Research Article

From Terror to Joy

Automatic Tuning to Positive Affective Information Following Mortality Salience

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ABSTRACT—*Reminders of death tend to produce strong cognitive and behavioral responses, but little or no emotional response. In three experiments, mortality salience produced an automatic coping response that involved tuning to positive emotional information. Subjects showed increased accessibility of positive emotional information (Experiments 1 and 3) and gave more weight to positive emotion in their judgments of word similarity (Experiment 2) after contemplating death than after thinking about dental pain. This automatic coping response was found both after a delay (Experiments 1 and 2) and directly after the mortality-salience manipulation (Experiment 3), which suggests that the coping process begins immediately. Tuning to positive emotional information in response to mortality salience was unconscious and counterintuitive (Experiment 3). These findings shed light on the coping process that ensues immediately following mortality salience and help to explain why a delay is often necessary to produce effects in line with terror management theory.*

Most living things strive to continue living. Humans are unusually aware of their mortality, and intuitively one would suppose that the thought of death should evoke a wave of fear and anxiety. Becker (1973) proposed that such a "denial of death" is the basis for much human motivation, and Greenberg, Pyszczynski, and Solomon (1986) elaborated this insight into a systematic psychological theory, known as terror management theory. Over the past two decades, many studies have confirmed that inducing people to contemplate their eventual death significantly affects a wide range of behavioral and cognitive responses, including aggression, defense of cultural worldviews, stereotyping, sexual attitudes, and prosocial behavior (see Greenberg, Solomon, & Pyszczynski, 1997; Landau, Greenberg, Solomon, Pyszczynski, & Martens, 2006; Pyszczynski, Greenberg, Solomon, Arndt, & Schimel, 2004). The terror itself, however, has been difficult to find. Somewhat surprisingly, subjects who contemplate their mortality rarely report emotional states that differ from those of subjects who consider activities unrelated to their own mortality (e.g., Greenberg, Simon, Pyszczynski, Solomon, & Chatel, 1992). Even when mortality salience does produce emotional effects, these emotions do not mediate the behavioral consequences of mortality salience (e.g., Greenberg et al., 1995).

Faced with the absence of demonstrable terror, the leading theorists revised terror management theory (Pyszczynski, Greenberg, & Solomon, 1999), dropping their early emphasis on paralyzing terror in favor of a more subtle dual-process approach. The revised theory depicted the idea of death as so threatening as to evoke psychological defenses designed to prevent the terror from becoming conscious (Pyszczynski et al., 1999). In laboratory studies, researchers began to find that mortality-salience manipulations worked best following a delay (e.g., Arndt, Greenberg, Solomon, Pyszczynski, & Simon, 1997). That is, the effects were found more reliably, and conformed better with theory, if subjects were given a few minutes' delay during which some coping process could take place, as opposed to being given the cognitive or behavioral measure immediately after they contemplated death.

In the present research, we sought to illuminate what occurs during that all-important coping period that begins when subjects think about dying. Our central hypothesis was that one response to the threatening idea of death is the commencement of a nonconscious search for emotionally pleasant, positive information. Clutching at happy thoughts may serve the function (central to terror management theory) of preventing the conscious mind from being paralyzed by the terror of death.

There is ample evidence that people seek to avoid, escape, or minimize emotional distress and, indeed, that such emotional coping effects start right away. Isen (1984, 1987) proposed that

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Journal Name	Manuscript No.		Author Received:	No. of pages: 7	PE: Tms/Gk

emotion regulation is so common as to create a confound for many research findings of ostensible effects of negative emotions, because people start trying to cheer themselves up when researchers induce emotional distress, and their self-regulatory efforts (rather than the distress itself) could cause the behavioral consequences observed. Taylor (1991) argued that people seek to minimize the long-term negative affective impact of aversive events spontaneously, so that it is often difficult to keep subjects in a bad mood once the bad mood has been induced (see also Gross & John, 2003; Worth & Mackie, 1987). Research on affective forecasting has shown that people typically do not experience as much distress as they anticipate, presumably because people have a so-called psychological immune system that quickly sets to work to alleviate distress and indeed operates so automatically that people are unaware of how powerful and effective it is (Gilbert, Pinel, Wilson, Blumberg, & Wheatley, 1998).

How does the unconscious mind reduce conscious distress? Helpful clues have emerged from research on aging. As people grow old and approach death, their cognitive processes appear to shift toward increased emphasis on pleasant, positive information (Carstensen & Mikels, 2005; Charles, Mather, & Carstensen, 2003; Carstensen & Mikels, 2005). Moreover, this tuning toward emotional positivity appears to be less a matter of deliberate, willful control than a seemingly effortless, automatic reorientation. Carstensen (Carstensen, Isaacowitz, & Charles, 1999) has explicitly linked this shift with an increased sense of mortality. She has proposed that these emotion-control goals and processes are present throughout life and simply become predominant among older persons because the competing goal of acquiring information becomes weak, insofar as the approach of death entails less need to acquire new information. According to this view, young people should also respond to threats (such as death) with automatic processes that regulate emotion by tuning to emotionally positive stimuli.

Hence, our hypothesis was that mortality salience will cause a nonconscious shift toward pleasant, positive thoughts. In three experiments, we tested the predictions that after a mortality-salience manipulation, positive information should become more accessible (Experiments 1 and 3), and positive emotional associations should take precedence over others (Experiment 2). We also sought to confirm the nonconscious nature of this coping process by showing that people's conscious intuitions about how they would react to contemplating death are quite different from their actual reactions (Experiment 3). Specifically, we predicted that people would expect that contemplating death would bring distress, rather than a tuning toward positive information.

We have noted the importance of a delay between the mortality-salience manipulation and the dependent measure. In Experiments 1 and 2, we followed previous work that achieved the delay by having subjects fill out mood reports after the mortality-salience manipulation (Goldenberg et al., 2006; Jonas & Fischer, 2006; See & Petty, 2006; Wisman & Goldenberg, 2005). Yet our interest is less in the consequences of delay than in the vital processes that occur during it, and so Experiment 3 dispensed with the delay. If the tuning toward emotional positivity is part of the coping process that begins immediately, then this effect should be evident on both immediate and delayed measures.

EXPERIMENT 1

Method

Two hundred five undergraduates (141 women, 64 men) participated in this study for extra credit in a course they were taking. In a large classroom, the experimenter handed subjects a questionnaire packet. By random assignment, half of the subjects answered two questions designed to induce thoughts of their own death, whereas the others answered two questions designed to induce unpleasant thoughts unrelated to death (i.e., dental pain). This manipulation of mortality salience has been used successfully in previous work (e.g., Schimel et al., 1999).

After the mortality-salience manipulation, subjects completed the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). In previous research, a measure of conscious emotion administered between the mortality-salience manipulation and the dependent measure has been used to test for possible mediation by emotion and to provide a delay (Goldenberg et al., 2006; Jonas & Fischer, 2006; See & Petty, 2006; Wisman & Goldenberg, 2005).

Subjects then completed a word-stem completion task, in which they formed English words (excluding proper names) from fragments (from Twenge, Koole, DeWall, Marquez, & Baumeister, 2006). In addition to several filler word stems, there were 18 stems that could be completed to form both positive emotion words and neutral words (e.g. *jo_* could be completed to form *joy* or a neutral word such as *jog*), as well as 14 stems that could be completed to form both negative emotion words and neutral words (e.g., *ang_ _* could be completed to form *angry* or *angle*). After this task, subjects were debriefed, thanked, given credit, and dismissed.

Results and Discussion

The main prediction for Experiment 1 was that facilitation of positive emotional stimuli would be greater among subjects in the mortality-salience condition than among subjects in the dental-pain condition. Because mortality salience could decrease emotionality overall, we computed a relative index of positivity facilitation by subtracting the number of negative emotion words formed in the completion task from the number of positive emotion words formed. Mortality-salience subjects had higher scores ($M = 2.17$, $SD = 2.21$) than dental-pain subjects ($M = 0.74$, $SD = 2.41$), $F(1, 203) = 19.54$, $p_{rep} > .998$, $d = 0.62$. Thus, thinking of death made people orient toward positive more than negative emotion words.

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We also analyzed the results for positive and negative words separately. Mortality-salience subjects completed more word stems with positive emotion words ($M = 6.54$, $SD = 2.18$) than dental-pain subjects did ($M = 5.69$, $SD = 2.12$), $F(1, 203) = 8.16$, $p_{rep} = .98$, $d = 0.40$. The number of word stems completed with negative emotion words did not differ between the two conditions, $F < 1$. Thus, mortality salience caused both absolute and relative increases in nonconscious positive affectivity.

One-way analyses of variance (ANOVAs) on the positive affect (PA) and negative affect (NA) indices of the PANAS revealed no significant difference between the mortality-salience and dental-pain conditions in reported PA, $F < 1$, or reported NA, $F(1, 203) = 1.32$. When we examined the results for the word-stem completion task in an analysis of covariance controlling for both PA and NA, the differences between conditions remained significant for both the number of word fragments completed with positive emotion words, $F(1, 201) = 7.34$, $p_{rep} = .97$, $d = 0.40$, and the facilitation scores, $F(1, 201) = 18.84$, $p_{rep} > .999$, $d = 0.62$. Thus, conscious emotional states were unaffected by the mortality-salience manipulation, as is commonly found, but nonconscious affective reactions were marked.

EXPERIMENT 2

Experiment 2 was a replication of Experiment 1. To increase generality and rule out the possibility that the results were due to a methodological artifact, we changed the dependent measure of nonconscious affective orientation and the measure of conscious emotional state. The self-report emotion measure again provided a delay between the mortality-salience induction and the dependent measure.

Method

Seventy-one undergraduates (57 women, 14 men) participated in this study in return for credit toward a course requirement. They arrived at the laboratory individually for a study ostensibly concerning the relation between personality and word categorization. After giving informed consent, subjects were exposed to the same manipulation used in Experiment 1, in which some participants contemplated their own mortality whereas others contemplated dental pain. They then completed the Brief Mood Introspection Scale (BMIS; Mayer & Gaschke, 1988).

After completing the mood measure, subjects were given instructions for the lexical judgment task. The experimenter said that this task measured perceptions of similarity between different words. Subjects were told that on each trial they would be presented with a word that was followed by two other words, and that they should judge which of the latter two words was more similar to the first word.

On each trial, a target word appeared in the center of the computer screen for exactly 2,000 ms. After the first 1,000 ms, two comparison words were presented on the same line, below the target word, for exactly 1,000 ms. The screen then went blank screen for exactly 2 s before the next trial. Subjects indicated which of the two comparison words was most similar to the target word by circling either "left" or "right" on a recording sheet. The order of the word triads and the position of the comparison words (left/right) were randomly determined.

After completing five practice trials with affectively neutral triads (Genter, 1988), subjects began the experimental trials. In each experimental triad, one of the comparison words was semantically related to the target word, whereas the other comparison word was emotionally similar to the target. For example, the target word *puppy* was followed by *beetle*, a semantically related word that refers to another animal, and by *parade*, an emotionally similar word that also refers to a joyous entity. Of the 28 triads, 10 involved an emotional similarity based on happiness, 9 involved an emotional similarity based on sadness, and 9 involved an emotional similarity based on fear (see Table 1). Twenty-seven of the triads had been used in previous research

TABLE 1
Word Triads Used in Experiment 2

Target	*Semantic associate*	*Emotional associate*
	Happy triads	
Mouth	Cheek	Smile
Joke	Speech	Sunbeam
Puppy	Beetle	Parade
Champagne	Soup	Circus
Trophy	Helmet	Wedding ring
Waterski	Elevator	Celebration
Baby	Minnow	Butterfly
Kiss	Handshake	Fortune
Beach	Valley	Rock concert
Music	Foghorn	Treasure
	Sad triads	
Grave digger	Lumberjack	Break-up
Coffin	Apartment	Depression
Cancer	Pulse	Divorce
Ambulance	Wheelbarrow	Poverty
Bankruptcy	Teller	Tomb
Hospital	Gas station	Failure
Forest fire	Toaster	Handicap
Tears	Breath	Disease
Orphan	Aunt	Gloom
	Fearful triads	
Snake	Armadillo	Guillotine
Electric chair	Sofa	Tumor
Tornado	Snow	Werewolf
Shark	Turtle	Avalanche
Bomb	Sparkler	Torture
Noose	Bracelet	Rabies
Nightmare	Thought	Punishment
Vulture	Parakeet	Insanity
State prison	Mousetrap	Quicksand

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(Niedenthal, Halberstadt, & Innes-Ker, 1999), and 1 (a happy triad) was created for the current experiment. When subjects finished, they were debriefed, thanked, and dismissed.

Results and Discussion

The lexical decision task we used shows what sort of associations people pursue. We coded choice of the semantic associate as 0 and choice of the emotional associate as 1 and averaged the score across all trials for each emotion type (happy, sad, afraid). Our prediction was that mortality salience would induce people to pursue positive emotional associations, and, indeed, subjects in the mortality-salience condition chose the emotional associates in happy triads ($M = .44$, $SD = .17$) more than subjects in the dental-pain condition did ($M = .34$, $SD = .16$), $F(1, 69) = 5.49$, $p_{rep} = .95$, $d = 0.61$. Moreover, this effect was specific to the happy triads. There were no differences between the mortality-salience and dental-pain conditions for the fearful or sad triads, both Fs < 1. Thus, relative to dental-pain subjects, mortality-salience subjects favored emotional associations when the emotions were positive, but not when they were negative. These findings suggest that mortality salience produces a tendency to become attuned to positive information, and that this tendency leads people to incorporate positive emotional information when making judgments.

The BMIS yields two subscores, one for emotional valence and one for arousal. One-way ANOVAs revealed that the mortality-salience and dental-pain subjects did not differ on either dimension, both Fs < 1. In an analysis of covariance that used both BMIS subscores as covariates, the effect of mortality salience on similarity judgments remained significant for happy triads, $F(1, 67) = 4.84$, $p_{rep} = .94$, $d = 0.61$. Thus, conscious emotional state was not affected by the manipulation and did not produce or mediate the main findings.

EXPERIMENT 3

Experiment 3 had two purposes. The first was to provide a more ambitious test of the hypothesis by dispensing with the delay between the manipulation and dependent measure. We hoped to show that the nonconscious coping process that deals with mortality salience (and perhaps similar threats) begins immediately. The second purpose was to test the hypothesis that people are unaware of the operation of what Gilbert et al. (1998) dubbed the psychological immune system. Half the subjects were exposed to the mortality-salience manipulation and filled out the response measures, but the rest were asked to imagine how they would respond. If the coping process is indeed nonconscious, then people would not be able to imagine and predict their reactions correctly. Specifically, we predicted that subjects exposed to the mortality-salience manipulation would show minimal conscious emotion and a nonconscious tuning toward positive stimuli, as in the first two studies, and that subjects who provided hypothetical responses, in contrast, would predict conscious emotion (distress) but not the nonconscious coping response.

Method

One hundred fifty-six undergraduates (112 women, 44 men) participated in return for credit toward a course requirement. The materials and procedure for Experiment 3 were similar to those used in Experiments 1 and 2. Subjects were randomly assigned to the mortality-salience or dental-pain condition. Within those conditions, they were also randomly assigned to either a direct-experience or an imaginary-perspective condition. Subjects in the direct-experience condition completed the questionnaire packet in the same manner as mortality-salience and dental-pain subjects in Experiments 1 and 2. In contrast, subjects in the imaginary-perspective condition were instructed to write down how they imagined they would feel if they were asked to write about their own mortality or dental pain.

The perspective instructions were sustained for the next step. Subjects completed either an explicit mood measure (the PANAS) or an implicit mood measure (the word-stem completion task used in Experiment 1). The direct-experience subjects responded as they actually felt, whereas the imaginary-perspective subjects indicated how they thought they would respond if they had just completed the first task. Finally, subjects were debriefed and dismissed.

Results and Discussion

The main predictions were that in the direct-experience condition, mortality-salience subjects would indicate no conscious emotion but a nonconscious shift toward affective positivity, whereas in the imaginary-perspective condition, mortality-salience subjects would predict conscious distress and no nonconscious response. A 2 (mortality salience: mortality salience vs. dental pain) $\times$ 2 (perspective: direct experience vs. imaginary perspective) $\times$ 2 (measure: explicit mood measure vs. implicit mood measure) ANOVA was conducted on standardized implicit and explicit mood scores. Results revealed the predicted three-way Mortality Salience $\times$ Perspective $\times$ Measure interaction, $F(1, 148) = 12.14$, $p_{rep} = .992$. (see Fig. 1).

To examine the three-way interaction, we conducted separate two-way ANOVAs on the explicit and implicit mood measures. The analysis of explicit negative emotion revealed the predicted main effects of mortality salience, $F(1, 74) = 5.59$, $p_{rep} = .95$, and perspective, $F(1, 74) = 16.89$, $p_{rep} = .997$, as well as the predicted Mortality Salience $\times$ Perspective interaction, $F(1, 74) = 7.48$, $p_{rep} = .97$. Planned comparisons demonstrated that mortality-salience subjects in the imaginary-perspective condition predicted more emotional distress ($M = 0.89$, $SD = 1.36$) than mortality-salience subjects in the direct-experience condition reported experiencing ($M = -0.44$, $SD = 0.48$), $F(1, 38) = 17.13$, $p_{rep} = .996$, $d = 1.29$. Real and hypothetical responses to

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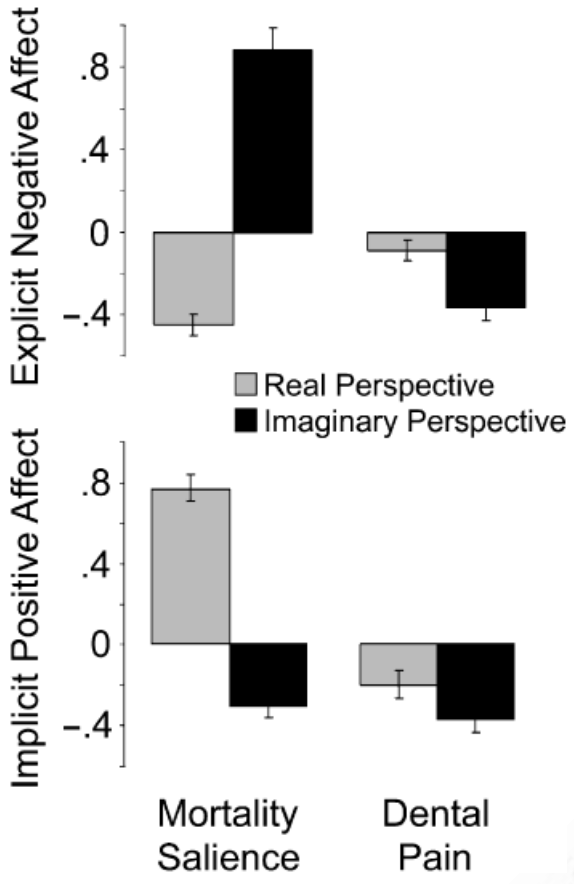

Fig. 1. Results from Experiment 3: explicit negative affect (negative affect subscale of the Positive and Negative Affect Schedule) and implicit positive affect (word-stem completion) as a function of mortality salience and perspective. Affect is reported as standardized mean scores.

the dental-pain condition did not differ in terms of negative emotion, $F(1, 36) = 1.60$.

We turn now to the nonconscious responses. ANOVA on the facilitation scores yielded the predicted Mortality Salience × Perspective interaction, $F(1, 74) = 4.87$, $p_{rep} = .94$. Significant main effects were also found for mortality salience, $F(1, 74) = 6.52$, $p_{rep} = .96$, and perspective, $F(1, 74) = 9.28$, $p_{rep} = .98$. Planned comparisons within the mortality-salience condition showed that directly experiencing that condition led to more facilitation of positive relative to negative emotion ($M = 0.77$, $SD = 0.94$) than did hypothetically imagining that experience ($M = -0.30$, $SD = 0.94$), $F(1, 39) = 13.34$, $p_{rep} = .99$, $d = 1.14$. For dental-pain subjects, in contrast, the facilitation index did not differ between the direct-experience ($M = -0.20$, $SD = 0.75$) and imaginary-perspective ($M = -0.37$, $SD = 0.95$) conditions, $F < 1$.

We also analyzed results for the positive and negative word stems separately. In the direct-experience condition, mortality-salience subjects, compared with dental-pain subjects, completed more word stems as positive emotion words, $F(1, 38) = 7.96$, $p_{rep} = .97$, $d = 0.89$, and marginally fewer word stems as negative emotion words, $F(1, 38) = 3.93$, $p_{rep} = .91$, $d = 0.63$. In contrast, in the imaginary-perspective condition, the mortality-salience and dental-pain conditions did not differ in the number of stems completed as either positive or negative emotion words, both Fs < 1.

Our findings suggest that the standard mortality-salience manipulation produced no change in explicitly reported negative emotion, but caused increases in automatic facilitation of positive emotional stimuli. In the direct-experience condition, there was no difference in explicitly reported emotion between the mortality-salience and dental-pain conditions, $F < 1$, as in previous work. On the implicit measure of accessibility of emotional associations, however, mortality salience led to greater facilitation of positive (relative to negative) emotional stimuli than dental pain did, $F(1, 38) = 12.81$, $p_{rep} = .99$, $d = 1.14$. These findings replicate Experiment 1.

The opposite pattern was observed among subjects who merely imagined experiencing the manipulation. In this case, mortality-salience subjects ($M = 0.89$, $SD = 1.36$) predicted significantly more explicit negative affect than dental-pain subjects did ($M = -0.10$, $SD = 0.74$), $F(1, 36) = 7.21$, $p_{rep} = .97$, $d = 0.90$. Imagining experiencing the mortality-salience manipulation did not cause changes in responses to the implicit mood measure, however, $F < 1$, $p_{rep} = .57$. Thus, subjects in the imaginary-perspective condition were wrong on both counts. They wrongly predicted that they would be quite consciously upset after contemplating death, and they failed to predict that mortality salience would cause them to show increased facilitation of positive emotional stimuli. It was apparently not intuitively obvious to subjects that mortality salience produces an automatic tuning to positive emotional information.

GENERAL DISCUSSION

Many effects of thinking about death are found only after a delay (Arndt et al., 1997). The present study suggests what is happening during that delay. Specifically, there appears to be a fairly automatic coping process that involves orienting toward emotionally positive, pleasant information and associations. Our findings suggest that this process begins rather quickly after thinking about death, and that people are unaware of it.

In three experiments, we had subjects think about either their own eventual death or an unpleasant but not fatal experience (a painful visit to the dentist). As in previous studies, thinking about one's death did not produce any increase in conscious negative emotions. But it did activate what appears to be a nonconscious emotional coping response. We found that contemplating death caused subjects to complete ambiguous word stems with relatively more positive emotion words, an indication of heightened accessibility of emotionally positive associations (Experiments 1 and 3). Contemplating death also made people favor positive emotional associations (Experiment 2). These effects were specific to emotionally positive material: No changes were observed for emotionally negative stimuli. Thus,

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thinking about death fosters an orientation toward emotionally pleasant stimuli.

These results are strongly counterintuitive. In Experiment 3, we assessed intuitions by asking some subjects to imagine the procedures and predict how they would respond. Their intuitive predictions bore no resemblance to the actual pattern of results. Whereas direct experience produced no conscious emotional reaction, subjects who imagined the procedures predicted overt emotional distress. And their intuitive predictions showed no sign of the coping response, namely, the shift toward favoring positive emotional associations.

The failure of subjects to predict intuitively the actual, significant effects of the manipulation seemingly confirms the view that those effects involve a nonconscious coping response. More broadly, they confirm the central argument of researchers, such as Gilbert et al. (1998), who propose that people are unaware of the power and operation of their psychological immune system. Apparently, a threatening event often causes the nonconscious mind to begin automatically orienting toward happy thoughts. This positivity may help minimize the distress that would otherwise arise. Therefore, emotional distress tends to be less than people predict, and even the terror associated with contemplating death can be stifled so as not to paralyze action.

Several researchers have suggested that coping processes begin immediately upon encountering a trauma or threat (e.g., Taylor, 1991; also Gilbert et al., 1998), whereas others have argued that observable effects that result from coping with the prospect of one's own mortality take time to develop (e.g., Pyszczynski et al., 1999). We propose that these processes begin quickly and soon bear fruit, thereby accounting for both prior observations that some effects of contemplating death emerge only after a delay and the current findings of immediate effects. Experiments 1 and 2 contained a brief delay between the manipulation of mortality salience and the dependent measure. Experiment 3 did not. The consistency of findings regardless of whether or not there was a delay suggests that the coping process we investigated does indeed begin rather quickly. We think our results show why a delay is often necessary: Important and powerful coping processes are hard at work in the minutes right after subjects think about death.

If anything, our effects were stronger without the delay than with the delay. The estimated effect sizes for the positive emotion responses (i.e., stems completed as positive emotion words) and facilitation index were larger in Experiment 3, which measured responses immediately ($d = 0.89$ and 1.14, respectively), than in Experiment 1, which measured them after a delay ($d = 0.40$ and 0.62). This pattern fits Taylor's (1991) hypothesis of an immediate mobilization-minimization response to trauma and threat. Thus, the current findings provide a further indication that the process we have identified begins immediately and continues during the delay that has proven vital to many terror management effects.

The present results shed light on automatic coping processes and what Gilbert et al. (1998) have called the psychological immune system. Death is a psychologically threatening fact, but when people contemplate it, apparently the automatic system begins to search for happy thoughts. Moreover, this occurs immediately and outside of awareness, a fact that may contribute to people's well-documented failure to predict how quickly they will recover from upsetting events. We have shown that the common response to contemplating death is a nonconscious orientation toward happy thoughts—and that this response is far contrary to intuitive predictions of a conscious reaction of emotional distress.

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(Received 11/6/06; Revision accepted 1/30/07;
Final materials received 2//07)

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