Journal of Personality and Social Psychology
2006, Vol. 91, No. 1, 49–62

Copyright 2006 by the American Psychological Association
0022-3514/06/$12.00 DOI: 10.1037/0022-3514.91.1.49

Self-Regulatory Processes Defend Against the Threat of Death: Effects of Self-Control Depletion and Trait Self-Control on Thoughts and Fears of Dying

Matthew T. Gailliot
Florida State University

Brandon J. Schmeichel
Texas A&M University

Roy F. Baumeister
Florida State University

Nine studies ($N = 979$) demonstrated that managing the threat of death requires self-regulation. Both trait and state self-control ability moderated the degree to which people experienced death-related thought and anxiety. Participants high (vs. low) in self-control generated fewer death-related thoughts after being primed with death, reported less death anxiety, were less likely to perceive death-related themes in ambiguous scenes, and reacted with less worldview defense when mortality was made salient. Further, coping with thoughts of death led to self-regulatory fatigue. After writing about death versus a control topic, participants performed worse on several measures of self-regulation that were irrelevant to death. These results suggest that self-regulation is a key intrapsychic mechanism for alleviating troublesome thoughts and feelings about mortality.

Keywords: self-regulation, mortality salience, death anxiety, thought suppression, terror management

The thought of death can be frightening. As a consequence, people prefer to avoid thinking about death (e.g., Aries, 1981; Becker, 1973). By what means are people capable of avoiding thoughts of death? The current work assesses the role of self-regulation in minimizing thoughts and anxiety surrounding death.

Self-regulation (or self-control) is the capacity to override one's thoughts, feelings, and habitual patterns of behavior. Self-regulation is a highly adaptive capacity that facilitates success in myriad domains of life, including interpersonal relationships, academic achievement, and coping with and adjusting to stress (e.g., Baumeister, Heatherton, & Tice, 1994; Mischel, Shoda, & Peake, 1988; Shoda, Mischel, & Peake, 1990; Tangney, Baumeister, & Boone, 2004). Awareness of mortality creates the potential for stress (e.g., see Greenberg et al., 2003; Pollak, 1979), and so it seems plausible that one benefit of self-regulation may be to minimize death-related thoughts and anxiety. Hence our central hypotheses in this investigation were (a) that low capacity for self-regulation, either as state or trait, would increase vulnerability to disturbing thoughts and feelings about death and (b) that coping with thoughts of death, like other acts of self-control, should demand and consume some of an individual's limited resources for self-regulation (Muraven & Baumeister, 2000).

Self-Regulation: Trait and State Differences

Some individuals are highly adept at self-regulation whereas others are not, and these individual differences in trait self-control have been associated with a diverse range of behavior. For example, compared with those lower in trait self-control, people higher in trait self-control are better at coping with anxiety and other negative moods, avoiding addictive behaviors, and responding to other people in prosocial, constructive ways (e.g., Finkel & Campbell, 2001; Mischel et al., 1988; Tangney et al., 2004). The diverse and substantial benefits of high trait self-control underscore the idea that self-regulation is a valuable tool in many aspects of life.

Self-regulation can vary not just as trait but also as state. For any individual, self-regulatory success is more likely at some times than at others. Recent work has suggested that self-regulation relies upon a limited resource or strength (for reviews, see Gailliot & Baumeister, in press; Muraven & Baumeister, 2000). Effortful acts of self-regulation appear to consume or deplete this limited resource, thereby impairing later attempts at self-regulation. For instance, participants in one study who performed a task that required self-control (i.e., suppressing or exaggerating responses to an emotional film) were less able to exert self-control on a subsequent task (i.e., squeezing a handgrip) than were participants who first completed a task that did not require self-control (i.e., watching the film without regulating emotional responses; Muraven, Tice, & Baumeister, 1998). Presumably, the initial act of self-control temporarily depleted self-regulatory strength, thereby impairing subsequent self-regulated performance.

Matthew T. Gailliot and Roy F. Baumeister, Department of Psychology, Florida State University; Brandon J. Schmeichel, Department of Psychology, Texas A&M University.

This research was supported by National Institutes of Health Grant MH 65559. Thanks to Lauren Brewer, Shenika Thomas, Savana Carroll, and Daniel Donaldson for helping to conduct the studies reported here.

Correspondence concerning this article should be addressed to Matthew T. Gailliot or Roy F. Baumeister, Department of Psychology, Florida State University, One University Way, Tallahassee, FL 32306-1270. E-mail: gailliot@psy.fsu.edu or baumeister@psy.fsu.edu

Thus, the ability to self-regulate may differ both across individuals (trait self-control) and within individuals across time (self-control depletion). The current work examined whether poor trait and state self-regulation, respectively, would hamper the management of concerns about death and whether the management of concerns about death would hamper self-regulation.

Self-Regulation and the Management of Mortality Concerns

The present work is based on the assumption that the idea of death is threatening and can evoke aversive thoughts and feelings. There are at least two ways in which self-regulation might facilitate the defense against these unwanted states. The first is thought control. Research indicates that people cope with thoughts of death and minimize preoccupation with death in part by suppressing such thoughts or redirecting their thoughts away from death (e.g., Greenberg, Pyszczynski, Solomon, Simon, & Breus, 1994; Harmon-Jones et al., 1997; Pollak, 1979). For instance, on explicit measures of mortality concerns (e.g., measures of death anxiety), most people score relatively low. On more implicit measures (e.g., word-association tests), however, people score significantly higher (e.g., Feifel & Branscomb, 1973; Pollak, 1979). This suggests that people possess an implicit awareness of death and that such thoughts are suppressed from explicit awareness.

Moreover, suppressing thoughts about death requires effortful, controlled processing (Greenberg et al., 1994; Harmon-Jones et al., 1997; Pyszczynski, Greenberg, & Solomon, 1999; see also Wegner, 1994). For example, immediately after thinking about mortality, one's death thoughts are suppressed and are less accessible to awareness (e.g., Arndt, Greenberg, Solomon, Pyszczynski, & Simon, 1997; Greenberg et al., 1994; Harmon-Jones et al., 1997). If cognitive resources are diverted by a concurrent task, however, death thoughts remain highly accessible to awareness (Arndt et al., 1997; Greenberg, Arndt, Schimel, Pyszczynski, & Solomon, 2001). Apparently the cognitive load diverts the resources needed to suppress death thoughts, so death thoughts remain highly accessible (see Smart & Wegner, 1999; Wegner & Zanakos, 1994; Wenzlaff & Wegner, 2000).

Low trait self-control and depleted self-control strength might also undermine the suppression of death thoughts. Thought suppression requires self-control (e.g., Baumeister et al., 1994; Wegner, 1994), and so dispositionally low or temporarily depleted self-control should be linked to poorer suppression, leading to increased accessibility of death-related thoughts and anxiety. Effortfully suppressing a thought reduces both its explicit and implicit accessibility (Anderson & Green, 2001; MacLeod, 1989; McBride & Dosher, 1997), and disrupting controlled efforts toward suppressing death thoughts increases the implicit accessibility of those thoughts (e.g., Arndt et al., 1997; Pyszczynski et al., 1999). Low self-control should therefore be associated with increased accessibility of both implicit and explicit death thoughts.

Likewise, thought suppression depletes self-control strength (e.g., Gordijn, Hindriks, Koomen, Dijksterhuis, & Van Knippenberg, 2004; Muraven et al., 1998). After thinking about death, people suppress thoughts about death. Self-regulatory resources should be depleted as a result. Self-regulation should therefore be impaired shortly after people think about and suppress thoughts of death.

A second way that self-regulation might facilitate the management of concerns about death is the regulation of emotion. An individual who capably controls his or her emotions is likely to experience less of the fear and anxiety associated with death. Emotion regulation requires self-control, and therefore both low trait self-control and self-control depletion undermine emotion regulation (e.g., Baumeister, Bratslavsky, Muraven, & Tice, 1998; Finkel & Campbell, 2001; Muraven et al., 1998; Tangney et al., 2004). Consequently, low trait self-control and self-control depletion should be associated with increased emotional preoccupation with death. In sum, we posited that self-regulation should facilitate suppressing thoughts about death and, to some extent, regulating emotional responses to concerns about death.

Another potential basis for predicting a link between self-regulation and death-thought accessibility, however, involves self-esteem. Terror management theory has suggested that self-esteem is primarily a defense against death, so chronic low self-esteem could leave people more vulnerable to thoughts and anxieties about death (e.g., see Pyszczynski, Greenberg, Solomon, Arndt, & Schimel, 2004). The present work is not concerned with self-esteem per se but with the possibility that self-esteem could account for the effects of self-regulation. Trait self-esteem and trait self-control are positively correlated (Tangney et al., 2004), hence it is theoretically possible that any effects of self-control are due to self-esteem. It is also plausible that high self-esteem results from having more effective self-control, so people with high self-esteem might be less vulnerable to self-control depletion. To test these possibilities, we assessed the role of self-esteem.

Research Overview

In nine studies, using both correlational and experimental methods, we tested whether self-regulation facilitates the management of mortality concerns. We first examined whether poor self-regulation would hamper the management of mortality concerns. Our first studies tested the prediction that people with low (vs. high) trait self-control would be more prone to come up with death-related thoughts in response to ambiguously evocative stimuli (Studies 1A and 1B) and would have higher death anxiety (Study 1C). Next, we manipulated temporary self-regulatory capacity by having participants complete either an initial task that required self-regulation or one that did not require self-regulation. To the extent that exercising self-control depletes the capacity for self-regulation (e.g., see Muraven & Baumeister, 2000), we expected to find greater death-thought accessibility (Study 2) and a greater proclivity to perceive death-related themes in an ambiguous stimulus (Study 3) among participants who had (vs. had not) previously expended their self-regulatory resources. Subsequently, we assessed (rather than manipulated) self-control depletion and death-thought accessibility and death anxiety (Study 4). In the final study in this group (Study 5), we sought to show that low trait self-control would leave people more vulnerable to the threat of mortality salience and would result in a heightened tendency to respond to that threat by bolstering support for a political leader (Landau et al., 2004). Such an externalizing response would presumably indicate that the inner defense mechanisms against death were inadequate.

Having thus shown the effects of poor self-regulation on mortality defenses, we turned this around to investigate the effects of

mortality defense on self-regulation. If (as argued above) self-regulation consumes a limited resource and defending against the threat of death consumes some of that resource then people's capacity for self-regulation should be diminished after they defend against such a threat. Participants in the last four studies wrote about either death or a control topic. We predicted that writing about death would activate defensive processes that would deplete self-regulatory resources, as indicated by poorer subsequent performance on the Stroop task (Study 6), impaired logical reasoning abilities (Study 7), reduced success at solving anagrams (Study 8), and less effortful persistence on word puzzles (Study 9).

Studies 1A–1C

In Studies 1A–1C we relied on measurement of trait self-control to test the hypothesis that weaker self-control would be associated with greater susceptibility to thoughts about death. We measured death-thought accessibility in different ways in each of these studies. In Study 1A we used ambiguous word puzzles that could be solved with either death-related or death-irrelevant words (e.g., *grave*, *grape*). We believed that greater accessibility of death thoughts among persons low in self-control would be reflected in higher rates of death-related word solutions. In a similar vein, in Study 1B we showed participants an ambiguous visual stimulus that could be construed as either related or unrelated to death. We then assessed spontaneous thoughts to determine the frequency of death-related thoughts the image evoked. In Study 1C we relied on a straightforward measure of death anxiety (Templer, 1970) to ascertain whether low self-control would be associated with greater fear related to death.

Method

Participants. Participants in these and all subsequent studies were undergraduate students enrolled in introductory psychology courses who received either extra credit or credit toward fulfilling a course requirement. The size and gender makeup of the samples in Studies 1A–1C were as follows: Study 1A ($N = 279$; 166 women, 113 men), Study 1B ($N = 13$; 12 women, 1 man), and Study 1C ($N = 163$; 118 women, 45 men).

Materials and procedures. At the start of the academic semester, participants completed measures of trait self-control (the Self-Control Scale; Tangney et al., 2004) and self-esteem (the Rosenberg Self-Esteem Scale; Rosenberg, 1965) during a mass-testing session. We used the brief version of the Self-Control Scale, which contains 13 items (e.g., "I have a hard time breaking bad habits" [reverse scored]; "I am good at resisting temptation") answered on a scale from 1 (*not at all like me*) to 5 (*very much like me*). The Rosenberg Self-Esteem Scale contains 10 items (e.g., "On the whole, I am satisfied with myself.") answered on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*). Higher scores on these measures indicate higher self-control and self-esteem, respectively.

Participants in Study 1C also completed the Social Interaction Anxiety Scale (Mattick & Clarke, 1998), as a measure of social anxiety, and the State–Trait Anxiety Index (Spielberger, Gorsuch, & Lushene, 1970), as a measure of general trait anxiety. These measures were used to control for general negative affect.

Studies 1A–1C were conducted 4–12 weeks after the initial mass-testing session. In each study, participants completed questionnaire packets that contained the focal materials along with other, non-death-related measures. In Study 1A, the packet included a list of 20 word fragments, some of which could be completed with death-related thoughts (e.g., *sk_ll* and *gra_e* could be solved with the words *skull* and *grave* or *skill* and *grape*, respectively). We counted and then standardized the number of death-related words used to complete the relevant word fragments to serve as a measure of implicit death-thought accessibility (see Greenberg et al., 1994).[1]

Figure 1. "All Is Vanity" by Charles Allan Gilbert. This picture, shown to participants in Study 1B, could be interpreted as either a woman or a skull.

The questionnaire packet completed by participants in Study 1B included a measure of explicit death-thought accessibility. Specifically, these participants were shown a picture that could be interpreted as depicting either (a) a woman sitting in front of a mirror while putting on makeup or (b) a skull (see Figure 1). Participants were instructed to list the first 10 words that came to mind as they viewed the image. A judge who was blind to trait self-control scores determined which thoughts on the thought-listing task were related to death (e.g., *skull* and *skeleton*). The number of thoughts related to death constituted the measure of explicit death-thought accessibility.

The questionnaire packet completed by participants in Study 1C contained the Death Anxiety Scale (Templer, 1970), which includes 15 items (e.g., "I am very much afraid to die" and "I fear dying a painful death")

[1] Participants completed a list that contained either 5 or 7 word fragments that could be solved with death-related thoughts. Accordingly, the number of death-related thoughts was standardized among participants who completed each list.

answered as either "true" or "false." Higher scores indicate greater death anxiety.

In these and all subsequent studies, participants were last thanked and fully debriefed. Because of the threatening nature of death, we were careful to explain the importance of and need for the research and to assuage any fears or concerns participants may have had. In this fashion, we tried to ensure that no participant left feeling distressed.

Results

In each study, higher trait self-control was associated with less preoccupation with death. Trait self-control correlated negatively with the number of word fragments completed with death-related words, $r(279) = -.13$, $p < .05$ (Study 1A), the number of death thoughts listed to the ambiguous image, $r(13) = -.59$, $p < .05$ (Study 1B), and death anxiety, $r(163) = -.36$, $p < .01$ (Study 1C).

Further analyses indicated that each relationship remained significant when controlling for self-esteem (all ps $\leq .05$) and that controlling for self-esteem did not change the strength of any relationship (all ps $> .11$). Self-esteem thus did not appear to account for the relationship between self-control and mortal concern.

Moreover, the relationship between self-control and death anxiety in Study 1C remained significant when controlling for social anxiety and trait anxiety (scores on the Social Interaction Anxiety Scale and State–Trait Anxiety Index, respectively; ps $< .05$). This suggests that the association between high trait self-control and low death anxiety was not simply the result of trait self-control buffering against negative affect in general.

Discussion

Studies 1A–1C provided initial evidence for the view that self-regulation protects people from the aversive awareness of death and mortality. High self-control predicted less explicit (death anxiety and responses to an image of a skull) and implicit (responses to word fragments) preoccupation with death.

We assume that people periodically confront cues or thoughts that remind them of death and that they therefore exercise self-regulation to prevent these thoughts from lingering in conscious awareness and escalating into greater anxiety. These results suggest that low self-control leaves people less effectively defended against the threatening idea of death and hence more prone to suffer both disturbing thoughts and anxious emotions in connection with death.

Study 2

In Studies 2 and 3 we used laboratory manipulations of self-regulation (rather than correlational evidence) to test the causal hypothesis that low self-control weakens defenses against death. In Study 2 we examined whether temporarily depleted self-regulatory strength would increase the cognitive accessibility of death-related thought. People typically try to minimize or suppress thoughts associated with death. We hypothesized that if self-regulation is needed to suppress death thoughts, then self-regulatory depletion should undermine this suppression and lead to increased accessibility of death-related thoughts.

Participants in Study 2 first completed either a task that required self-regulation (thought suppression) or a control task. Thought suppression requires self-control and has been shown to deplete self-regulatory strength (Muraven et al., 1998).

Following this initial task, participants completed the same measure of implicit death thoughts used in Study 1A (word fragment completion). We predicted that participants in the depletion condition would complete the word fragments with death-related words more often than would participants in the no-depletion condition, indicating greater accessibility of death-related thoughts when self-regulatory capacity had been reduced.

Method

Participants. Participants were 19 undergraduates (13 women, 6 men) who completed the Rosenberg Self-Esteem Scale during a mass-testing session at the start of the semester. The present study occurred approximately 3 months later. Participants were run individually and told the study was to investigate impression formation and thought patterns.

Procedure. The first task served as the manipulation of self-regulatory resources. Specifically, participants completed a thought-recording exercise (borrowed from Wegner, Schneider, Carter, & White, 1987). Participants were given a sheet of paper and asked to write down all of their thoughts for 5 min. Participants randomly assigned to the no-depletion condition received no additional instructions. Participants assigned to the depletion condition were instructed further not to think about a white bear. Each time they did happen to think about a white bear, they were to place a mark on the page and attempt to stop thinking about a white bear.

After the thought-listing task, participants rated the difficulty of the task (as a manipulation check), and they completed the Brief Mood Introspection Scale (BMIS; Mayer & Gaschke, 1988). The BMIS contains 20 items indicative of mood (e.g., happy, sad) and arousal (e.g., peppy, drowsy). Participants rated each item to indicate how they were feeling at the present moment, using a scale from 1 (*definitely do not feel*) to 7 (*definitely feel*). Participants also indicated to what extent they tried to follow the task instructions (effort) and how well they felt that they followed those instructions (perceptions of task performance).

Next, participants completed an unrelated filler task (i.e., making personality judgments of children in a video) that bolstered the cover story. The personality-judgment task took approximately 4 min. Afterward, participants completed the same series of word fragments used in Study 1A.

Results and Discussion

Manipulation check. Participants in the depletion condition rated their suppression task as being somewhat more difficult ($M = 3.78$, $SD = 1.92$) than did the participants in the no-depletion condition ($M = 2.40$, $SD = 1.26$), $t(17) = 2.53$, $p = .08$. This pattern suggests that the depleting task required more effortful self-regulation than did the nondepleting task.

Implicit death thoughts. We predicted and confirmed that death-related thoughts would be more accessible to the minds of depleted than to those of nondepleted participants. Depleted participants ($M = 2.22$, $SD = 1.48$) solved more word fragments with death-related words than did nondepleted participants ($M = 0.90$, $SD = 1.20$), $t(17) = -2.15$, $p < .05$. This pattern is consistent with the view that self-regulatory resources help reduce death-thought accessibility. Participants who possessed greater self-regulatory strength (i.e., nondepleted participants) exhibited less death-thought accessibility than did participants who had previously expended their self-regulatory strength. Presumably, depleted participants were less able to suppress thoughts of death, and thus death thoughts increased in accessibility. The word-fragment completion task required participants to execute a mental

search for possible solutions, and solutions related to death appeared to be more accessible when self-regulatory resources were depleted.

Self-esteem, mood, arousal, task performance, and effort. Additional analyses suggested that the difference in accessibility of implicit death thoughts between depleted and nondepleted participants was not attributable to differences in self-esteem, mood, arousal, effort, or perceptions of task performance. Regression analysis indicated that self-esteem did not moderate the effect of depletion on the accessibility of death thoughts ($t < 1$, *ns*). Further, depleted and nondepleted participants did not differ in arousal, task performance, or effort (all ps $> .24$), nor did any of these factors significantly predict the number of implicit death thoughts (all ps $> .24$). Depleted and nondepleted participants did differ in self-reported mood valence ($p < .05$) such that depleted participants were in a more negative mood, but mood did not significantly predict the number of implicit death thoughts ($p > .32$), and the difference in death thoughts between the two conditions was significant even when controlling for mood, $F(1, 16) = 3.19$, $p < .05$ (one-tailed).

Study 3

The purpose of Study 3 was to provide converging evidence that self-regulatory depletion increases death-thought accessibility. The design of the study mirrored that of Study 2. Participants first completed either a task (controlling attention while watching a video) that has been shown to deplete self-regulatory strength (e.g., Schmeichel, Vohs, & Baumeister, 2003) or a control task. Participants then completed a measure of death-thought accessibility for which they listed their thoughts about an ambiguous image. We predicted that participants who first performed the self-regulatory (vs. the control) task would respond to the ambiguous image with more death-related thoughts because they had depleted self-regulatory strength.

Method

Participants. Sixty-seven undergraduate students (49 women, 18 men) participated in a classroom setting. They were told that the study was to investigate people's attitudes and opinions.

Procedure. The first task served as the manipulation of self-regulatory resources. Specifically, participants watched a 6-min video (without sound) of a woman talking (modified from Gilbert, Krull, & Pelham's, 1988, study). In the bottom corner of the screen, common one-syllable words (e.g., *hair*, *hat*) appeared individually for 10 s. Participants randomly assigned to the depletion condition were instructed to focus their attention on the woman's face and to refrain from looking at the words. If they happened to look at the words, they were to refocus their attention on the woman as quickly as possible. Attention automatically orients toward novel stimuli appearing in the environment (e.g., see Shiffrin & Schneider, 1977), and so the task required these participants to exert self-control by overriding prepotent orienting of attention to the words and maintain attention instead on the woman's face only. Participants assigned to the no-depletion condition were instructed to watch the video as they would normally (i.e., as if they were sitting at home watching TV) and hence were not required to exert self-control.

After the video-watching task, participants completed the target materials (described below) that were embedded among other measures (not related to death) that helped bolster the cover story about attitudes and opinions. Participants completed measures of mood and arousal (the BMIS) 4–5 min after the initial video-watching task. Participants subsequently completed a measure of death-thought accessibility (listing thoughts to an ambiguous drawing) that was identical to the one used in Study 1B except that a different drawing was used (see Figure 2).

Results and Discussion

Explicit death thoughts. Depleted participants ($M = 1.34$, $SD = 1.00$) listed more death-related thoughts while viewing the drawing than did nondepleted participants ($M = .97$, $SD = .45$), $t(65) = 1.99$, $p = .05$. Presumably, participants who possessed full self-regulatory strength were able to suppress thoughts of death while viewing the drawing. Depleted participants, lacking self-regulatory strength, were less able to suppress such thoughts. The results of Study 3 thus replicated those of Study 2, using different methods. In both studies, weakening self-control by depleting its resources led participants to have more thoughts about death.

Moreover, the finding that depletion increased death thoughts and anxiety after a short delay indicates that the effects of depletion are somewhat enduring. One may very well be susceptible to greater mortal concern long after having exerted self-control.

Mood and arousal. Analyses indicated that the effect of depletion on the accessibility of death-related thoughts was not mediated by mood or arousal. Depleted and nondepleted participants did not differ in arousal ($p > .19$), but depleted participants

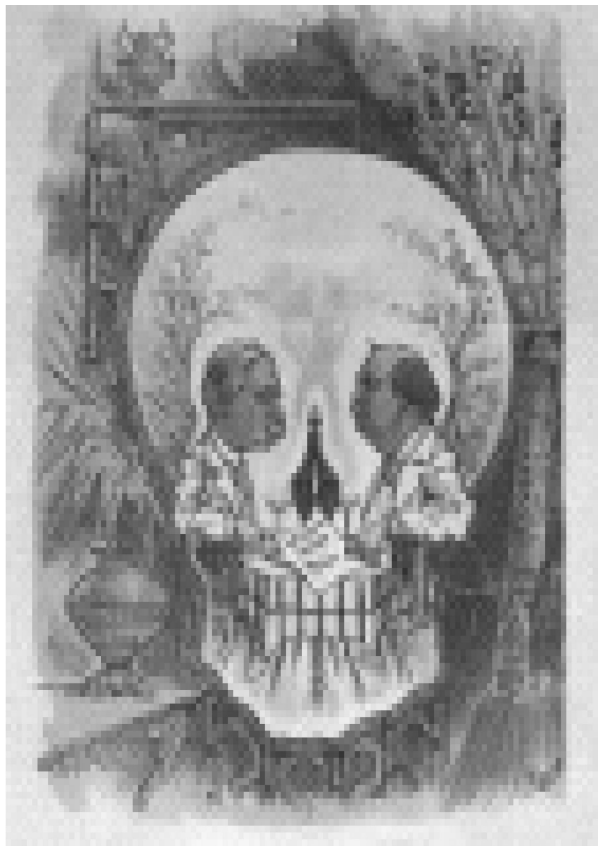

Figure 2. Artwork (Gillam) from the May 1894 cover of *Judge* magazine. This picture, shown in Study 3, could be interpreted as either two men or a skull.

were in a somewhat more negative mood ($p = .06$). However, neither mood nor arousal significantly predicted the number of death thoughts (ps = .22 and .38, respectively), and the difference in death thoughts between the two conditions was significant, even when controlling for mood, $F(1, 63) = 2.93$, $p < .05$ (one-tailed).

Study 4

The purpose of Study 4 was to provide additional evidence that self-regulatory depletion increases death thoughts and anxiety. Specifically, we assessed (rather than manipulated) temporary self-regulation abilities using a recently developed scale that has been shown to measure self-regulatory depletion (Twenge, Muraven, & Tice, 2004; see also Finkel & Campbell, 2001, for a similar measure). Participants then completed measures of implicit death-thought accessibility (word fragments) and death anxiety. We hypothesized the following: If self-regulation helps to minimize death-thought accessibility and death anxiety, then participants who report more self-regulatory depletion should exhibit more death-thought accessibility and death anxiety than should participants who report relatively less self-regulatory depletion.

Method

Participants. One hundred fifty-nine undergraduate students (110 women, 49 men) participated. The study was conducted in a classroom setting, and participants were told that it was to investigate attitudes and vocabulary. They completed questionnaire packets that contained all instructions and materials (i.e., the focal materials along with other, nondeath-related personality measures.)

Procedure. Specifically, participants completed a measure that assessed perceptions of the momentary availability of self-regulatory resources (the State Depletion Scale; Twenge et al., 2004). The State Depletion Scale contains 25 items (e.g., "I feel like my willpower is gone." "My mental energy is running low.") answered on a scale from 1 (*not true*) to 7 (*very true*; $\alpha = .91$). Higher scores indicate greater self-regulatory depletion.

Subsequent measures in the packet assessed implicit death-thought accessibility and death anxiety. Specifically, participants completed the Death Anxiety Scale (Templer, 1970) and the same word fragments as used in Study 1A and Study 2.

Results and Discussion

State self-control depletion correlated positively with implicit death thoughts, $r(159) = .20$, and death anxiety, $r(159) = .43$ (both ps $< .05$). Participants who indicated that they were relatively more depleted solved more word fragments with death-related words and reported more death anxiety than did participants whose self-regulatory resources were less depleted.

These findings converge with those of the previous studies. Measured self-control depletion revealed the same association between depletion and death-thought accessibility as did manipulated self-control depletion in Studies 2 and 3. Presumably, participants who were relatively less depleted were more capable of managing concerns about death and thus experienced relatively less preoccupation with death. The results thus far are highly consistent with the hypothesis that self-regulation minimizes death-thought accessibility and death anxiety.

Study 5

The purpose of Study 5 was to test the hypothesis that good self-regulation reduces concerns about death by examining the consequences of increased death concerns rather than the extent of them. Specifically, Study 5 examined the role of trait self-control in one well-documented consequence of mortality salience: increased worldview defense.

When mortality is made salient, people bolster faith in their own culture and react more positively toward others who support their cultural norms and values, and they react more negatively toward others who disagree with their cultural norms and values (e.g., Florian & Mikulincer, 1997; Greenberg et al., 1990; Heine, Harihara, & Niiya, 2002; Ochsmann & Mathey, 1994). Likewise, mortality salience has been shown to increase support for political leaders. For instance, after writing about death or the September 11, 2001, terrorist attacks on the United States, participants (from the United States) showed increased support for current President George W. Bush compared with participants who wrote about merely aversive topics such as dental pain (Landau et al., 2004). Study 5 of the current investigation was a partial replication of the Landau et al. (2004) study that assessed the relationships among mortality salience, trait self-control, and support for the President.

We made a few hypotheses about the results of Study 5: If self-control is used to reduce death-related thought and anxiety, then participants higher in trait self-control should be more capable of managing concerns about death following a mortality-salience induction than should participants lower in trait self-control. The more effective suppression abilities of individuals high (vs. low) in trait self-control should reduce both implicit and explicit death-thought accessibility (Anderson & Green, 2001; MacLeod, 1989; McBride & Dosher, 1997). To the extent that support for President Bush is exacerbated by death concerns, participants high in trait self-control should not show increased support for the President after thinking about death.

Participants first did or did not write about their own death. Then they read a short passage in support of President Bush and indicated how much they agreed with the passage. Our prediction was that mortality salience would boost support for the President but only among participants with low trait self-control.

Method

Participants. Participants were 88 undergraduates (41 women, 47 men) who completed a brief measure of trait self-control (Tangney et al., 2004) and self-esteem (Rosenberg, 1965) during a mass-testing session earlier in the semester. The present study was conducted in classrooms in groups of 10–25 participants approximately 2 weeks prior to the 2004 U.S. presidential election (some 7 weeks after the mass-testing session). Participants were told that the study was to investigate personality characteristics and political attitudes. They received a packet that contained all materials for the experiment.

Procedure. Participants first completed a demographic questionnaire and two filler personality-related questionnaires. Participants randomly assigned to the mortality-salience condition then completed a questionnaire that asked them to describe the emotions that the thought of their own death aroused in them and to write about what will happen to their bodies as they physically die (see Rosenblatt, Greenberg, Solomon, Pyszczynski, & Lyon, 1989). Participants in the control condition did not complete this questionnaire but instead proceeded immediately to the next items in the packet, two personality-relevant measures intended to bolster the cover story.

These measures were included immediately after the mortality-salience manipulation but before the target dependent variable (described below), because the effects of the mortality-salience manipulation used typically emerge only after a short delay or distraction (see Pyszczynski et al., 1999).

To test the effect of mortality salience on worldview defense, we asked participants next to read and evaluate a statement (used in Landau et al.'s, 2004, study) regarding President Bush and his antiterrorism policies. The passage praised the United States and President Bush and his actions against terrorism.

After reading the passage, participants responded to the following items on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*): "To what extent do you endorse this statement?"; "I share many of the attitudes expressed in the above statement"; and "Personally I feel secure knowing that the President is doing everything possible to guard against any further attacks against the United States." Participants also indicated their political orientation by placing a mark on a continuous spectrum that ranged from *Liberal* to *Conservative*. The responses to the Likert items and spectrum (measured in centimeters across the spectrum) were standardized (z scored) and averaged ($\alpha = .91$), and the single score served as our dependent measure of support for President Bush (higher scores indicated greater support).

Results

A regression analysis was conducted to predict support for the President from trait self-control scores, mortality-salience condition, and their interaction, while controlling for self-esteem.[2] The analysis indicated a significant effect of mortality-salience condition ($\beta = 1.35$, $p < .05$). Participants in the mortality-salience condition indicated supporting President Bush to a greater extent than did participants in the control condition. This replicates the findings of Landau et al. (2004), in which mortality salience increased support for President Bush. The effect of self-control approached significance ($\beta = .29$, $p = .06$) as did its interaction with mortality-salience condition ($\beta = -1.89$, $p = .06$).

To interpret the interaction between mortality salience and self-control, and also to test directly our specific hypothesis, we assessed the simple effect of mortality-salience condition among participants who were relatively high versus relatively low in trait self-control (one standard deviation above and below the mean on the self-control scale, respectively; Aiken & West, 1991), controlling for trait self-esteem. Results indicate that the effect of mortality salience on support for the President was significant and robust for participants low in self-control ($p < .05$) but was nonsignificant and negligible for those high in self-control ($p > .67$; see Figure 3). Thus, although mortality salience increased support for the President, this effect occurred primarily among participants lower in trait self-control. Participants higher in self-control did not show increased support for the President after thinking about death.

Discussion

These findings converge upon the hypothesis that self-regulation facilitates the management of concerns about death. Whereas the results of the previous studies indicate that good trait and state self-control reduces death-thought accessibility and death anxiety, the results of Study 5 suggest that high trait self-control helps to reduce defensive reactions to mortality salience. Mortality salience increases liking for charismatic and decisive leaders (Cohen, Solomon, Maxfield, Pyszczynski, & Greenberg, 2004; Landau et al., 2004). People with high trait self-control were apparently less cognizant of death after mortality salience, however, and so after thinking about death they did not increase support for President Bush.

Study 6

The central hypothesis of this investigation is that defending against the threatening idea of death requires self-regulation and consumes self-regulatory resources. Thus far we have presented evidence that when the capacity for self-regulation is low, thoughts and fears of death are more common. We turn now to a complementary way of testing the hypothesis, which is to show that when people defend themselves against thoughts and feelings about death, they deplete their self-regulatory resources. Past work has shown that following mortality salience, people actively and effortfully suppress thoughts of death (Arndt et al., 1997; Greenberg et al., 1994; Harmon-Jones et al., 1997). The result should be impaired performance on subsequent tasks requiring self-regulation.

In Study 6, participants wrote about death or a control topic. We assumed that writing about death but not the control topic would activate disturbing thoughts and feelings that would require self-regulatory exertion to defend the self against them. Participants were then provided a delay that allowed participants sufficient time to suppress thoughts of death (if they had them). After the delay, participants completed the Stroop color–word interference task as a measure of self-regulation. For the Stroop task, participants saw words (i.e., *red*, *blue*, *green*) on a computer screen, and they were to respond by indicating the font color of the word. On some trials (incongruent trials), the meaning of the word differed from its font color (e.g., *red* appeared in a blue font), so on these trials participants had to exert self-control by overriding the tendency to read the word and respond instead according to the font color. Performance on the Stroop task was operationalized as the number of errors made during incongruent trials. We predicted that participants who wrote about death would make more Stroop errors than would those who wrote about a neutral topic, thereby suggesting that their self-regulatory resources had been depleted by the mortality-salience induction.

We also assessed performance on Stroop trials that did not require self-control (i.e., congruent trials or trials for which the font color and meaning of the word were the same). This allowed us to determine whether mortality salience would impair automatic cognitive processing, as might be expected if the self-regulatory impairments following mortality salience are caused by another factor aside from self-control depletion (e.g., mood or arousal). We predicted that mortality salience would not influence performance on congruent trials.

[2] Including self-esteem and its higher order interactions with self-control and mortality-salience condition yielded no significant effects as a function of self-esteem (all ps $> .21$). In addition, our primary results remained relatively unchanged when excluding self-esteem from the model. We included self-esteem in the model to demonstrate that the relationship between trait self-control and worldview defense (support for President Bush) was not attributable to self-esteem.

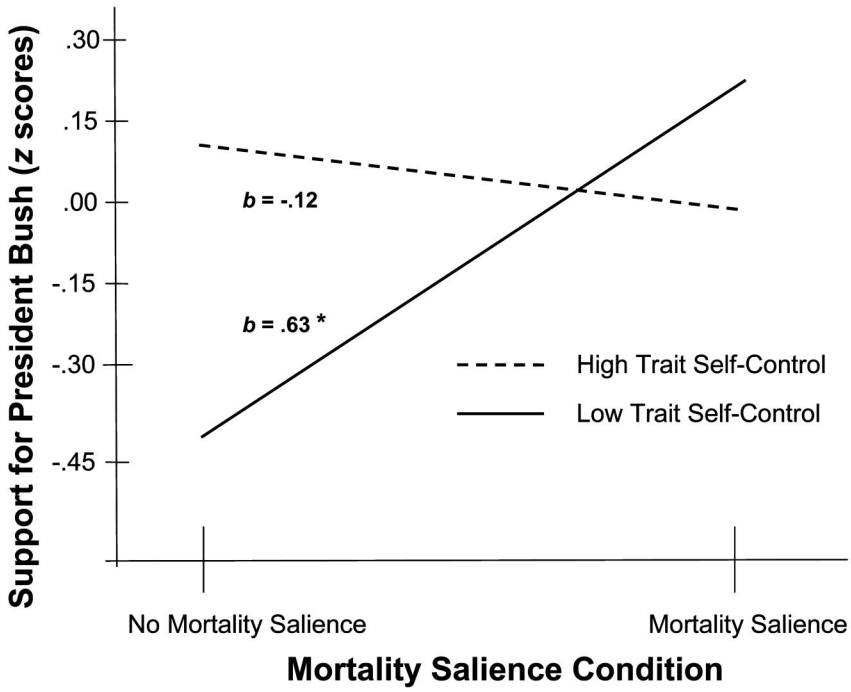

Figure 3. Support for President George W. Bush as a function of mortality-salience condition and trait self-control (Study 5).

Method

Participants. Fifty-seven undergraduate students (45 women, 12 men) participated. Five participants were excluded from all analyses because of technical difficulties (e.g., being interrupted while completing the Stroop task) or for not following instructions, leaving a final sample of 52 (42 women, 10 men). Participants were randomly assigned to condition.

Procedure. Participants were run individually and were told that the study was to investigate personality and perception. Participants first completed a computer task that was similar to the Stroop task so they could become familiarized with how to respond on the keyboard. Specifically, participants completed 60 trials in which a string of *X*s (*XXXXX*) appeared on the computer screen in either a red, green, or blue font. Participants were to indicate the color of the *X*s by pressing one of three computer keys (the *R*, *G*, or *B* key) as quickly as possible. Following each response, the next string of *X*s appeared immediately.

After practicing the computer task, participants wrote about either death or dental pain. As in Study 5, mortality-salience participants described the emotions that the thought of their own death aroused in them and what will happen to them as they physically die, whereas the dental-pain participants described the emotions that the thought of their own dental pain aroused in them and what would happen to them if they were to experience dental pain (see Rosenblatt et al., 1989). Participants then completed the BMIS, as a measure of mood and arousal, and a filler task (a crossword puzzle) for 4 min to provide sufficient time for them to suppress thoughts of death (Pyszczynski et al., 1999).

Participants then completed the final Stroop task. For this task, participants completed 3 blocks of trials in which the word *red*, *blue*, or *green* appeared on the computer screen in either a red, blue, or green font. Participants were to indicate the font color by pressing one of three computer keys (the *R*, *G*, or *B* key) and were asked to respond as quickly and accurately as possible. The first and third blocks consisted of 30 congruent trials in which the meaning and font color of the word were the same. The second block consisted of 60 incongruent trials in which the meaning and font color of the word were different. At the end of the task, participants completed demographic information, indicated whether they had completed the Stroop task before ("yes" or "no"), and were probed for suspicion. No participant indicated that he or she thought that writing about death or dental pain might influence performance on the Stroop task.

Results

Stroop task performance. In all of our analyses involving Stroop task performance, we controlled for whether participants had ever performed the Stroop task before, because there is a large practice effect on Stroop task performance (MacLeod, 1991). An analysis of covariance indicated that mortality-salience participants made more errors ($M = 2.50$, $SD = 1.86$) on the incongruent trials on the Stroop task than did dental-pain participants ($M = 1.40$, $SD = 1.85$), $F(1, 49) = 4.26$, $p < .05$. This result suggests that mortality salience impaired participants' ability to exert self-control.

Additional analyses indicated that the two groups did not differ on the number of errors on either block of congruent trials (both Fs < 1, *ns*). This pattern of results suggests that mortality salience did not impair automatic processing (congruent trials) but did impair controlled processing (incongruent trials). Further, participants did make some errors on the congruent trials on the first and third blocks (in the mortality-salience condition, $M = .32$ and .63 [excluding one outlier on this measure], respectively; in the dental-pain condition, $M = .25$ and .63, respectively). This suggests that the congruent trials were somewhat cognitively demanding, yet mortality salience did not impair performance on these trials.

In addition, mortality-salience and dental-pain participants did not differ in their reaction times on either the incongruent or

congruent trials (Fs < 1, *ns*). This suggests that the increased number of errors among mortality-salience participants was not the result of a speed–accuracy trade-off, such as if they had made more errors because they responded faster.

Mood and arousal. Mortality-salience and dental-pain participants did not differ in mood valence or arousal (as assessed by the BMIS; ts < 1, *ns*). This suggests that mortality-salience participants' performing worse on the Stroop task than dental-pain participants was probably not attributable to mood or arousal.

Discussion

Participants who wrote about death performed worse (i.e., made more errors) on the Stroop task than did control participants but only on trials that required self-control (i.e., incongruent trials). This suggests that mortality salience impaired the ability to exert self-control. Presumably, after thinking about death, participants suppressed thoughts of death, and the act of thought suppression depleted their self-regulatory strength. Participants who wrote about death rather than dental pain did not perform worse on trials that did not require self-control (i.e., congruent trials), which suggests that mortality salience did not have an adverse effect on automatic cognitive processes.

Study 7

The results of Study 6 suggest that mortality salience subsequently impairs self-control but not cognitive processing in general. It is plausible, however, that the congruent Stroop trials were relatively easy and therefore a poor measure of general cognitive abilities. In Study 7 we therefore provided another test of the hypothesis that mortality salience impairs self-control but not other cognitive processes by using a more difficult task to assess general cognitive abilities.

Participants first wrote about either death or uncertainty. Uncertainty salience has been shown to be a poignant self-threat (e.g., van den Bos, Poortvliet, Maas, Miedema, & van den Ham, 2005) and therefore seemed an adequate control topic. Participants then completed problems requiring either analytical reasoning or rote memory.

Research has indicated that analytical reasoning suffers more from self-regulatory depletion than does rote memory (Schmeichel et al., 2003). Consistent with the idea that coping with thoughts of death depletes self-regulatory resources, we therefore predicted that mortality salience would cause participants to perform worse on problems requiring analytical reasoning but not rote memory.

Method

Participants. Participants were 38 undergraduates (24 women, 14 men). Data from 1 participant who failed to follow instructions were excluded from all analyses. Participants were run together in a large group and were told that the study was to investigate personality and cognitive abilities.

Procedure. Participants randomly assigned to the mortality-salience condition first completed the essay about death used in the previous studies. Participants assigned to the uncertainty-salience condition described the emotions uncertainty arouses in them and what would happen to them if they were to experience uncertainty. Afterward, participants completed a filler questionnaire for approximately 5 min to allow them to suppress any thoughts about death they may have had.

Participants then completed either 6 analytical reasoning problems or 20 verbal definition problems requiring rote memory (e.g., defining *moratorium*, *allude*, *augment*). These problems were borrowed from a Graduate Record Examinations preparation book and were classified as easy. Each problem had 4 or 5 multiple-choice answers. Participants were instructed to choose the most appropriate answer.

Results and Discussion

A 2 (mortality vs. uncertainty salience) $\times$ 2 (analytical vs. rote memory problems) between-subjects analysis of variance indicated a significant interaction between mortality-salience condition and problem type, $F(1, 33) = 4.76$, $p < .05$. Simple contrasts indicated that, among participants who completed the analytical reasoning problems, mortality-salience participants ($M = 1.38$, $SD = 1.19$) solved fewer problems correctly than did uncertainty-salience participants ($M = 2.56$, $SD = 1.13$), $F(1, 33) = 6.34$, $p < .05$. Among participants who completed the rote memory problems (verbal definitions), mortality-salience ($M = 16.20$, $SD = 1.55$) and uncertainty-salience ($M = 15.50$, $SD = 3.27$) participants did not differ in the number of problems solved correctly ($F < 1$, *ns*).

Mortality salience thus impaired performance on problems requiring self-control (analytical reasoning skills) but not problems requiring only more basic cognitive processing (rote memory for verbal definitions). This underscores the notion that mortality salience depletes self-regulatory strength and that the deficits in self-regulation following mortality salience are particular to self-regulation and not cognitive processing in general.

An alternative interpretation of why mortality salience might impair self-regulation, however, might be that thoughts of death rebound after mortality salience (e.g., Arndt et al., 1997; Wegner, 1994) and thereby distract participants from self-regulatory tasks. Similarly, it is plausible that other aftereffects of mortality salience (e.g., worldview activation; Arndt, Greenberg, & Cook, 2002) could somehow interfere with self-regulation. The results of Studies 6 and 7 directly contradict these possibilities, however. Mortality salience did not impair performance on congruent Stroop trials (Study 6) or on rote memory (Study 7), as one might have expected if the hyperaccessibility of death thoughts or worldview constructs impaired cognitive performance. If participants' minds were full of rebounding thoughts of death, for instance, they probably would not have been able to perform very well at rote memory.

To provide another test of the alternative explanation that mortality salience impairs self-regulation via distraction, in Study 8 we tested for moderation by trait self-esteem. There is some evidence that mortality salience might not increase the accessibility of death thoughts or worldview defense among individuals with high self-esteem (see Pyszczynski et al., 2004). We made the following hypothesis: If the hyperaccessibility of death thoughts and not the depletion of self-regulatory resources impairs self-regulation following mortality salience, then self-esteem might moderate the effect of mortality salience on self-regulation.

Study 8

Participants in Study 8 first wrote about either death or dental pain and then solved anagrams. Solving anagrams has been used

frequently in prior research on self-regulation (e.g., Baumeister et al., 1998; Gordijn et al., 2004). The task requires self-control insofar as one must combine letters into different groupings and then break them apart (overriding) to try a different combination. Persistence and attention control are also required, insofar as one must work diligently on the task and avoid being distracted, and so self-regulation is required to remain focused and succeed. We predicted that participants would solve fewer anagrams after writing about death than after writing about dental pain, consistent with the idea that suppressing thoughts of death requires and therefore depletes self-regulatory strength.

Method

Participants. Participants were 46 undergraduates (32 women, 14 men) who completed the Rosenberg Self-Esteem Scale during a mass-testing session at the start of the semester. The present study occurred approximately 3 months later. The study was conducted in a classroom setting, and participants were told that the study was to investigate personality and cognition.

Procedure. At the beginning of the session, participants were given a list of 80 five-letter anagrams to solve to serve as a baseline measure of anagram-solving ability. They were given 5 min to complete as many anagrams as they could. Next, participants were randomly assigned to respond to the questions about death or dental pain that were used in Study 6. To provide a delay that would allow time for participants to suppress thoughts of death, we then asked participants to complete two filler questionnaires for approximately 5 min. For the final task, participants were given another list of anagrams to solve for 5 min.

Last, participants were probed for suspicion. No participant indicated that he or she thought that writing about death or dental pain might influence performance at solving anagrams.

Results and Discussion

Anagram performance. An analysis of covariance that used the number of anagrams solved at the start of the session as a covariate indicated that mortality-salience participants solved fewer anagrams at the end of the session ($M = 18.27$, $SD = 5.68$) than did dental-pain participants ($M = 21.80$, $SD = 5.68$), $F(1, 43) = 4.41$, $p < .05$. Mortality-salience and dental-pain participants did not differ in the number of anagrams solved at the start of the session ($t < 1$, *ns*). These results are consistent with the idea that coping with thoughts of death requires and therefore depletes self-control strength.

Self-esteem. A regression analysis indicated that the effect of mortality salience on anagram performance was not moderated by self-esteem ($t < 1$, *ns*). This suggests that the effect of mortality salience was not related to self-esteem, as might have been expected if the relationship between mortality salience and anagram performance was attributable to hyperaccessibility of death thoughts or worldview constructs.

Study 9

The purpose of Study 9 was to provide additional evidence that mortality salience depletes self-regulatory strength and that the self-regulatory impairments following mortality salience are not caused by worldview activation or a rebound in thoughts of death. Specifically, after writing about death or dental pain, participants completed a sheet filled with word fragments (e.g., *so_a*). We told participants to solve all of the word fragments but that they could stop when they wanted. The word fragments were relatively easy and with enough persistence (self-control), one could eventually solve each one by substituting into the word fragment different letters in the alphabet. Still, the task is lengthy and discouraging, and so persisting requires one to override the impulse (strengthened by the experimenter's permission) to quit. In this sense, quitting early and leaving more word fragments unsolved was an indicator of impaired self-regulation.

Further, as in the previous studies, some of the word fragments could be solved with words related to death. Responses to these items served as a measure of death-thought accessibility that allowed us to test whether impaired self-regulation following mortality salience might be attributable to the hyperaccessibility of death thoughts.

As another approach to examine whether the hyperaccessibility of death thoughts (rather than self-control depletion) after mortality salience impairs subsequent self-regulatory performance, we provided an opportunity for participants to engage in worldview defense before solving the word fragments. There is some evidence that engaging in worldview defense after thinking about death reduces the accessibility of death thoughts (Arndt et al., 1997; Greenberg et al., 2001). Therefore, if mortality salience leads to worldview defense, then any subsequent impairments in self-regulation would likely not be due to heightened accessibility of death thoughts.

Method

Participants. Participants were 55 undergraduates (24 women, 18 men, 13 unreported). The study was conducted in a classroom setting, and participants were told that it was to investigate the relationship between people's attitudes and their lexicon. Participants received a packet that contained all materials for the experiment and were allowed to work through the packet at their own pace.

Procedure. Participants first completed a filler questionnaire and then the same mortality-salience manipulation used in Study 8. Specifically, participants were randomly assigned to write about either death or dental pain. After this questionnaire, participants completed two more filler questionnaires for approximately 5 min to provide time for participants to suppress any thoughts about death.

The next questionnaire constituted the measure of worldview defense. Specifically, participants read two handwritten essays about the United States that were ostensibly written by two foreigners (borrowed from Greenberg, Simon, Pyszczynski, Solomon, & Chatel's, 1992, study). The order of the two essays was counterbalanced across participants. One essay was in support of the United States and praised Americans, whereas the other essay was not in support of the United States and criticized Americans. Participants evaluated the truth and validity of the essay and the likability, intelligence, and knowledgeability of each essay's author on 9-point scales. The summed evaluations of each essay served as the measures of favorability toward worldview-consistent and worldview-inconsistent opinions, respectively. In accord with past research (e.g., Greenberg et al., 1994), worldview defense was defined as the difference between these two measures. Larger differences indicate more pronounced worldview defense.

For the final task, participants completed the same list of 20 word fragments used in Study 1A. Specifically, 15 word fragments could be solved with only neutral words not related to death (e.g., *soda*), and 5 word fragments could be solved with either neutral or death-related words. Participants were asked to do their best to solve all of the word fragments

and were given as much time as they needed to complete the task. It was left to their discretion as to when they decided to stop.

Results and Discussion

Worldview defense. Mortality-salience participants engaged in worldview defense ($M = 13.71$, $SD = 12.93$) to a greater extent than did dental-pain participants ($M = 7.69$, $SD = 13.06$), $t(51) = -1.65$, $p = .05$ (one-tailed). This finding is consistent with previous research showing that mortality salience increases worldview defense. Given past findings that worldview defense reduces the accessibility of death thoughts (Arndt et al., 1997; Greenberg et al., 2001), this suggests that the accessibility of death thoughts may have been attenuated among mortality-salience participants.

Unsolved word fragments. Mortality-salience participants left more neutral word fragments unsolved ($M = 3.52$, $SD = 3.86$) than did dental-pain participants ($M = 1.43$, $SD = 1.58$), $t(27.37) = -2.45$, $p < .05$ (degrees of freedom have been adjusted to correct for a violation of the homogeneity of variance assumption). This is consistent with the idea that mortality salience, or at least the typical response to it, is depleting. Mortality-salience participants persisted less on the subsequent task than did dental-pain participants.

Further, the difference between the two conditions in the number of word fragments left unsolved remained significant even when controlling for the number of target items completed with words related to death (implicit death thoughts) and worldview defense scores (both Fs ≥ 6.87, ps $< .05$). This suggests that any difference between mortality-salience and dental-pain participants in the extent to which death thoughts were cognitively accessible or the extent to which they engaged in worldview defense did not account for the finding that mortality-salience participants left more word fragments unsolved. The impairments in self-regulation among mortality-salience participants therefore appeared independent of death-thought accessibility and worldview defense.

In addition, mortality-salience and dental-pain participants did not differ in the number of target items related to death unsolved ($t < 1.05$, *ns*). This suggests that mortality-salience participants did not leave more neutral word fragments unsolved simply because they solved instead more death-related word fragments.

Further analysis indicated that greater worldview defense was associated with leaving more neutral word fragments unsolved, $r(53) = .27$, $p = .05$. This suggests that being more threatened by the thought of death (and hence being more defensive) was associated with greater depletion. The fact that worldview defense did not account for the effect of mortality salience on depletion, however, indicates that engaging in worldview defense was not the cause of depletion. Rather, it was likely the self-regulatory effort of having to cope with the threat of death that depleted self-regulatory resources.

In sum, participants who wrote about death solved fewer neutral word fragments than did participants who wrote about dental pain. Results also indicated that the accessibility of death thoughts probably did not account for the differences in self-control. Mortality-salience participants persisted less even though they were given the opportunity to engage in worldview defense, which should have attenuated the accessibility of death thoughts (Arndt et al., 1997; Greenberg et al., 2001). Likewise, the number of implicit death thoughts and the extent of worldview defense did not seem to account for their reduced persistence. The most parsimonious explanation for these results is that participants' self-regulatory resources were depleted following mortality salience.

General Discussion

The current work shows that self-regulation plays a key role in managing thoughts of death and death-related anxiety. Using a variety of measures and manipulations, in nine studies we showed that poor self-regulation undermines the management of mortality concerns and that the management of mortality concerns undermines subsequent self-regulation. Specifically, people with low trait self-control had more thoughts about death and higher death anxiety than did people with high trait self-control (Studies 1A–1C). Low state self-control, created by prior and seemingly irrelevant exercises that depleted self-regulatory strength, likewise made people more susceptible to intrusive thoughts about death (Studies 2–3). Perceiving oneself to be low in self-regulatory strength was associated with a similar upsurge in thoughts of death and death anxiety (Study 4). In addition, one defensive reaction to the threat of death is to increase support for an ostensibly strong and patriotic authority figure (Cohen et al., 2004; Landau et al., 2004), and such defensive shifts in political preferences in response to thoughts of death were found mainly among people low in trait self-control (Study 5).

Further, mortality salience led to impairments in self-regulation. Participants who had to think and write about death later performed worse on the Stroop task (Study 6) and analytical reasoning problems (Study 7), solved fewer anagrams (Study 8), and quit sooner on a task of persistence (Study 9), as compared with participants who wrote about a control topic. People effortfully suppress thoughts of death following their activation (Arndt et al., 1997; Greenberg et al., 1994; Harmon-Jones et al., 1997; Pyszczynski et al., 1999), and so it seems likely that the act of suppressing thoughts of death after writing about death depleted participants' self-regulatory strength.

These findings are consistent with the view that thoughts about death and mortality are disturbing and are widely treated as threats that must be kept at bay. Specifically, we propose that the world contains many cues that could evoke thoughts and feelings about death, and that people use self-regulation to prevent these cues from flooding the conscious mind with troublesome thoughts and aversive emotions such as anxiety (Greenberg, Pyszczynski, & Solomon, 1986). But because the capacity for self-regulation is limited, and because some people have more of it than others, the regulatory process is not consistently effective. Hence some stimuli will evoke conscious thoughts about death, at least for some of the people some of the time. Trait and state capacity for self-regulation appears to offer an effective basis for predicting and understanding who will suffer most from such thoughts and fears.

Implications, Limitations, and Alternative Explanations

These results are consistent with previous work showing that people actively and effortfully suppress thoughts of death (e.g., Greenberg et al., 1994; Harmon-Jones et al., 1997). Whereas previous work showed that a concurrent cognitive load undermines the suppression of death thoughts (Arndt et al., 1997), the current work indicates that depleted self-regulatory strength and low trait

self-control also undermine the suppression of death thoughts. And conversely, the suppression of death thoughts depletes self-control strength. Taken together, the picture that emerges is that people actively seek to suppress or minimize awareness of death and that concurrent cognitive activity, previous self-regulatory exertion, or habitually poor self-regulatory abilities undermine such efforts.

Though a few alternative explanations may be proposed for the link between self-control and mortal concern, they seem largely unable to account for the bulk of the current findings. Specifically, the results appeared independent from any effects of self-esteem, arousal, mood, or general negative affect (i.e., general anxiety and social anxiety in Study 1C). Some effects may be explainable in terms of social desirability, such as if people giving socially desirable responses reported having both high self-control and low death anxiety, yet this view cannot adequately account for all of the findings. It is unclear, for example, how social desirability would have been related to support for President Bush (Study 5). The social desirability explanation also does not easily account for the fact that mortality salience impaired performance on tasks that required self-control but not other cognitive tasks (Studies 6 and 7). We also controlled for self-esteem in most of the studies. Insofar as reporting having high self-esteem indicates giving socially desirable responses, then the results do not appear caused by differences in social desirability.

Further, the effect of depletion following mortality salience did not appear attributable to distraction by thoughts about death (Study 9), active attempts toward defending one's worldviews (Study 9), or deficits to general cognitive abilities (Studies 6 and 7). The most parsimonious conclusion is that mortality salience impaired self-control by depleting self-regulatory resources. Indeed, mortality salience increased worldview defense (Study 9), a defensive reaction aimed at coping with the threat of death, and greater worldview defense predicted (but did not account for) greater depletion. Participants who seemingly attempted to cope the most with death and therefore found it the most frightening were the most depleted.

Studies 1A–1C were correlational, which makes it difficult to draw causal conclusions. Still, they do indicate a personality pattern that seems to make people more vulnerable to unwelcome thoughts and emotions. Preliminary evidence has linked low self-control to a variety of maladaptive behavior patterns (e.g., Gottfredson & Hirschi, 1990; Tangney et al., 2004). It is plausible that one reason people with low versus high self-control engage in such maladaptive behaviors is that they have substantial death anxiety. For example, both low self-control and death anxiety are associated with increased aggression (McGregor et al., 1998; Stucke & Baumeister, in press; Tangney et al., 2004) and risky sexual behavior (Taubman Ben-Ari, 2004; Wills, Gibbons, Gerrard, Murry, & Brody, 2003). Perhaps people with low self-control engage in such behaviors in part as a response to preoccupation with death (see Tice, Bratslavsky, & Baumeister, 2001).

If we could generalize the present results to other sources of stress, threat, and trauma, this work would be even more important, but we hesitate to generalize without further evidence. It is plausible that self-regulation might be more closely tied to coping with the threat of death than with other threats or aversive states. The thought of death can be especially threatening and trigger active efforts toward suppression (e.g., Arndt et al., 1997), perhaps more so than most other thoughts. Our use of dental pain and uncertainty as control conditions was intended to differentiate death from other bad thoughts, and clearly in the present studies death had effects that were not duplicated by dental pain or uncertainty. Death could represent a particularly important problem because it threatens to nullify one's life and its meaning, and so people may seek to defend against the thought of death more extensively than they would defend against the thought of other misfortunes. Future research may profitably examine whether self-regulation and self-control depletion are relevant to psychological defenses against more than death.

Concluding Remarks

Coping with unwanted thoughts and feelings can be an effortful struggle. Death is inevitable and inescapable, and so people must protect themselves from thoughts of death if they are to reduce the anxiety that the awareness of death might evoke. Rational attempts to deny death ultimately fail, however, and so people must engage in other defenses to ward off the threat of death (Pyszczynski et al., 1999). The current work indicates that self-regulation is a useful tool in the psychological defense against death. Through effective self-regulation, people can minimize their awareness of death and reduce anxiety associated with death. But this peace of mind comes at a cost. When thoughts of death arise, it takes effortful self-control to suppress them, and these efforts consume resources that leave people with less self-control afterward—causing people to perform less effectively on many tasks. Conversely, expending resources on any sort of self-control task reduces one's defenses, thereby opening the door for disturbing thoughts of death.

References

Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interaction.* Newbury Park, CA: Sage.

Anderson, M. C., & Green, C. (2001, March 15). Suppressing unwanted memories by executive control. *Nature, 6826,* 366–369.

Aries, P. (1981). *The hour of our death.* New York: Oxford University Press.

Arndt, J., Greenberg, J., & Cook, A. (2002). Mortality salience and the spreading activation of worldview-relevant constructs: Exploring the cognitive architecture of terror management. *Journal of Experimental Psychology: General, 131,* 307–324.

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.

Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology, 74,* 1252–1265.

Baumeister, R. F., Heatherton, T. F., & Tice, D. M. (1994). *Losing control: How and why people fail at self-regulation.* San Diego, CA: Academic Press.

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

Cohen, F., Solomon, S., Maxfield, M., Pyszczynski, T., & Greenberg, J. (2004). Fatal attraction: The effects of mortality salience on evaluations of charismatic, task-oriented, and relationship-oriented leaders. *Psychological Science, 15,* 846–851.

Feifel, H., & Branscomb, A. B. (1973). Who's afraid of death? *Journal of Abnormal Psychology, 81,* 282–288.

Finkel, E. J., & Campbell, W. K. (2001). Self-control and accommodation in close relationships: An interdependence analysis. *Journal of Personality and Social Psychology, 81,* 263–277.

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.

Gailliot, M. T., & Baumeister, R. F. (in press). Self-control and business ethics: How strengthening the self benefits the corporation and the individual. In R. A. Giacalone, C. L. Jurkiewicz, & C. Dunn (Eds.), *Positive psychology, ethics, and social responsibility in organizational life.* Greenwich, CT: Information Age.

Gilbert, D., T., Krull, D. S., & Pelham, B. W. (1988). Of thoughts unspoken: Social inference and the self-regulation of behavior. *Journal of Personality and Social Psychology, 55,* 685–694.

Gordijn, E. H., Hindriks, I., Koomen, W., Dijksterhuis, A., & Van Knippenberg, A. (2004). Consequences of stereotype suppression and internal suppression motivation: A self-regulation approach. *Personality and Social Psychology Bulletin, 30,* 212–224.

Gottfredson, M. R., & Hirschi, T. (1990). *A general theory of crime.* Stanford, CA: Stanford University Press.

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., Martens, A., Jonas, E., Eisenstadt, D., Pyszczynski, T., & Solomon, S. (2003). Psychological defense in anticipation of anxiety: Eliminating the potential for anxiety eliminates the effect of mortality salience on worldview defense. *Psychological Science, 14,* 516–519.

Greenberg, J., Pyszczynski, T., & Solomon, S. (1986). The causes and consequences of a need for self-esteem: A terror management theory. In R. F. Baumeister (Ed.), *Public self and private self* (pp. 189–212). New York: Springer-Verlag.

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

Greenberg, J., 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., Pyszczynski, T., Solomon, S., & Chatel, D. (1992). Terror management and tolerance: Does mortality salience always intensify negative reactions to others who threaten one's worldview? *Journal of Personality and Social Psychology, 63,* 212–220.

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.

Heine, S. J., Harihara, M., & Niiya, Y. (2002). Terror management in Japan. *Asian Journal of Social Psychology, 5,* 187–196.

Landau, M. J., Solomon, S., Greenberg, J., Cohen, F., Pyszczynski, T., Arndt, J., et al. (2004). Deliver us from evil: The effects of mortality salience and reminders of 9/11 on support for President George W. Bush. *Personality and Social Psychology Bulletin, 30,* 1136–1150.

MacLeod, C. M. (1989). Directed forgetting affects both direct and indirect tests of memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 15,* 13–21.

MacLeod, C. M. (1991). Half a century of research on the Stroop effect: An integrative review. *Psychological Bulletin, 109,* 163–203.

Mattick, R. P., & Clarke, J. C. (1998). Development and validation of measures of social phobia scrutiny fear and social interaction anxiety. *Behaviour Research and Therapy, 36,* 455–470.

Mayer, J. D., & Gaschke, Y. N. (1988). The experience and meta-experience of mood. *Journal of Personality and Social Psychology, 55,* 102–111.

McBride, D. M., & Dosher, B. A. (1997). A comparison of forgetting in an implicit and explicit memory task. *Journal of Experimental Psychology: General, 126,* 371–392.

McGregor, H. A., Lieberman, J. D., Greenberg, J., Solomon, S., 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.

Mischel, W., Shoda, Y., & Peake, P. K. (1988). The nature of adolescent competencies predicted by preschool delay of gratification. *Journal of Personality and Social Psychology, 54,* 687–696.

Muraven, M., & Baumeister, R. F. (2000). Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin, 126,* 247–259.

Muraven, M., Tice, D. M., & Baumeister, R. F. (1998). Self-control as a limited resource: Regulatory depletion patterns. *Journal of Personality and Social Psychology, 74,* 774–789.

Ochsmann, R., & Mathey, M. (1994). *Depreciating of and distancing from foreigners: Effects of mortality salience.* Unpublished manuscript, Universitat Mainz, Mainz, Germany.

Pollak, J. M. (1979). Correlates of death anxiety: A review of empirical studies. *Omega: Journal of Death & Dying, 10,* 97–121.

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 Review, 106,* 835–845.

Pyszczynski, T., Greenberg, J., Solomon, S., Arndt, J., & Schimel, J. (2004). Why do people need self-esteem? A theoretical and empirical review. *Psychological Bulletin, 130,* 435–468.

Rosenberg, M. (1965). *Society and the adolescent self-image.* Princeton, NJ: Princeton University Press.

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.

Schmeichel, B. J., Vohs, K. D., & Baumeister, R. F. (2003). Intellectual performance and ego depletion: Role of the self in logical reasoning and other information processing. *Journal of Personality and Social Psychology, 85,* 33–46.

Shiffrin, R. M., & Schneider, W. (1977). Controlled and automatic human information processing: I. Detection, search, and attention. *Psychological Review, 84,* 1–66.

Shoda, Y., Mischel, W., & Peake, P. K. (1990). Predicting adolescent cognitive and self-regulatory competencies from preschool delay of gratification: Identifying diagnostic conditions. *Developmental Psychology, 26,* 978–986.

Smart, L., & Wegner, D. M. (1999). Covering up what can't be seen: Concealable stigma and mental control. *Journal of Personality and Social Psychology, 77,* 474–486.

Spielberger, C. D., Gorsuch, R. L., & Lushene, R. E. (1970). *Manual for the State–Trait Anxiety Inventory.* Palo Alto, CA: Consulting Psychologists.

Stucke, T. S., & Baumeister, R. F. (in press). Ego depletion and aggressive behavior: Is the inhibition of aggression a limited resource? *European Journal of Social Psychology.*

Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality, 72,* 271–322.

Taubman Ben-Ari, O. (2004). Intimacy and risky sexual behavior: What does it have to do with death? *Death Studies, 28,* 865–887.

Templer, D. I. (1970). The construction and validation of a death anxiety scale. *Journal of General Psychology, 82,* 165–177.

Tice, D. M., Bratslavsky, E., & Baumeister, R. F. (2001). Emotional distress regulation takes precedence over impulse control: If you feel bad, do it! *Journal of Personality and Social Psychology, 80,* 53–67.

Twenge, J. M., Muraven, M., & Tice, D. M. (2004). *Measuring state self-control: Reliability, validity, and correlations with physical and psychological stress.* Unpublished manuscript, San Diego State University.

van den Bos, K., Poortvliet, P. M., Maas, M., Miedema, J., & van den Ham, E. J. (2005). An enquiry concerning the principles of cultural norms and values: The impact of uncertainty and mortality salience on reactions to violations of bolstering of cultural worldviews. *Journal of Experimental Social Psychology, 41,* 91–113.

Wegner, D. M. (1994). Ironic processes of mental control. *Psychological Review, 101,* 34–52.

Wegner, D. M., Schneider, D., Carter, S. R., & White, T. L. (1987). Paradoxical effects of thought suppression. *Journal of Personality and Social Psychology, 53,* 5–13.

Wegner, D. M., & Zanakos, S. (1994). Chronic thought suppression. *Journal of Personality, 62,* 615–640.

Wenzlaff, R. M., & Wegner, D. M. (2000). Thought suppression. *Annual Review of Psychology, 51,* 59–91.

Wills, T. A., Gibbons, F. X., Gerrard, M., Murry, V. M., & Brody, G. H. (2003). Family communication and religiosity related to substance use and sexual behavior in early adolescence: A test for pathways through self-control and prototype perceptions. *Psychology of Addictive Behaviors, 17,* 312–323.

Received May 1, 2005
Revision received November 1, 2005
Accepted November 3, 2005 ■

ORDER FORM

Start my 2006 subscription to ***Journal of Personality and Social Psychology***! ISSN: 0022-3514

___ $202.00, APA MEMBER/AFFILIATE _____
___ $421.00, INDIVIDUAL NONMEMBER _____
___ $1,249.00, INSTITUTION _____
In DC add 5.75% / In MD add 5% sales tax _____
TOTAL AMOUNT ENCLOSED $ _____

Subscription orders must be prepaid. (Subscriptions are on a calendar year basis only.) Allow 4-6 weeks for delivery of the first issue. Call for international subscription rates.

SEND THIS ORDER FORM TO:
American Psychological Association
Subscriptions
750 First Street, NE
Washington, DC 20002-4242

AMERICAN PSYCHOLOGICAL ASSOCIATION

Or call **800-374-2721**, fax **202-336-5568**.
TDD/TTY **202-336-6123**.
For subscription information, e-mail:
subscriptions@apa.org

Send me a FREE Sample Issue
Check enclosed (make payable to APA)
Charge my: VISA MasterCard American Express

Cardholder Name _____
Card No. _____ Exp. Date _____
_____
Signature (Required for Charge)

BILLING ADDRESS:
Street _____
City _____ State _____ Zip _____
Daytime Phone _____
E-mail _____

MAIL TO:
Name _____
Address _____
_____
City _____ State _____ Zip _____
APA Member # _____ *PSPA16*