self-report) to measure challenge and threat may not be sensitive to changes in nonconscious evaluation processes such as those that may be influenced by religious symbols. Psychophysiological markers potentially measure nonconscious as well as conscious responses, thereby allowing for a more robust assessment of the influence of religious symbols.

Second, such markers allow for the avoidance of self-presentational problems (Crowne & Marlowe, 1964; Hessing, Elffers, & Weigel, 1988; Roth, Snyder, & Pace, 1986) that might be especially problematic when using self-report techniques to measure religious persons' responses to religious symbols. Finally, such measures allow for the assessment of coping (challenge and threat) responses during the episode itself and thereby avoid limitations in retrospective and prospective self-reports of internal states and behavior (Newby-Clark & Ross, 2003; Ross, 1989; Vallone, Griffin, Lin, & Ross, 1990).

Hypotheses

We proposed several hypotheses regarding the influence of religious symbols during potentially stressful performance situations. First, religious symbols should influence cardiovascular responses consistent with challenge and threat motivational states. Specifically, positive religious symbols, signifying resources available to religious persons (e.g., for Christians, Jesus and the church as supportive resources) and the rewards of sub-

scribing to religious beliefs (e.g., ascent to heaven), should increase resource evaluations leading to challenge. As noted, previous research has provided evidence that religious icons (i.e., the Pope) can nonconsciously influence self-evaluations (Baldwin et al., 1990). Negative religious symbols, signifying the dangerous aspects of one's religious beliefs (e.g., demons and hell), should increase demand evaluations and lead to threat. Indeed, research has shown that evaluations of danger can be influenced through nonconscious channels (see LeDoux, 1996). Also, positive religious symbols may decrease demand evaluations and negative religious symbols may decrease resource evaluations (if the symbols discourage the use of religion as a coping resource). Taken together, these postulates are consistent with Lazarus and Folkman (1984) and Pargament (1997), who suggest that religion may serve both positive and negative functions in coping.

Second, religious symbols should evoke responses even when such symbols are outside of participants' conscious awareness. If collective representations such as religious symbols need not reach awareness to be influential, then such symbols should have the capacity to influence (cardiovascular components of) motivational states outside of participants' conscious awareness. Furthermore, religious symbols are likely to convey powerful meaning in an immediate, summary form (e.g., Ortner, 1973) and therefore should exert an influence even when exposure to such symbols is brief. Indeed, within social psychology, a large empirical literature demonstrates that unreportable stimuli in general (i.e., not necessarily religious) can be influential. Aggressive behavior, interpretations of others' behavior, attitudes, memory ability, and even physiological responses have been influenced by stimuli presented outside of participants' awareness (e.g., Chartrand & Bargh, 1996; Chen & Bargh, 1997; Devine, 1989; Dijksterhuis, Aarts, Bargh, & van Knippenberg, 2000; Murphy & Zajonc, 1993; Ohman & Mineka, 2001; Weisbuch, Mackie, & Garcia-Marques, 2003). In addition, previous research suggests that affectively valenced images can influence physiological responses even when such images are unreportable (for reviews, see LeDoux, 1996; Ohman & Mineka, 2001).

Third, religious symbols should influence only those persons for whom the symbols represent meaningful resources or demands. For example, images of Jesus may not offer any resource-enhancing support for individuals who do not believe that Jesus was divine. Thus, Christian symbols should affect cardiovascular responses consistent with challenge and threat for Christians but not non-Christians.

Fourth, following the reasoning of TMT and others, we predicted that religious symbols would be especially influential during a task that addressed an existential question; specifically, discussing one's own mortality. Not only might this situation specifically call forth religious coping mechanisms but religious symbols also may be encoded as especially important in light of an existential issue. In support of this hypothesis, research has shown that people are more likely to treat religious symbols (a cross) as sacred following thoughts of an inevitable demise (vs. thinking about television; Greenberg et al., 1995).

EXPERIMENT 1

Overview

In this experiment, we addressed Hypotheses 1, 2, and 4. We reasoned that unreportable religious symbols would influence cardiovascular responses consistent with challenge and threat states during a motivated performance situation. Participants presented with Christian religious symbols outside of their conscious awareness subsequently engaged in a motivated performance task. The motivated performance task was manipulated so that half of the participants were assigned to deliver a speech relevant to existential issues (their own mortality), whereas the other participants were assigned to deliver a less relevant (but still negatively toned) speech (visiting the dentist; for similar methodology, see Greenberg et al., 1990).

We hypothesized that participants exposed to negative religious symbols would exhibit threat during the speech, as compared to participants exposed to the positive religious symbols and as measured through the cardiovascular markers of challenge and threat. We hypothesized that this pattern would be more pronounced among participants giving the speech on death.

Method

Participants and setting. Participants were selected based on their response (during a prescreening session) to the question, "With what religion were you raised?" Only those who reported being raised as Christians were considered for selection. This selection criterion was used to ensure that participants had enough experience with Christianity such that they most likely would have learned the meaning of these symbols. This criterion resulted in 115 undergraduate students participating in this experiment in exchange for course credit.[2]

The social psychophysiology laboratory in the Department of Psychology at the University of California, Santa Barbara, served as the experimental setting. This laboratory contains separate control, participant preparation, and recording rooms as well as physiological recording, audiovisual, and computer equipment.

Stimuli. Stimuli were culled from a variety of religious books. Criteria for selecting symbols were to choose symbols (a) so as not to not confound familiarity with valence (i.e., only relatively obscure symbols were chosen); (b) that contained a variety of colors and complexity—so, for example, not all positive symbols were simple or all negative symbols complex; and (c) whose positive and negative valence and intensity were equivalent (see below). Selection of symbols resulted in 10 negative and 11 positive symbols. Figure 1 depicts examples. Positive symbols included images of Christ ascending to heaven, Mother Mary holding the Baby Jesus, and Christ's healing powers. Negative symbols included images of satanic worship, demons, and satanic symbols.

To determine the relative valence and intensity of the symbols, 31 undergraduates, who did not participate in either experiment reported here, rated the religious symbols on two 7-point, Likert-type scales (*bad-good*; *not disturbing–disturbing*). For each of the two items, the average ratings for the positive (αs = .95 and .91) and negative symbols (αs = .85 and .76) were calculated. As expected, participants rated the positive symbols (M = 5.1) as more positive than the negative symbols (M = 3.2), $F(1, 29) = 38.8$, $p < .001$, and less disturbing (M = 1.8) than the negative symbols ($M = 4.4$), $F(1, 29) = 95.9$, $p < .001$. Although both patterns were significantly stronger among Christian than non-Christian participants, resulting in two-way interactions, $F(1, 29) = 17.1$, $p < .001$, and $F(1, 29) = 10.7$, $p < .01$, respectively, both patterns were significant for non-Christian-raised participants, $F(1, 12) = 5.78$, $p < .05$, and $F(1, 12) = 38.65$, $p < .001$. Hence, the positive religious symbols appeared to be positively valenced as compared to the negative symbols for all participants. These participants also were asked to rate the relevance of each symbol—when these ratings were entered as covariates, the interaction between Christian background and symbol valence was eliminated, suggesting that differences in positive versus negative ratings of the symbols were due to the stronger meaning that these symbols held for Christians relative to non-Christians.

Masks for each symbol were created by digitally altering the images. Each symbol had its own mask, created by "tilezing" the religious image (a special effects option in Adobe PhotoShop), which clusters adjacent colors and results in a stained glass appearance. The resultant image was then rotated 180 degrees.

Physiological measures. Cardiac and hemodynamic measures were recorded noninvasively using equipment meeting commercial and hospital safety standards and following guidelines established by the Society for Psychophysiological Research (e.g., Sherwood et al., 1990). A Minnesota Impedance Cardiograph (Model 304B), a Cortronics (Model 7000) continuously inflated

Figure 1 **The symbols on the left are examples of the negative Christian symbols. The symbols on the right are examples of the positive Christian symbols.**

blood pressure monitor, and a Coulbourn ECG amplifier/coupler (Model S75-11) provided physiological signals. The impedance signals were conditioned using Coulbourn amplifiers (Model S79-02).

Impedance cardiographic (ZKG) and electrocardiographic (EKG) recordings provided continuous measures of cardiac performance. The former uses a tetrapolar aluminum/Mylar tape electrode system to provide basal transthoracic impedance (Z0) and the first derivative of basal impedance (dZ/dt). Two pairs of ZKG electrodes completely encircle the participant. Inner electrodes are placed at the base of the neck and at the thoracic xiphisternal junction; outer electrodes are placed on the neck and abdomen. The impedance cardiograph passes a 4mA AC 100 kHz current through the two outer electrodes and measures Z0 via the two inner electrodes.

Electrocardiograph recordings were obtained using either an external EKG Standard Lead II configuration (right arm, left leg, and right leg ground) or via the impedance cardiograph. The Cortronics blood pressure monitor provided continuous noninvasive recordings of blood pressure. An interactive software program (Kelsey & Guethlein, 1990) was used to record and later score the cardiac and hemodynamic data.

Prior to analyses, reactivity scores (i.e., changes from baseline resting levels) for all CV variables were calculated. Patterns of four CV variables typically identify challenge and threat states: heart rate (HR); ventricular contractility (VC), an index of the left ventricle's contractile force; cardiac output (CO), the amount of blood in liters pumped by the heart per minute; and total peripheral resistance (TPR), an index of net constriction versus dilation in the vascular system (vasoconstriction vs.

vasodilation). For presentational purposes, VC is calculated by multiplying preejection period (PEP) by –1, where PEP represents the time in milliseconds in the cardiac cycle from initiation of ventricular depolarization to opening of the aortic valve and ejection of blood; a larger VC value thus corresponds to greater contractility. TPR is calculated by dividing mean arterial pressure by cardiac output and multiplying the total by 80 (Sherwood et al., 1990). Significant increases in HR and VC indexed SAM activation (common to both challenge and threat), whereas CO and TPR were used to differentiate challenge and threat responses more specifically.[3] As noted above, challenge and threat are endpoints of a bipolar continuum—greater CO and lesser TPR index greater challenge (less threat)—it is such relative between-group differences that were measured here.

Procedures. Upon arrival, each participant entered a preparation room and was presented an information sheet that described the physiological measures. The experimenter then applied sensors necessary for physiological recording. The participant sat upright in a comfortable upholstered chair with a computer keyboard across his or her lap. The experimenter instructed the participant to sit quietly and relax for several minutes. A 5-min baseline period began once the experimenter left the room. Cardiovascular responses collected during this period served as baseline levels of physiological responses. Physiological recording continued for the duration of the experiment.

Next, the participant heard audiotaped instructions explaining a tile-counting task. From the participant's perspective, this task appeared to be a decision-making task that involved a series of images that had a tile or stained-glass appearance (i.e., the masks), which were presented on the computer screen. The participants were presented with a variety of these images presented off-center in random quadrants of the computer screen and estimated whether the image that they observed contained fewer or greater than 100 tiles. The tile images, which actually served as backward masks for the unreportable stimuli (religious symbols), were presented for 1 s per symbol and were replaced by a series of five stars in the middle of the screen following each presentation. Participants were instructed to focus attention on the stars prior to each trial. Immediately following disappearance of the stars, a positive or negative Christian symbol was presented parafoveally (minimum of a 3.2-degree angle in this case) for 30 ms. Immediately following the Christian symbol, the tile mask appeared for 1,000 ms. According to Bargh and Chartrand (2000), such parafoveally presented images remain outside of conscious awareness if such images are presented for no more than 60 ms (conservatively). Limiting presentation time to 30 ms and use of a backward mask ensured that the symbols were not reportable. The presentation phase lasted approximately 1 min.

Immediately following the presentation of the symbols, participants heard instructions explaining that they would deliver a speech. Participants were randomly assigned to one of two speech topics—thoughts of your own death or visiting the dentist. For the former, participants were instructed to talk about the thoughts that came to mind when they contemplated their own death, what they thought happened to their body when they died, and what in general they believed happened to their existence once they were dead. For the latter speech, participants were instructed to elaborate on the process of visiting the dentist, what happened when he or she went there, what were some of the procedures they have had performed, and their general feelings regarding visiting the dentist. For both conditions, the speech topics were displayed on the computer monitor for the participant's reference. Participants had 1 min to prepare and 2 min to deliver the speech. The participant was cued by the experimenter, via intercom, when to begin the preparation, delivery, and end the speech. Cardiovascular responses during the first minute of the speech served as the critical dependent variable for subsequent analyses.

Following the speech, the physiological sensors were removed from the participant who was immediately debriefed by the experimenter. During this debriefing, participants were asked if they had seen anything besides the tiles during the tile-counting task. No participants reported seeing anything else before or after the tiles.

Results

Analytical strategy. Mean cardiovascular values were calculated for each minute within each rest and task period. Univariate outliers (those exceeding more than 3.3 standard deviation units from the grand mean) were transformed by assigning the deviant raw score to a value one unit larger or smaller than the next most extreme score (Tabachnick & Fidell, 1996)—there were four such data points. Our analytic strategy included three steps. First, we tested for baseline resting differences between conditions. Second, we confirmed SAM-axis activation by testing VC and HR reactivity against zero. Last, we performed ANCOVA analyses to examine the effects of religious symbol (positive vs. negative), speech (death vs. dental), and their interaction on CO and TPR reactivity during the first task minute. Unless otherwise noted, covariate-adjusted means are reported and Cohen's *d* is reported as the effect size estimate for relevant comparisons.

Baseline differences. Four separate ANOVAs testing for differences in baseline physiological levels by image valence (positive vs. negative) and speech topic (death

vs. control) revealed no significant main effects or interactions (Fs < 1). As is typical when baseline responses do not differ among levels of between-subjects factors, reactivity scores (differences from baseline) were used as the primary dependent variables (Llabre, Spitzer, Saab, Ironson, & Schneiderman, 1991). Although change scores (of which reactivity is one example) are sometimes discouraged on psychometric grounds, their use is common in psychophysiological research. Indeed, Llabre et al. (1991) concluded that change scores are not only appropriate but preferable when analyzing physiological data. In addition, absolute differences from baseline are meaningful within the biopsychosocial model as challenge and threat indices are based on patterns of cardiovascular changes (e.g., Mendes et al., 2003). Reactivity scores were calculated for each cardiovascular measure by subtracting the average value from the last minute of the rest period from the average value from the first minute of the speech delivery task. Because even nonsignificant error variance associated with baseline values can result in artificially inflated or deflated reactivity scores (thereby increasing error variance in reactivity scores), baseline values also are used as covariates (removing this covariate does not change the significance patterns reported herein; see also Seery et al., 2004).

Challenge and threat markers. HR and VC reactivity (indexing SAM axis activity) should increase during both challenge and threat. Across all four experimental conditions, t tests revealed that HR differed significantly from zero (i.e., baseline; all ps < .0001; covariate-adjusted means reported, with standard error in parenthesis): Negative Symbols–Death Speech M = 21.2 (2.2); Positive Symbols–Death Speech M = 22.7 (2.3); Negative Symbols–Dental Speech M = 22.6 (2.2); Positive Symbols–Dental Speech M = 20.1 (2.1). Neither the main effects nor the interaction were significant when examining religious symbol and speech effects on HR reactivity. We then examined VC reactivity during the speech. Significant increases in VC from zero (i.e., baseline) were observed across all four experimental conditions (all ps < .0001; covariate adjusted means reported, with standard error in parenthesis): Negative Symbols–Death Speech M = 12.7 (2.5); Positive Symbols–Death Speech M = 18.6 (2.6); Negative Symbols–Dental Speech M = 13.3 (2.4); Positive Symbols–Dental Speech M = 14.9 (2.4). An examination of VC differences as a function of religious symbol and speech revealed no significant main effects or interactions. The significant VC and HR reactivity data confirmed SAM axis activation, which, according to the biopsychosocial model, justified further exam- ination of the CV variables for challenge and threat distinctions.

Recall that greater CO and lesser TPR index greater challenge (lesser threat). A main effect of valence emerged for TPR and CO. TPR was significantly higher (M = 35.2, SE = 25.9) and cardiac output was significantly lower (M = .07, SE = .189) for participants exposed to negative symbols than for participants exposed to positive symbols (TPR M = –61.9, SE = 26.3; CO M = .78, SE = .192), $F(1, 102) = 6.84$, $p < .05$, $d = .51$, and $F(1, 102) = 6.83$, $p < .05$, $d = .51$, for TPR and CO, respectively. These differences indicate that participants exposed to negative religious symbols were significantly more likely to exhibit the threat pattern (therefore less likely to exhibit the challenge pattern) than participants exposed to positive religious symbols. Although no other main effects or interactions approached significance (ps > .18), planned contrasts supported our prediction that the effect of image valence would be more pronounced during the death speech compared to the dental speech. As Figures 2 and 3 depict, for participants giving a speech on death, those presented with negative symbols had significantly higher TPR, M = 68.9 (SE = 37.4), $F(1, 105)$ = 7.35, $p < .01$, $d = .75$, and lower CO, M = –.17 (SE = .27), $F(1, 105) = 7.35$, $p < .01$, $d = .78$, than participants exposed to the positive symbols (TPR: M = –73.7, SE = 38.9; CO: M = .90, SE = .28), indicating that participants exposed to unreportable negative religious symbols were significantly more likely to exhibit the threat pattern than were participants similarly exposed to positive symbols. Among participants giving a speech on going to the dentist, no effects of image valence occurred (Fs ≤ 1, ds < .27), although the direction of the means was consistent with that observed during the death speech and the effect sizes in this comparison were nontrivial. Post hoc comparisons within valence between speech type were not significant (ps > .19).

Discussion

Consistent with Hypotheses 1 and 2, Experiment 1 demonstrated that religious stimuli presented outside of conscious awareness influenced individuals during motivated performance situations. Participants exposed to unreportable negative Christian symbols exhibited a cardiovascular pattern consistent with greater threat during a subsequent speech than participants exposed to positive Christian symbols. In addition, consistent with Hypothesis 4, this effect was significant only for participants delivering a speech about their own death.

Inherent in our explanation is that the Christian meaning (rather than an incidental element) of the symbols influenced participants. In contrast to this assertion, some have argued that the influence of unreportable stimuli is limited to incidental elements of those stimuli (e.g., Abrams & Greenwald, 2000). For example, one might argue that the influence of an ephemeral image of

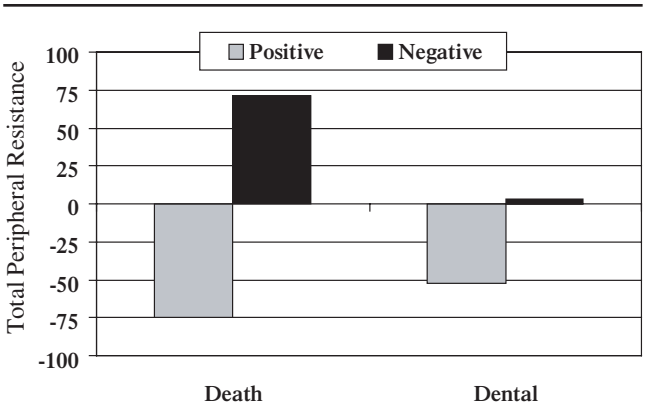

Figure 2 TPR as a function of image valence and speech content in Experiment 1.
NOTE: Numbers higher on the y-axis indicate greater threat. TPR = total peripheral resistance.

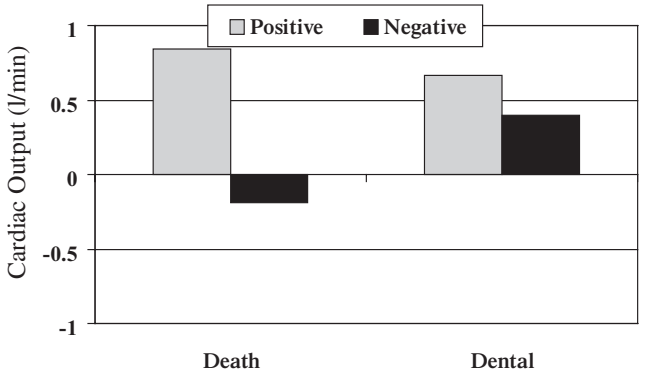

Figure 3 CO as a function of image valence and speech content in Experiment 1.
NOTE: Numbers lower on the y-axis indicate greater threat. CO = cardiac output.

Christ ascending to Heaven was due to a characteristic such as the image's "blueness" rather than the complex religious meaning of the image. To provide a more conservative test and rule out the possibility that an incidental element evoked by the symbols was the mechanism through which cardiovascular differences emerged, Experiment 2 compared the influence of unreportable Christian symbols to nearly identical, scrambled images, which held no religious meaning.

EXPERIMENT 2

Overview

The second experiment attempted to replicate the results of the first experiment, refine the methodology (ruling out an alternative interpretation), and test the third hypothesis proposed above. To rule out the possibility that an incidental stimulus feature of the symbols influenced participants, we introduced control conditions that employed images that were scrambled to remove the social meaning of the Christian symbols. These scrambled images were otherwise identical to the Christian symbols in size, shape, color, and color ratio. Hence, image type (Christian vs. control) was an additional factor in the design. Two further refinements were made. First, to address the hypothesis that Christian symbols should only influence Christians (third hypothesis), we added non-Christian participants to our sample and included religious beliefs (Christian vs. non) as a factor. In addition, only the death speech was used because it was only during that speech that Christian participants showed differential reactions to the negative versus positive symbols. Our prediction was that Christian participants would exhibit a cardiovascular pattern consistent with greater threat after exposure to the negative symbols than after exposure to the positive symbols but that these effects would not occur for non-Christians and they would not occur when the images lacked Christian meaning (control images).

Method

Participants. Two hundred six undergraduate students from an introductory psychology course served as participants in exchange for course credit.[4] As in the first experiment, participants were selected based on their response (during a prescreening session) to the question, "With what religion were you raised?" Those that responded Christian (or some Christian denomination) were included in that group; all others were included in the non-Christian group.

Control images. Control images were created by altering the symbols to remove Christian content. Adobe PhotoShop was used to first blur and then remove details from each Christian symbol (see Figure 4). These control images were then rotated 180 degrees. The same masks and exposure time that were used for the Christian symbols were used for these control images. Hence, both positive control images and negative control images were used in addition to the positive and negative Christian symbols.

Procedures. Procedures were identical to Experiment 1, with the following modifications: (a) all participants gave death speeches, (b) half of the participants were exposed only to the control images, (c) half of the participants were not raised as Christians, and (d) a systematic verbal debriefing protocol was used. During this debriefing, participants were first asked if anything had seemed a bit odd during the experiment. Then, they were asked if they had seen anything odd during the tile-counting task. It was only then that they were asked if they had seen anything just before or just after they saw each tile. One

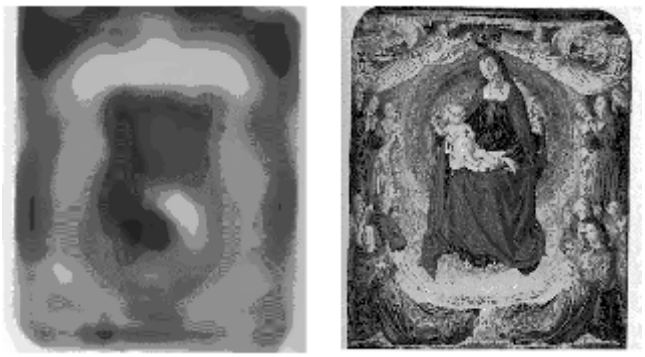

Figure 4 Control images: The image on the left is an example of the control image for the religious symbol on the right.

participant had learned about the experiment ahead of time and claimed he could see religious symbols. This participant was dropped from analyses.

Results

Analytical strategy. Mean cardiovascular values were calculated for each minute within each rest and task period. Univariate outliers (those exceeding more than 3.3 standard deviation units from the grand mean) were transformed by assigning the deviant raw score to a value one unit larger or smaller than the next most extreme score (Tabachnick & Fidell, 1996)—there were fourteen such data points. Our analytic strategy was otherwise identical to that of Experiment 1, save that all analyses included three factors: religious symbol (positive vs. negative), image type (religious vs. color), and participant religion (Christian vs. non-Christian).

Baseline differences. Four separate ANOVAs testing for differences in baseline physiological levels by image valence (positive vs. negative), image content (Christian symbol vs. control image), and religious upbringing (Christian vs. non) revealed no significant main effects or interactions (Fs < 1). Reactivity scores were calculated for each cardiovascular measure by subtracting the average value from the last minute of the rest period from the average value from the first minute of the speech delivery task. To control for any nonsignificant differences, baseline values were again used as covariates (removing this covariate did not alter the patterns of significance reported below).

Challenge and threat markers. SAM axis activation was confirmed during the speech by testing HR and VC reactivity scores against zero. Across all eight experimental conditions, HR increased significantly from baseline (see Table 1). Neither the main effects nor the interaction were significant when examining condition effects on HR reactivity. Significant increases in VC were observed across all eight experimental conditions (see Table 1), although there was a significant main effect of image content, such that participants exposed to control images had significantly higher VC reactivity than those exposed to religious symbols. No other significant main effects or interactions emerged on VC reactivity. The significant increases from baseline in HR and VC confirmed that SAM axis activation occurred, which justified further examination of the CV variables for challenge and threat effects.

TABLE 1: Means and Univariate Tests From Zero (Baseline) of HR and VC Reactivity in Experiment 2

	Negative	*Positive*
Christian		
Religious symbols		
HR	17.2	19.4
VC	8.4	10.8
Control images		
HR	20.9	19.2
VC	11.8	10.5
Non-Christian		
Religious symbols		
HR	18.1	19.4
VC	7.5	9.1
Control images		
HR	21.2	22.0
VC	13.9	11.8

NOTE: All condition means were tested against zero to determine significant increases or decreases from baseline, all ps < .0001. HR = heart rate, VC = ventricular contractility.

Separate ANCOVA analyses were used to determine whether the predicted patterns of CV responses occurred as a result of image valence, image content, religion, or the interactions among these variables. When examining differences in TPR as a function of our IVs, no significant main effects or two-way interactions were observed. However, the predicted three-way interaction was significant, $F(1, 182) = 4.92$, $p < .05$.

To understand this interaction, simple effects tests were conducted (a priori hypotheses justified these tests—we therefore used the MSE from the overall sample). Among Christian-raised participants, the two-way interaction between image valence and content was significant, $F(1, 182) = 3.76$, $p = .05$. The nature of the interaction was such that Christian-raised participants presented with negative Christian symbols exhibited higher TPR ($M = 65.2$, $SE = 31.3$, consistent with greater threat) than those exposed to the positive Christian symbols ($M = -22.1$, $SE = 31.3$, consistent with challenge) $F(1, 182) = 3.92$, $p < .05$, $d = .54$, thereby replicating the results of the first experiment. In contrast, Christian-raised participants did not differ in their reactions to the negative control images ($M = -7.4$, $SE = 31.1$) and positive control images ($M = 36.1$, $SE = 36.4$), $F(1, 182) = .83$, *ns*, $d = .26$. There were no significant differences among

any of the non-Christian participant groups, accounting for the three-way interaction noted above and depicted in Figure 5.

A consistent pattern emerged for CO, which yielded a marginal three-way interaction, $F(1, 182) = 3.22$, $p = .07$. Again, simple effects tests among Christian participants yielded a significant two-way interaction between image valence and content, $F(1, 182) = 3.79$, $p = .05$. The nature of the interaction paralleled the results observed with TPR reactivity. Among Christian-raised participants, those exposed to negative Christian symbols exhibited lower CO ($M = -.22$, $SE = .26$, consistent with threat) than those exposed to positive Christian symbols ($M = .55$, $SE = .26$, consistent with challenge), $F(1, 182) = 4.65$, $p < .05$, $d = .58$. In contrast, Christian-raised participants did not differ in their reactions to the negative control images ($M = .31$, $SE = .25$) compared to the positive control images ($M = .08$, $SE = .29$), $F(1, 182) = .36$, *ns*, $d = .29$. Similar to the TPR data, no significant differences emerged among non-Christian-raised participants, accounting for the three-way interaction (see Figure 6).[5]

Discussion

Experiment 2 replicated the critical results of the first experiment and ruled out incidental stimulus content as a potential explanation for the obtained CV data. Consistent with the third hypothesis, Christian participants responded differently to the unreportable symbols than non-Christian participants. More specifically, Christian participants exhibited a cardiovascular pattern more consistent with threat following the negative Christian symbols than following the positive Christian symbols. This pattern did not emerge among non-Christian participants. This finding suggests important boundary conditions for the effects of unreportable stimuli and that the influence was due to the Christian content. In addition, the differences observed with the Christian symbols were not observed with control images. This finding furthers our argument that the influence of the symbols derived from culturally learned meaning of the symbols rather than some incidental quality (e.g., color).

GENERAL DISCUSSION

Consistent with our hypotheses, the results of these experiments suggest that religious symbols can have a substantial and nonconscious influence on coping processes. During a motivated performance situation, religious stimuli that people did not consciously perceive influenced motivational and related physiological states. However, important boundary conditions apparently exist. The results of Experiment 1 provide evidence indicating that unreportable religious symbols were influential only when the subsequent task was relevant to existential issues. Thus, whereas a fleeting image of Jesus might positively influence an individual's experience as he or she delivers a eulogy, the same image probably would not influence his or her experience playing a word game. The results of Experiment 2 provide evidence that unreportable religious symbols were influential only when they were personally relevant. Thus, whereas a fleeting image of Jesus' image might positively influence a Christian during a relevant task, the same image probably would not influence an atheist. Hence, it appears that unreportable religious symbols must be both task- and self-relevant to exert an effect during a motivated performance task.

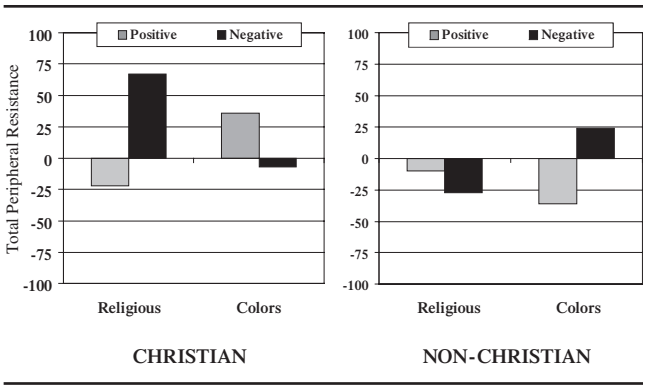

Figure 5 TPR as a function of participant religion, image valence, and image content in Experiment 2.
NOTE: Numbers higher on the y-axis indicate greater threat. TPR = total peripheral resistance.

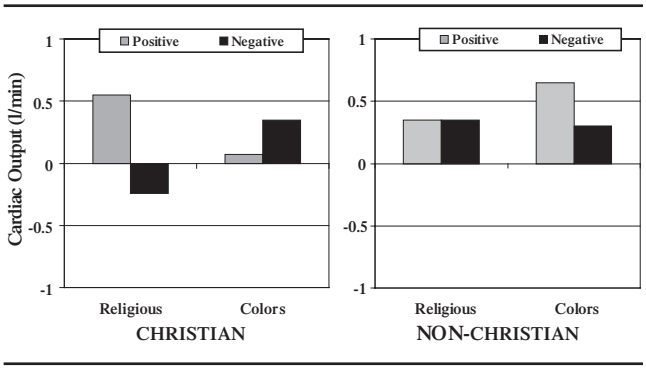

Figure 6 CO as a function of participant religion, image valence, and image content in Experiment 2.
NOTE: Numbers lower on the y-axis indicate greater threat. CO = cardiac output.

Possible Mechanisms

Numerous experiments and correlational studies have shown that religious people often use religion as a coping resource during potentially threatening situations (Pargament, 1997), whereas nonreligious people rely on different (although not necessarily better or worse) resources. In the studies reported here, because Christian-raised participants would have been more

likely to use Christianity as a coping resource than non-Christians, any changes in the utility of Christianity as a resource should have especially affected how Christians coped with the speech task. Positive symbols should have made the positive aspects of Christians' religion (e.g., "Jesus loves me") more accessible for them, thereby increasing the utility of religion as a coping resource (leading to challenge). Conversely, negative symbols should have made the negative aspects of their religion (e.g., "If I don't repent, I'll go to hell") more accessible, thereby decreasing the utility of religion as a coping resource (leading to threat). Indeed, the results of the second experiment suggest that the negative religious symbols may have been more influential than the positive religious symbols (see Note 5). According to previous research (Ochsmann, 1984; Osarchuk & Tatz, 1973), these effects on coping resources should have been more likely to occur during tasks relevant to existential issues (e.g., speaking about death).

It is also possible that religious cues could affect danger evaluations. Blascovich and Mendes (2000) have suggested that danger (or lack thereof) is an important component of demand evaluations—therefore, other evaluations being equal, any increase in danger evaluations should lead to greater threat. Furthermore, substantial evidence indicates that danger cues can be influential even when outside of conscious awareness (e.g., LeDoux, 1996; Murphy & Zajonc, 1993; Ohman & Mineka, 2001).

In terms of the present investigation, satanic symbols could have triggered greater danger to Christians than non-Christians. However, this mechanism alone cannot explain why the symbols did not significantly influence Christian participants during the dental speech. If the symbols elicited increased danger, then threat should have resulted regardless of task differences introduced after the presentation phase. Furthermore, tests on the religious stimuli ratings revealed that non-Christian participants rated the negative symbols as more disturbing than the positive symbols, suggesting that similar to Christians, non-Christians may have made danger evaluations that differentiated the negative from the positive symbols. However, non-Christian participants were not influenced by unreportable presentation of these symbols. It seems reasonable to speculate that a danger mechanism is not solely responsible for the current findings but rather that such a mechanism either acted in concert with the religious coping mechanism or did not exert an influence in these experiments.

Because cardiovascular measurement in this investigation was not accompanied by behavioral or self-report measures, it is also possible that the Christian symbols automatically triggered the observed cardiovascular responses without corresponding changes in the experience of challenge and threat. However, numerous experimental and nonexperimental studies have shown that within motivated performance situations, the different patterns of cardiovascular response measured here occur when, and only when, different patterns of challenge/threat response also occur (Tomaka et al., 1993, 1997; for a review, see Blascovich & Tomaka, 1996). Although these patterns have been refined over several years (Blascovich, Mendes, Tomaka, et al., 2003), the basic elements relevant to the current investigation remain, which suggests that the observed cardiovascular responses could not have occurred separate from challenge and threat responses. The idea that affectively valenced symbols automatically give rise to patterns of physiological response unaccompanied by evaluation processes is nonetheless intriguing and worthy of future investigation.

Relation to Prior Work on Religious Symbols

The results of the present investigation are consistent with certain aspects of traditional theories regarding religious symbols, although these theories were not explicitly tested here. For example, there is some support for the notion that religious symbols can exert a nonconscious influence on coping processes (Jung, 1964). However, the fact that only Christian-raised participants were influenced by the symbols in our studies suggests that the meaning of the symbols was learned throughout their lifetime and was therefore transmitted culturally (not genetically, as Jung suggested). The findings here also are consistent with Ortner's (1973) theory that complex symbols (e.g., a painting of Jesus ascending to heaven) serve a summary function.

These findings also are consistent with existential accounts of religious symbols, which argue that religious worldviews function to create structured, meaningful human lives in an unstructured, meaningless world (e.g., Becker, 1973; Greenberg et al., 1997; Nietzsche, 1887/1974; Sartre, 1956). The fact that religious symbols only exerted an influence on motivational states during a speech about death suggests that these symbols may function at least in part to help individuals cope with existential issues. TMT (Greenberg et al., 1997), in particular, holds that people cling to their cultural worldview (i.e., the beliefs held by their ingroup, including religious beliefs) to fend off potential terror associated with knowledge of their inevitable demise. In most TMT studies, participants have been primed with death and then their beliefs or attitudes toward outgroup members have been subsequently measured. The current experiments reverse that paradigm, however. Rather than prime participants with death and then measure their worldview-related beliefs, we primed Christian participants with the positive or negative

aspects of their worldview and then measured their reactions as they talked about death. Consistent with TMT, obtained results indicated that the primes only exerted influence when participants were Christian, when the symbols were Christian (i.e., relevant to their worldview), and when the speech was about death.

Implications for Challenge and Threat Theory

Although the biopsychosocial model of challenge and threat (Blascovich & Mendes, 2000; Blascovich & Tomaka, 1996) maintains that evaluations of demands and resources can occur on both conscious and nonconscious levels, the present studies provide the most direct evidence to date in support of nonconscious evaluations. Participants could not report or recall the symbols to which they were exposed, but cardiovascular patterns consistent with challenge/threat responses were nonetheless affected. This suggests that evaluations of demands and resources must have been affected by nonconscious influences, perhaps in the form of outright nonconscious evaluations or at least nonconscious effects on conscious evaluations.

Although the biopsychosocial model of challenge and threat specifically applies to cardiovascular patterns observed during motivated performance situations, it remains possible that religious symbols influence coping processes outside of motivated performance situations. However, the data reported here cannot speak to that possibility.

Conclusions

The findings here demonstrate that complex, culturally constructed religious symbols presented outside of conscious awareness can influence psychological and physiological states during motivated performance situations. Such situations encompass many of the important events faced in everyday life (e.g., test taking, job interviews, and interpersonal interactions), suggesting that the effects of symbols may have important practical significance. Future research should be directed toward understanding the processes involved in the observed effects and their generalization to other stimuli.

NOTES

1. Challenge may result in only sympathetic-adrenal-medullary (SAM) axis activity because of the relatively short half-life (several minutes) of the neurochemical output of the SAM axis, catecholamines. The resulting fast spike of energy presumably functions to provide the body with a means for coping with events that should not require extensive activity; for example, events for which one is confident of one's success. In contrast, the product of threat and hypothalamic-pituitary-adrenocortical (HPA) activation is the release of cortisol, which has a half-life in the body of approximately 90 min. The HPA response would therefore appear to prepare the body for prolonged activity, such as that required by highly demanding tasks for which one does not currently have adequate resources.

2. Data from eight participants were excluded due to difficulty in consistently identifying the "b" inflection (the opening of the aortic valve) on the dz/dt waveform. This attrition left a total of 107 participants with usable physiological data: 26 in the Negative Symbols–Death Speech condition, 28 in the Negative Symbols–Dental Speech condition, 24 in the Positive Symbols–Death Speech condition, and 29 in the Positive Symbols–Dental Speech condition.

3. In the past, VC also has been used to differentiate challenge and threat (see Blascovich, Mendes, Hunter, & Salomon, 1999; Blascovich, Mendes, Hunter, Lickel, & Kowai-Bell, 2001; Mendes, Blascovich, Lickel, & Hunter, 2002; Mendes, Blascovich, Major, & Seery, 2001), but it does not do so consistently (e.g., Blascovich et al., 2001, Experiment 3), although it should increase from baseline in both. Accordingly, for the following experiments, cardiac output (CO) and total peripheral resistance (TPR) were used to test for differences in challenge versus threat. However, we tested for increases in ventricular contractility (VC) (as well as heart rate [HR]) to confirm sympathetic activation.

4. Data from 10 participants were excluded due to an inability to consistently locate "b" on the dz/dt waveform. In addition, 3 participants were excluded because they had irregular heartbeats and 2 participants were excluded because they did not speak English well (and therefore had difficulty understanding and performing the speech task). This attrition left a total of 191 participants with usable physiological data: 27 Christians and 23 non-Christians exposed to negative Christian symbols; 27 Christians and 19 non-Christians exposed to positive Christian symbols; 28 Christians and 22 non-Christians exposed to negative control images; and 20 Christians and 25 non-Christians exposed to positive control images.

5. The three-way interaction also may be broken down between positive and negative images. Among participants exposed to negative symbols or colors, the two-way interaction between symbol type and religion was significant for TPR, $F(1, 182) = 4.18$, $p < .05$, but not for CO, $F(1, 182) = 1.58$, *ns*. The nature of the interaction was such that Christian-raised participants presented with negative Christian symbols exhibited higher TPR ($M = 65.2$, $SE = 31.34$) and lower CO ($M = -.22$, $SE = .26$) than non-Christian participants presented with negative Christian symbols (TPR: $M = -26.84$, $SE = 33.75$; CO: $M = .35$, $SE = .27$), $F(1, 182) = 4.11$, $p < .05$, $d = .56$, and $F(1, 182) = 2.31$, $p = .12$, $d = .43$, respectively, for TPR and CO. Christian-raised participants presented with negative Christian symbols also exhibited marginally higher TPR and lower CO than Christian-raised participants presented with the negative color controls (for this latter group, TPR: $M = -22.1$, $SE = 30.81$; CO: $M = .35$, $SE = .25$), $F(1, 182) = 3.06$, $p = .08$, $d = .54$, and $F(1, 182) = 2.19$, $p = .13$, and $d = .43$, respectively, for TPR and CO. There were no significant or near-significant differences between any of the groups exposed to positive Christian symbols or color controls.

REFERENCES

Abrams, R. L., & Greenwald, A. G. (2000). Parts outweigh the whole (word) in unconscious analysis of meaning. *Psychological Science, 11*, 118-124.

Baldwin, M. W., Carrell, S. E., & Lopez, D. F. (1990). Priming relationship schemas: My advisor and the Pope are watching me from the back of my mind. *Journal of Experimental Social Psychology, 26*, 435-454.

Bargh, J. A. (1994). The four horseman of automaticity: Awareness, intention, efficiency, and control in social cognition. In R. S. Wyer & T. K. Srull (Eds.), *Handbook of social cognition* (Vol. 1, pp. 1-40). Hillsdale, NJ: Lawrence Erlbaum.

Bargh, J. A., & Chartrand, T. L. (2000). The mind in the middle: A practical guide to priming and automaticity research. In H. T. Reis & C. M. Judd (Eds.), *Handbook of research methods in social and personality psychology* (pp. 253-285). New York: Cambridge University Press.

Barthes, R. (1957). *Mythologies*. Canada: HarperCollins.

Becker, E. (1973). *The denial of death*. New York: Free Press.

Blascovich, J., & Mendes, W. B. (2000). Challenge and threat appraisals: The role of affective cues. In J. P. Forgas (Ed.), *Feeling and thinking: The role of affect in social cognition* (pp. 59-82). New York: Cambridge University Press.

Blascovich, J., Mendes, W. B., Hunter, S. B., Lickel, B., & Kowai-Bell, N. (2001). Perceiver threat in social interactions with stigmatized others. *Journal of Personality and Social Psychology, 80*, 253-267.

Blascovich, J., Mendes, W. B., Hunter, S. B., & Salomon, K. (1999). Social "facilitation" as challenge and threat. *Journal of Personality and Social Psychology, 77*, 68-77.

Blascovich, J., Mendes, W. B., & Seery, M. D. (2002). Intergroup encounters and threat: A multi-method approach. In D. M. Mackie & E. R. Smith (Eds.), *From prejudice to intergroup emotions: Differentiated reactions to social groups* (pp. 89-109). New York: Psychology Press.

Blascovich, J., Mendes, W. B., Tomaka, J., Salomon, K., & Seery, M. (2003). The robust nature of the biopsychosocial model challenge and threat: A reply to Wright and Kirby. *Personality & Social Psychology Review, 7*(3), 234-243.

Blascovich, J., & Tomaka, J. (1996). The biopsychosocial model of arousal regulation. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 28, pp. 1-51). San Diego, CA: Academic Press.

Cacioppo, J. T., & Tassinary, L. G. (1990). *Principles of psychophysiology: Physical, social, and inferential elements*. Cambridge, UK: Cambridge University Press.

Chartrand, T. L., & Bargh, J. A. (1996). Automatic activation of impression formation and memorization goals: Nonconscious goal priming reproduces effects of explicit task instructions. *Journal of Personality and Social Psychology, 71*, 464-478.

Chen, M., & Bargh, J. A. (1997). Nonconscious behavioral confirmation processes: The self-fulfilling consequences of automatic stereotype activation. *Journal of Experimental Social Psychology, 33*, 541-560.

Crowne, D. P., & Marlowe, D. (1964). *The approval motive: Studies in evaluative dependence*. New York: John Wiley.

Devine, P. G. (1989). Stereotypes and prejudice: Their automatic and controlled components. *Journal of Personality and Social Psychology, 56*, 5-18.

Dienstbier, R. A. (1989). Arousal and physiological toughness: Implications for mental and physical health. *Psychological Review, 96*, 84-100.

Dijksterhuis, A., Aarts, H., Bargh, J. A., & van Knippenberg, A. (2000). On the relation between associative strength and automatic behavior. *Journal of Experimental Social Psychology, 36*, 531-544.

Durkheim, E. (1995). *The elementary forms of religious life*. New York: Simon & Schuster. (Original work published 1912)

Evans-Pritchard, E. E. (1956). *Nuer religion*. Oxford, UK: Oxford University Press.

Freud, S. (2000). *Totem and taboo: Resemblances between the psychic lives of savages and neurotics*. Amherst, NY: Prometheus Books. (Original work published 1938)

Geertz, C. (1973). *The interpretation of cultures*. New York: Basic Books.

Greenberg, J., Porteus, J., Simon, L., & Pyszczinski, T. (1995). Evidence of a terror management function of cultural icons: The effects of mortality salience on the inappropriate use of cherished cultural symbols. *Personality and Social Psychology Bulletin, 21*, 1221-1228.

Greenberg, J., Pyszczynski, T., Solomon, S., Rosenblatt, A., Veeder, M., Kirkland, S. L., et al. (1990). Evidence for terror management theory II: The effects of mortality salience on reactions to those who threaten or bolster the cultural worldview. *Journal of Personality and Social Psychology, 58*, 308-318.

Greenberg, J., Solomon, S., & Pyszczynski, T. (1997). Terror management theory of self-esteem and cultural worldviews: Empirical assessments and conceptual refinements. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 29, pp. 61-139). San Diego, CA: Academic Press.

Hawkley, L. C., Burleson, M. H., Berntson, G. G., & Cacioppo, J. T. (2003). Loneliness in everyday life: Cardiovascular activity, psychosocial context, and health behaviors. *Journal of Personality and Social Psychology, 85*, 105-120.

Hessing, D. J., Elffers, H., & Weigel, R. H. (1988). Exploring the limits of self-reports and reasoned action: An investigation of the psychology of tax evasion behavior. *Journal of Personality and Social Psychology, 54*, 405-413.

James, W. (1997). *Varieties of religious experience*. New York: Simon & Schuster. (Original work published 1936)

Jung, C. G. (Ed.). (1964). Approaching the unconscious. In *Man and his symbols* (pp. 18-103). London: Aldus Books Limited.

Kelsey, R., & Guethlein, W. (1990). An evaluation of the ensemble averaged impedance cardiograph. *Psychophysiology, 27*, 24-33.

Kierkegaard, S. (1981). *The concept of anxiety*. Princeton, NJ: Princeton University Press. (Original work published 1844)

Kruglanski, A. W. (1989). *Lay epistemics and human knowledge: Cognitive and motivational bases*. New York: Plenum.

Langer, S. (1942). *Philosophy in a new key: A study in the symbolism of reason, rite, and art*. Cambridge, MA: Harvard University Press.

Lazarus, R. S. (1982). Thoughts on the relations between emotion and cognition. *American Psychologist, 37*, 1019-1024.

Lazarus, R. S. (1984). On the primacy of cognition. *American Psychologist, 39*, 124-129.

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York: Springer.

LeDoux, J. E. (1996). *The emotional brain: The mysterious underpinnings of emotional life*. New York: Simon & Schuster.

Lerner, M. J. (1980). *The belief in a just world: A fundamental delusion*. New York: Plenum.

Levi-Strauss, C. (1964). *Totemism*. London: Merlin Press.

Llarbe, M. M., Spitzer, S. B., Saab, P. G., Ironson, G. H., & Schneiderman, N. (1991). The reliability and specificity of delta versus residualized change as measures of cardiovascular reactivity to behavioral changes. *Psychophysiology, 28*, 701-711.

McGregor, I. (2003). Defensive zeal: Compensatory conviction about attitudes, values, goals, groups, and self-definition in the face of personal uncertainty. In S. J. Spencer, S. Fein, M. P. Zanna, & J. M. Olsen (Eds.), *Motivated social perception: The Ontario symposium* (Vol. 9, pp. 73-92). Hillsdale, NJ: Lawrence Erlbaum.

Mendes, W. B., Blascovich, J., Lickel, B., & Hunter, S. B. (2002). Challenge and threat during social interaction with white and black men. *Personality and Social Psychology Bulletin, 29*, 939-952.

Mendes, W. B., Blascovich, J., Major, B., & Seery, M. D. (2001). Challenge and threat responses during downward and upward social comparisons. *European Journal of Social Psychology, 31*, 477-497.

Mendes, W. B., Reis, H., Seery, M. D., & Blascovich, J. (2003). Cardiovascular correlates of emotional expression and suppression: Do content and gender context matter? *Journal of Personality and Social Psychology, 84*, 771-792.

Murphy, S. T., & Zajonc, R. B. (1993). Affect, cognition, and awareness: Affective priming with optimal and suboptimal stimulus exposures. *Journal of Personality and Social Psychology, 64*, 723-739.

Newby-Clark, I. R., & Ross, M. (2003). Conceiving the past and the future. *Personality and Social Psychology Bulletin, 29*, 807-818.

Nietzsche, F. W. (1887/1974). *The gay science*. Toronto, Canada: Random House.

Ochsmann, R. (1984). Belief in afterlife as a moderator of fear of death? *European Journal of Social Psychology, 14*, 53-67.

Ohman, A., & Mineka, S. (2001). Fears, phobias, and preparedness: Toward an evolved module of fear and fear learning. *Psychological Review, 108*, 483-522.

Ortner, S. B. (1973). On key symbols. *American Anthropologist, 75*, 1338-1446.

Osarchuk, M., & Tatz, S. J. (1973). Effect of induced fear of death on belief in afterlife. *Journal of Personality and Social Psychology, 27*, 256-260.

Pargament, K. I. (1997). *The psychology of religion and coping: Theory, research, practice*. New York: Guilford.

Ross, M. (1989). Relation of implicit theories to the construction of personal histories. *Psychological Bulletin, 96*, 341-357.

Roth, D. L., Snyder, C. R., & Pace, L. M. (1986). Dimensions of favorable self-presentation. *Journal of Personality and Social Psychology, 51*, 867-874.

Sartre, J. P. (1956). *Being and nothingness*. New York: Simon & Schuster.

Seery, M. D., Blascovich, J., Weisbuch, M., & Vick, S. B. (2004). The effects of self-esteem level and stability on cardiovascular reactions to performance feedback. *Journal of Personality and Social Psychology, 87*, 133-145.

Sherwood, A., Allen, M. T., Fahrenberg, J., Kelsey, R. M., Lovallo, W. R., & van Dooren, L. J. P. (1990). Methodological guidelines for impedance cardiography. *Psychophysiology, 27*, 1-23.

Tabachnick, B. G., & Fidell, L. S. (1996). *Using multivariate statistics* (3rd ed.). New York: HarperCollins.

Tomaka, J., & Blascovich, J. (1994). Effects of justice beliefs on cognitive appraisals of and subjective physiological, and behavioral responses to potential stress. *Journal of Personality and Social Psychology, 67*, 732-740.

Tomaka, J., Blascovich, J., & Kelsey, R. M. (1993). Subjective, physiological, and behavioral effects of challenge and threat appraisal. *Journal of Personality and Social Psychology, 65*, 248-260.

Tomaka, J., Blascovich, J., Kibler, J., & Ernst, J. (1997). Cognitive and physiological antecedents of threat and challenge appraisal. *Journal of Personality and Social Psychology, 73*, 63-72.

Vallone, R. P., Griffin, D. W., Lin, S., & Ross, L. (1990). Overconfident prediction of future actions and outcomes by self and others. *Journal of Personality and Social Psychology, 58*, 582-592.

Weisbuch, M., Mackie, D. M., & Garcia-Marques, T. (2003). Prior source exposure and persuasion: Further evidence for misattributional processes. *Personality and Social Psychology Bulletin, 29*, 691-700.

Received August 27, 2004
Revision accepted December 15, 2004