Mortality Salience Reduces Attentional Bias for Fear-Relevant Animals

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Abstract

This research investigated the influence of reminders of mortality on biased attention for fear-relevant animals across 2 studies. In each study, participants completed a baseline dot-probe test of attention to fear-relevant animals (snakes and spiders). After random assignment, participants completed a mortality salience or control writing task (about watching television in Study 1 and about writing an important exam in Study 2). Finally, participants completed the dot-probe measure a second time. In both studies, those in the mortality salience condition showed a significant reduction in bias for fear-relevant animals from baseline to post-manipulation, whereas no change was found for those in the control conditions. These data suggest that the previously demonstrated lack of emotional response to mortality salience may, in part, result from the avoidance of fear-relevant stimuli.

Mortality Salience Eliminates Attentional Bias for Fear-Relevant Stimuli

Terror Management Theory (TMT; for a review, see Greenberg, Solomon, & Pyszczynski, 1997) has focused researchers on the ever-present potential for fear and anxiety arising from awareness of mortality. TMT suggests that human psychology is powerfully motivated by the desire to keep consciousness free from thoughts of death. One research paradigm in this tradition examines individuals' responses to conscious reminders of their mortal nature. This line of work suggests that psychological defenses against conscious thoughts of mortality operate in 2 stages (Pyszczynski, Greenberg, & Solomon, 1999). The process operates by first moving death thoughts out of conscious awareness (*proximal defenses*), then by resolving death anxieties lingering at the periphery of consciousness through symbolic identification with cultural structures that will outlive the individual (*distal defenses*). Proximal defenses occur immediately following death reminders, and work to resolve death concerns relatively directly by rationalizing away feelings of vulnerability to mortality or cognitively suppressing thoughts of death. Distal defenses operate at a more abstract level by affirming one's sense of worth in the context of a meaningful cultural system, and are manifest only after a delay of a few minutes between the mortality reminder and the dependent measure (Pyszczynski et al., 1999).[1]

The current research focuses on the attentional processes that are associated with the proximal defense stage (i.e., immediately following reminders of death). Research examining proximal defenses against conscious reminders of mortality suggests that active thoughts of death result in one of two defensive reactions. If possible, individuals engage in thoughts or behaviors that suggest they are not susceptible to death in the immediate future. For example, following conscious reminders of death, young adults have been shown to endorse self-aspects related to a long life (Greenberg, Arndt, Simon, Pyszczynski, & Solomon, 2000), indicate greater

intentions to engage in healthy behaviors (Arndt, Schimel, & Goldenberg, 2003; Taubman Ben-Ari, & Findler, 2005), and report invulnerability to physical pain (MacDonald, 2008). In the absence of such opportunities for rationalization, those reminded of their mortality cognitively suppress death-related thought (Greenberg, Pyszczynski, Solomon, Simon, & Breus, 1994).

Researchers have explained the process by which death-thought is suppressed by drawing on Wegner's (1994) ideas regarding ironic processes of mental control. Wegner (1994) proposed that efforts to control unwanted thought involve both a relatively conscious process that searches for cognitions unrelated to the unwanted thought (i.e., the desired state of consciousness) and a relatively non-conscious process that monitors for signs that the unwanted thought may be reemerging. The ironic aspect of such suppression attempts is that, by maintaining vigilance for the unwanted thought, the latter process may lead to increased identification and activation of the undesired cognition. In the mortality salience context, efforts to suppress death-related thought should involve conscious processes aimed at distraction and unconscious processes that are alert for thoughts of death (Arndt, Greenberg, Solomon, Pyszczynski, & Simon, 1997). Research suggests that efforts to suppress death-related thought are successful immediately following reminders of mortality, but that the underlying vigilance for thoughts of death leads such thoughts to become highly accessible as time passes (Arndt et al., 1997).

Although the evidence is clear that reminders of mortality lead to the suppression of death-related thought, we propose that such suppression is not strictly limited to thoughts of death, but rather extends to threatening stimuli more generally. In order for death cues to be processed quickly enough to allow them to be suppressed before emerging into consciousness, these cues may well need to be processed in terms of very basic features (i.e., accuracy sacrificed for speed of processing). As a result, cognitions that share some of death's basic features, such as strong threat value, may also be suppressed following mortality salience. Thus, during the

proximal defense stage, when research suggests that death-thought suppression efforts are successful (Arndt et al., 1997), strong threat-related cognitions besides death may also be kept from conscious awareness.

Past research has hinted at the possibility that threatening stimuli other than death-thought may be suppressed during the proximal defense stage, but limitations in methodology may have undermined its ability to pinpoint the effect. In one of the few direct examinations of the cognitive processes underlying proximal mortality defenses, DeWall and Baumeister (2007) found that participants in a mortality salience condition completed more word stems with positive emotion words immediately following the manipulation than those in a control condition. Of most relevance to the current research, a marginal effect such that mortality salience led to completion of fewer negative emotion words was also found. This latter finding is consistent with the avoidance of fear-relevant stimuli other than thoughts of death. However, as the word-completion measure is not designed to track cognitive processes in real-time it may lack sensitivity.

In order to more sensitively test the effects of mortality salience on the processing of fear-relevant stimuli during the proximal defense stage, the current research employed the dot-probe paradigm. In the dot-probe task, participants are presented simultaneously with two visual images and asked to indicate which of the stimuli is replaced by a target probe. If a particular stimulus captures attention preferentially, reaction times to probes that replace that stimulus should be relatively fast. The validity of the dot-probe task is attested to by research showing that individuals high in trait anxiety, who should be hypervigilant for threat, respond more quickly to probes that replace threat-related words than neutral words (for a review, see Mogg & Bradley, 1999). However, as the threat value of a stimulus increases, the stimulus becomes increasingly likely to capture attention regardless of an individual's level of trait anxiety (Fox,

2004). Research has shown that images of so-called phylogenetically fear-relevant stimuli, such as snakes and spiders, are preferentially processed by anxious and non-anxious individuals alike (for a review see Öhman & Mineka, 2001). For example, Lipp and Derakshan (2005) showed that a dot-probe that replaced snakes or spiders was identified more quickly than a probe that replaced flowers or mushrooms, an effect that was not qualified by anxiety (state or trait) or general fearfulness. However, if mortality salience leads to the suppression of cognitions with strong threat value, then those reminded of mortality should not show such biased attention for fear-relevant animals.

Across 2 studies, the present research examined responses to visual images of fear-relevant stimuli (i.e., snakes and spiders) following random assignment to mortality salience or control conditions. Consistent with past research, we predicted that participants would demonstrate biased attention for fear-relevant animals at baseline. However, we also predicted a significant reduction in biased attention for fear-relevant animals following the manipulation among those randomly assigned to the mortality salience condition.

Study 1

Method

Participants

Participants were drawn from the University of Queensland introductory psychology participant pool and received course credit in exchange for participation. A total of 50 individuals participated (34 females, 14 males, 2 gender not recorded) ranging in age from 17 to 32 years (average age = 20.02 years, SD = 3.30).

Procedure

Participants arrived at the lab individually, and were told the study focused on emotional writing and attention. After informed consent was obtained, participants were seated at a

computer and provided with instructions for the dot-probe task (see below). This first dot-probe task provided a baseline measure of attentional bias. Following completion of this task, participants began the writing portion of the study.

The writing task formed the mortality salience manipulation, and was based on methods employed in previous TMT research (Rosenblatt, Greenberg, Solomon, Pyszczynski, & Lyon, 1989). Participants were asked to respond to 2 open-ended questions regarding either their own death (n = 26) or a control topic (n = 24). The instructions for the mortality questions read, "Please briefly describe the emotions that the thought of your own death arouses in you," and, "What do you think happens to you as you physically die and once you are physically dead?" Participants in the control condition wrote about watching television. The control questions read, "Please briefly describe the emotions that the thought of watching television arouses in you," and, "What happens to you emotionally as you watch television and once you have watched television" (Rosenblatt et al., 1989). Immediately upon completion of the writing task, participants engaged in the dot-probe task a second time. At the end of the study, participants were thanked and debriefed. This procedure was approved by the University of Queensland Behavioural and Social Science Ethical Review Committee.

Measures

Dot-probe task. The dot-probe task was run on a 486 compatible Dell PC with a 17-inch (43-cm) Dell Trinitron color monitor. The task was controlled by custom-written software run via DOS. Responses to the task were collected using a two-button box plugged in to the games port of the computer. Four pictures each of snakes, spiders, birds, and fish (16 total) provided the fear-relevant and fear-irrelevant stimuli. These pictures have been used in previous research on preferential processing of animal fear-relevant stimuli (Lipp & Waters, 2007). The pictures

were processed using Jasc Paint Shop Pro software and saved using a 256 color palette (Web save format, error diffusion method) at 300 X 225 pixels.

Participants were asked to indicate whether two small dots, the probe, that could appear either in the left or the right half of the screen were positioned vertically (:) or horizontally (..) by pressing the corresponding button on the button box. Buttons were labeled ':' or '..' and the location of the labels was counterbalanced across participants such that for half ':' was on the right. Participants completed 120 trials in this task. Each trial began with the presentation of a white fixation cross (1 pixel wide, 2 x 2 cm, 1.53° x 1.53°) in the centre of the screen. After 1000 ms, two pictures were added to the cross, one in the centre of the left and one in the centre of the right half of the screen. The pictures, e.g., a snake and a bird, were 7.73 x 10.34 cm in size (7.03° x 9.39°) separated by a gap of 3.24 cm (2.95°). The pictures were presented for 500 ms and were replaced by two white dots (8 pixels, .4 cm, .33°, in diameter) presented either horizontally or vertically in the centre of either the left or the right half-screen. Dots were presented for 1000 ms followed by a period of 4000 ms during which the computer waited for a response. Thus, a trial was terminated 4000 ms after the disappearance of the dots or when participants pressed one of the buttons. The fixation cross remained on the screen for the entire trial, i.e., for 6500 ms or until a button was pressed. The inter-trial interval, the time from button press to appearance of the next fixation cross, was 1000 ms. The trials were ordered in 5 blocks of 24 trials in which every combination of picture on the left (4) x picture on the right (3) x probe position (2) was presented. Two pictures depicting different animal species were presented on each trial. The nature of the probe, horizontal vs. vertical, was counterbalanced across trials such that each combination of probe and position was used equally often. The four different exemplar pictures were allocated to trials at random with the restriction that no picture was repeated before all others had been shown. The sequence of individual trials was randomized within blocks with

the restriction that no more than three consecutive trials were of the same content, e.g., a spider and a fish, or required the same response. All participants were presented with the same trial sequence.

Before the baseline dot-probe task began, participants completed 10 practice trials. They were instructed to press the button corresponding to the dots displayed as quickly as possible while being accurate. No practice trials were offered for the post-manipulation dot-probe task which began immediately following completion of the writing task.

Mood. Following the second dot-probe task, participants completed a measure of positive and negative mood created for use in the current study. Participants indicated the extent to which they currently felt a number of mood states on a 9-point scale (1 = *not at all* to 9 = *very strongly*). The positive mood items included happy, content, safe, and calm (Cronbach's α = .76), whereas the negative mood items included sad, hopeless, uncomfortable, and scared (Cronbach's α = .80)

Results

Probe detection times were measured in milliseconds and inspected for outliers defined as values falling three standard deviations or greater from the mean for each participant individually. Outliers and response times shorter than 100 ms were removed and coded as missing values. Errors, defined as pressing the wrong button, were recorded throughout the task. No main effects nor interactions of condition and time of testing were found for number of outliers or errors committed. Average response times were calculated with outlier and error trials removed. Only trials in which a fear-irrelevant animal and a fear-relevant animal were presented were included in the analyses. Attentional bias scores were calculated as the time taken to detect the probe when on the same side of the screen as a fear-relevant animal subtracted

from the time taken to detect the probe when on the opposite side of the screen as a fear-relevant animal. Thus, higher scores reflect more biased attention toward fear-relevant animals.

Computer problems led to the loss of data from two participants (one in each experimental condition). Analyses of bias for fear-relevant animals were conducted using a mixed-model ANOVA with one between participants factor (experimental condition) and one within-participants factor (time of testing). No main effects were found for the analysis of bias for fear-relevant animals, but the condition by time of testing interaction was significant, F (1, 46) = 7.61, p = .008, partial η^2 = .142, see Figure 1. For those in the mortality salience condition, bias for fear-relevant animals was significantly greater at baseline (M = 16.34, SD = 26.91) than following the manipulation (M = 2.55, SD = 26.28), t(46) = 8.01, p < .001. For those in the control condition, bias for fear-relevant animals did not significantly differ from baseline (M = 8.49, SD = 21.40) to post-manipulation (M = 13.32, SD = 20.78), t (46) = 1.07, *ns*. The difference between the mortality salience and control conditions was not significant at baseline, t (46) = 1.12, p = .267. This difference also did not reach significance at post-manipulation, although the direction of the trend was reversed, t (46) = -1.58, p = .121. In addition, an ANCOVA controlling for baseline bias suggested that post-manipulation bias was significantly lower in the mortality salience condition than the control condition, F (1, 45) = 6.15, p = .018. Analyses of bias within groups were conducted using one-sample t-tests. In the control condition, bias for fear-relevant animals was marginally significant (i.e., greater than 0) at baseline, t (24) = 1.98, p = .059, and conventionally significant post-manipulation, t (24) = 3.21, p = .004. In the mortality salience condition, bias for fear-relevant animals was significant at baseline, t (22) = 2.91, p = .008, but not post-manipulation, t (22) = 0.47, p = .646. Neither positive nor negative mood differed significantly across conditions (both ps > .30). Positive mood showed a marginally significant, positive relation with post-manipulation bias for

threatening animals, $r = .28$, $p = .052$. All other relations between the mood variables and attentional bias at either baseline or post-manipulation were not significant (all ps > .12).

Discussion

As predicted, participants who were consciously reminded of mortality exhibited a significant decrease in biased attention for fear-relevant animals. No such change in biased attention was evident for those in the control condition. One potential criticism of Study 1, however, is that the control condition involved writing about a relatively neutral topic. That is, the effect of the mortality salience condition could be attributed to either reminders of death per se or simply engaging with any stressful topic. Study 2 examined this interpretation by replacing the television writing task with a writing task focusing participants on an issue involving high degrees of stress for university students: taking an important exam.

Study 2

Method

Participants

Participants were drawn from the University of Queensland introductory psychology participant pool and received course credit in exchange for participation. A total of 38 individuals participated (31 females, 7 males) ranging in age from 17 to 34 years (average age = 19.11 years, SD = 2.90).

Procedure

The procedure for Study 2 was identical to that of Study 1, with one change. Rather than writing about television viewing, participants in the control condition wrote about writing their next important exam (Simon, Greenberg, Harmon-Jones, Solomon, et al., 1997). The instructions for the control questions read, "Please briefly describe the emotions that the thought of writing your next important exam arouses in you," and "What do you think will happen to you

as you write your next important exam and when you have written your next important exam?" (Simon et al., 1997). The Cronbach's α for the positive mood scale was .77 and for the negative mood scale was .80.

Results

The analysis strategy mirrored that of Study 1, including the removal of outlier and error trials. As in Study 1, no main effects nor interactions of condition and time of testing were found for number of outliers nor errors committed. No main effects were found for the analysis of bias for fear-relevant animals, but the condition by time of testing interaction was marginally significant, F (1, 36) = 2.99, p = .092, partial η^2 = .077, see Figure 2. For those in the mortality salience condition, bias for fear-relevant animals was significantly greater at baseline (M = 18.57, SD = 29.60) than following the manipulation (M = 8.38, SD = 16.78), t (36) = 2.07, p < .05. For those in the control condition, bias for fear-relevant animals did not significantly differ from baseline (M = 13.88, SD = 19.32) to post-manipulation (M = 21.03, SD = 19.51), t (36) = 1.02, *ns*. The mean difference in attentional bias did not differ across the mortality salience and control conditions at baseline, t < 1, *ns*. However, after the manipulation, bias was significantly lower in the mortality salience than the control condition, t (36) = 2.14, p = .039. This result was confirmed by an ANCOVA controlling for baseline bias, which again revealed significantly lower bias scores in the mortality salience than control condition, F (1, 35) = 4.43, p = .043. In the control condition, bias for fear-relevant animals was significant (i.e., greater than 0) at baseline, t (18) = 3.13, p = .006, and post-manipulation, t(18) = 4.70, p < .001. In the mortality salience condition, bias for fear-relevant animals was also significant at baseline, t (18) = 2.74, p = .014, and post-manipulation, t (18) = 2.18, p = .043. As in Study 1, neither positive nor negative mood differed significantly across conditions (both ps > .58). Nor did either mood

scale correlate significantly with attentional bias at either baseline or post-manipulation (all *p*s > .31).

Discussion

As in Study 1, participants in the mortality salience condition experienced a significant reduction in bias for fear-relevant animals following reminders of death. Also replicating Study 1, no change in attentional bias was found for those in the control condition. This was true despite the fact that participants in the control condition wrote about a potentially stressful topic. This suggests that the bias-reducing effect of the mortality salience condition is a result of reminders of death rather than reminders of stress more generally.

General Discussion

Across two studies, participants who were reminded of their mortality evidenced a significant reduction in degree of biased attention for snakes and spiders. This was not true for the control group in either Study 1 (who were reminded of television viewing) or Study 2 (who were reminded of stressful exam writing). These results suggest that not only do proximal defenses against mortality salience involve the suppression of death-related thought, but this defensive stage is also related to a failure to engage with fear-relevant information more generally.

These results are particularly interesting in light of the fact that, although people expect thinking about death to lead to the experience of negative emotion (DeWall & Baumeister, 2007), self-reported affect following reminders of mortality rarely differs from control conditions at either the proximal or distal defense stage (e.g., Arndt et al., 1997; Greenberg, Simon, Pyszczynski, Solomon, & Chatel, 1992). In addition, psychophysiological methods such as measures of skin-conductance (Rosenblatt et al., 1989) and facial electromyography (Arndt, Allen, & Greenberg, 2001) employed to detect any non-conscious emotional reactions to

mortality salience have provided little evidence of affective responses. This lack of negative emotional reaction to death reminders may seem understandable at the distal defense stage when coping mechanisms have had time to operate. However, a lack of negative emotional response seems more curious immediately following reminders of death when higher-order cognitive defenses have not had time to operate. The current results suggest that failing to engage with fear-relevant information may play a role in minimizing negative emotional responses to mortality salience. Importantly, distal defenses have been shown to be eliminated by a placebo pill purported to be an anxiety blocker, suggesting that although such defenses are not aimed at reducing a current experience of anxiety, they may be used to eradicate concerns over the *potential* to experience anxiety (Greenberg, Martens, Jonas, Eisenstadt, et al., 2003). As a result, the most practical implication of the current work for attention researchers may be the provision of a useful paradigm (i.e., reminders of mortality) for the investigation of emotional coping responses to situations that are seen as holding the potential to create strong anxiety without the need to recruit special populations (e.g., snake phobics).

However, the lack of emotional response to mortality salience also provides a particular challenge in understanding the mechanisms underlying the current set of results. Research has generally supported an important distinction in reaction to threat between fear responses and anxious responses (e.g., Gray & McNaughton, 2000; Grillon, 2002). Fear is construed as promoting response to an imminent danger whereas anxiety is construed as promoting preparation for the possibility of danger. In speculating on the mechanisms underlying the failure to engage with fear-relevant stimuli in the current research, the consistent lack of data supporting a particular emotional response to mortality salience makes unclear whether the current effect is best construed as a fear response or an anxious response. Indeed, the fact that

the effect was found for reminders of mortality but not another stressful event (writing an exam) suggests that the mechanism of action may be something other than anxiety or fear.

Although we have framed the current effect in terms of fear-relevant cues that are suppressed as a result of minimal processing of threat-related cognitions, our inability to point to a direct mechanism necessitates the consideration of alternative hypotheses. One possibility takes into account the unavoidable nature of death. Perhaps, when threat cannot be escaped, suppressing attention to threat may be a useful means of emotional coping. Research has suggested that feeling psychologically overwhelmed may lead to a state of overstimulation (Caruth, 1995). That is, unavoidable threat may trigger multiple competing thoughts and action tendencies. Reducing attention to threat may free cognitive resources, allowing higher-order processing and the restoration of psychological stability. Such an explanation is analogous to some key features of dissociative disorders including the compartmentalization or splitting off of negative memories following a traumatic event (Isaac & Chand, 2006). Conversely, the effortful suppression of death-related thought may consume cognitive resources during the proximal defense stage that are then unavailable for processing even the low-level perceptual features of fear-relevant stimuli. In this sense, the identification of a current threat may appropriate cognitive resources in order to deal with the current threatening situation, perhaps at the cost of one's ability to identify other potential threats. A third perspective suggests that exposure to a strongly threatening stimulus such as reminders of mortality may reduce the threat value of the ostensibly threatening stimuli used in Stroop and dot-probe tasks. In the current research, for example, reminders of mortality may have rendered images of snakes and spiders to a relatively non-threatening status. Analogously, although it is often said the average person is more scared of public speaking than death, this comparison would likely change in the face of a mortal threat. Clearly, further research will be needed before a mechanism can be confidently identified.

The current results are consistent with the trends found by DeWall and Baumeister (2007) showing lower completion of negative emotion word stems immediately following mortality salience, and thus in the proximal defense stage. However, it is important to note that the existing literature provides little evidence that the failure to engage with fear-relevant stimuli would extend to the distal defense stage. For example, in research incorporating both mortality reminders and a delay (necessary for the emergence of distal defenses), DeWall and Baumeister (2007) found that, relative to control conditions, those in mortality salience conditions were more likely to group positive words by emotional content rather than semantic meaning and were more likely to complete word stems with positive emotion words. However, this research found no differences across conditions for grouping of sadness- and fear-related words, or for the completion of word stems with negative emotion words. Thus, these researchers found evidence of bias for positive emotional stimuli at the distal defense stage, but not for a lack of engagement with negative stimuli.

Further, in other research examining attention to threat following both a reminder of mortality and a delay, reaction times to spider-related words in a Stroop task did not significantly differ across mortality and control conditions for either spider-phobic or non-phobic participants (the authors did note a non-significant trend towards reduced bias for spider-related words among spider phobics in the mortality salience condition; Strachan, Schimel, Arndt, Williams, Solomon, et al., 2007). On subsequent measures, spider-phobic participants in the mortality salience condition spent less time viewing pictures of spiders than phobic participants in the control condition. However, the phobic participants in the mortality salience condition also rated these pictures as more threatening. Thus, if anything, this mixed evidence more strongly supports heightened processing of fear-relevant stimuli at the distal defense stage, at least for phobic participants.

The present research is not without limitations. Most importantly, these studies failed to include reliable measures of anxiety and fear. Although a general mood measures revealed no relation between mood and attentional bias for fear-relevant animals, the items contained in this measure were not specific enough to distinguish between anxious and fearful responses. Such a measure would have been very useful in more specifically targeting the mechanism responsible for the current set of effects.

The current data provide unique insight into potential effects of mortality salience on attentional processes. Ironically, reminders of the ultimate threat of death appear to reduce rather than enhance biased attention to threatening stimuli. Future research examining the relation of this proximal response to mortality salience with more distal responses such as enhanced worldview defense would appear to be of value. More generally, this research may provide a useful tool for examination of the influence of anxiety-coping responses on attentional processes without the need to recruit samples of phobic individuals.

Footnotes

[1] Another TMT paradigm examining the effects of subliminal death reminders has shown that non-conscious death primes lead to distal defenses without a delay (e.g., Arndt, Greenberg, Pyszczynski, & Solomon, 1997).

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Figure 1. Bias for fear-relevant animals by experimental condition and time of testing. Higher scores indicate more bias for fear-relevant animals.

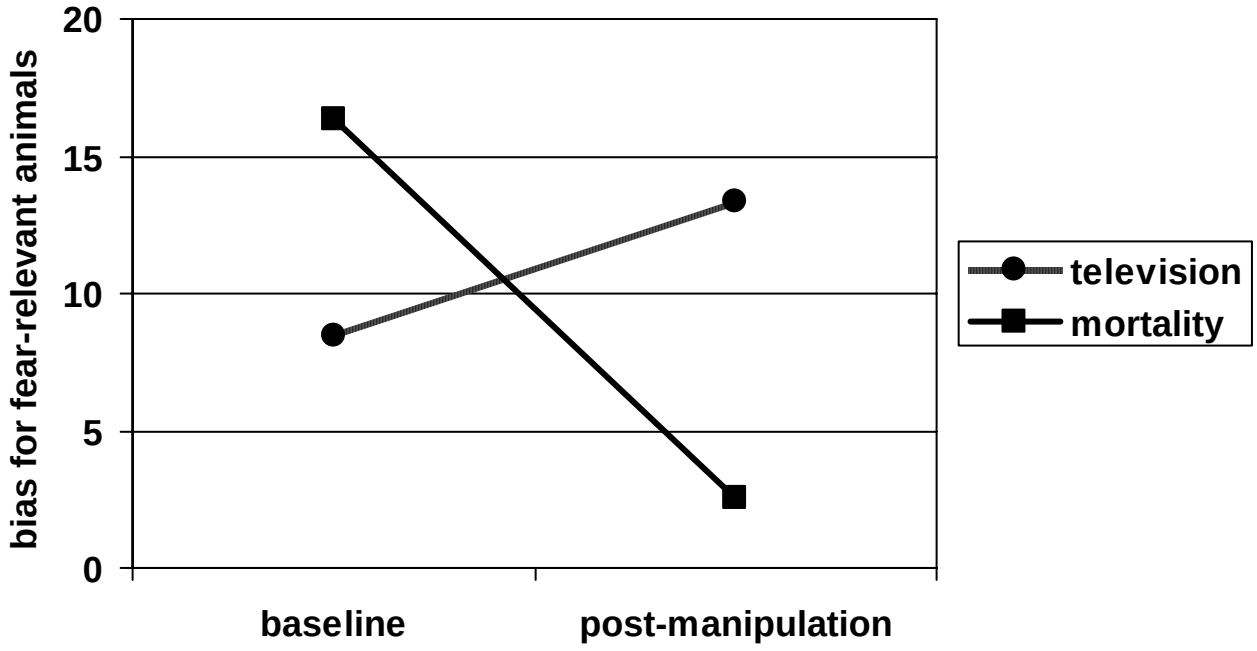

Figure 2. Bias for fear-relevant animals by experimental condition and time of testing. Higher scores indicate more bias for fear-relevant animals.