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# The impact of mortality awareness on meaning in life among Christians and atheists

Kenneth E. Vail III<sup>a</sup> and Melissa Soenke<sup>b</sup>

<sup>a</sup>Department of Psychology, Cleveland State University, Cleveland, USA; <sup>b</sup>Department of Psychology, California State University Channel Islands, Camarillo, USA

## ABSTRACT

Research derived from terror management theory suggests that reliance on a terror-managing set of beliefs when reminded of death can influence one's perception of meaning in life. The present research builds on prior work suggesting that religious concepts help to manage the awareness of death, and expands on that work to explore the challenges of religious and atheistic terror management. It was hypothesized that religious participants would be able to sustain perceived meaning in life when reminded of death, but that atheists would be vulnerable to a reduction in meaning when reminded of death. To test that idea, Christians and atheists were first reminded of either mortality or a control topic, and then asked to rate how strongly they felt life was meaningful. Results indicated that ratings of meaning in life were lower in the mortality salience condition, relative to the control condition, among the atheists but not among the Christians. Implications regarding religious and non-religious terror management strategies are discussed.

## ARTICLE HISTORY

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purpose

Humans face a unique problem in that, on the one hand, they share with other animals the evolutionarily adaptive motivation to survive, but on the other hand, they also have the unique cognitive ability to engage in the types of thought (e.g., self-aware, symbolic, temporal) that allow them to recognize their abstract and impending mortality. That awareness of the inevitability of death creates a potential for anxiety that must be managed to continue to effectively function in the world. According to terror management theory (TMT; Greenberg, Pyszczynski, & Solomon, 1986), to manage that awareness of impermanence – of death – people are motivated to maintain a sense of permanence by (1) adopting a cultural worldview, a socially constructed system of meaning that can offer a sense of secular (e.g., contributions to the future of society) or supernatural (e.g., heaven, afterlife) immortality, and (2) striving to live up to the standards and values of that worldview, reflected in self-esteem. By believing themselves to be a valued part of a seemingly permanent way of life, people can symbolically transcend the reality of their mortal impermanence. Indeed, reliance on cultural worldviews (Simon, Arndt, Greenberg, Solomon, & Pyszczynski, 1998) and self-esteem (Taubman - Ben-Ari, 2011) can sustain the perception that life is meaningful in the face of death. The present research examines whether specific worldviews – religious belief – offer similar meaning in the face of death.

Considerable research derived from TMT suggests that the awareness of mortality can motivate people to rely on their readily available worldviews to maintain a sense of meaning and provide a sense of existential security (see Pyszczynski, Solomon, & Greenberg, 2015 for review). For example, successfully affirming one's system of meaning and value can reduce worldview defence and death-

thought accessibility (e.g., Jonas & Fischer, 2006; Schmeichel & Martens, 2005). Other work has shown that when managing the awareness of death, the opportunity to engage in worldview defence (versus not engaging in such defense) can help maintain the perception of meaning in life (Simon et al., 1998). Similarly, individuals who do not rely on a well-structured meaning system (e.g., Vess, Routledge, Landau, & Arndt, 2009), or who fail to successfully uphold one (Taubman - Ben-Ari, 2011), appear to experience a blow to their meaning in life after being reminded of death. For example, among people with lower (compared to higher) self-esteem, mortality salience (MS) reduces the perception of meaning in life (Taubman - Ben-Ari, 2011) and increases the search for meaning (Juhl & Routledge, 2014). These findings point to the possibility that the awareness of mortality might have a negative impact on the perception of meaning in life among individuals who lack terror-managing beliefs, but not among those who adopt such beliefs.

Religious worldviews may represent one such belief system, and address the problem of mortality in a unique way: offering promises of supernatural immortality based on the idea that people have a soul that will continue to exist beyond physical death. Prior work has shown that heightened belief in religious concepts, such as belief in an afterlife and creation stories, is associated with reduced death thought accessibility and worldview defences (e.g., Dechesne et al., 2003; Schimel, Hayes, Williams, & Jahrig, 2007) and sustained sense of hope (Wisman & Heflick, 2015). Interestingly, research based on dual-process models of cognitive processing (Chaiken & Trope, 1999; Evans, 2008, 2010; see also Baumard & Boyer, 2013) suggests that these types of religious concepts appear to be cognitively intuitive, buttressed by basic adaptive cognitive inclinations (e.g., Barrett, 2004; Bloom, 2007; Boyer, 1994). That is, without logic and conscious attention, people engaging in quick, automatic, and implicit processing often “intuitively” over-extend basic cognitive abilities (e.g., theory of mind [supernatural agency], judgement of utility [teleology]) to facilitate religious concepts. In contrast, engaging in slower, more deliberate, and explicit processing allows people the opportunity to regulate their behaviours according to their adopted beliefs (e.g., Gervais, 2015; Gervais & Norenzayan, 2012; Jarnefelt, Canfield, & Kelemen, 2015). Thus, when people are motivated to manage the awareness of mortality they may automatically activate such terror-managing concepts (Norenzayan & Gervais, 2013; Vail & Soenke, 2015). Indeed, consistent with these ideas, mortality reminders motivate people to reflexively activate supernatural concepts (e.g., god, angel, heaven) and then, if those concepts are consistent with their accepted worldviews, to more strongly accept and express those concepts as religious belief (Jong, Halberstadt, & Bluemke, 2012; Norenzayan & Hansen, 2006; Vail, Arndt, & Abdollahi, 2012). This reliance on a set of terror-managing beliefs among religious believers may help sustain their perception that life is meaningful even when aware of death.

Atheists, however, explicitly reject religious supernatural concepts. Instead, they tend to seek symbolic immortality through secular value systems (e.g., Vail & Soenke, 2015) and possibly even literal immortality through scientific research and medical life extensions (e.g., Lifshin, Greenberg, Soenke, & Pyszczynski, 2016). That atheistic rejection of the supernatural in favour of the secular is also reflected in prior research findings. Mortality reminders do cause non-religious participants to automatically associate supernatural concepts as “real” (Jong et al., 2012), suggesting that even the non-religious respond to death awareness by reflexively preparing terror-managing supernatural concepts. But, when participants are allowed to reflect on their accepted beliefs, atheists do not allow those religious concepts to emerge as adopted, explicit belief (Jong et al., 2012). That is, when atheists are allowed to self-report their belief, MS does *not* increase non-religious participants’ general religiosity, faith in a higher power, or faith in any of a number of possible supernatural agents (Norenzayan & Hansen, 2006; Vail et al., 2012) and can even increase their rejection of religion (Jong et al., 2012, Study 1). Thus, when managing the awareness of mortality atheists reflexively activate supernatural concepts, but then when they are able to reflect on the fact that those concepts are not consistent with their accepted worldviews, they override those concepts to abstain from and more strongly reject religion. This rejection of, rather than acceptance of, a terror-managing set of religious beliefs may at least temporarily undermine atheists’ ability to perceive meaning in life when managing the increased awareness of death.

## The present research

Given the above analysis, the present research explored the previously untested hypothesis that reminders of death would undermine meaning in life among atheists, but not among the religious. To test that hypothesis, Christians and atheists were reminded of death (versus a control topic) and then perceived meaning in life was measured. Prior work has also shown that MS can reduce reports of meaning in life among those with low personal need for structure (PNS) (Vess et al., 2009), which may be associated with category (atheist versus religious), and polls show that certain demographic dimensions (e.g., age, sex, and education level) differ among the broader atheist versus religious populations (e.g., Pew Research Center, 2015). Therefore, the present work tested the moderating role of category (atheist versus religious) alongside measures of PNS, age, sex, and education level.

## Method

### Participants

The present theoretical perspective suggests that if we want to study what happens when people reject supernatural belief, then the critical category is the “atheist” category, and it must be clear that the individuals categorized as atheists meet the appropriate definition. Thus, the methodology in this study used a theory-informed categorization that views atheism as the “baseline” for non-belief, as the position that categorically rejects supernatural concepts. All other categories reflect positions that are likely to accept supernatural concepts in one way or another; some such people positively identify with an organized religion (Christian, Muslim, Jewish, Buddhist, Hindu, etc.), some accept supernatural concepts but do not accept organized religion (e.g., religiously unaffiliated; unchurched believers; spiritual but not religious, Heflick and Goldenberg (2012), for example, reported that “spiritual but not religious” participants expressed belief in supernatural concepts, such as an afterlife), and some are open to supernatural concepts but have not fully accepted them or feel their existence cannot be known (e.g., agnostics). Thus, although there is of course heterogeneity in strength of belief and strength of religious social “identity” among those who would identify as anything but atheist, the focus here is on the difference between atheists and non-atheists. For the purposes of this research, atheists were compared against the most abundantly available non-atheist group: Christians.

Additionally, meta-analyses of mortality salience effect sizes were consulted to estimate the sample sizes necessary to achieve a sufficient level of power to detect MS effects within each category (atheists, Christian), should such effects be present. Burke, Martens, and Faucher (2010) found an overall MS effect size of  $r = 0.35$  ( $d = 0.75$ ) on a broad range of studies using a wide variety of outcomes (defence of national identity, attitudes toward animals, health risk evaluations, sports team affiliations, physical aggression, attitudes toward women, self-complexity, academic test scores, etc.). Thus, an a priori power analysis (G\*Power; Faul, Erdfelder, Buchner, & Lang, 2009), assuming the anticipated  $r = 0.35$  ( $d = 0.75$ ), prescribed about 58 participants per each of the Christian and atheist samples, for a total sample size of about 116.

Because of the difficulty of locating and recruiting sufficient numbers of atheists for an in-lab study, the present research was conducted online (the survey was set to allow only IP addresses located in the USA). The study link was posted on Amazon Mechanical Turk (where the majority of subscribers are Christians) and to an atheist discussion forum ([www.reddit.com/r/atheism](http://www.reddit.com/r/atheism), where the majority of subscribers are atheists). The links remained active until we obtained the approximate numbers of participants recommended by the power analysis.

We obtained responses from 128 Mechanical Turk workers; of those 128 respondents, 56 identified as Christian, 19 as atheist, as well as 36 agnostic, 10 “spiritual,” 4 “other,” 1 Muslim, 1 Buddhist, 1 Hindu, and no Jewish. We also obtained responses from 75 /r/atheism online forum subscribers; of those 75 /r/atheism respondents, 60 identified as atheist, as well as 1 Christian, 7 agnostic, and 7

“other.” Overall, there were 203 respondents; of those, we obtained responses from 57 Christians and 79 atheists, as well as 43 agnostic, 11 “other,” 10 “spiritual,” 1 Muslim, 1 Buddhist, 1 Hindu, and no Jewish. Thus, enough Christian and atheist respondents were recruited to permit a sufficiently powered analysis, but respondents who indicated the non-atheist and non-Christian categories (agnostic, spiritual, Muslim, Jewish, Buddhist, Hindu, or “other”) were either not present or too few to permit a sufficiently powered analysis.<sup>1</sup>

The final sample consisted of 136 participants (age  $M = 34.62$ ,  $SD = 11.80$ , 3 missing; 79 male, 57 female; education  $M = 15.53$  years,  $SD = 2.74$  years). Of that final sample, 57 were Christian and 79 were atheist. The atheist and Christian samples did not differ in age ( $M = 33.82$  versus  $M = 35.68$ ,  $|t| < 1$ ). Cross-tabulation showed ( $\chi^2(1) = 4.63$ ,  $p = 0.03$ ) the samples differed in that the Christian sample had roughly equal proportions of males and females, whereas the atheist sample had higher proportions of males (66%) than females (34%), reflecting the broader atheist population (Pew Research Center, 2015). Atheists also tended to have roughly one more year of education (atheist  $M = 15.94$  versus Christian  $M = 14.96$  years,  $t(1,134) = 2.08$ ,  $p = 0.04$ ), again reflecting broader population differences (Pew Research Center, 2015).

### **Materials and procedure**

Data were collected during May 2015. The study was hosted on Qualtrics.com (Provo, UT) and participants were recruited via Amazon Mechanical Turk (AMT) in exchange for \$0.50 and from a specific online forum frequented by atheists (i.e., reddit.com/r/atheism). In all cases, the study link was posted using a neutral title and description (e.g., “A survey about social attitudes and personality”) to conceal its true purpose and associated hypotheses. Upon obtaining informed consent, the following materials (available as Supplementary Materials, Appendix A) were presented:

#### **Personal need for structure**

A short six-item version of the PNS scale (Thompson, Naccarato, Parker, & Moskowitz, 2001) was presented ( $\alpha = 0.89$ ). The PNS scale measures individual preferences for order, certainty, and unambiguous knowledge. Example items include, “I enjoy having a clear and structured mode of life” and “I become uncomfortable when the rules in a situation are not clear.” Each item used a 6-point Likert-type scale (1 = *strongly disagree*, 6 = *strongly agree*).

#### **Mortality salience**

Following previous research (Rosenblatt, Greenberg, Solomon, Pyszczynski, & Lyon, 1989), participants were randomly assigned to respond to either MS or a negative event topic prompt. In the MS condition, two prompts asked participants to “Please briefly describe the emotions that the thought of your own death arouses in you,” and “Jot down, as specifically as you can, what you think happens to you as you physically die.” The negative event topic prompts asked participants to “Please briefly describe the emotions that the thought of dental pain arouses in you,” and “Jot down, as specifically as you can, what you think happens to you as you physically experience dental pain.” This comparison topic was chosen because negative events (e.g., death, pain) can at times challenge people’s belief that life is meaningful and ordered; thus, because the dental pain prompt reminded participants of a negative event, it allowed us to determine whether MS causes any effects on meaning in life beyond simply being a negative event.

#### **Delay and distraction**

Next, the 60-item positive and negative affect schedule (PANAS-X; Watson & Clark, 1992) and a reading task provided the delay needed to observe distal terror management effects (see Pyszczynski, Greenberg, & Solomon, 1999).

### Meaning in life

Meaning in life was assessed using an eight-item meaning-in-life measure (Krause, 2007;  $\alpha = 0.86$ ). The measure captures individual perceptions of having meaningful values, purpose, goals, and past experiences. Example items include: “I feel like I have found a really significant meaning in my life” and “I have a system of values and beliefs that guide my daily activities.” Each item used a 6-point Likert-type scale (1 = *strongly disagree*, 6 = *strongly agree*).

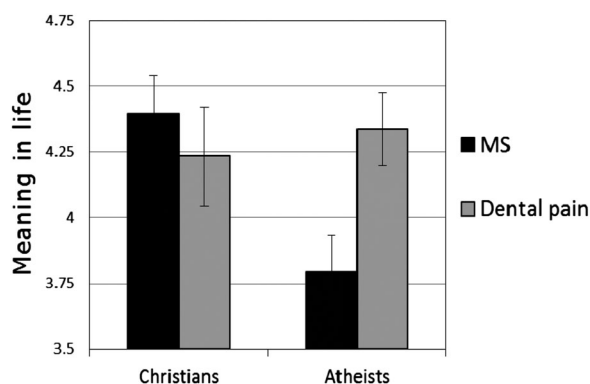
### Religious/philosophical identification

At the end of the survey, participants completed a demographic questionnaire. The demographics page asked about age, sex, education level, and religious/philosophical identification. Regarding identification, participants were asked, “What religion or philosophy are you affiliated with, if any?” Response options were: “Christian,” “Muslim,” “Jewish,” “Buddhist,” “Hindu,” “Atheist (I do not believe supernatural beings exist),” “Spiritual (I believe supernatural beings do exist, but I do not follow a specific religion),” “Agnostic (I’m not sure whether, or it is impossible to know whether, supernatural beings do or do not exist),” and “other.” Participants who selected either the “Christian” or “atheist” option were included in the study. Cross-tabulation showed ( $\chi^2(1) = 1.71, p = 0.19$ ) that Christian versus atheist religious/philosophical identifications were not impacted by the MS manipulation.

## Results

### Meaning in life

A 2 (category: Christian versus atheist)  $\times$  2 (MS versus pain) ANOVA revealed no main effects of either religious/philosophical identification or MS, though the predicted two-way interaction emerged,  $F(1,132) = 5.27, \eta_p^2 = 0.04, p = 0.02$  (see Figure 1). Among atheists, meaning in life was lower in the MS ( $M = 3.80, SE = 0.14$ ) condition than in the pain ( $M = 4.34, SE = 0.14$ ) condition ( $t[78] = -2.78, d = -0.63, p < 0.01$ ); in contrast, among Christians there was no statistical difference between meaning in life ratings reported in the MS ( $M = 4.40, SE = 0.14$ ) and pain ( $M = 4.23, SE = 0.19$ ) conditions ( $t(56) = 0.70, d = 0.19, p = 0.49$ ). From another angle, when reminded of death, meaning in life was lower for atheists than for Christians ( $t(76) = -3.04, d = -0.70, p < 0.01$ ); in contrast, when reminded of pain, there was no statistical difference between meaning-in-life ratings reported by atheists and Christians ( $t(58) = 0.45, d = 0.12, p = 0.66$ ).



**Figure 1.** Meaning in life was lower in the MS (versus pain) condition among atheists but not among Christians.

Note. Meaning in life was measured on a 1–6 Likert-type scale.



## Affect

The PANAS-X includes 13 subscales: positive mood, negative mood, fear, hostility, guilt, sadness, happiness, self-assuredness, attentiveness, serenity, surprise, fatigue, and shyness (all  $\alpha$ s  $\geq 0.69$ ). A 2 (Christian versus atheist)  $\times$  2 (MS versus pain) MANOVA revealed no interactions or main effects of MS (all  $p$ 's  $\geq 0.18$ ), consistent with most previous TMT research showing that MS does not influence explicit affect.<sup>2</sup> However, there did emerge main effects of category such that, compared to Christians, atheists felt less attentive ( $F(1,132) = 5.35$ ,  $\eta_p^2 = 0.04$ ,  $p = 0.02$ ), more serene ( $F(1,132) = 6.34$ ,  $\eta_p^2 = 0.05$ ,  $p = 0.01$ ), and more fatigued ( $F(1,132) = 11.58$ ,  $\eta_p^2 = 0.08$ ,  $p = 0.001$ ).

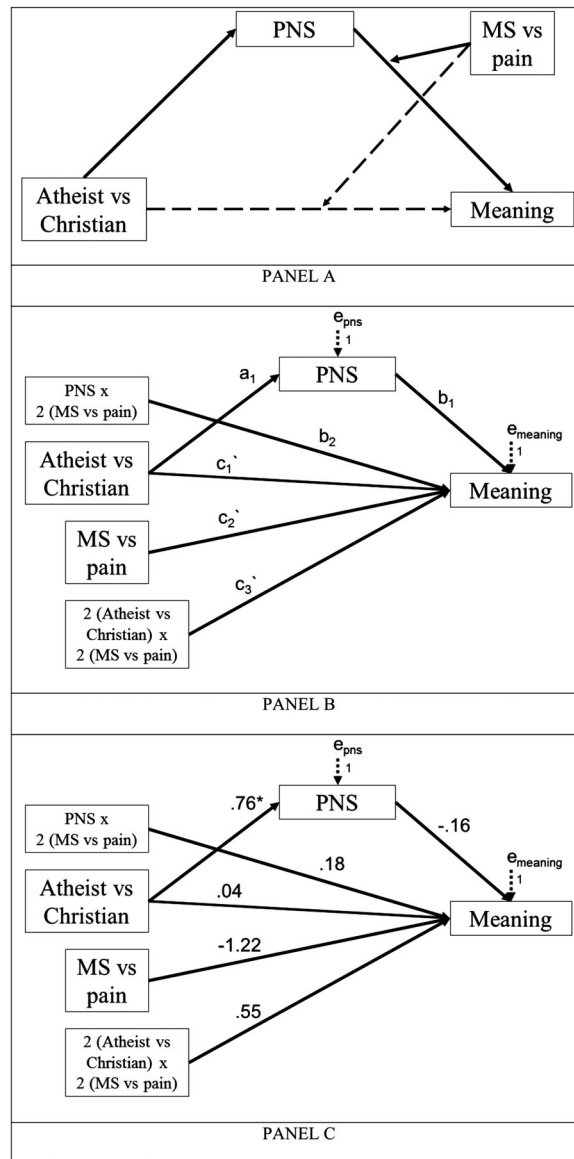
## Ancillary analyses: personal need for structure

An independent-samples  $t$ -test showed that, compared to Christians ( $M = 4.59$ ,  $SD = 0.80$ ), atheists ( $M = 3.84$ ,  $SD = 0.99$ ) reported lower PNS ( $t(1,134) = -4.78$ ,  $p < 0.01$ ). As an initial probe for whether this difference in PNS could have explained (mediated) the moderating effect of being atheist versus Christian on the effect of MS (versus control) on meaning in life, we first checked to see whether there was a similar PNS  $\times$  MS interaction on meaning in life. That continuous  $\times$  categorical interaction was analysed following standard methods prescribed by Aiken and West (1991). PNS was centred about the mean, MS was dummy coded, and the interaction term was computed. There was no main effect of PNS on meaning in life ( $\beta = -0.02$ ,  $t(135) = -0.22$ ,  $p = 0.83$ ) but there was a trending PNS  $\times$  MS interaction ( $F(1,132) = 2.88$ ,  $\eta_p^2 = 0.02$ ,  $p = 0.09$ ). Thus, we further probed the interaction to determine whether the data pattern was similar to the pattern among atheists and Christians described above. It was not. Among those low in PNS ( $-1$  SD), meaning in life was lower in the MS condition than in the pain condition ( $\beta = -0.27$ ,  $t(132) = -2.21$ ,  $p = 0.03$ ); in contrast, among those high in PNS ( $+1$  SD) there was no statistical difference between meaning-in-life ratings reported in the MS and pain conditions ( $\beta = 0.03$ ,  $t(132) = 0.24$ ,  $p = 0.81$ ). However, in contrast with the effect of being atheist versus Christian, PNS was not statistically related to meaning in life in either the pain condition ( $\beta = -0.17$ ,  $t(58) = -1.28$ ,  $p = 0.21$ ) or the MS condition ( $\beta = 0.13$ ,  $t(76) = 1.12$ ,  $p = 0.27$ ).

This non-significant interaction pattern suggests that although meaning in life was lower in the MS condition among those with low, but not high PNS, the effects of need for structure did not mirror the effects of being atheist versus Christian. Nevertheless, as an added precaution, we conducted a formal test of the conditional indirect effect of category (atheist versus Christian)  $\rightarrow$  PNS  $\rightarrow$  meaning in life within the MS and pain conditions using model 15 (Figure 2A) of the PROCESS statistical macro for SPSS (Hayes, 2013). This model used a bootstrapping method (5000 bootstrapped resamples) to estimate the various path coefficients specified in Figure 2B. The model indicated that, although PNS and category indeed shared at least some overlapping variance as moderators of the MS effect in the model (both interaction terms  $b_2$  and  $c_3$  became non-significant when entered simultaneously; see Table 1), it also demonstrated that PNS did not statistically mediate the effect of category (atheist versus Christian) in the model. That is, the model found the conditional direct effect of atheist/Christian category on meaning in life in the MS condition ( $b = 0.59$ , 95% CI = [0.17, 1.00]); but, importantly, the model did *not* find support for a significant conditional indirect effect (category  $\rightarrow$  PNS  $\rightarrow$  meaning in life) in the MS condition ( $b = 0.02$ , 95% CI = [-0.16, 0.24]).

## Ancillary analyses: demographics

As mentioned in the participant section above, the demographics of the atheist and Christian samples differed slightly in that the atheist sample had a higher proportion of males and more years of education. To examine whether sex differences could have explained (mediated) the moderating effect of being atheist versus Christian in the observed 2 (category: atheist versus Christian)  $\times$  2 (MS versus control) on meaning in life, we first conducted an ANOVA to test whether there was a



**Figure 2.** An illustration of the mediated moderation model, which tested whether PNS mediates the moderating effect of category (atheist versus religious) on the effect of MS (versus pain) on meaning in life. Panel A depicts the conceptual model, panel B depicts the statistical model, and panel C depicts the results. The model found that there were no conditional indirect effects through PNS.  $*p \leq 0.05$ .

similar 2 (Male versus Female)  $\times$  2 (MS versus control) interaction on meaning in life. There was a non-significant main effect of sex ( $F(1,134) = 3.16$ ,  $\eta_p^2 = 0.02$ ,  $p = 0.08$ ), such that meaning in life was slightly lower among males than females. However, there was no hint of a Sex  $\times$  MS interaction ( $F(1,132) = .09$ ,  $\eta_p^2 = 0.001$ ,  $p = 0.76$ ), so sex was not a viable mediator and is not considered further.

A similar test was conducted for education, following standard methods prescribed by Aiken and West (1991). Years of education was centred about the mean, MS was dummy coded, and the interaction term was computed. There was a non-significant main effect of years of education ( $F(1,134) = 3.42$ ,  $\eta_p^2 = 0.03$ ,  $p = 0.07$ ), such that meaning in life was slightly positively associated with education. There was a non-significant Education  $\times$  MS interaction ( $F(1,132) = 3.09$ ,  $\eta_p^2 = 0.02$ ,  $p = 0.08$ ). We



**Table 1.** Mediated moderation process model statistics.

Outcome: PNS		Coefficient ( <i>b</i> )	<i>SE</i>	<i>t</i>	<i>p</i>
<i>a</i> <sub>1</sub>	constant	3.84	0.10	37.43	<0.001
	Category	0.76	0.16	4.78	<0.001
Outcome: Meaning in life		Coefficient ( <i>b</i> )	<i>SE</i>	<i>T</i>	<i>p</i>
<i>b</i> <sub>1</sub>	constant	4.93	0.50	9.86	<0.001
	PNS	-0.16	0.13	-1.23	0.22
<i>c</i> <sub>1</sub>	Category	0.04	0.26	0.16	0.88
<i>c</i> <sub>2</sub>	MS	-1.21	0.67	-1.81	0.07
<i>c</i> <sub>3</sub>	Category × MS interaction	0.54	0.34	1.63	0.11
<i>b</i> <sub>2</sub>	PNS × MS interaction	0.18	0.17	1.08	0.28
Conditional direct effects on meaning		Coefficient	<i>SE</i>	LLCI	ULCI
Pain condition: Category		0.04	0.26	-0.48	0.56
MS condition: Category		0.59	0.21	0.17	1.00
Conditional indirect effects on meaning		Coefficient	<i>SE</i>	LLCI	ULCI
Pain condition: Category via PNS		-0.12	0.08	-0.30	0.03
MS condition: Category via PNS		0.02	0.10	-0.16	0.25
Test of equality of conditional indirect effects via PNS		Index	<i>SE</i>	LLCI	ULCI
		0.14	0.13	-0.08	0.44

Note: Category was coded, 0 = atheist, 1 = Christian; MS was coded, 0 = pain, 1 = MS; PNS = Personal need for structure; LLCI = Lower limit 95% confidence interval; ULCI = Upper limit 95% confidence interval.

probed this interaction to determine whether the data pattern was similar to the pattern observed among atheists and Christians described above. Among those with more years education (+1 *SD*), meaning in life was not statistically different in the MS condition compared to the pain condition ( $\beta = 0.05$ ,  $t(132) = 0.47$ ,  $p = 0.64$ ); in contrast, among those with fewer years education (-1 *SD*) meaning in life was lower in the MS condition than the pain condition ( $\beta = -0.25$ ,  $t(132) = -2.08$ ,  $p = 0.04$ ). From the other angle, years of education was positively related to meaning in life in the death condition ( $\beta = 0.34$ ,  $t(76) = 2.40$ ,  $p = 0.02$ ) but was not statistically associated with meaning in the pain condition ( $\beta = 0.03$ ,  $t(58) = 0.25$ ,  $p = 0.80$ ). Recall that atheists in this study tended to have more years of education than Christians. However, MS decreased meaning among atheists but not Christians, whereas MS decreased meaning among those with fewer, but not more years of education. Additionally, whereas being atheist (versus being Christian) was associated with lower meaning in the MS condition, having more years of education was associated with increased meaning in the MS condition. Thus, the pattern of results involving education did not mirror the effect of religious category, and are not considered further.

### Ancillary analyses: affect

Additionally, as revealed in the affect section above, the atheist and Christian samples differed in that the atheist sample felt less attentive and more serene and fatigued. To examine whether differences in these affects could have explained (mediated) the moderating effect of being atheist versus Christian in the observed 2 (category: atheist versus Christian) × 2 (MS versus control) on meaning in life, we examined parallel Attentiveness × MS, a Serenity × MS, and a Fatigue × MS interaction on meaning-in-life ratings. For each, the continuous × categorical interaction was analysed following standard methods prescribed by Aiken and West (1991); the continuous affect measures were centred about the mean, MS was dummy coded, and the interaction terms were computed. There was a main effect of attentiveness on meaning in life ( $\beta = 0.25$ ,  $t(134) = 2.96$ ,  $p < 0.01$ ) such that attentiveness was positively associated with meaning-in-life ratings, but there was no Attentiveness × MS interaction ( $F(1,132) = 2.39$ ,  $\eta_p^2 = 0.02$ ,  $p = 0.12$ ). Similarly, there was no main effect of fatigue on meaning in life ( $\beta = -0.13$ ,  $t(134) = -1.61$ ,  $p = 0.11$ ) nor was there a PNS × MS interaction ( $F(1,132) < 0.01$ ,  $\eta_p^2 < 0.001$ ,  $p = 0.94$ ). Neither attentiveness nor fatigue interacted with MS,

indicating that they are not viable mediators of atheist/Christian category, so they are not considered further.

There was a main effect of serenity on meaning in life ( $\beta = 0.48$ ,  $t(134) = 6.27$ ,  $p < 0.01$ ) such that serenity was positively associated with meaning in life ratings, as well as a Serenity  $\times$  MS interaction ( $F(1,132) = 8.93$ ,  $\eta_p^2 = 0.05$ ,  $p < 0.01$ ). Thus, we further probed the interaction to determine whether the data pattern was similar to the pattern observed among atheists and Christians described above. It was not. Among those high in serenity (+1 *SD*), meaning in life was not statistically different in the MS and pain conditions ( $\beta = 0.12$ ,  $t(132) = 1.17$ ,  $p = 0.24$ ); in contrast, among those low in serenity (−1 *SD*) meaning in life ratings were lower in the MS than in the pain condition ( $\beta = -0.32$ ,  $t(132) = -3.06$ ,  $p < 0.01$ ). Additionally, from the other angle, serenity was positively related to meaning in life in the death condition ( $\beta = 0.65$ ,  $t(76) = 6.82$ ,  $p < 0.01$ ) but not the pain condition ( $\beta = 0.21$ ,  $t(58) = 1.78$ ,  $p = 0.07$ ). While atheists in this study reported more serenity than Christians, MS decreased meaning among atheists but not Christians, whereas MS decreased meaning among those with lower but not higher serenity. Additionally, whereas being atheist (versus being Christian) was associated with lower meaning in the MS condition, having more serenity was associated with increased meaning in the MS condition. Thus, the pattern of results involving serenity did not mirror the effect of religious category, so serenity is not a viable mediator and is not considered further.

## Discussion

The present study found that meaning-in-life ratings were lower among atheists in the MS condition, relative to the pain condition. Christians' levels of meaning in life were statistically unaffected by reminders of death. These findings provide evidence consistent with the present hypothesis, suggesting that the awareness of death at least temporarily undermined meaning in life among atheists but not among Christians.

The present study also converges with and expands upon prior work on the terror-managing quality of religious beliefs. Prior research suggests that religious concepts are cognitively intuitive (e.g., Bloom, 2007; Boyer, 1994) and that such beliefs help serve the function of managing the awareness of death (e.g., Dechesne et al., 2003). Supernatural concepts have been shown to be implicitly associated with “real” more strongly when participants are reminded of death (Jong et al., 2012). And if such concepts are consistent with an individual's accepted worldview (Christianity, Islam, etc.), then the individual more strongly accepts religion; but if not (e.g., as in atheism), then they override those concepts and more strongly reject religion (Jong et al., 2012; Norenzayan & Hansen, 2006; Vail et al., 2012). The present work builds on this prior research, and extends it by considering the impact of such terror-management strategies on perceptions of meaning in life. Indeed, an acceptance of supernatural belief may have helped the Christians in this study sustain the perception that life is meaningful even when reminded of death, whereas the rejection of such terror-managing beliefs may have at least temporarily undermined the atheists' ability to do the same.

Additionally, although these findings demonstrate that atheists, but not religious individuals, report lower levels of meaning in life when reminded of death, the present work did not reveal the mechanism behind that effect. PNS did not explain the moderating effects of the atheist versus Christian category; however, the present work did find partial replication of Vess et al.'s (2009) work. In several studies, Vess et al. found that MS reduced reported meaning in life among those with low PNS, whereas it increased it among those with high PNS. The present work similarly found that MS reduced reported meaning in life among those with low PNS, but that it had no effect among those with high PNS. Additionally, neither measured demographics (age, sex, education) nor affective reactions could explain the moderating effects of the atheist versus Christian category. Thus, the present research appeared to rule out PNS, demographics (age, sex, education), and affective reactions as explanatory mechanisms.

By the same token the present findings are also generative, pointing to at least four alternative directions for future research. First, if atheists are, in fact, experiencing a reduction in meaning in

life after death reminders because they override their supernatural concepts, then increased cognitive load might prevent them from overriding those concepts and enable them to sustain meaning in the face of mortality. Similarly, increased analytic thinking, which increases the likelihood of overriding religious concepts and reduces faith (Norenzayan & Gervais, 2013), may pose an obstacle to religious participants' perception of religious concepts and their maintenance of meaning in life when managing death awareness.

Second, although the present work shows that atheists reminded of death report less meaning in life, this work does not necessarily show that they are worse off as a result – that is, it does not necessarily demonstrate that atheists reminded of death report lower subjective well-being (cf., Routledge et al., 2010). It remains possible that atheists may simply be able to more clearly appreciate and accept that the world is a relatively meaningless place, without it necessarily bothering them or undermining their well-being.<sup>3</sup> That is, atheists reminded of death may be more likely to feel that because life is relatively meaningless, it is simply up to them to make their own meaning (such as Nietzsche suggested in his infamous “God is dead” passages, for example). Indeed, other work has shown that people reminded of death may rely on secular immortality modes if presented with the opportunity (Vail et al., 2012). However, no prior work has investigated the potential for atheists reminded of death to reject religion, acknowledge the meaninglessness of life (while maintaining well-being), and opt instead for secular or self-determined sources of meaning and value. Future research might therefore seek to test whether or not death awareness similarly undermines atheists' subjective well-being in addition to perceptions of meaning in life.

Third, in addition to rejecting terror-managing religious beliefs, atheists may also have experienced a reduced ability to sustain meaning in life when managing death awareness because they may not perceive themselves as having a sustainable worldview or much social value (i.e., comparatively lower self-esteem). That is, it may not necessarily be that the religious have an unusually high level of self-esteem, but that atheists – being a minority group often made the brunt of social prejudice and discrimination – may be unprotected by lowered self-esteem. Indeed, atheism is widely derided (Jones, 2012) and globally persecuted (International Humanist and Ethical Union, 2014), and research suggests that 4 in 10 atheists report personally experiencing discrimination and the rest are reportedly aware of their marginalized status (Cimino & Smith, 2011; Cragun, Kosmin, Key-sar, Hammer, & Nielsen, 2012). Atheists' perceived discrimination is related to poor well-being, including reduced self-esteem (Doane & Elliott, 2014). Thus, given that people with lower self-esteem report lower meaning in life when reminded of death (Taubman - Ben-Ari, 2011), future research may seek to investigate the possible role of anti-atheist prejudice and low self-esteem in atheists' apparently reduced ability to sustain meaning in life when managing death awareness.

Fourth, if atheists experience difficulty maintaining meaning in life while managing death awareness due to a lack of available secular (non-religious) beliefs, then future work might investigate whether atheists need to seek out some other secular terror-managing system that would be explicitly acceptable to them. On a similar note, the religious may find themselves formally or informally part of cohesive groups with clear group identities, which has been shown to be involved in effective terror management (Castano, 2004). Alternatively atheists may not think of themselves as a cohesive group with a clear group identity. There may be cultural variations in those sorts of conditions both within and between nations/regions. For example, a cross-cultural approach to the issue might investigate how atheists manage concerns about mortality in societies such as that in the USA, which is predominantly religious and has clear religious group identities, compared to societies where secular life is dominant. Contemporary Scandinavian societies, for example, are reported to be the least religious and most strongly secular in the world (Norris & Inglehart, 2004; Zuckerman, 2008). Atheists in Scandinavia, and other similar societies, might be able to manage death awareness by more easily grasping and affirming their secular worldviews, social value, and social identities, allowing them to maintain their perception of meaning in life while managing death awareness.

Overall, the present research suggests that the awareness of mortality undermined the perception of meaning in life among atheists, but not among the religious. The present study built on prior

research about the impact of terror-managing religious beliefs, and extended it by suggesting that, whereas accepting such beliefs may help sustain the perception of meaning in life when managing the awareness of death, rejecting them may instead leave atheistic individuals less able to do so. This work, though of course limited, advances and opens the door to further investigations of the study of the challenges of both religious and atheistic terror management.

## Notes

1. We also analyzed the data in two additional, alternative ways. The first analyzed the results with the other religious respondents (the Muslim, Hindu, and Buddhist respondents) added with the Christians in a “religious” category. The second analyses the results with agnostics ( $n = 43$ ) as a third category alongside the target samples of Christians and atheists.

In the first analysis, we added the Muslim, Hindu, and Buddhist respondents to the Christians to form a “religious” category. A 2 (“religious” vs. atheist)  $\times$  2 (MS vs. pain) ANOVA, yielded a pattern of results similar to those found using the all-Christian category. There were again no main effects of either religious/philosophical identification or MS, though the predicted 2-way interaction emerged,  $F(1, 135) = 3.84$ ,  $\eta_p^2 = .03$ ,  $p = .05$ . Among atheists, meaning in life was lower in the MS condition than in the pain condition ( $t[78] = -2.76$ ,  $d = -.63$ ,  $p < .01$ ); in contrast, among the “religious” participants there was no statistical difference between meaning in life ratings reported in the MS and pain conditions ( $t[59] = .23$ ,  $d = .06$ ,  $p = .49$ ). From another angle, when reminded of death, meaning in life was lower for atheists than for the “religious” ( $t[76] = -2.95$ ,  $d = -.68$ ,  $p < .01$ ); in contrast, when reminded of pain there was no statistical difference between meaning in life ratings reported by atheists and the “religious” ( $t[58] = .04$ ,  $d = .01$ ,  $p = .96$ ).

We also ran a second analysis with an added third category of agnostics ( $n = 43$ ) alongside the target samples of Christians and atheists. A 3 (Christian vs agnostic vs. atheist)  $\times$  2 (MS vs. pain) ANOVA, again found no main effects of either religious/philosophical identification or MS, though the predicted 2-way interaction still emerged,  $F(2, 173) = 3.41$ ,  $\eta_p^2 = .04$ ,  $p = .04$ . Among atheists, meaning in life was lower in the MS condition than in the pain condition ( $t[78] = -2.57$ ,  $d = -.58$ ,  $p = .01$ ); among Christians there was no statistical difference between meaning in life ratings reported in the MS and pain conditions ( $t[56] = .64$ ,  $d = .17$ ,  $p = .52$ ); and among agnostics there was no statistical difference between meaning in life ratings reported in the MS and pain conditions ( $t[42] = .84$ ,  $d = .26$ ,  $p = .40$ ). From another angle, when reminded of death, meaning in life was lower for atheists than for Christians ( $t[76] = -2.44$ ,  $d = -.56$ ,  $p < .01$ ) and marginally lower than agnostics ( $t[61] = -1.60$ ,  $d = -.41$ ,  $p = .11$ ); in contrast, when reminded of pain there was no statistical difference between meaning in life ratings reported by atheists, agnostics, and Christians ( $|t|s < .96$ ,  $|d|s < .30$ ,  $ps > .34$ ). MS had no effect among agnostics and Christians, but reduced meaning in life among atheists, which is consistent with predictions that this effect is unique to individuals who categorically reject supernatural concepts. However, we also note that the agnostic sample is underpowered, and caution against any firm conclusions based on these analyses.

2. We also tested the effect of the MS induction on fear, following Lambert et al.’s (2014) recommendation to combine the PANAS-X items *afraid*, *scared*, and *frightened* ( $\alpha = .91$ ) to produce an alternative subscale measure of fear. The present data showed that this alternative composition of the fear subscale was not influenced by MS compared to a pain condition ( $F[1, 132] = 1.42$ ,  $\eta_p^2 = .01$ ,  $p = .24$ ). Lambert et al. used a comparison against a neutral condition, whereas the present work used a comparison against a potential fear/anxiety prime (e.g., pain). The present work is therefore not a direct replication attempt, but the implication of the present findings is more important: the present work followed Lambert et al.’s method of scoring fear affect and did not find any effect of MS condition on fear beyond another fear/anxiety condition (i.e., pain), yet still demonstrated an MS effect on meaning in life—highlighting the unique psychological impact of MS against a control condition that is similarly fear-inducing. Thus, the observed results do not appear to be due to possible differential influences of MS on fear.
3. Thanks to an anonymous reviewer for raising this point.

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