

Mortality Salience and the Spreading Activation of Worldview-Relevant Constructs: Exploring the Cognitive Architecture of Terror Management

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Seven experiments assessed the hypothesis derived from terror management theory that reminding people of their mortality would increase accessibility of constructs central to their worldview. Experiment 1 found that mortality primes, relative to control primes, increased accessibility of nationalistic constructs for men but not for women. Experiment 2 replicated this finding and also found that mortality salience increased romantic accessibility for women but not for men. Four subsequent experiments supported the role of unconscious death-related ideation in producing these effects. A final experiment demonstrated that situational primes can increase the accessibility of nationalistic constructs for women after mortality salience. The roles of situational cues and individual differences in the effects of exposure to death-related stimuli on worldview-relevant construct accessibility are discussed.

Research based on terror management theory (Solomon, Greenberg, & Pyszczynski, 1991) has consistently found that reminders to individuals about their mortality (mortality salience) engenders responses aimed at shoring up faith in their cultural belief system or worldview (worldview defense; see Greenberg, Solomon, & Pyszczynski, 1997, for a review). Such responses are posited to attenuate the existential concerns engendered by thoughts of death by weaving the individual more securely into a meaningful cultural fabric. Previous studies have focused on the critical role that the accessibility of death-related thought plays in these effects (e.g., Arndt, Greenberg, Solomon, Pyszczynski, & Simon, 1997; Greenberg, Arndt, Schimel, Pyszczynski, & Solomon, 2001; Greenberg, Pyszczynski, Solomon, Simon, & Breus, 1994; Mikulincer & Florian, 2000). However, whereas death-thought accessibility has garnered a fair amount of empirical attention, little if any attention has been directed toward understanding what other types of thoughts are naturally triggered by death-related ones. Indeed, in a typical worldview defense study, participants are reminded of death and are then confronted with and respond to particular stimuli (e.g., evaluating an essay that derogates their political or religious affiliation). Because these stimuli inevitably direct participants' attention to certain domains, the natural sequence from

death thoughts to worldview defense remains unexplored. The present research was therefore focused on how thoughts of mortality spontaneously affect our broader cognitive landscape. Based on models of semantic associative priming and spreading activation (e.g., Anderson & Bower, 1973; McNamara, 1992; McKoon & Ratcliff, 1992), we reasoned that death-related thought should trigger an increase in the accessibility of constructs of central value within the individual's worldview. As our research using American college student samples progressed, we uncovered a consistent gender difference in the worldview-relevant thoughts that spontaneously increase in accessibility after reminders of death.

Spreading Activation, Compound Cue Models, and Psychological Defense

Over the last few decades, research has firmly established that priming effects, whether inside or outside conscious awareness, can lead to a wide range of effects that facilitate understanding of social behaviors and attitudes (e.g., Fazio, Sanbonmatsu, Powell, & Kardes, 1986; see e.g., Bargh, 1996; Higgins, 1996, for a review). For example, Bargh, Raymond, Pryor, and Strack (1995) demonstrated that for certain male individuals, the priming of power-related constructs led to more sexually oriented perceptions of female targets. This work is particularly interesting as an instance in which activation of one area of content (i.e., power) led to outcomes in another area (i.e., sex), presumably because of the associative linkages between power and sex these individuals developed. In recent years, research has also examined such priming effects on motivational constructs (e.g., Bargh & Gollwitzer, 1994). Thus, on the heels of repeated pairing between a goal and a particular cue, that cue can function to automatically activate the goal. In this way, much of the social research on diffuse priming effects can be accounted for by spreading activation models (e.g., Anderson & Bower, 1973; Collins & Loftus, 1975; Marcel, 1983).

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The mechanisms by which primes increase the accessibility of associated targets are an area of some debate within the cognitive psychology literature. More traditional spreading activation accounts, which are generally based on Hebb's (1948) classic models of contiguous activation, posit that conceptual knowledge is organized into a semantic network that features connections between semantically or associatively linked concepts (Klinger & Greenwald, 1995). When a concept is activated within this network, the activation and thus heightened accessibility spreads to other interconnected concepts. Over the last decade, however, McKoon and Ratcliff (e.g., 1992) have proposed an alternative account of these priming relationships and the activation of content in long-term memory. They assert that construct activation via priming can be understood as a function of multiple cues in the environment. That is, spreading activation does not simply reflect the free association between cue and outcome (cf. McNamara, 1994) but reflects the effect of that cue in collaboration with other features of the situation (Ratcliff & McKoon, 1994).

In addition to their implications for memory processes, such models can also be applied to explaining the cognitive processes by which an individual manages threats to self. Consider, for example, the work of Spencer, Fein, Wolfe, Fong, and Dunn (1998), who posited that a threat to an individual's self-image motivates the individual to self-affirm by insulating himself or herself with self-protective beliefs. Because one vehicle by which individuals are thought to affirm their value is through the stereotypical perceptions of others (Fein & Spencer, 1997), Spencer et al. (1998) hypothesized and found that a self-image threat increased the accessibility of stereotypical perceptions when participants were primed with that stereotype. In related research, Dodgson and Wood (1998) found that high self-esteem participants responded to failure feedback with heightened accessibility of positive thoughts over negative thoughts. These findings would seem to fit well with a compound cue approach wherein the threat to self, in conjunction with the salient self-protective domain (stereotypes, positive thoughts), combined to increase the accessibility of self-protective cognitions. Given these and other contributions that compound cue models of activation have made to the understanding of socially oriented and self-defensive cognition, these models may also be useful for shedding light on terror management processes.

Terror Management Theory and Mortality Salience Effects

Considerable terror management research has found that death-related thought motivates defense of one's cultural worldview (for a review, see Greenberg et al., 1997). Across at least seven different countries (e.g., Baldwin & Wesley, 1996; Florian & Mikulincer, 1997), more than 90 studies have found that a reminder to participants of their mortality increases such responses as positive evaluations of those who validate the participants' belief system and negative evaluations of those who threaten it (e.g., Rosenblatt, Greenberg, Solomon, Pyszczynski, & Lyon, 1989), perceived consensus for the participants' beliefs (Pyszczynski et al., 1996), reluctance to violate cultural norms (Greenberg, Simon, Porteus, Pyszczynski, & Solomon, 1995), stereotypical thinking and preferences (Schimmel et al., 1999), and aggression against those who violate the cultural worldview (McGregor et al.,

1998). Moreover, these effects occur in response to a number of different operationalizations to heighten death-related thought (e.g., proximity to a funeral home, subliminal death primes) and have occurred relative to a variety of control conditions (e.g., failure, test anxiety, social exclusion).

From the perspective of terror management theory, the awareness of inevitable mortality is a developmental catalyst that motivates a substantial amount of an individual's emersion in a social and cultural world as children learn to identify with the worldview and their sense of value within that worldview whenever bothered by thoughts of death. Thus, intimations of death become associated with aspects of the security-providing internalized worldview, particularly those aspects central to providing meaning and bases of self-worth. This analysis implies that the cognitive architecture constructed over the socialization process puts knowledge of one's mortality in a prominent and deeply rooted position within a larger network of knowledge structures that function as self-protective beliefs. According to spreading activation models, then, when death becomes accessible, so should important elements of the individual's worldview. This general hypothesis was assessed across all seven experiments.

Parameters by Which Mortality Salience Increases Worldview Accessibility

If accessible death-related thought activates an individual's most central worldview-relevant beliefs, then patterns of worldview activation after mortality salience should conform to the known progression of death-thought accessibility. This progression of effects is therefore likely to be different from simple spreading activation and more compatible with a compound cue model. Wegner and Smart (1997) offered a useful perspective from which to consider the potentially different activation effects of mortality salience. These researchers drew a distinction between instances of typical surface activation and what they referred to as *deep cognitive activation*. The latter state occurs when a thought is accessible but is not conscious, presents motivational significance for the individual, and can trigger indirectly associated self-protective pathways.

As Wegner and Smart (1997) pointed out, previous terror management work is consistent with the characterization of mortality salience as deep activation. Death-thought accessibility is low immediately after an explicit mortality salience induction but increases after a delay (Greenberg et al., 1994). Drawing from research on the ironic processes of mental control (Wegner, 1992), studies indicate that when death-related thoughts are in focal attention, people's initial response is to try and suppress these thoughts (Arndt, Greenberg, Solomon, et al., 1997). In contrast, when death primes are presented outside of conscious awareness via subliminal priming techniques, death-thought accessibility increases immediately thereafter (Arndt, Greenberg, Pyszczynski, & Solomon, 1997). Thus, if the accessibility of worldview beliefs is increased specifically by the nonconscious heightened accessibility of death-related thought, increases in worldview accessibility should only occur when a delay follows an explicit mortality salience treatment. However, this activation should occur directly after exposures to subliminal death primes. In this way, worldview accessibility after mortality salience should reflect a qualified or

two-step automatic activation effect (cf. Bargh, 1996; Fazio et al., 1986). In the first step, conscious death-related thought is suppressed and thus should not spread to activate worldview thoughts. When death thoughts are accessible but outside of focal attention, they should then spread to activate important self-protective beliefs. Experiments 3, 4, 5, and 6 assessed these hypotheses directly.

Differences Between Spontaneous Worldview Accessibility and Worldview Defense

One may wonder if such a finding would really provide a contribution beyond the existing findings of increased worldview defense after mortality salience. For a number of reasons, we think that it would. At the simplest level, despite all the research to date, we do not know what thoughts are triggered by these treatments in addition to death-related ones. We only know how the treatments affect reactions to other people or stimuli that bolster or threaten participants' worldviews. Assessment of the kinds of thoughts that spontaneously become accessible provides insight into people's underlying associative network surrounding death, which is uncontaminated by other stimuli that guide people toward certain aspects of the worldview.

We think that this type of assessment is also important because it allows for specification of individual differences in the central aspects of people's worldviews. Although terror management theory posits that self-protective beliefs are drawn from the prevailing worldview and are thus likely to share many commonalities, it is clear that there are a number of individual differences in the extent to which individuals identify with and defend those beliefs (e.g., McGregor et al., 1998; Taubman Ben-Ari, Florian, & Mikulincer, 1999). It seems fair to assume that individuals who do not defend a particular aspect of the worldview after mortality salience may not be strongly identified with that aspect; yet even among individuals who defend the component of the worldview when threatened, it may not be the most fundamental source of protection. Rather, as reactance theory (Brehm, 1966) might suggest, a particular domain may be less important although still available as a source of protection, so when threatened, the individual will defend it. Previous terror management work has not been able to examine this possibility, because in each case where worldview defense was measured participants were asked to respond to some type of salient worldview threat; an inevitable procedural step that would unavoidably render that aspect of their beliefs more salient.

The present research, in contrast, offers a new means through which to assess whether there are individual differences in the constitution of the worldview by measuring the spontaneous accessibility of worldview-relevant beliefs after mortality salience. In this way, the present study also differs from the research of Spencer et al. (1998) who primed the stereotypic self-protective belief (e.g., having an Asian woman hold up words to which participants responded) before assessing its accessibility. Thus, because the present measure (e.g., a word-fragment completion task) of accessibility involves no threat to aspects of the worldview and does not involve any evaluation or demand toward particular aspects of the worldview, it provides the opportunity to more clearly decipher how, when, and for whom mere mortality-related thoughts activate certain worldview-relevant constructs.

Gender Differences in Spontaneous Worldview Accessibility

We began this research with the assumption that for our American participants nationalistic sentiment would be a central component of most Americans' worldviews. Indeed, one of the more common findings in the terror management literature has been that mortality salience intensifies pro-American biases among U.S. participants (Greenberg et al., 1997). As in all terror management research, those studies on pro-U.S. bias as a form of worldview defense were routinely examined for gender differences and none were found. However, as noted previously, a measure of spontaneous accessibility may reveal differences that are obscured when participants are directed toward particular aspects of the worldview. Consequently, the current study examined with particular interest the possibility of gender differences in responses to death-related thought.

Recent research points to the differential effect that certain primes can have on men and women. For example, Mussweiler and Forster (2000) found that, presumably because of a number of different evolutionary and cultural experiences (e.g., Koss, Gidycz, & Wisniewski, 1987), priming sex would increase aggressive perceptions of ambiguous behavior for women but sex primes would increase aggressive behavior for men. In the present context, evolutionary and cultural factors may further operate to render different types of beliefs more central to men and women's repertoire of psychological defenses. As Gabriel and Gardner (1999) have shown, men and women may be motivated toward similar goals (e.g., social connectedness) but seek to satiate those goals in different ways. What are the domains that might be expected to become spontaneously but differentially accessible for men and women? Although we initially thought that reliance on nationalistic beliefs would generalize across men and women, men are often more overtly patriotic than women and are frequently more strongly invested in certain domains of American politics (e.g., Norrander, 1999). These variations in political activity reflect the gender differences that men tend to be more competitive and interested in power struggles whereas women tend to show more altruism and are more interested in establishing and maintaining reciprocal relationships (Archer, 1996; Geary, 1998). Such gender differences are revealed through the patriotic associations generated by high school girls and boys (Kelly, 1987). Therefore, for men, mortality salience may readily increase the accessibility of nationalistic cognitions. This possibility was assessed in Experiments 1, 2, and 4. Although women have been found to defend nationalistic beliefs when they are attacked, nationalistic constructs may not be as likely to become spontaneously accessible after mortality salience. Instead, there might be other beliefs that women more routinely use as psychological defenses against existential concerns.

Based largely on Rank's (e.g., 1941/1958) work, Becker (1973), referring to what he called the *romantic solution*, argued that as spiritual and religious belief systems have lost their mass appeal, more reliance and pressure has been placed on romantic relationships to provide a sense of meaning and value for individuals (cf. Greenberg, Pyszczynski, & Solomon, 1995; Solomon et al., 1991). Although overlooked for a number of years by researchers who examined terror management processes, a recently increasing number of studies have established connections between aware-

ness of death, love, and relationships (e.g., Goldenberg, Pyszczynski, McCoy, Greenberg, & Solomon, 1999; Mikulincer, Florian, Birnbaum, & Malishkevich, 2002). For example, reminders of mortality have been found to increase commitment to romantic relationships, particularly among individuals who characterize themselves as having secure relationships (Mikulincer & Florian, 2000).

A number of lines of work further suggest that a romantic relationship component of the worldview may often be particularly important for women. For example, sociological data indicate that women are more strongly socialized to invest themselves in romantic and intimate commitments as a way of maintaining personal value and meaning (e.g., Cross & Madson, 1997; Culp & Beach, 1998; Greene & Wheatley, 1992; Rosenberg, 1981). As scholars have increasingly argued, this makes evolutionary sense (see e.g., Buss & Schmidt, 1993; Geary, 1998; Trivers, 1972). Due to differential paternal uncertainty and the realities of women's reproductive systems, women may have become more concerned with romantic relationships because it was adaptive to do so in the sense of building a strong bond with a man to facilitate gene perpetuation through successful offspring. Through cultural and evolutionary processes, then, relationships may have become a more central component of many women's worldviews and thus have become strongly linked to the associative network surrounding knowledge of death. If this is the case, then, for women, mortality salience might be more likely to increase the accessibility of thoughts pertaining to romantic relationships. This possibility was assessed in Experiments 2, 3, 5, and 6.

Finally, in Experiment 7, we assessed whether the priming of nationalistic constructs in combination with death thought could increase accessibility of nationalistic constructs in women. Support for this hypothesis would indicate that in response to high death-thought accessibility, a variety of worldview-relevant constructs could become more accessible, depending on either spontaneous proclivities or situational primes. In this way, the present research is compatible with compound cue models of spreading activation (Ratcliff & McKoon, 1994), which posit that construct activation varies as a function of multiple cues in the stimulating environment.

Experiment 1

In Experiment 1, we presented participants with the mortality salience (or control) treatment used in most terror management research and measured the accessibility of cognitions related to a nationalistic worldview. As mentioned previously, we did not design Experiment 1 to specifically test for gender differences. To index nationalistic accessibility, we developed a word fragment completion measure that was based on similar measures used extensively in previous research (e.g., Bassili & Smith, 1986; Gilbert & Hixon, 1991; Greenberg et al., 1994; Mikulincer & Florian, 2000; Steele & Aronson, 1995; Tulving, Schacter, & Stark, 1982). Moreover, because prior work has indicated that death accessibility and worldview defense only increase after mortality salience when a delay intervenes between the treatment and these measures (e.g., Arndt, Greenberg, Solomon, et al., 1997), we included a delay between the mortality salience treatment and accessibility assessment. If knowledge of mortality is embedded in an associative network that also includes important beliefs and

values, then the reminder to participants of their mortality should also increase the accessibility of nationalistic worldview constructs.

Method

Participants and design. Participants were 14 male and 32 female introductory psychology students at the University of Missouri—Columbia who were randomly assigned to either a mortality salient or dental pain salient condition in a between-subjects design.

Procedure. Three to six participants per session were informed by the experimenter, who was blind to conditions, that the study concerned the relationship between a few personality characteristics. Participants were further told they would also complete a word fragment measure that was being pre-tested for future studies. Participants were assured of the anonymity of their responses to all aspects of the study, and steps were taken to ensure the privacy of their responses. After signing a consent form, participants were asked to complete a packet of personality questionnaires that contained either the mortality salience or control treatment. The mortality salience treatment (Rosenblatt et al., 1989) consisted of having participants respond to two open-ended questions: "Please briefly describe the emotions that the thought of your own death arouses in you" and "Jot down, as specifically as you can, what you think will happen to you physically as you die and once you are physically dead." The dental pain control treatment consisted of parallel questions with respect to the experience of dental pain.

After the mortality or control treatment, all participants completed the Positive and Negative Affect Schedule—Expanded Form (PANAS-X; Watson & Clark, 1992), and then a word search puzzle that was presented as a new technique for assessing visual recognition (e.g., Greenberg, Arndt, Simon, Pyszczynski, & Solomon, 2000). Participants searched for neutral television-related words (e.g., commercial, program, and channel) in a letter matrix that was presented on two pages for 3 min. The final questionnaire was a word fragment completion measure that was designed to assess the accessibility of cognitions that pertain to a nationalistic worldview. Participants were presented with a list of 26 word fragments they were to complete with the first word that came to mind by filling in the missing letters. Seven of the 26 fragments could be completed with one nationalistic word or one of perhaps a few different neutral words. For example, participants saw the fragment F __ G, which could be completed with the nationalistic *flag* or with the neutral *frog*. The remaining possible nationalistic terms were PATR ___ (*patriot* or *patrols*), __ ATES (*states* or *plates*), SEN ___ (*senate* or *senile*), _ AW (*law* or *paw*), ANT ___ (*anthem* or *antler*), and _ASH (*cash* or *bash*).¹ We pretested this measure on a separate sample of 20 students to ensure that each of the fragments

¹ At first glance, it may seem a bit odd to include *cash* as a fragment for the accessibility of nationalistic ideation. However, our original approach in designing this measure was to consider concepts that reflect American capitalistic society. It should be noted that the overall pattern of results across all studies is the same when this fragment is not included in the nationalistic accessibility score. We also examined the word fragments as a within-subjects variable for both nationalistic constructs and for the romantic fragments used in the subsequent experiments. For both constructs, there tended to be significant main effects for fragment, for example; $F_s(6, 306) > 4.30, ps < .001, \eta^2 > .07$, which indicated that some fragments were more frequently completed with nationalistic (or romantic) words than others (F __ G, SEN ____, PATR ____, and _ASH tended to be more frequently completed with nationalistic words than __ ATES, _ AW, or ANT ____; _RIDE, _ARRY, and R _M ____ tended to be more frequently completed with romantic words than WI ___, _OVER, SE __, or _ATE). However, there were no significant interactions involving any of the independent variables, all $F_s < 1.8, ps > .10$.

was completed with the target word no more than 50% of the time. The remaining 19 fragments could only be completed with neutral words (e.g., SO_A as *sofa*; WAT__ as *water*). After participants completed this measure, they were probed for suspicion, debriefed, and compensated with research credits.

Results

We first counted the number of nationalistic word fragment completions for each participant and subjected this count to a 2 (gender: male vs. female) \times 2 (salience: mortality vs. dental pain) analysis of variance (ANOVA; $MSE = 1.27$). In terms of the simple effects of mortality salience, this analysis supported our hypothesis: nationalistic accessibility was higher after participants thought about their mortality ($M = 2.30$) than when they thought about dental pain ($M = 1.61$), $F(1, 42) = 8.02$, $p < .01$, $\eta^2 = .16$. However, the Gender \times Mortality Salience interaction was also significant, $F(1, 42) = 5.35$, $p < .03$, $\eta^2 = .11$. The cell means for this interaction are presented in Table 1. Pairwise comparisons revealed that among male participants, mortality salience led to significantly greater accessibility than did dental pain, $t(42) = 3.10$, $p < .01$, $\eta^2 = .19^2$; whereas for females, there was no difference between mortality salience and controls, $t < 1$. When men and women within conditions were compared, men were marginally higher in nationalistic accessibility than women in the mortality salient condition, $t(42) = 1.96$, $p < .06$, $\eta^2 = .08$, but not in the dental pain condition, $t < 1.4$.

We also assessed whether our mortality salience treatment, alone or differentially as a function of gender, had any effect on self-reported mood as measured by the PANAS-X. The PANAS-X is a 60-item adjective checklist (scored on a 5-point scale with 1 being low and 5 being high) that contains subscales for positive and negative mood as well as 11 other specific mood subscales. Because items in the positive and negative mood scales also appear in the other subscales, we conducted a 2 (salience) \times 2 (gender) multivariate analysis of variance (MANOVA) on the 11 specific subscales and 2 (salience) \times 2 (gender) ANOVAs on the positive and negative mood scales. There were no significant effects from any of these analyses, all $F_s < 1$. In addition, we also examined analyses of covariance (ANCOVAs) to determine whether positive or negative affect mediated the interaction on accessibility. In both cases, the main effect and interaction remained significant, all $F_s > 4.95$, $p_s < .04$, which suggests that, as with previous terror management research, self-report affect was not involved with these accessibility effects.

Table 1
Cell Means for the Gender \times Mortality Salience Interaction on Nationalistic Accessibility in Experiment 1

Gender	Mortality salient	Dental pain
Men		
<i>M</i> (<i>SD</i>)	3.00 (1.29)	1.14 (1.07)
<i>n</i>	7	7
Women		
<i>M</i> (<i>SD</i>)	2.00 (1.15)	1.81 (1.05)
<i>n</i>	16	16

Note. Higher numbers reflect more nationalistic word completions.

Discussion

The results indicate that a reminder to participants of their mortality can indeed trigger heightened accessibility of worldview relevant content. Following a number of studies finding that mortality salience increases pro-American bias among American participants, Experiment 1 documents that mortality salience can also spontaneously increase the accessibility of nationalistic themes. This is consistent with the idea that knowledge of one's mortality resides within an associative network of knowledge structures that features beliefs that function to assuage concerns about mortality.

However, the significant increase in nationalistic accessibility after mortality salience was evident only for men. One possible explanation is that issues about mortality are more of a concern for men than women, and thus such reminders activate the associated worldview network only for men. We view this as unlikely given the previous research that has found mortality salience effects for both men and women. In our view, a more plausible explanation is that, at least for our sample of midwestern American participants, men and women generally rely on different components of the worldview to buffer mortality concerns. Whereas for men, such components include nationalistic beliefs, for women these beliefs may be a less prevalent source of protection. As noted earlier, some prior work is consistent with this possibility (e.g., Norrander, 1999; see also Archer, 1996; Geary, 1998), and this appears also to be true for our participant pool. During introductory psychology screening sessions in the 1st year in which these studies were run, male students more strongly endorsed the item "How important to you is your identification as an American?" than did female students, $F(1, 2211) = 10.80$, $p < .001$, $\eta^2 = .005$. Although the magnitude of this difference is small, and this single question is not likely to be the most reliable or sensitive indicator of nationalistic importance, it is consistent with the notion that perhaps women did not show the increased accessibility after mortality salience because such beliefs were not as central to their worldview. It may be that for women, other worldview-relevant beliefs play a greater role in self-protection and thus are more likely to become accessible.

Experiment 2

The critical question then becomes what beliefs are more likely to serve this self-protective function for women? As we previously reviewed, a number of lines of work that focus on differential socialization, cultural, and evolutionary experiences suggest that components of the worldview that may be particularly important for women concern romantic relationships (e.g., Buss & Schmidt, 1993; Culp & Beach, 1998; Geary, 1998; Greene & Wheatley, 1992). If this is the case, for women mortality salience should increase the accessibility of thoughts pertaining to romantic relationships. To assess this possibility as well as to replicate our initial results, we followed the same procedure as in Experiment 1,

² In computing the pairwise comparisons and their associated effect sizes, we used the error term and degrees of freedom from the overall ANOVA because they provide a more stable and accurate estimate of error variability (see e.g., Keppel, 1991; Maxwell & Delaney, 2000). In addition, for effect sizes, the overall degree of freedom offers a more conservative estimate.

Table 2
Cell Means for the Gender × Mortality Salience × Accessibility Measure Interaction in Experiment 2

Gender	Nationalistic completions		Relationship completions	
	Mortality salient	Dental pain	Mortality salient	Dental pain
Men				
<i>M</i> (<i>SD</i>)	0.59 (1.27)	-0.26 (0.84)	0.17 (1.11)	-0.33 (0.58)
<i>n</i>	15	12	15	12
Women				
<i>M</i> (<i>SD</i>)	-0.37 (0.72)	0.04 (0.82)	0.61 (1.02)	-0.51 (0.82)
<i>n</i>	14	14	14	14

Note. Scores are expressed as standardized *z* scores. High scores reflect greater accessibility.

but we substituted an accessibility measure that indexed both nationalistic thoughts and thoughts pertaining to romantic relationships. If our analysis is correct, then we should find a three-way interaction such that mortality salience triggers increased accessibility of nationalistic thoughts for men but increased accessibility of romantic relationship thoughts for women.

Method

Participants and design. Participants were 27 male and 28 female introductory psychology students at the University of Missouri—Columbia; they were randomly assigned to receive either a mortality salience or dental pain salience questionnaire. Thus, Experiment 2 used a 2 (gender: male vs. female) × 2 (salience: mortality vs. dental pain) between-subjects × 2 (accessibility: nationalistic vs. relationship) within-subjects design.

Procedure. The procedure was the same as in Experiment 1, except for the content of the accessibility measure. This form contained 34 fragments; the seven nationalistic items and fillers from Experiment 1 and seven pretested fragments that could be completed with words related to romantic relationships (e.g., WI__ could be completed as *wife* or *with*). The remaining possible relationship fragments were _OVER (*lover* or *cover*), _ARRY (*marry* or *carry*), SE_ (*sex* or *set*), R_M____ (*romance* or *reminds*), _ATE (*date* or *late*), and _RIDE (*bride* or *pride*). After participants completed this measure, they were probed for suspicion, debriefed, and compensated with research credits.

Results

We counted first the number of relationship and nationalistic word fragment completions and transformed these counts, separately within each measure, into standardized *z* scores. We note at this point that for all experiments the same significance levels of the critical interactions are obtained when the raw, untransformed means are analyzed. We then conducted a 2 (gender: male vs. female) × 2 (salience: mortality vs. dental pain) between-subjects × 2 (accessibility: nationalistic vs. relationship) within-subjects ANOVA (*MSE* = .95). This analysis revealed a main effect for mortality salience, $F(1, 51) = 9.78, p < .01, \eta^2 = .16$, which reflects higher accessibility after mortality salience. However, this effect was qualified by the predicted three-way interaction be-

tween gender, mortality salience, and accessibility measure, $F(1, 51) = 5.87, p < .02, \eta^2 = .10$. The means for this interaction are presented in Table 2.

Pairwise comparisons within each type of accessibility provided strong support for our hypotheses. Specifically, among men, mortality salience led to increased nationalistic accessibility relative to their dental pain counterparts, $t(51) = 2.24, p < .05, \eta^2 = .09$. However, for women, mortality salience did not increase nationalistic accessibility relative to female dental pain participants, $t < 1$. Thus, these data replicate the results found in Experiment 1. However, a different picture emerges for the accessibility of thoughts pertaining to romantic relationships. Here, women evidenced higher relationship accessibility after being reminded of their mortality relative to their dental pain counterparts, $t(51) = 3.03, p < .01, \eta^2 = .15$. However, this same effect was not significant among men, $t(51) = 1.34$.

Looking at relative comparisons of the two types of constructs within groups, in the dental pain conditions, levels of accessibility do not differ, all *t*s < 1.4.³ However, within the mortality salient condition, the women exhibited higher accessibility for relationship than for national concepts, $t(51) = 2.75, p < .01, \eta^2 = .13$. Although in the expected opposite direction, for men this comparison did not approach significance, $t(51) = 1.19$. Inspection of the means in Table 2 suggests that although the general pattern of

³ Throughout the experiments, we report comparisons between types of accessible content. This is done in the interest of thoroughness, but it is important to note that such comparisons should be interpreted with caution. As Fazio (1990) and others point out in a discussion of latency measures of accessibility, a judgment may be made for a number of reasons in addition to the semantics of the word target (e.g., word frequency). Although this point is perhaps particularly relevant to Experiment 5, a similar caution can be expressed with regard to the word fragment measure. It is unclear whether differences, or lack thereof, between (in this case) nationalistic and relationship word completions reflect attention to the content of the fragment or occur, for example, because some of the fragments may just be easier to complete than others. For this reason, we believe the comparisons within an accessibility type as a function of the between-subjects manipulations are the most important for assessment of the effects of mortality salience.

means was as expected there was a nonsignificant tendency for mortality salient men, relative to control men, to exhibit higher accessibility of relationship constructs as well as nationalistic constructs. Experiment 4 provides further data on men that can help in determining whether this tendency for increased relationship accessibility is reliable.

We followed a similar data analytic approach to the examination of scores on the PANAS-X as we did in Experiment 1. The only significant effect or interaction was an effect for salience on the MANOVA, $F = 2.11$, $p < .05$. However, inspection of the univariate F tests found that only the serenity scale revealed an effect that even approached significance, $F(1, 50) = 3.79$, $p < .06$, $\eta^2 = .07$, all other F s < 1 , $ps > .34$, with mortality salience participants showing higher serenity than dental pain participants (M s = 3.74 vs. 3.24). To assess whether serenity levels influenced the accessibility effect, we conducted ANCOVAs with serenity scores on both accessibility scales and found that in neither case was serenity a significant covariate (both $ps > .25$) and the inclusion of serenity scores did not substantially impact the size of the Mortality Salience \times Gender interaction. In addition, we also conducted 2×2 ANCOVAs with positive and negative mood covariates and found, again, that the interaction remained significant, both F s > 5.50 , $ps < .03$. Thus, it does not appear that self-report affect played a role in the accessibility effects of present interest. As in Experiment 1, previous terror management work has repeatedly found that self-reported affect does not play a role in the worldview defense responses that are observed in response to mortality salience (Greenberg et al., 1997; see also Arndt, Allen, & Greenberg, 2001), and so this lack of affective involvement was expected.

Discussion

The results of Experiment 2 indicate that mortality salience increases the accessibility of worldview-relevant constructs but that these constructs can differ for men and women. After being reminded of their mortality, men, but not women, showed increased accessibility of nationalistic thoughts. However, in women mortality salience failed to activate cognitions relevant to nationalism but it did activate cognitions pertaining to romantic relationships. Although there was a trend for mortality salient men to show a similar increase in romantic accessibility, it was not reliable.

Experiment 3

An important factor underlying cultural worldview defenses after mortality salience is the accessibility of death-related cognition (for a review, see Pyszczynski, Greenberg, & Solomon, 1999). Although in the past decade a number of techniques have been used to manipulate mortality salience (e.g., proximity to a funeral home), the most common is to have participants answer two open-ended questions about their own death. In such a situation, mortality salience-induced worldview defense occurs more strongly when a delay follows this manipulation, that is, when such thoughts are highly accessible but not in focal attention (Arndt, Greenberg, Solomon, et al., 1997; Greenberg et al., 1994). The same pattern is found with respect to the accessibility of death-related cognition; it is low initially after mortality salience and increases after a delay. Thus, ironically, mortality salience-induced

worldview defenses, or *distal defenses*, appear to be typically obtained when mortality is no longer salient. This is presumably because people often react to conscious thoughts of mortality by suppressing them (Arndt, Greenberg, Solomon, et al., 1997), seeking to escape self-focused attention (Arndt, Greenberg, Simon, Pyszczynski, & Solomon, 1998), or engaging in pseudo-rational biases to deny vulnerability to a short life expectancy (e.g., Greenberg et al., 2000). These more immediate and direct forms of defense that are provoked by conscious death-related ideation are referred to as *proximal defenses*.

More direct evidence that *unconscious* mortality concerns motivate distal worldview defenses followed from studies that presented subliminal reminders of death via words on a computer screen. Despite reporting no conscious awareness of the primes, those exposed to the "death" primes exhibited increased death-thought accessibility and increased worldview defense (e.g., Arndt, Greenberg, Pyszczynski, & Solomon, 1997; Dechesne, Janssen, & van Knippenberg, 2000). Moreover, research also indicates that the same conditions that attenuate the effects of mortality salience on worldview defense (e.g., boosted or dispositionally high self-esteem; a rational mode of thinking) also attenuate the delayed increase in death-thought accessibility after mortality reminders (Harmon-Jones et al., 1997; Simon et al., 1997; but see Mikulincer & Florian, 2000) and that mortality salience-induced worldview defense functions at least in part to reduce elevated death-thought accessibility (e.g., Arndt, Greenberg, Solomon, et al., 1997; Greenberg et al., 2001). The emerging picture indicates that these cultural worldview defenses are triggered by the unconscious elevation of death-thought accessibility. In Wegner and Smart's (1997) language, these effects unfold as a result of the "deep cognitive activation" of mortality-related cognitions.

In Experiments 1 and 2, we assumed that because the nonconscious accessibility of death-related thoughts is posited to increase the accessibility of worldview-relevant cognitions, such effects would parallel the progression of death-thought accessibility after an explicit reminder of mortality. Thus, based on prior work (e.g., Arndt, Greenberg, Solomon, et al., 1997; Greenberg et al., 1994), we included a delay exercise in between the salience inductions and accessibility measurements in Experiments 1 and 2. In Experiments 3–6, we wanted to assess the role of consciousness and accessibility of death-related thought more directly. Because of practical concerns associated with the availability of sufficient participants to be involved in these studies, we used only female participants in Experiments 3, 5, and 6, and we used only male participants in Experiment 4. In this way, we were able to preserve the opportunity to replicate, once again, our findings regarding differential accessibility for both men and women. Experiment 3 was designed to replicate Experiment 2, but it also manipulated whether participants completed the accessibility measures immediately after the salience treatment or after a delay. If death-related thought spreads to activate the prominent cognitions of an individual's worldview network when such thoughts are highly accessible but outside of current focal attention, then we would expect to replicate Experiment 2 and find increased romantic accessibility when a delay follows mortality reminders; however, this same increase should not be evident when accessibility is assessed immediately after the mortality salience manipulation.

Method

Participants and design. Fifty-one female introductory psychology students at the University of Missouri—Columbia were randomly assigned to conditions in a 2 (salience: mortality vs. dental pain) \times 2 (timing of accessibility measure: immediate vs. delay) between-subjects \times 2 (type of accessibility: nationalistic vs. relationship) within-subjects design.

Procedure. The procedure was the same as in Experiment 2, except for the timing of the worldview accessibility measure. Whereas Experiments 1 and 2 had all participants complete the accessibility assessment after doing the PANAS-X and word search puzzle, in Experiment 3, half the participants completed the accessibility measure prior to the PANAS-X and word search puzzle. Specifically, after completion of the mortality salience or dental pain questionnaire, participants completed the accessibility measure and then the PANAS-X and word puzzle or the PANAS-X and word search puzzle and then the same word completion questionnaire used in Experiment 2. Upon completion of all materials, participants were probed for suspicion, debriefed, and compensated with research credits.

Results

Because we used only women participants in Experiment 3, we expected mortality salience to increase relationship accessibility—but not nationalistic accessibility—when such thoughts were assessed after a delay, but not when they were assessed immediately after mortality salience. We scored the accessibility measure in the same manner as in Experiment 2 and conducted a 2 (salience: mortality vs. dental pain) \times 2 (timing of accessibility measure: immediate vs. delayed) between-subjects \times 2 (type of accessibility: nationalistic vs. relationship) within-subjects ANOVA ($MSE = .68$). The analysis revealed the predicted three-way interaction between mortality salience, timing of the accessibility measure, and accessibility, $F(1, 47) = 5.80, p = .02, \eta^2 = .11$. The means for this interaction are presented in Table 3.

Planned comparisons within each type of accessibility indicated that when there was a delay between the salience manipulation and participants' completion of the accessibility measure, mortality salience led to increased relationship accessibility relative to their dental pain counterparts, $t(47) = 2.17, p < .05, \eta^2 = .09$. In contrast, there was no significant difference in relationship accessibility between the mortality salience and dental pain salience immediate assessment conditions, $t < 1$. After mortality salience, relationship accessibility was higher when participants completed the accessibility measure after a delay than when they completed it immediately thereafter, $t(47) = 3.25, p < .05, \eta^2 = .18$. Yet,

there was no such difference between the immediate and delayed dental pain salience conditions, $t < 1$; this same pattern was also not evident for the accessibility of nationalistic thoughts. It is perhaps interesting to note that there was some indication that nationalistic accessibility was inhibited when a delay followed the mortality salience induction. Among mortality salient participants, nationalistic accessibility was lower after a delay than without a delay, $t(47) = 2.14, p < .05, \eta^2 = .09$. Such accessibility in the mortality salience delayed condition, however, did not significantly differ from the nationalistic accessibility of participants in the dental pain salience delayed assessment condition, $t < 1.3$. A similar comparison in Experiment 2, although in the same direction, was also nonsignificant, $t < 1$. Although these ambiguous comparisons caution against strong interpretation of this pattern, these results tentatively suggest the possibility that women's heightened accessibility of relationships may in part be at the expense of nationalistic accessibility, an issue we will return to later.

Within type of accessibility measure, after a delay, mortality salience led to higher relationship than nationalism accessibility, $t(47) = 3.19, p < .05, \eta^2 = .18$. When accessibility was assessed immediately after mortality salience, nationalistic content was higher than relationship content for these female participants, $t(47) = 2.20, p < .05, \eta^2 = .09$. Inspection of the means suggests that this unexpected difference in the immediate mortality salient condition had more to do with low accessibility of relationship constructs than with high accessibility of nationalistic constructs. Consistent with this idea, in the immediate condition, nationalistic constructs were not reliably higher for mortality salient participants than for dental pain participants, $t < 1$. In neither dental pain condition was the comparison between types of constructs significant, $t_s < 1$.

As with the prior experiments, there was no indication that the mortality treatment, either alone or with a delay, impacted scores on the PANAS-X. Specifically, 2 (salience: mortality vs. dental pain) \times 2 (timing: immediate vs. delay) ANOVAs on both the positive and negative mood scales revealed no effects or interactions involving mortality salience, all $F_s < 1$. Likewise, there were no significant effects revealed from a similar 2 \times 2 MANOVA on the 11 remaining subscales, all $F_s < 1.2$; ANCOVAs with positive and negative affect scores as covariates did not compromise the

Table 3
Cell Means for the Mortality Salience \times Timing of the Accessibility Measure \times Accessibility Measure Interaction in Experiment 3

Timing	Nationalistic completions		Relationship completions	
	Mortality salient	Dental pain	Mortality salient	Dental pain
Delay				
<i>M</i> (<i>SD</i>)	-0.41 (0.81)	0.01 (0.69)	0.62 (1.10)	-0.08 (1.08)
<i>n</i>	13	13	13	13
Immediate				
<i>M</i> (<i>SD</i>)	0.28 (1.40)	0.13 (0.95)	-0.43 (0.83)	-0.12 (0.71)
<i>n</i>	13	12	13	12

Note. Accessibility scores are expressed as standardized *z* scores. High scores reflect greater accessibility.

significance of the interaction on accessibility, both $F_s > 5.60$, $p_s < .03$.

Discussion

The results of Experiment 3 confirmed the crucial role of a delay when worldview accessibility was accessed after explicit reminders of mortality. In Experiment 3, composed of all female participants, relationship accessibility increased when a delay followed mortality salience, but there was no such increase when it was assessed immediately after participants completed the mortality salience questionnaire. Moreover, such effects were not found with regard to nationalistic accessibility, which suggests that such thoughts are indeed less central to women's network of self-protective beliefs. The present findings not only replicate the results of Experiment 2, but they also suggest that the triggers that activate spreading along the worldview network are not conscious thoughts of death, but rather, the unconscious resonances of death thoughts once they have been removed from focal attention.

Experiment 4

To more directly assess the role of nonconsciousness heightened death-thought accessibility in these effects, we again followed previous terror management studies (e.g., Arndt, Greenberg, Pyszczynski, & Solomon, 1997) and used subliminal priming techniques to activate thoughts of death outside of conscious awareness. If the accessibility of individually relevant worldview constructs does indeed parallel patterns of death-thought accessibility, then subliminal death primes should increase the immediate accessibility of nationalistic thoughts among the male participants who completed the study. We also assessed the accessibility of relationship thoughts to examine whether the nonsignificant elevation suggested by the results of Experiment 2 reflected a reliable phenomenon.

Method

Participants and design. Twenty-nine male introductory psychology students at the University of Missouri—Columbia were randomly assigned to a subliminal death prime or subliminal pain prime condition before responding to the accessibility measure. Three participants were discarded from the sample for expressing suspicion about our cover story and procedures.

Procedure. Upon participants' arrival at the laboratory, the experimenter explained that the study concerned processes of word perception. One to two participants per session were told that they would complete a task on computers in which they would make judgments about relationships between words and then they would complete a pencil-and-paper word task. Participants were assured of the anonymity of their responses, and they completed all materials and tasks in private cubicles. After the experimenter explained the above conditions, participants signed a consent form. They were then ushered to adjacent cubicles that housed the computers.

Participants first completed the word relationship task. Stimuli for this task were presented on a 15-in. Gateway color monitor controlled by an IBM-compatible computer using the DMASTR display software developed by K. I. Forster and J. C. Forster.⁴ This program synchronizes the timing of the display and uses normal IBM bit-mapped font, and it constituted the manner by which we presented our subliminal primes. The first few frames presented instructions followed by three practice items. The instructions, also previously verbally reviewed by the experimenter, explained that the

word relation program flashes two words on the computer and participants are to indicate whether or not they think the words are related by pressing either the right or left shift key. For example, if they saw the words "rose" and "flower", they were to press the right shift key, but if they saw such words as "sneaker" and "fajita," they were to press the left shift key. The first and third stimuli were the words for which the participants were to determine the presence or absence of a relationship. These words also served as a forward (and fixation point) and backward mask, respectively, and were displayed for 356 ms. The critical subliminal primes were presented between the two mask words for 28.5 ms as in Arndt, Greenberg, Pyszczynski, and Solomon (1997). In the subliminal death prime condition, participants were exposed to 10 such trials in which the word "dead" was presented in between the masks; in the control condition, participants were exposed to 10 such trials in which the word "pain" was presented. The program that the participants received was prepared ahead of time by another assistant, thus enabling us to keep the experimenter blind to conditions.

After these trials, an instruction on the computer asked participants to complete a questionnaire that had been left next to the computer. This form was the same accessibility measure used in Experiments 2 and 3. Participants were then given a series of manipulation check questions to assess their awareness of the stimuli display. Specifically, with one question per page, participants were asked to indicate how many words they saw in each display; whether they ever saw more than two words flashed at a time; if they did, whether the words were the same or different from other words; to list what words they think might have been flashed; and to assume that a word had been flashed and to guess from a list of five options which word they thought it may have been. Two of these options were the words "dead" and "pain," respectively. After participants completed this form, they were probed for suspicion, fully debriefed, and thanked for their time.

Results

We initially examined whether the subliminal prime manipulation affected participants' error or reaction times on the word relationship task by using their responses on the practice items as covariates. However, as in prior work, there was no hint of such effects, all $F_s < 1$.

Checks on awareness of subliminal stimuli. To assess awareness of the stimuli, we examined participants' responses to the five questions delivered at the conclusion of the session. Twenty-two of the 23 participants indicated that they saw two words. With the next question, 3 participants responded that they "may have seen" more than two words "but they were unsure." Pearson chi-square tests showed that these responses did not differ by condition, $\chi^2(1, N = 26) < 1.1, p > .30$. For the questions that asked if the word was the same or different and that asked for participants to list possibilities, all participants either did not answer or wrote such phrases as "I have no idea." Pearson chi-square test that was conducted on the multiple choice question in which participants were asked to guess which word was presented revealed that the conditions did not differ in their guesses, $\chi^2(2, N = 26) = 4.73, p > .09$. Although this test was marginal, it should be noted that all of the participants in the dead prime condition did not guess the word "dead" but instead either guessed other options or did not answer, whereas 3 participants in the pain prime condition guessed

⁴ The software program was originally developed at Monash University and The University of Arizona in 1975 and has since been revised numerous times. For more information visit <http://www.u.arizona.edu/~kfoster/dmastr/dmastr.htm>.

“dead.” Thus, as in previous research (e.g., Arndt, Greenberg, Pyszczynski, & Solomon, 1997; Dechesne, Janssen, & van Knippenberg, 2000), there was no conscious retrospective awareness of the masked words.

Worldview accessibility. Because we used male participants, we expected that priming thoughts of death outside of conscious awareness would increase nationalistic accessibility but would have no such effect on relationship accessibility. A 2 (prime: dead vs. pain) between-subjects \times 2 (accessibility: nationalistic vs. relationship) within-subjects ANOVA ($MSE = .79$) on participants’ standardized responses within each type of accessibility measure revealed a marginal two-way interaction, $F(1, 24) = 3.33$, $p < .08$, $\eta^2 = .12$, which did however conform to our predictions. Cell means are presented in Table 4. Subliminal dead primes significantly increased the number of stems that participants completed with nationalistic fragments, $t(24) = 2.65$, $p < .02$, $\eta^2 = .23$. However, there was absolutely no effect of the subliminal prime manipulation on the accessibility of relationship thoughts, $t < 1$. Comparisons between the two accessibility measures found that although dead prime participants exhibited nonsignificantly higher nationalistic than relationship accessibility ($ts < 1.30$), relationships seemed more accessible than national constructs in the pain condition.

Discussion

Experiment 4 examined the effects of death-related primes presented outside of conscious awareness. The subliminal nature of the stimuli in Experiment 4 is supported by the fact that the experiment used the same presentation parameters as the study of Arndt, Greenberg, Pyszczynski, and Solomon (1997). In their study, even when participants were informed that the prime would be one of two possibilities, they were unable to determine above chance levels what prime they had been shown immediately after presentation. Such a finding goes a long way toward satisfying the criterion for subliminal priming advanced by even the most skeptical of observers (e.g., Holender, 1986). In addition, inspection of the present awareness checks also suggests that participants had no retrospective awareness of what primes had been flashed as they worked on the computer word task. The results of Experiment 4 thus provide converging evidence for the effects of nonconscious but accessible death-related thought on the spreading activation to worldview relevant cognitions.

Whereas Experiments 1–3 used an explicit mortality salience treatment and needed a delay in order for the worldview accessibility effects to emerge, Experiment 4 found that when death

thoughts are primed outside of conscious awareness, a delay is not necessary. Specifically, male participants exposed to subliminal death primes evidenced higher nationalistic accessibility immediately after the primes than did participants exposed to subliminal pain primes. It is worth noting that whereas Experiment 2 revealed a slight trend for mortality salience to increase the accessibility of romantic relationship cognitions in males, there was no hint of such an effect in Experiment 4.

Experiment 5

Experiment 5 was designed to address a few remaining issues. First, although the present theoretical analysis and results suggest that women should show increased relationship accessibility in response to death primes presented outside of conscious awareness, Experiment 5 provided an empirical test of this hypothesis by using female participants and adopting the subliminal priming method. In addition, in each of the other experiments reported herein, a word fragment completion measure was used to index levels and type of accessibility. Although such measures have been found to be quite effective in assessing activated constructs (Basilii & Smith, 1986; Gilbert & Hixon, 1991; Greenberg et al., 1994; Mikulincer & Florian, 2000; Steele & Aronson, 1995; Tulving et al., 1982), similar findings with an alternative measure would offer converging support for the notion that such effects do indeed reflect increased accessibility. Toward this end, Experiment 5 examined participants’ reaction time (RT) to worldview relevant and irrelevant stimuli in the context of a lexical decision task (i.e., judgments about whether a string of letters is a word or nonword). The reasoning behind such measures is that judgments about stimuli relevant to accessible constructs are more quickly rendered when that construct, or constructs that prime those stimuli, has been activated (see e.g., Bargh & Chartrand, 2000; Fazio, 1990). Finally, we contrasted the effects of interest with a different aversive topic and presented control participants with subliminal primes of the word “fail.”

Method

Participants and design. Twenty-four female students at The University of Missouri—Columbia were randomly assigned to receive either dead or fail primes. The dependent measure was participants’ RTs to both relationship and nationalistic words. One participant was dropped before analysis because of technical difficulties with the computer equipment.

Procedure. The procedure was similar to Experiment 4, except in Experiment 5 participants were told they would do, and received instructions for, a couple of word perception tasks on the computers. The first phase of the study was identical to the priming phase of Experiment 4, except participants in the control condition were exposed to subliminal primes of the word “fail” instead of “pain.” After this phase, using DMASTR software, the program progressed directly to the second word perception task. Participants were told that a string of letters would be presented quickly on the screen (1,000 ms) and would be both preceded and followed by a string of x’s (which therefore served as a fixation point and erased traces of the display from the monitor). Participants were to decide as quickly as possible whether it was a word (e.g., “table”) by pressing the left shift key or a nonword (e.g., “baspet”) by pressing the right shift key. Nonwords were formed by changing one letter in nouns and verbs. Participants were then presented with a total of 48 trials that displayed eight relationship words (“dates,” “bride,” “wife,” “marriage,” “husband,” “engaged,” “lover,” and “romance”), 8 nationalistic words

Table 4
Mean Nationalistic and Relationship Accessibility
in Experiment 4

Condition	Subliminal “dead”	Subliminal “pain”
Nationalistic completions	0.45 (0.94)	−0.45 (0.87)
Relationship completions	0.00 (1.16)	0.00 (0.86)
<i>n</i>	13	13

Note. Accessibility scores are expressed as standardized *z* scores. High scores reflect greater accessibility. Standard deviations are given in parentheses.

("senate," "patriot," "law," "congress," "states," "anthem," "america," and "national"), along with 8 filler words (e.g., "counter") and 24 nonwords (e.g., "plrform"). An initial random order of display was determined that evenly distributed the word types across the 48 trials and was presented to all participants. Before being debriefed, participants completed the same awareness check questions as in Experiment 4.

Results

Checks on awareness of subliminal stimuli. As with Experiment 4, there was no indication that participants were aware that a subliminal prime had been presented. At least 21 of the 23 participants indicated that they saw only two words, did not think that they saw more than two words, and could not or did not guess whether a word, if flashed, was the same or different. Moreover, no participant listed any possible words that may have been flashed and could not accurately guess which word may have been flashed from the multiple choice options ($\chi^2 < 1$). We then proceeded to examine the RT data to the relationship and nationalistic words.

Worldview accessibility. Any response to the lexical decision task that was less than 200 ms was recoded to 200 ms, and any response that was greater than 2,000 ms was recoded to 2,000 ms.⁵ Mean RTs were then computed for the relationship and nationalistic words, respectively. Notwithstanding the recoding, as may often be the case with RT latencies (Bargh & Chartrand, 2000; Fazio, 1990), the data violated assumptions of homogeneity of variance, $F_{s_{\max}} > 13$, $ps < .001$. To more closely preserve the nature of the distribution, we conducted a log transformation of the RT data (Bargh & Chartrand, 2000; Fazio, 1990; Kirk, 1995; Smith & Lerner, 1986; Winer, 1971). Although this transformation reduced but did not eliminate the heterogeneity, $F_{s_{\max}} > 5$, $ps < .02$, heterogeneity is considered much less of a problem if cell sizes are approximately equal (Kirk, 1995).

A 2 (dead vs. fail prime) between-subjects \times 2 (relationship vs. nationalistic word) within-subjects ANOVA ($MSE = .01$) was then performed on the log RTs. This analysis revealed the expected Prime \times Word Type interaction, $F(1, 21) = 5.65$, $p < .03$, $\eta^2 = .21$.⁶ The cell means for this interaction are presented in Table 5 and provide converging support for the previous findings using word fragment completion measures of accessibility. There was no difference between subliminal dead prime and subliminal fail prime participants in response latencies for nationalistic words, $t < 1$. However, as predicted, participants exposed to subliminal dead primes responded significantly more quickly to the relationship words than did participants exposed to subliminal fail primes, $t(21) = 2.75$, $p < .05$, $\eta^2 = .23$. We also compared RTs between

the relationship and nationalistic word types within each of the two conditions; in neither case were there significant differences, $ts < 1.25$. As mentioned in Footnote 2, this result is difficult to interpret as it may reflect a number of differences between the characteristics of the words (e.g., familiarity; see Fazio, 1990). For this reason, we believe the more critical comparisons to be those that involve the between-subject manipulation of death salience within each type of accessibility.

Discussion

The present results provide further support for the hypothesis that accessible but nonconscious death-related thought activates pertinent constructs to the individual's worldview. In providing such a replication using female participants, a lexical decision task, and a control word of "fail," Experiment 5 extends the prior findings in three important ways. It shows that women's initial responses to death primes presented outside of conscious awareness are similar to the delayed response to explicit death primes, these effects can be found using an alternative method of assessing construct accessibility, and they occur relative to another aversive control term, *fail*.

Experiment 6

A remaining issue with the present analysis is whether the subliminal nature of the death prime is in fact what leads to immediate increases in worldview accessibility. It may not be subliminality per se that results in immediately high worldview accessibility, but some other difference between the subliminal death prime presentations and the explicit mortality writing task used in Experiments 1–3. Although a previous study (Arndt, Greenberg, Pyszczynski, & Solomon, 1997, Study 3) found that supraliminal death primes do not increase immediate worldview defense, we do not know that this would also apply to worldview accessibility. To ascertain whether the conscious awareness of death is a critical influence in the patterns of worldview accessibility that have emerged, we examined the immediate and delayed impact of subliminal and supraliminal death primes under conditions that are otherwise identical. Participants who are presented

Table 5
Mean Nationalistic and Relationship Accessibility (Expressed as Log Transformation of Response Times) in Experiment 5

Condition	Subliminal "dead"	Subliminal "fail"
Nationalistic latencies	2.84 (0.07)	2.85 (0.27)
Relationship latencies	2.79 (0.09)	2.90 (0.19)
<i>n</i>	11	12

Note. Low scores reflect greater accessibility. Standard deviations are given in parentheses.

⁵ Both Bargh and Chartrand (2000) and Fazio (1990) recommend the consideration of such a technique on the grounds that a response less than 200 ms occurs too quickly and a response in excess of 2,000 ms is too long to be psychologically meaningful in the context of assessing automatic activation effects. We therefore followed this practice with the present study, although such recoding was only required on less than 5% of the responses. It should be noted that such responses did not differ by condition, and this recoding did not alter the significance of the critical interaction.

⁶ Following Macrae, Bodenhausen, and Milne (1995), we initially inspected RTs to the filler words. Because no differences between conditions were found, it is not discussed further except to note that a 2×3 ANOVA with the filler words also yielded a significant two-way interaction. This interaction is also obtained using a number of other data analytic strategies. As examples, we conducted square-root and reciprocal transformation of the data, as well as a 2 (dead vs. fail prime) \times 2 (relationship vs. nationalistic) ANOVA on the residuals for relationship and nationalistic RT after regressing out RT to the filler words, and we found the same pattern of effects.

with subliminal death primes should show an immediate increase in worldview accessibility, whereas participants presented with supraliminal death primes should not. In contrast, these latter participants should show patterns of elevated worldview accessibility after a delay, whereas participants who receive subliminal death primes may not.

Method

Participants and design. Forty-eight female psychology students at The University of Missouri—Columbia were randomly assigned to conditions in a 2 (death display: subliminal vs. supraliminal) \times 2 (timing of accessibility measure: immediate vs. delayed) design. The dependent measure was participants' accessibility of relationship thoughts as assessed with a word fragment questionnaire. Three participants from supraliminal conditions were dropped, because they could not report what word prime had been presented.

Procedure. The procedure was quite similar to Experiment 4, except participants were told that the study was examining word relationship perception under the presence or absence of distraction. To keep the experimenter blind to conditions, all participants were informed that they might or might not be presented with a distractor word in between the target words, and participants then completed a program that either presented the word "dead" for 28.5 ms, as in Experiments 4 and 5, or a program that displayed the word "dead" for 356 ms. After completion of the program, participants completed one of two sets of materials. In the immediate conditions, participants first completed a word fragment accessibility questionnaire that contained the seven relationship fragments from Experiments 2–4, the puzzle delay task from Experiments 1–3, and the PANAS–X. In the delayed conditions, participants completed the puzzle delay task, the PANAS–X, and then the accessibility questionnaire. Before being debriefed, participants completed the same awareness check questions.

Results

Checks on awareness of subliminal or supraliminal stimuli. In Experiment 6, it was critical that participants in the supraliminal conditions did in fact see the prime word. Thus, on the basis of the manipulation check questions, we discarded three participants who either reported only seeing two words or could not identify the word "dead" as the distractor that had been presented. Subliminal prime participants, in contrast, gave no indication that another word had been flashed. Of the 21 participants who wrote anything in response to the questions, all indicated that they did not see more than two words, could not or did not guess whether it would have been the same or different had it been flashed, did not list any possible words that may have been flashed, and could not accurately guess which word may have been flashed from the multiple choice options. As expected, all chi-squares on these questions significantly differed by subliminal versus supraliminal prime conditions, all χ^2 s $>$ 20, $p <$.001.

Worldview accessibility. A 2 (death display: subliminal vs. supraliminal) \times 2 (timing of accessibility measure: immediate vs. delayed) ANOVA ($MSE = .94$) on the number of fragments participants completed with relationship words revealed a significant Display \times Timing interaction, $F(1, 44) = 4.11$, $p <$.05, $\eta^2 = .09$. As can be seen in Table 6, this interaction conformed closely to the predicted pattern. Although the pairwise comparisons were not significant, there was a clear crossover pattern such that participants presented with the subliminal death primes tended

Table 6
Cell Means for the Subliminality \times Timing of Assessment Interaction on Relationship Accessibility in Experiment 6

Condition	Subliminal "dead"	Supraliminal "dead"
Immediate assessment		
<i>M</i> (<i>SD</i>)	1.62 (0.77)	1.00 (0.67)
<i>n</i>	13	10
Delayed assessment		
<i>M</i> (<i>SD</i>)	1.10 (1.10)	1.67 (1.23)
<i>n</i>	10	12

Note. High scores reflect greater accessibility.

to have higher immediate romantic accessibility than did supraliminal prime participants, $t(44) = 1.51$, whereas supraliminal prime participants tended to have higher delayed accessibility than did subliminal prime participants, $t(44) = 1.36$. Looked at differently, subliminal prime participants tended to show higher romantic accessibility immediately than after a delay, $t(44) = 1.27$, whereas supraliminal prime participants tended to show higher romantic accessibility after a delay than they did immediately, $t(44) = 1.60$.

A 2 \times 2 MANOVA on the 11 PANAS–X subscales and 2 \times 2 ANOVAs on the positive and negative mood subscales revealed only one significant effect for timing on negative mood, $F(1, 43) = 8.98$, $p <$.01, $\eta^2 = .18$, all other F s $<$ 1.6. Delay participants reported higher negative mood ($M = 1.62$, $SD = .61$) than did immediate participants ($M = 1.20$, $SD = .25$). However, as with previous studies, there was no indication that negative mood (or positive mood) mediated the accessibility effects. Also, 2 \times 2 ANCOVAs on romantic accessibility with negative mood and positive mood as covariates revealed that the Display \times Timing interaction remained significant, both F s $>$ 4.3, $ps <$.05.

Discussion

Prior to Experiment 6, a question remained: Was the consciousness of death-related thought the catalyst behind the delayed increase in worldview accessibility? The results of Experiment 6 add to the confidence with which this question can be answered. Despite the fact that the dead prime was presented in an otherwise equivalent manner, there was a clear pattern for subliminal dead prime participants to show immediate but not delayed increases in worldview accessibility, whereas participants who were able to consciously identify the dead stimulus showed heightened worldview accessibility after a delay but not immediately after the prime. Once again, in addition to their support for the terror management analysis of the spreading activation of death thoughts, these data support a compound cue understanding of how content can be activated in long-term memory (Ratcliff & McKoon, 1994). It would appear that there are multiple cues present in the confrontation with conscious death thoughts, which in addition to activating worldview content lead to an initial dampening of that effect.

Experiment 7

The first six experiments provide converging evidence that heightened death-thought accessibility increases the accessibility

of worldview-relevant constructs. They also show that death thought triggers nationalistic thoughts for men, whereas it triggers relationship thoughts for women. Although we think that these results can be reasonably explained by the idea that relationships are more central to young American women's worldviews than they are to those of young American men, they do raise the question of why previous research has examined but not found gender differences in pro-American bias as a form of worldview defense after mortality salience. One explanation is that although the most central, security-providing aspect of the worldview was what spontaneously became accessible after increased death-thought accessibility, other aspects of the worldview may also become accessible and be defended when those aspects of the worldview are made salient (i.e., when there are different situational cues to be compounded with the prime; McKoon & Ratcliff, 1992). In all prior worldview defense studies, the to-be-defended element of the worldview is made salient as participants confront the stimulus they evaluate. Thus, if America is made salient prior to a reminder of mortality, we would expect that such a reminder would increase the accessibility of nationalistic thoughts in American women.

Method

Participants and design. Eighty-one female introductory psychology students at the University of Missouri—Columbia were randomly assigned to conditions in a 2 (initial prime: food vs. America) \times 2 (salience: mortality vs. dental pain) between-subjects \times 2 (type of accessibility: nationalistic vs. relationship) within-subjects design. Accessibility of nationalistic and relationship-related cognitions was assessed using the same word fragment completion questionnaire as in Experiments 2–4.

Procedure. The procedure was the same as in Experiment 2, except for the addition of a questionnaire used to prime the construct of either food or nationalism that mirrored the mortality and dental pain questionnaire. To make salient thoughts pertaining to nationalism, participants were asked two open-ended questions: "Please briefly describe the emotions that the thoughts of being an American arouses in you" and "Jot down, as specifically as you can, what you think about when you think of being an American." The food control treatment consisted of parallel questions with respect to food: "Please briefly describe the emotions that the thoughts of eating food arouses in you" and "Jot down, as specifically as you can, what you think about when you think of eating food." After this questionnaire, participants completed the mortality salience or dental pain (control) questionnaire followed by the PANAS-X, the word search puzzle, and the accessibility measure. Once all materials were completed, participants

were probed for suspicion, debriefed, and compensated with research credits.

Results

A 2 (prime: America vs. food) \times 2 (salience: mortality vs. dental pain) between-subjects \times 2 (type of accessibility: nationalistic vs. relationship) within-subjects ANOVA ($MSE = .84$) revealed a main effect for mortality salience, $F(1, 77) = 7.30, p < .01, \eta^2 = .09$, which reflected overall greater accessibility after mortality salience. This effect was qualified by the predicted three-way interaction between prime, salience, and accessibility, $F(1, 77) = 4.97, p < .03, \eta^2 = .06$. The means for this three-way interaction are presented in Table 7.

Planned comparisons were first conducted within each type of accessibility. In the food prime condition, mortality salient participants showed higher relationship accessibility than dental pain salient participants and than mortality salient participants first primed with American identification, both $t_s > 2.42, p_s < .05, \eta^2 > .07$. In the patriotism prime conditions, there was no significant difference in relationship accessibility for mortality salient participants compared to their dental pain counterparts, $t(77) = 1.03$. These results therefore replicated the earlier findings among women: mortality salience led to greater spontaneous relationship accessibility if the participants were not primed with another possible worldview-relevant construct.

Of course, the question of particular interest is whether or not priming American identification for female participants will lead mortality salience to increase the accessibility of constructs relevant to that identification. In the American prime conditions, mortality salience increased patriotic accessibility compared to the dental pain salient participants and compared to mortality salient food prime participants, both $t_s > 2.52, p_s < .05, \eta^2 > .08$. Notably, there was no significant difference in patriotic accessibility for dental pain salient participants regardless of initial prime, $t < 1$, which indicates that priming patriotism was not enough to make patriotism accessible without mortality salience, perhaps because of the delay involved. In the food prime conditions, patriotic accessibility did not differ between the mortality salience and dental pain conditions, $t < 1$, which replicates the previous findings that patriotism is not a spontaneously prominent aspect of the worldview for women.

Table 7
Cell Means for the Prime \times Mortality Salience \times Accessibility Measure Interaction in Experiment 7

Prime	Nationalistic completions		Relationship completions	
	Mortality salient	Dental pain	Mortality salient	Dental pain
American prime				
<i>M</i> (<i>SD</i>)	0.56 (1.05)	0.14 (0.66)	0.21 (0.93)	0.50 (0.77)
<i>n</i>	23	19	23	19
Food prime				
<i>M</i> (<i>SD</i>)	0.32 (1.07)	0.19 (0.91)	0.69 (0.96)	0.06 (0.95)
<i>n</i>	22	17	22	17

Note. Accessibility scores are expressed as standardized *z* scores. High scores reflect greater accessibility.

Comparisons between accessibility measures indicated that for mortality salient food prime participants, relationship accessibility was higher than nationalistic accessibility, $t(77) = 3.71, p < .01, \eta^2 = .15$. However, for mortality salient American prime participants, nationalistic accessibility was higher than relationship accessibility, $t(77) = 2.86, p < .01, \eta^2 = .10$. These comparisons were not significant in the dental pain conditions, both t s < 1.21 .

Participants' self-reported affect was analyzed through their scores on the various subscales of the PANAS-X, as in the previous experiments. A 2 (initial prime) \times 2 (salience) MANOVA on the 11 subscales revealed no significant main or interaction effects, F s(1, 77) < 1.24 . Additionally, 2 (initial prime) \times 2 (salience) ANOVAs were conducted on the positive and negative mood scales. These analyses revealed only a single main effect for salience on negative mood, $F(1, 77) = 7.92, p < .01, \eta^2 = .09$, all other F s < 1.23 ; dental pain salient participants indicated greater negative mood than mortality salient participants (M s = 1.63 vs. 1.30). To assess if negative mood (or positive mood) influenced accessibility, we conducted 2 (initial prime) \times 2 (salience) ANCOVAs on both accessibility scales. This revealed that negative mood was not a significant covariate for either type of accessibility (both p s $> .13$) and that the inclusion of the mood scores did not substantially impact the size of the initial Prime \times Salience interactions.

Discussion

Experiment 7 replicated the tendency for mortality salience to increase the accessibility of relationship thoughts in women, but it also showed that nationalistic thoughts rather than relationship thoughts would increase in accessibility, if America was first made salient. This latter finding supports our explanation of why worldview defense studies have not found gender differences. Although there is a gender difference in spontaneous accessibility after a reminder of death, cues in the situation, in conjunction with such a reminder, can trigger women as well as men toward nationalistic aspects of their worldview. This suggests that although individuals within a culture may vary in the aspects of the worldview that are most closely associated with thoughts of mortality, these thoughts may trigger a variety of aspects of the worldview, depending on their relative salience in a particular context. In mortality salient participants, the nationalistic prime not only facilitated the accessibility of related constructs, it seemed to inhibit an increase in the accessibility of relationship-related constructs. Although further investigation of this phenomenon is needed, it is broadly consistent with other work that suggests that the activation of one set of constructs can inhibit activation of other constructs in response to a given stimulus (e.g., Macrae, Bodenhausen, & Milne, 1995; Tipper, 1992).

General Discussion

In seeking to understand the processes engendered by mortality salience, previous research had pointed to the importance of measuring the accessibility of death-related cognition. However, this prior work had not investigated how other thoughts are activated by such cognition. The present series of experiments provides a number of insights regarding the broader cognitive architecture surrounding awareness of death.

Across seven experiments, primes that activated mortality thoughts were also found to increase the accessibility of constructs relevant to the individual's worldview. These effects were found with two different measures of construct accessibility (word fragment completion tasks and a lexical decision task) in comparison to three different control topics (dental pain, pain, and failure) and with two different methods of inducing death-related thoughts (explicit mortality salience treatments and subliminal death primes). However, the method of mortality salience induction was found to exert a critical effect on the timing of increased worldview accessibility that followed, which suggests that the motivational properties underlying the connection between worldview cognitions and death-related thought may operate a bit differently than patterns typically found with associative networks. An explicit reminder to participants of their death (either with a writing task or with supraliminal word presentations) increased worldview accessibility only after a delay, at a time when previous research had shown death-thought accessibility to be high but outside focal attention (Arndt, Greenberg, Solomon, et al., 1997; Greenberg et al., 1994). Death primes that were presented outside of conscious awareness, however, increased worldview accessibility immediately. Taken together, these results support the idea that nonconscious knowledge of mortality is embedded in an associative network that also contains interconnections with beliefs that function to protect individuals from these concerns. This research initiates a new direction of inquiry through which advanced understanding of mortality salience effects can be achieved, and it also serves to illuminate at least one way in which deeply rooted motivational forces can impact the cognitive organization of knowledge structures.

In so doing, the present experiments contribute another piece to a recently developed process model to account for mortality salience effects (see Pyszczynski et al., 1999). Figure 1 depicts an expanded view of this process model. Prior work, based largely on the accessibility of death-related thought, suggested that death thoughts first provoke proximal defenses designed to remove death-related cognitions from conscious awareness. Thus, for example, individuals may seek to avoid self-reflective thought (Arndt et al., 1998), suppress death thoughts (Arndt, Greenberg, Solomon, et al., 1997), deny vulnerability to relevant risk factors (Greenberg et al., 2000), or increase intentions to exercise to be more healthy (Arndt, Schimel, & Goldenberg, in press). Once such proximal defenses are relaxed, there is a delayed increase in death accessibility. This increase in death-thought accessibility then spreads to increase the accessibility of constructs that serve the self-protective goal of buffering the individual from these concerns. Such spreading can apparently be directed by individual differences in important worldview beliefs and by situational factors that render particular beliefs more salient. With the goal of self-protection and the accessibility of protective structures now increased, individuals may then be more likely to respond with defense to that which impinges on important elements of those beliefs. Although awaiting further research, we would speculate that the increased accessibility of particular worldview themes serves as a sort of homing beacon through which the individual searches for the most desired form of defense. As previous research indicates (Arndt, Greenberg, Solomon, et al., 1997; Greenberg et al., 2001; Mikulincer & Florian, 2000), successful engagement of these defenses reduces death-thought accessibility.

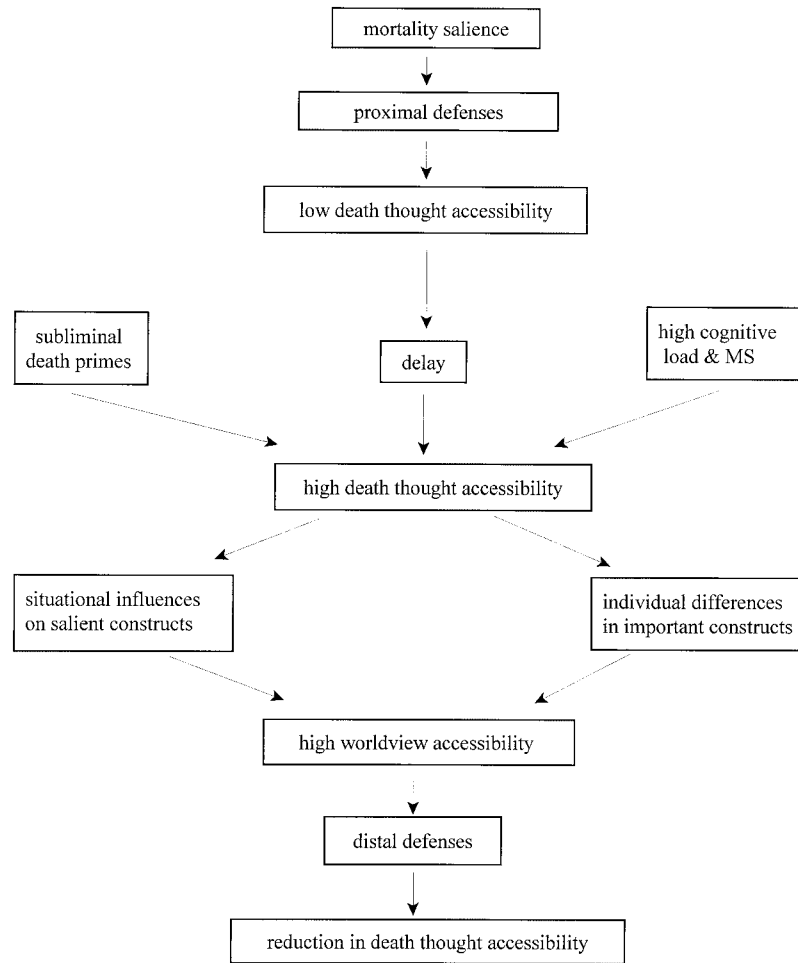


Figure 1. Processes activated by mortality salience (MS).

Viewed within this larger scheme of psychological defense and associative networks, these findings suggest a process by which deeply rooted motives might weave themselves into our everyday cognitive architecture. From the perspective of such network models (e.g., Collins & Loftus, 1975; McNamara, 1992; Klinger & Greenwald, 1995), when an associative link forms between two objects (or cognitions) in memory, activation of the one can spread to activate the other. Such connections extend to the associations between self-related threats and the construct accessibility of cognitions that serve the goal of protecting the individual from that threat (Spencer et al., 1998; Dodgson & Wood, 1998). It seems reasonable, then, that a core human dilemma, as awareness of mortality is posited to be, would similarly develop associations with the cognitions that function to protect an individual from these concerns. However, as these results indicate, the effect of death primes on this belief activation is not just a free associative function (cf. McNamara, 1992), but it depends on other situational cues that may highlight other relevant beliefs or that may affect the likelihood of suppression.

The results demonstrate, moreover, that death-related associative networks can also vary across individuals in consistent ways.

This is not surprising in light of a variety of studies that identify many ways in which people seek to insulate themselves from the reality of their mortality. Prior work has indicated that, in addition to moderation of mortality salience effects by more global individual differences such as self-esteem (e.g., Harmon-Jones et al., 1997), depression (e.g., Simon, Arndt, Greenberg, Solomon, & Pyszczynski, 1998), or neuroticism (e.g., Goldenberg et al., 1999), the particular nature of the individual's worldview can affect the type of defense in which an individual overtly engages. Although nationalistic affiliations have been the target in many terror management studies, other issues such as political orientation; specific attitudes toward flag-burning; authoritarianism; need for structure; specific self-esteem investments; attachment style; and coping styles have all been shown to affect the forms of defense triggered by heightened death-thought accessibility (see e.g., Arndt & Greenberg, 1999; Dechesne, Janssen, & van Knippenberg, 2000; Greenberg et al., 1997; Mikulincer & Florian, 2000; Taubman Ben-Ari et al., 1999).

Of course, in the present experiments, we specifically found that mortality salience increased nationalistic construct accessibility for men but relationship construct accessibility for women. The notion

that romantic relationships can serve to assuage mortality concerns fits the theorizing of Rank (1941/1958), Becker (1973), and, more recently, that of terror management theorists as well (Florian & Mikulincer, 1998a; Goldenberg et al., 1999; Greenberg et al., 1995; Mikulincer & Florian, 2000; Solomon et al., 1991). Perhaps it is also reflected in Hollywood's penchant for propagating the notion that love conquers death in films ranging from *Ghost* to *The Matrix*. Mikulincer and Florian (2000) have recently supported this idea empirically by finding that mortality salience increases feelings of love for one's partner in securely attached individuals.

Our experiments suggest that romantic relationships may play a particularly central role in terror management for women, at least in the United States. Based on other work on gender differences (e.g., Buss & Schmidt, 1993; Eagly & Steffen, 1984; Geary, 1998; Hatfield & Rapson, 1987; Hendrick & Hendrick, 1991; Moskowitz, Suh, & Desaulniers, 1994), it seems reasonable to suggest that some combination of genetic predispositions and gender role socialization experiences facilitate a particularly strong associative connection between death-related self-protective goals and romantic relationships in women. Thus, gender may be one of a number of individual difference variables that reflect or contribute to different ways of dealing with the same core human existential dilemma.

However, it is also likely that most people have multiple sources of meaning and value to draw on when reminded of mortality. Indeed, recent research has shown that, depending on individual differences and situational positive or negative framing of in-groups, people may respond to increased death-thought accessibility by either increasing or decreasing particular social identifications (Arndt, Greenberg, Schimel, Pyszczynski, & Solomon, 2002; Dechesne, Janssen, & van Knippenberg, 2000; Dechesne, Greenberg, Arndt, & Schimel, 2000). Similarly, in our Experiment 7, when female participants were primed for nationalistic constructs, mortality salience led to increased accessibility of nationalistic constructs rather than relationship constructs. This shows that people can be flexible with regard to the aspects of the worldview that they defend or with which they identify and also with regard to which aspects spontaneously become accessible after death reminders. Thus, the pattern of beliefs that is activated by mortality salience depends in part on the degree to which situational and individual factors render those beliefs particularly cognitively available.

Although more research on these processes is clearly needed, one of the promising implications of the present research is that, by measuring the accessibility of different worldview relevant cognitions after mortality salience, it may be possible to determine which of the many important beliefs that people hold are used specifically for terror management purposes and perhaps to determine the breadth of such resources as well. Such assessments may be useful both in experimental investigations and clinical application of these and other related ideas. Indeed, the present findings can be seen as broadly consistent with Yalom's (1980) contention that reminders of death can be used as a catalyst to identify the pursuits in which individuals invest themselves to make life seem meaningful. Moreover, by applying therapies that encourage the application of particular belief and value structures, it may be possible to help individuals adopt more healthy and productive responses to such existential concerns.

References

- Anderson, J. R., & Bower, G. H. (1973). *Human associative memory*. Washington, DC: Winston.
- Archer, J. (1996). Sex differences in social behavior. *American Psychologist*, *51*, 909–917.
- Arndt, J., Allen, J. J. B., & Greenberg, J. (2001). Traces of terror: Subliminal death primes and facial electromyographic indices of affect. *Motivation and Emotion*, *25*, 253–277.
- Arndt, J., & Greenberg, J. (1999). The effects of a self-esteem boost and mortality salience on responses to boost relevant and irrelevant worldview threats. *Personality and Social Psychological Bulletin*, *25*, 1331–1341.
- Arndt, J., Greenberg, J., Pyszczynski, T., & Solomon, S. (1997). Subliminal exposure to death-related stimuli increases defense of the cultural worldview. *Psychological Science*, *8*, 379–385.
- Arndt, J., Greenberg, J., Schimel, J., Pyszczynski, T., & Solomon, S. (2002). To belong or not to belong, that is the question: Terror management and identification with gender and ethnicity. *Journal of Personality and Social Psychology*, *83*, 26–43.
- Arndt, J., Greenberg, J., Simon, L., Pyszczynski, T., & Solomon, S. (1998). Terror management and self-awareness: Evidence that mortality salience provokes avoidance of the self-focused state. *Personality and Social Psychological Bulletin*, *24*, 1216–1227.
- Arndt, J., Greenberg, J., Solomon, S., Pyszczynski, T., & Simon, L. (1997). Suppression, accessibility of death-related thoughts, and cultural worldview defense: Exploring the psychodynamics of terror management. *Journal of Personality and Social Psychology*, *73*, 5–18.
- Arndt, J., Schimel, J., & Goldenberg, J. L. (in press). Death can be good for your health: Fitness intentions as a proximal and distal defense against mortality salience. *Journal of Applied Social Psychology*.
- Baldwin, M. W., & Wesley, R. (1996). Effects of existential anxiety and self-esteem on the perception of others. *Basic and Applied Social Psychology*, *10*, 75–95.
- Bargh, J. A. (1996). Automaticity in social psychology. In E. T. Higgins & A. W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (pp. 169–183). New York: Guilford Press.
- Bargh, J. A., & Chartrand, T. L. (2000). The mind in the middle: A practical guide to priming and automaticity research. In H. T. Reis and C. M. Judd (Eds.), *Handbook of research methods in social and personality psychology* (pp. 253–285). Cambridge, England: Cambridge University Press.
- Bargh, J. M., & Gollwitzer, P. M. (1994). Environmental control of goal-directed action: Automatic and strategic contingencies between situation and behavior. In W. Spaulding (Ed.), *Integration of motivation and cognition: The Nebraska Symposium on Motivation* (Vol. 41, pp. 71–124). Lincoln: University of Nebraska Press.
- Bargh, J. A., Raymond, P., Pryor, J. B., & Strack, F. (1995). Attractiveness of the underling: An automatic power–sex association and its consequences for sexual harassment and aggression. *Journal of Personality and Social Psychology*, *68*, 768–781.
- Bassili, J. N., & Smith, M. C. (1986). On the spontaneity of trait attribution. *Journal of Personality and Social Psychology*, *50*, 239–245.
- Becker, E. (1973). *The denial of death*. New York: Free Press.
- Brehm, J. W. (1966). *A theory of psychological reactance*. New York: Academic Press.
- Buss, D. M., & Schmidt, D. P. (1993). Sexual strategies theory: An evolutionary perspective on human mating. *Psychological Review*, *100*, 204–232.
- Collins, A. M., & Loftus, E. F. (1975). A spreading-activation theory of semantic processing. *Psychological Review*, *82*, 407–428.
- Cross, S., & Madson, L. (1997). Models of the self: Self-construals and gender. *Psychological Bulletin*, *122*, 5–37.
- Culp, L. N., & Beach, S. R. H. (1998). Marriage and depressive symptoms:

- The role and bases of self-esteem differ by gender. *Psychology of Women Quarterly*, 22, 647–663.
- Dechesne, M., Greenberg, J., Arndt, J., & Schimel, J. (2000). Terror management and sports fan affiliation: The effects of mortality salience on fan identification and optimism. *European Journal of Social Psychology*, 30, 813–835.
- Dechesne, M., Janssen, J., & van Knippenberg, A. (2000). Defense and distancing as terror management strategies: The moderating role of need for structure and permeability of group boundaries. *Journal of Personality and Social Psychology*, 79, 923–932.
- Dodgson, P. G., & Wood, J. V. (1998). Self-esteem and the cognitive accessibility of strengths and weaknesses after failure. *Journal of Personality and Social Psychology*, 75, 178–197.
- Eagly, A. H., & Steffen, V. J. (1984). Gender stereotypes stem from the distribution of women and men into social roles. *Journal of Personality and Social Psychology*, 46, 735–754.
- Fazio, R. H. (1990). A practical guide to the use of response latency in social psychological research. In C. Hendrick and M. S. Clark (Eds.), *Research methods in personality and social psychology* (pp. 74–97). London: Sage Publications.
- Fazio, R. H., Sanbonmatsu, D. M., Powell, M. C., & Kardes, F. R. (1986). On the automatic activation of attitudes. *Journal of Personality and Social Psychology*, 50, 229–238.
- Fein, S., & Spencer, S. J. (1997). Prejudice as self-image maintenance: Affirming the self through derogating others. *Journal of Personality and Social Psychology*, 73, 31–44.
- Florian, V., & Mikulincer, M. (1997). Fear of death and the judgment of social transgressions: A multidimensional test of terror management theory. *Journal of Personality and Social Psychology*, 73, 369–380.
- Florian, V., & Mikulincer, M. (1998a). Symbolic immortality and the management of the terror of death. *Journal of Personality and Social Psychology*, 74, 725–734.
- Gabriel, S., & Gardner, W. L. (1999). Are there “his” and “hers” types of interdependence? The implications of gender differences in collective versus relational interdependence for affect, behavior, and cognition. *Journal of Personality and Social Psychology*, 77, 642–655.
- Geary, D. C. (1998). *Male, female: The evolution of human sex differences*. Washington, DC: American Psychological Association.
- Gilbert, D. T., & Hixon, J. G. (1991). The trouble of thinking: Activation and application of stereotypic beliefs. *Journal of Personality and Social Psychology*, 60, 509–517.
- Greenberg, J. L., Pyszczynski, T., McCoy, S. K., Greenberg, J., & Solomon, S. (1999). Death, sex, love, and neuroticism: Why is sex such a problem? *Journal of Personality and Social Psychology*, 77, 1173–1187.
- Greenberg, J., Arndt, J., Schimel, J., Pyszczynski, T., & Solomon, S. (2001). Clarifying the function of mortality salience-induced worldview defense: Renewed suppression or reduced accessibility of death-related thoughts? *Journal of Experimental Social Psychology*, 37, 70–76.
- Greenberg, J., Arndt, J., Simon, L., Pyszczynski, T., & Solomon, S. (2000). Proximal and distal defenses in response to reminders of one’s mortality: Evidence of a temporal sequence. *Personality and Social Psychology Bulletin*, 26, 91–99.
- Greenberg, J., Pyszczynski, T., & Solomon, S. (1995). Toward a dual-motive depth psychology of self and human behavior. In M.H. Kernis (Ed.), *Efficacy, agency, and self-esteem* (pp. 73–99). New York: Plenum.
- Greenberg, J., Pyszczynski, T., Solomon, S., Simon, L., & Breus, M. (1994). Role of consciousness and accessibility of death-related thoughts in mortality salience effects. *Journal of Personality and Social Psychology*, 67, 627–637.
- Greenberg, J., Simon, L., Porteus, J., Pyszczynski, T., & Solomon, S. (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., Solomon, S., & Pyszczynski, T. (1997). Terror management theory of self-esteem and social behavior: Empirical assessments and conceptual refinements. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 29, pp. 61–139). New York: Academic Press.
- Greene, A. L., & Wheatley, S. M. (1992). “I’ve got a lot to do and I don’t think I’ll have the time”: Gender differences in late adolescents’ narratives of the future. *Journal of Youth and Adolescence*, 21, 667–686.
- Harmon-Jones, E., Simon, L., Greenberg, J., Pyszczynski, T., Solomon, S., & McGregor, H. (1997). Terror management theory and self-esteem: Evidence that increased self-esteem reduces mortality salience effects. *Journal of Personality and Social Psychology*, 72, 24–36.
- Hatfield, E., & Rapson, R. L. (1987). Gender differences in love and intimacy: The fantasy vs. the reality. *Journal of Social Work and Human Sexuality*, 5, 15–26.
- Hebb, D. O. (1948). *Organization and behavior*. New York: Wiley.
- Hendrick, C., & Hendrick, S. S. (1991). Dimensions of love: A sociobiological interpretation. *Journal of Social and Clinical Psychology*, 10, 206–230.
- Higgins, E. T. (1996). Knowledge activation: Accessibility, applicability, and salience. In E. T. Higgins & A. W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (pp. 133–168). New York: Guilford Press.
- Holender, D. (1986). Semantic activation without conscious identification in dichotic listening, parafoveal vision, and visual masking: A survey and appraisal. *Behavioral and Brain Sciences*, 9, 1–66.
- Kelly, R. M. (1987). Subjective culture and patriotism: Gender, ethnic, and class differences among high school students. *Political Psychology*, 8, 525–546.
- Keppel, G. (1991). *Design and analysis: A researcher’s handbook*. Upper Saddle River, NJ: Prentice-Hall.
- Kirk, R. E. (1995). *Experimental design: Procedures for the behavioral sciences* (3rd ed.). Pacific Grove, CA.: Brooks/Cole Publishing.
- Klinger, M. R., & Greenwald, A. G. (1995). Unconscious priming of association judgements. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 21, 246–255.
- Koss, M. P., Gidycz, C. A., & Wisniewski, N. (1987). The scope of rape: Incidence and prevalence of sexual aggression and victimization in a national sample of higher education students. *Journal of Consulting and Clinical Psychology*, 55, 162–170.
- Macrae, C. N., Bodenhausen, G. V., & Milne, A. B. (1995). The dissection of selection in person perception: Inhibitory processes in social stereotyping. *Journal of Personality and Social Psychology*, 69, 397–407.
- Marcel, A. J. (1983). Conscious and unconscious perception: An approach to the relations between phenomenal experience and perceptual processes. *Cognitive Psychology*, 15, 238–300.
- Maxwell, S. E., & Delaney, H. D. (2000). *Designing experiments and analyzing data: A model comparison perspective*. Mahwah, NJ: Lawrence Erlbaum.
- McGregor, H., Lieberman, J. D., Solomon, S., Greenberg, J., Arndt, J., Simon, L., & Pyszczynski, T. (1998). Terror management and aggression: Evidence that mortality salience motivates aggression against worldview threatening others. *Journal of Personality and Social Psychology*, 74, 590–605.
- McKoon, G., & Ratcliff, R. (1992). Spreading activation versus compound cue accounts of priming: Mediated priming revisited. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 18, 1155–1172.
- McNamara, T. P. (1992). Priming and constraints it places on theories of memory and retrieval. *Psychological Review*, 99, 650–662.
- McNamara, T. P. (1994). Priming and theories of memory: A reply to Ratcliff and McKoon. *Psychological Review*, 101, 185–187.
- Mikulincer, M., & Florian, V. (2000). Exploring individual differences in reactions to mortality salience: Does attachment style regulate terror

- management mechanisms? *Journal of Personality and Social Psychology*, 79, 260–273.
- Mikulincer, M., Florian, V., Birnbaum, G., & Malishkevich, S. (2002). The death-anxiety buffering function of close relationships: Exploring the effects of separation reminders on death-thought accessibility. *Personality and Social Psychology Bulletin*, 28, 287–299.
- Moskowitz, D. S., Suh, E., & Desaulniers, J. (1994). Situational influences on gender differences in agency and communion. *Journal of Personality and Social Psychology*, 66, 753–761.
- Mussweiler, T., & Forster, J. (2000). The sex-aggression link: A perception-behavior dissociation. *Journal of Personality and Social Psychology*, 79, 507–520.
- Norrander, B. (1999). The evolution of the gender gap. *Public Opinion Quarterly*, 63, 566–576.
- Pyszczynski, T., Greenberg, J., & Solomon, S. (1999). A dual-process model of defense against conscious and unconscious death-related thoughts: An extension of terror management theory. *Psychological Bulletin*, 106, 835–845.
- Pyszczynski, T., Wicklund, R. A., Floresky, S., Gauch, G., Koch, S., Solomon, S., & Greenberg, J. (1996). Whistling in the dark: Exaggerated estimates of social consensus in response to incidental reminders of mortality. *Psychological Science*, 7, 332–336.
- Rank, O. (1958). *Beyond psychology*. New York: Dover. (Original work published 1941)
- Ratcliff, R., & McKoon, G. (1994). Retrieving information from memory: Spreading activation theories versus compound-cue theories. *Psychological Review*, 101, 177–184.
- Rosenberg, M. (1981). The self-concept: Social product and social force. In M. Rosenberg & R. H. Turner (Eds.), *Social psychology: Sociological perspectives* (pp. 591–624). New York: Basic Books.
- Rosenblatt, A., Greenberg, J., Solomon, S., Pyszczynski, T., & Lyon, D. (1989). Evidence for terror management theory I: The effects of mortality salience on reactions to those who violate or uphold cultural values. *Journal of Personality and Social Psychology*, 57, 681–690.
- Schimmel, J., Simon, L., Greenberg, J., Pyszczynski, T., Solomon, S., Waxmonski, J., & Arndt, J. (1999). Support for a functional perspective on stereotypes: Evidence that mortality salience enhances stereotypic thinking and preferences. *Journal of Personality and Social Psychology*, 77, 905–926.
- Simon, L., Arndt, J., Greenberg, J., Solomon, S., & Pyszczynski, T. (1998). Terror management and meaning: Evidence that the opportunity to defend the worldview in response to mortality salience increases the meaningfulness of life in the mildly depressed. *Journal of Personality*, 66, 359–382.
- Simon, L., Greenberg, J., Harmon-Jones, E., Solomon, S., Pyszczynski, T., Arndt, J., & Abend, T. (1997). Cognitive-experiential self-theory and terror management theory: Evidence that terror management occurs in the experiential system. *Journal of Personality and Social Psychology*, 72, 1132–1146.
- Smith, E. R., & Lerner, M. (1986). Development of automatism of social judgements. *Journal of Personality and Social Psychology*, 50, 246–259.
- Solomon, S., Greenberg, J., & Pyszczynski, T. (1991). A terror management theory of social behavior: The psychological functions of self-esteem and cultural worldviews. In M.P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 24, pp. 93–159). New York: Academic Press.
- Spencer, S. J., Fein, S., Wolfe, C. T., Fong, C., & Dunn, M. A. (1998). Automatic activation of stereotypes: The role of self-image threat. *Personality and Social Psychology Bulletin*, 24, 1139–1152.
- Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual performance of African Americans. *Journal of Personality and Social Psychology*, 69, 797–811.
- Taubman Ben-Ari, O., Florian, V., & Mikulincer, M. (1999). The impact of mortality salience on reckless driving—A test of terror management mechanisms. *Journal of Personality and Social Psychology*, 76, 35–45.
- Tipper, S. P. (1992). Selection for action: The role of inhibitory mechanisms. *Current Directions in Psychological Science*, 1, 1–4.
- Trivers, R. (1972). Parental investment and sexual selection. In B. Campbell (Ed.), *Sexual selection and the descent of man: 1871–1971* (pp. 136–179). Chicago: Aldine.
- Tulving, E., Schacter, D. L., & Stark, H. A. (1982). Priming effects in word-fragment completion are independent of recognition memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 8, 336–342.
- Watson, D., & Clark, L. A. (1992). Affects separable and inseparable: On the hierarchical arrangement of the negative affects. *Journal of Personality and Social Psychology*, 62, 489–505.
- Wegner, D. M. (1992). You can't always think what you want: Problems in the suppression of unwanted thoughts. In M.P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 25, pp. 193–225). San Diego, CA: Academic Press.
- Wegner, D. M., & Smart, L. (1997). Deep cognitive activation: A new approach to the unconscious. *Journal of Consulting and Clinical Psychology*, 65, 984–995.
- Winer, B. J. (1971). *Statistical principles in experimental design* (2nd ed.). New York: McGraw Hill.
- Yalom, I. D. (1980). *Existential psychotherapy*. New York: Basic Books.

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