

ETD Archive

---

2018

## Atheism and the Effects of Mortality Salience and Limited Analytic Processing Ability on Religious Faith and Teleological Thinkin

Brett Jordan Waggoner  
*Cleveland State University*

Follow this and additional works at: <https://engagedscholarship.csuohio.edu/etdarchive>



Part of the [Psychology Commons](#)

[How does access to this work benefit you? Let us know!](#)

---

### Recommended Citation

Waggoner, Brett Jordan, "Atheism and the Effects of Mortality Salience and Limited Analytic Processing Ability on Religious Faith and Teleological Thinkin" (2018). *ETD Archive*. 1094.  
<https://engagedscholarship.csuohio.edu/etdarchive/1094>

This Thesis is brought to you for free and open access by EngagedScholarship@CSU. It has been accepted for inclusion in ETD Archive by an authorized administrator of EngagedScholarship@CSU. For more information, please contact [library.es@csuohio.edu](mailto:library.es@csuohio.edu).

ATHEISM AND THE EFFECTS OF MORTALITY SALIENCE AND LIMITED  
ANALYTIC PROCESSING ABILITY ON RELIGIOUS FAITH AND  
TELEOLOGICAL THINKING

BRETT J. WAGGONER

BACHELOR OF ARTS IN PSYCHOLOGY

Florida International University

December 2013

Submitted in partial fulfillment of requirements for the degree

MASTER OF ARTS IN PSYCHOLOGY

at the

Cleveland State University

May 2018

We hereby approve this thesis for

BRETT J. WAGGONER

Candidate for the Master of Arts in Psychology degree for the

Department of Psychology

and the CLEVELAND STATE UNIVERSITY'S

College of Graduate Studies by

---

Thesis Committee Chairperson, Kenneth E. Vail III Ph.D.

---

Department & Date

---

Thesis Committee Member (Methodologist), Eric Allard Ph.D.

---

Department & Date

---

Thesis Committee Member, Robert Hurley Ph.D.

---

Department & Date

---

Thesis Committee Member, Ilya Yaroslavsky Ph.D.

---

Department & Date

Student's Date of Defense: May 1, 2018

ATHEISM AND THE EFFECTS OF MORTALITY SALIENCE AND LIMITED  
ANALYTIC PROCESSING ABILITY ON RELIGIOUS FAITH

BRETT WAGGONER

**ABSTRACT**

The scenario of the atheist in the proverbial foxhole has been a topic of discussion in religious circles for centuries. Building on prior research utilizing terror management theory (TMT), a dual process model of cognition, and previous work suggesting that humans are intuitively wired for teleological and religious concepts, the researchers set out to examine atheist's religiosity when confronted with the reality of one's impermanence. To explore this idea, the present experiment recruited a sample of atheists, manipulated their awareness of mortality, manipulated their ability to employ analytic thinking, and measured various intuitive cognitions (e.g., teleological reasoning) alongside religious belief. Results suggest that atheists in the speeded conditions reported higher agreement with teleological items; but the same did not happen for religious items. Additionally, atheists primed with mortality salience (vs. control) reported lower agreement with religious items in the un-speeded condition, but not in the speeded condition; a similar interaction was not observed for the teleology items. Limitations and potential directions for future research are discussed.

## TABLE OF CONTENTS

	Page
ABSTRACT.....	iii
LIST OF TABLES .....	vi
LIST OF FIGURES .....	vii
CHAPTER	
I. INTRODUCTION .....	1
1.1 TMT and Research.....	2
1.2 TMT and Religion.....	5
1.3 Atheism, TMT, and Analytical Thinking .....	8
II. THE PRESENT RESEARCH.....	14
III. METHOD .....	17
3.1 Estimation of Minimal Sample Size .....	17
3.2 Recruitment.....	18
3.3 Participant Characteristics .....	18
3.4 Materials and Procedures.....	19
3.5 Demographics .....	22
IV. RESULTS .....	24
4.1 Preliminary Analyses .....	24
4.2 Target Analyses .....	25
V. DISCUSSION .....	30
5.1 Data in context: Interpretations, implications, and future directions.....	30

5.2 Limitations .....	35
5.3 Conclusion .....	36
REFERENCES .....	38
APPENDICES	
A. Personality/filler items for cover story .....	43
B. Manipulation #1: MS and Dental pain conditions .....	43
C. PANAS-L .....	46
D. Manipulation #2: Speeded condition instructions .....	47
E. Manipulation #2: Un-speeded condition instructions .....	50
F. Demographics measure .....	51
G. SUPPLEMENTAL .....	53
H. Tables .....	54
I. Figures .....	57

## LIST OF TABLES

Table		Page
I.	Target block and dependent measure items .....	54
II.	Item endorsement descriptive statistics, by condition .....	55
III.	Item endorsement descriptive statistics, by condition .....	56

## LIST OF FIGURES

Figure	Page
1. Faith in supernatural/religious concepts .....	47
2. Unjustified teleological statements .....	48
3. General religious/supernatural concepts .....	60
4. Christian supernatural concepts .....	61
5. Hindu supernatural concepts .....	62



## **CHAPTER I**

### **INTRODUCTION**

In his classic novel *The Stranger*, French novelist Albert Camus (1942) tells the story of Meursault, a man who views life as completely meaningless, with death being the only ultimate destination, and with no God to save him from his unavoidable doom. While Meursault is in prison awaiting a death sentence, he is visited by the prison chaplain, who tries to convince Meursault that there is a God and that he should repent. Yet, even as the guillotine awaits him, the atheistic Meursault contemplates the nature of existence and comes to the conclusion that God is of no importance and that faith would be a waste of what little time he has left. Despite the chaplain's repeated attempts, Meursault remains steadfast in rejecting the faith that promises to save him from his impending doom.

Meursault's situation, as the atheist in the proverbial foxhole, has been a topic explored by philosophers and writers for many years. But in the past few decades, experimental psychology has begun to bring a scientific perspective to these profound issues as well. One particularly relevant psychological perspective is that of terror management theory (TMT; Greenberg, Pyszczynski, & Solomon, 1986), which posits that humans deal with the awareness of death by immersing themselves in socially

established worldviews that imbue the world with significance and offer the possibility of permanence. One type of cultural worldview that offers a strong sense of immortality is religion, which offers literal immortality (e.g., the promise of an afterlife) to its followers. However, atheists nevertheless choose to reject the supernatural claims of religion, and thus do not reap the psychological benefits that religion has to offer for managing the awareness of death. One of the explanations as to why atheists reject religion and other teleological concepts may be that they engage in analytical thinking to over-ride these otherwise cognitively intuitive beliefs (Gervais & Norenzayan, 2012). However, no previous research has tested this idea; that atheists maintain their disbelief, even under death awareness, by cognitively over-riding the motivation to express religious faith. The present thesis seeks to test this possibility.

### **TMT and Research**

Humans are fundamentally social creatures that form groups and participate in vast cultures that consist of shared beliefs, values, and customs that give structure, meaning, and significance to the world around them. Humans invest in culture by participating in social and religious rituals, attending and cheering at sports events, participating in national ceremonies, or coming together for a common social cause, such as education, healthcare, or even music appreciation. When looking at human cultures from an evolutionary perspective one might wonder why humans are the only species to form such complex systems, and furthermore what function culture serves for our species. As humans developed a more advanced prefrontal cortex, they gained the ability to engage in abstract reasoning and planning—the ability to mentally simulate objects (including themselves) across time, and imagine the way that future events (hunts, crop

harvests, social interactions) might unfold. However, due to this simulation, humans eventually became aware of the inevitable fact that all forms of life, including themselves, are impermanent. Although other animals are able to recognize immediate threats of mortality such as the threat of a charging lion that could easily kill them, only humans are consciously aware of the inevitability of death.

Such an awareness can potentially leave humans with a profound problem: one is aware of impending mortality but has no way of avoiding such a threat. Thus, according to TMT (Greenberg et al., 1986), in the absence of physical recourse, humans have developed psychological ways of mitigating the problem, by developing and participating in permanence-promising cultural systems. Cultural worldviews, shared sets of beliefs, values, and customs, imbue the world with a sense of meaning, purpose, value, and significance, and ultimately offer a set of social standards by which humans can qualify for a death-denying sense of permanence. One form of this permanence is through a legacy, a form of symbolic, non-supernatural (secular) immortality: the notion that one continues to live on after death through one's lifetime accomplishments, such as contributions through patriotism, business acumen, creative projects such as art, literature, and film, and progeny, just to name a few (Routledge, Arndt, 2008). A second form of permanence promised by some cultures is supernatural (religious) immortality: the notion that although one may physically die, one will continue to exist eternally via a soul (Kesebir, 2011). This kind of immortality is almost exclusively provided by religions, which outline concepts consistent with eternal life, such as spirits, gods, souls, creation, afterlife, heavens, and so on. This latter form of immortality has a long history and is an especially effective terror management system given that it directly addresses

the problem of death by suggesting that physical death is actually not the end (Becker, 1973).

A significant amount of research has gone into testing the claims of TMT. Much of this work makes use of the *mortality salience hypothesis* (Rosenblatt, Greenberg, Solomon, Pyszczynski, & Lyon, 1989), which holds that: if faith in cultural worldviews helps manage the awareness of death, then increasing mortality salience (MS) should increase faith in one's cultural worldviews. In such research studies, participants are first randomly assigned to either a MS condition or a control topic condition (other similarly negative, but not mortality-related, topics, e.g., pain, failure, loneliness, uncertainty), and then are given an opportunity to express faith in their cultural worldviews. MS has been primed numerous ways (Burke, Martens, & Faucher, 2010), from simply asking participants to write about the thoughts that the awareness of their death arouses in them, to subliminal priming of the word "DEATH", to field studies with various proximity to death-related stimuli such as cemeteries, funeral services, or even insurance logos or news headlines (e.g., political issues such as terrorism, capital punishment, abortion, war, violent crime, natural disasters, etc.). MS effects have been observed in hundreds of studies, on worldview-relevant topics ranging from defense of one's country and national identity, attitudes toward animals, health risk evaluations, sports team affiliations, physical aggression, attitudes toward women, self-complexity, academic test scores, public policy issues, and so on (Burke et al., 2010).

For example, one study by Greenberg, Porteus, Simon, Pyszczynski, and Solomon (1995) investigated the effects of MS on people's performance on a creative problem-solving task in which the solution to the tasks involved desecrating revered cultural

symbols (e.g., sifting sand from a jar of ink using an American flag, thus defacing the flag). MS caused participants to take twice as long to complete the task when they required the desecration of cultural symbols. Other studies have found that MS increases self-esteem striving in participants (Pyszczynski, Greenberg, Solomon, Arndt, & Schimel, 2004), which is consistent with the idea that self-esteem reflects a positive evaluation of whether one is living up to the permanence-promising standards and values of one's culture and can therefore be considered a valuable member and contributor to their culture.

### **TMT and Religion**

From a TMT perspective, religion serves as a very effective way to manage death awareness, given that it can provide both non-supernatural and supernatural immortality. Regarding the former, religious believers can attain a non-supernatural legacy through their religion by spreading the teachings and doctrines of their faith to their children and other non-believers to perpetuate and increase the dominance and perceived veracity of their religious views. However, the primary element that distinguishes religion from other non-religious cultural beliefs is that religions offer supernatural permanence—concepts (e.g., souls, spirits, gods, heaven) that provide literal permanence after one's physical death. This desire for permanence has featured in thousands of now-defunct religions and mythologies and continues to be a fundamental feature in various contemporary world religions, each supplying their own spiritual solution to the problem of human mortality through their own theological doctrines.

Given the role that religion's supernatural immortality can play in assuaging death anxiety, several empirical studies have investigated mortality salience and religious

belief. One study found that when Christian participants were reminded of mortality they increased their defense of their worldview by increasing support for a Christian who shared their worldview, but not for a Jewish person (Greenberg, Pyszczynski, Solomon, Rosenblatt, Veeder, Kirkland, & Lyon 1990). Another study by Osarchuk and Tatz (1973), found that MS caused believers to increase their faith in an afterlife. Furthermore, numerous studies have investigated the effects of MS on belief in supernatural agents (spirits, gods), which supply the theological foundation for spiritual existence, an afterlife, and an immortal soul. One study by Norenzayan and Gervais (2006) found that when religious participants were made aware of death, they increased belief in various supernatural agents. Additionally, Vail, Arndt, & Abdollahi (2012) found that MS led American Christians and Iranian Muslims to each increase general religiosity and faith in a higher power; but, more specifically, MS also led Christians to increase faith in God/Jesus and reject other religions' agents (Allah, Buddha), and led Iranian Muslims to increase belief in Allah and reject the agents of other religions (God/Jesus, Buddha). Jong, Halberstadt, & Bluemke (2012) found similar findings, showing that MS led Christians to increase general religiosity.

Other related research has provided evidence that affirming afterlife beliefs and religious concepts can serve as a buffer to the awareness of death. One study (Dechesne, Pyszczynski, Arndt, Ransom, Sheldon, Knippenberg, & Janssen, 2003) had participants read a fake article ostensibly about Harvard medical research, reporting examinations of over 600 out of body near death experiences, in which survivors reported floating above their bodies and seeing deceased loved ones, and concluded this as evidence of an afterlife. Other participants read a different article that offered the alternative conclusion

that such an experience is the by-product of biological processes, such as oxygen deprivation in the brain. MS produced the usual defensive responses among participants in the afterlife-debunked group, but not in the afterlife-affirmation group, suggesting that the affirmation of spiritual afterlife served as a buffer against mortality awareness and its consequences. Another study (Jackson, Jong, Bluemke, Poulter, Morgenroth, & Halberstadt, 2017) investigated the extent to which one's religious views are capable of psychologically shielding oneself from the anxiety of one's death. They found that believers reported higher death anxiety when their worldview was threatened, and that religious belief alleviated believer's implicit death anxiety.

Another study by Schimel, Hayes, Williams, and Jahrig (2007) showed that when creationist participants were exposed to a scientific article challenging the validity of creationism and arguing instead in favor of evolution, they reported increased death thought accessibility (indicating that creationism was being effectively used to shield against death thought) but not after reading an article on a neutral topic. Other research investigating the buffering effects of religious beliefs found that MS can increase participant's belief in intelligent design (creationism) rather than evolutionary theory (Tracey, Hart, & Martens, 2011). Given that religion provides an explanation of the universe, existence, and individual lives as an intended phenomenon created for a purpose, these teleological worldviews help to buffer the existential anxiety produced by the insignificance of individual existence. These studies lend further support to the notion that belief in supernatural agency and spiritual immortality serve a unique protection from the awareness of mortality. Indeed, Davis, Juhl, & Routledge (2011) found that

experimentally elevating teleological beliefs reduced death thought accessibility, while mortality salience increased teleological beliefs, despite judgement errors.

These studies provide strong empirical support for the notion that religious concepts serve a special terror management function given that they deny the impermanence that is related to death. Rather, religion offers that the continuation of the self is possible after death. However, despite the usefulness and effectiveness of these religious buffers, there are a population of individuals that are reluctant to embrace these beliefs, and others who even go so far as to outright reject them. Such people provide an interesting demographic worth considering and studying, to further understand the intricacies and exceptions behind the acceptance and rejection of religious beliefs and the mechanics of terror management more broadly.

### **Atheism, TMT, and Analytic Thinking**

Recent polls (Pew, 2015) show that the number of people in the world who identify as non-religious is on the rise, with different categories of religious skepticism, including spiritual but unaffiliated, agnostics, and atheists. The spiritual but unaffiliated are individuals who apparently still accept supernatural concepts such as gods, souls, and heaven, but choose not to identify with a particular organized religion, denomination, or form of worship. Research has shown that up to 50% of those who report themselves as unaffiliated still believe in supernatural concepts (Vernon 1969, Baker & Smith, 2009), making them unlikely to abstain from expressing faith in supernatural concepts to manage the awareness of death.

More genuinely skeptical are the agnostics and atheists. Agnostics differ from the spiritual but unaffiliated in that they believe that it is epistemologically impossible to



have knowledge as to whether supernatural concepts, such as God, exist or not. But by the same token, while agnosticism does not embrace a belief in God, it also does not reject the possibility that a God does exist; it simply claims that one cannot know for sure if either position is true. Atheists, however, differ from both the spiritual but unaffiliated and the agnostics in that they express a stronger skepticism of religion and religious claims, rejecting the existence of God and supernatural concepts as altogether unwarranted ideas (Dawkins, 2006). Many atheists tend to reject religion and its doctrines on the grounds that religious and spiritual claims do not meet the burden of proof (Russell, 1957). In particular, atheists would argue that there is no valid scientific evidence for the existence of God, and potentially some evidence that makes the existence of one (or many) unlikely (e.g., Dawkins, 2006). Given that atheists reject the supernatural claims made by religion, one important question is whether atheists are able to maintain their rejection of available religious and supernatural concepts and beliefs when coping with the awareness of death.

One response to that question takes the form of the popular aphorism, “There are no atheists in foxholes,” implying that the awareness of death is enough to inspire religious faith. However, the existence of groups like the Military Association of Atheists and Freethinkers serves as anecdotal evidence of atheists who face the threat of death often, as soldiers, yet still maintain their atheism and reject religious faith. Additionally, qualitative research on atheists on their deathbeds revealed that they typically requested that hospital staff refrain from bed-side proselytizing and respect their (dis)beliefs (Smith & Stoner, 2007). These two social examples represent anecdotal evidence that there are atheists in foxholes.

But while social examples are insightful and useful, experimental research is still needed for such questions. There are several studies that have tested MS effects among the non-religious and have found that MS does not increase their expressed faith (Norenzayan & Hansen, 2012; Vail et al., 2012; Jong et al 2012). A study by Vail et al. (2012), that specifically sampled atheists, found that MS did not lead atheists to report stronger religiosity, faith in a higher power, or faith in any of various supernatural agents. Other research (Jong et al., 2012) has assessed the impact of MS on non-religious participants' implicit associations and explicit religious faith. In two studies, when participants were asked to categorize various stimuli words as quickly as possible, MS led non-religious participants to more quickly associate supernatural concepts (e.g., heaven, god) with "real" rather than "imaginary," perhaps indicating an initial *implicit* activation of supernatural concepts when made aware of death. However, in a third study, when participants were asked to *explicitly* indicate their faith on Likert-type items, at their own pace, the non-religious participants again continued to explicitly reject religious faith even after MS. Together, these findings suggest that when atheists are reminded of death they may initially implicitly activate religious concepts, to *reflexively* prepare themselves to express terror-managing faith in supernatural concepts; but, when given time to *reflect* on supernatural concepts, over-ride that preparation and ultimately reject religious/supernatural beliefs given the stance that such supernatural claims do not meet the logical burdens of proof.

Indeed, recent research suggests that religious concepts, such as supernatural agency and teleological creation, are developmentally natural intuitions, meaning that the religious conceptualizations of supernatural agents, immortal souls, and afterlife are

buttressed by basic, evolutionarily adaptive cognitive inclinations to make intuitive causal attributions and interpret others' intentions (theory of mind), make moral judgments, engage in social learning, and judge the utility or purposes of people and objects (teleological reasoning), among other tasks (Barrett, 2000, 2004; Bering, 2006, 2010; Bloom, 2007; Boyer, 1994; Guthrie, 1993). As but one example, the evolutionarily adaptive ability to detect the intentions and desires of others created an "intuitive" inclination to see agency where there is none, to see "faces in the clouds" (Guthrie, 1993; Barrett, 2000). Implicit preferences for teleological explanations in both children and adults have led Kelemen and Rosset (2009) to argue that teleological explanations are used as a default explanation for many phenomena. Such research can help to explain why religion comes so naturally to humans, why it is a nearly universal phenomenon, and perhaps also why even atheists will implicitly activate religious concepts when aware of death. However, although religious and supernatural tendencies are intuitive, or natural, this does not mean that such intuitions will inevitably lead atheists to accept the supernatural concepts or explicit belief.

Recently, Norenzayan & Gervais (2013) have provided data-based arguments concerning the cognitive and motivational factors by which religious beliefs and concepts may be accepted. First, atheism can emerge due to a cognitive inability to mentally comprehend the concept of gods or supernatural agents. Such is the case among people with autism (Norenzayan, Gervais, & Trzesniewski, 2012) and among young children (Makris & Pnevmatikos, 2007), both having difficulty representing others' minds. Second, atheism may emerge when individuals are not motivated to convert religious intuitions into explicit belief, such as if a region is marked by relative economic

prosperity, health, and safety (Zuckerman, 2008). Third, atheism may emerge in regions characterized by strong secular cultures rather than in cultures shaped by religion. The fourth factor, engaging in analytic processing, is a much more common—and is by far the most commonly reported reason for atheism (Silver, 2014). Research on this topic is consistent with dual-process models of cognitive processing (Chaiken & Trope, 1999; Evans, 2008, 2010; also, Baumard & Boyer, 2013) which hold that intuitive processing (System 1) is quick, automatic, and implicit, whereas reflective processing (System 2) is typically slower, more deliberate, and explicit. For example, rather than relying on intuitive cognitive processes, which is associated with stronger religious belief, weaker and less prevalent religious belief occurs among those who engage in more analytic thinking. While analytic cognitive style helps over-ride cognitive intuitions that lead, for example, to endorsement of creationism rather than evolution (Gervais, 2015), experimental evidence shows that activating analytic thinking (e.g., via perceptual disfluency, or image-based or lexical primes of analytic thinking concepts), presumably over-riding intuition, decreases religious belief (Gervais & Norenzayan, 2012).

Furthermore, experimental conditions that *prevent* analytic thinking (e.g., high-speed response trials) have been shown to prevent people from engaging in analytical thinking and over-riding those intuitions—leading even Finns and American atheists to make cognitively intuitive errors consistent with religious creationist views (Jarnefelt, Canfield, & Kelemen, 2015). For example, Jarnefelt et al., 2015 presented believers and non-believers with images of both living and non-living things (e.g., a giraffe, a mountain) and asked them to judge whether “any being purposefully made the thing in the picture”, to measure teleological reasoning. When participants answered the questions

at their own pace, believers gave more teleological answers (the object was made by a “being”) than did non-believers (the object was not made by a “being”). However, when speeded, non-believer’s answers were more teleological, resembling those of believers. This suggests that when speeding restricts non-believer’s ability to engage in reflective thinking (system 2), forcing them to rely on intuitive processes (system 1), their responses become similar to that of religious individuals, revealing implicit reliance on teleological intuitions. This perspective further offers a way to understand why atheists reminded of death initially implicitly activate religious concepts (Jong et al., 2012), but maintain their rejection of religion when asked to provide explicit responses on self-report measures. This analysis leads to the novel theoretical perspective that atheists maintain their disbelief, even when made aware of death, by cognitively over-riding the motivation to express religious faith—and, therefore, that conditions that prevent people from cognitively over-riding religious intuitions would result in reminders of mortality leading even atheists to increase expressed religious faith.

## **CHAPTER II**

### **THE PRESENT RESEARCH**

The present research sought out to explore the role that analytic thinking may play in maintaining atheism in the face of the awareness of death, and further investigate the question of whether there are atheists in foxholes. The present study sampled atheists and used a 2 (MS vs control) x 2 (unspeeded vs speeded trials) x 4 (DV items: religious vs. intuitive but incorrect [teleological] vs. intuitive and correct [yes-bias] vs. non-intuitive and incorrect [no-bias]) design, explained further immediately below.

First, atheists were recruited based on a premeasure in which respondents identified their religious persuasion. Second, participants were contacted and recruited to complete the primary materials. The materials were borrowed methods from previous research (Vail et al., 2012) to manipulate the awareness of mortality (MS prime vs. control topic prime). Then, borrowing from both Kelemen et al., (2009) and Vail et al., (2012), participants were asked to indicate their agreement with a series of Likert-type self-report items assessing 1) religious faith, 2) agreement with intuitive but factually incorrect statements about teleological design, 3) intuitive and factually correct statements about causation and teleology (designed to bias questions toward agreement; a “yes”-bias), and 4) non-intuitive and factually incorrect statements about causation and

teleology (designed to bias questions toward disagreement; a “no”-bias). This measure was then manipulated according to Kelemen’s method; participants were randomly assigned to either complete the measure at their leisure (a typical Likert-type self-report; “unspeded trials” condition) or under a time pressure (“speded trials” condition). The purpose of the time pressure condition was to prevent participants from having the time to cognitively over-ride their intuitions, whatever those intuitions may be.

The first hypothesis was: a replication of prior research (Kelemen et al., 2009) in the control condition, such that low agreement with the teleological items should be found in the un-speded condition, but that they should increase agreement in the spedded trials condition—reflecting a reduced ability to logically over-ride intuitive concepts.

The second hypothesis was a simple extension of that prior research, connecting it directly to religious faith. In the control condition, it was expected that atheists in the un-speded condition would report low agreement with the religious faith items but increase expression of faith in the spedded condition—reflecting a reduced ability to analytically over-ride intuitively appealing, yet logically unwarranted (from an atheistic perspective), concepts.

The third and focal hypothesis was a full extension, intersecting this prior work with the motivational factor of death awareness. It was expected that in the un-speded condition, MS (vs. control) would have no impact on what is anticipated to be atheists’ rejection of the religious and teleological items—reflecting the idea that, even in the awareness of death, atheists likely utilize their analytic resources to cognitively over-ride such otherwise intuitive concepts. However, in the spedded condition, MS (vs. control) was expected to increase atheists’ agreement with the religious and teleological items—

reflecting the idea that the awareness of death exert a motivational influence on belief in intuitive (yet unwarranted) concepts if atheists are unable to wield their analytic resources to cognitively over-ride such processes. Lastly, we expected to find no effects of MS, or the MS x Trial Speeding interaction, on the yes-bias or no-bias items.



## **CHAPTER III**

### **METHOD**

#### **Estimation of Minimum Sample Size**

Sample size planning was based on selecting a “minimally important effect size” threshold (effects below which would be disregarded as trivial). The target analyses involved one set of religious/supernatural concepts dependent measures (with three subscales of general, Christian, and Hindu varieties) and one dependent measure on unjustified teleological statements.

Sample size planning for the first set was based on repeated measure ANOVA techniques, with an effect size of measuring the effect of a possible MS\*Speed interaction on the three subscale measures of general, Christian, and Hindu religious/supernatural beliefs. Using an a-priori power analysis for F-family tests for ANOVA (repeated measures, within-between interaction) (G\*Power; Faul, Erdfelder, Buchner, & Lang, 2009), we selected a minimum effect size threshold of  $f = .175$  (a small-medium effect), and set power to .80 for detecting effects at  $p = .05$ , with 4 groups, 3 measures, and an assumed (but actually unknown) correlation between measures of  $r = .50$ . This analysis recommended a minimum sample size of at least 80 participants.

Sample size planning for the second dependent measure was based on ANOVA techniques, with an effect size of measuring the effect of a possible MS\*Speed interaction on agreement with the teleological statements. Using an a-priori power analysis for F-family tests for ANOVA (fixed effects, special, main effects, and interactions) (G\*Power; Faul, Erdfelder, Buchner, & Lang, 2009), we selected a minimum effect size threshold of  $f = .175$  (a small-medium effect), and set power to .80 for detecting effects at  $p = .05$ , with 1 numerator df and 4 groups. This analysis recommended a minimum sample size of at least 259 participants.

### **Recruitment**

Due to the difficulty of recruiting sufficient numbers of atheists from the local population, a research panel company, *TurkPrime*, was hired to recruit atheist participants throughout the USA. TurkPrime is an academic research panel recruitment firm, and is a third-party entity separate from Amazon's Mechanical Turk (MTurk) crowd-sourced workforce platform. TurkPrime offers options for interfacing with MTurk's web-based workforce platform, but it also offers a number of other targeted recruitment services. An initial assessment by TurkPrime determined that there were not enough naïve atheists available via MTurk, so recruitment was instead accomplished through TurkPrime's independent *PrimePanels* recruitment service, which extends beyond MTurk to hundreds of other web-based platforms to reach up to 20 million respondents globally. The survey was set-up/coded on Qualtrics, and TurkPrime used PrimePanels to distribute the Qualtrics link to panel members who had previously indicated being "atheist" on a demographic item. Data collection took place over roughly two weeks (March 6-22, 2018) at the cost of \$4.00 per respondent.

## **Participant Characteristics**

A total of 497 panel members were initially recruited and completed the informed consent; 53 respondents either did not provide any data or discontinued the study, and thus did not respond to the MS manipulation, DVs, and/or complete the demographic survey (thus not able to confirm their atheist status). Of the remaining 444 participants, 70 reported being something other than atheist (34 “agnostic”, 28 “spiritual”, 3 “Christian”, 1 “Hindu”, 1 “Buddhist”, 1 “Jewish”, and 2 “other”). Of the remaining 374 atheists who completed the study, one skipped the manipulation and one skipped the dependent variable and were necessarily dropped.

Thus, the final sample consisted of 372 atheists who completed all the key manipulations and dependent variables. At the end of the survey, participants indicated age, sex, race, ethnicity, religious affiliation, years of education, and political orientation (see descriptives in *Table 1*).

## **Materials and Procedure**

In all cases, the study link was distributed 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 were presented.

**Cover story, personality measure.** To bolster the cover story and acclimate respondents to the survey format, a six-item version of the personal need for structure scale (PNS, Thomson et al., 2001) was presented. 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*). This measure is unrelated to the present hypothesis, and so will not be further mentioned.

**Mortality salience manipulation.** Following previous research (Rosenblatt et al., 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 and once you are physically dead.” The negative event topic prompts asked participants parallel questions about public speaking. This comparison topic was chosen to determine whether MS causes any effects beyond simply being a negative event.

**Delay and distraction.** Next, the 26-item positive and negative affect schedule (PANAS, Lambert, Eadeh, Peak, Scherer, Schott, & Slochower, 2014) was administered<sup>1</sup>, as well as a brief 3-5 minute reading task (an excerpt taken from Albert Camus’ *The Growing Stone*), followed by the self-affirmation manipulation. These materials were included to provide the delay and task-switching distraction needed to move death-awareness out of focal attention to observe distal terror management effects (see Pyszczynski, et al., 1999).

**Time pressure manipulation.** Participants were then randomly assigned to either a speeded or unspeeded condition. In the unspeeded condition, they were allowed to respond to each item at their own pace. In the speeded condition, however, they had just 3 seconds to respond to each dependent variable item. All participants were first presented with a “practice block” of 8 items for the sole purpose of acclimating

---

<sup>1</sup> Interested readers can find supplemental analyses on affect in Appendix B.

participants to the task. Following the practice block, the task paused, the instructions were presented again, and then participants completed a “target block” of 40 items that contained the key dependent measures. In the un-speeded condition, participants were told they would be able to take their time and think about their response, whereas participants in the speeded condition were informed that they would only have three seconds, and since this was a short period of time, they would need to respond as quickly as they could. See *Appendix A* for specific instructions, including language about the time-pressure manipulation, used in each condition.

**Target block: dependent measures and checks.** A total of 40 items were included in the target block and were presented in random order for each participant.

*Faith in religious/supernatural concepts.* The primary target dependent measure consisted of 12 items which assessed faith in religious/supernatural concepts ( $\alpha = .92$ ). Six of these items were domain-general ( $\alpha = .84$ ); three of those items explicitly evoked Christian religious/supernatural concepts ( $\alpha = .87$ ); and the remaining three of those items explicitly evoked Hindu religious/supernatural concepts ( $\alpha = .81$ ). An overall mean score was computed such that higher scores indicated greater faith.

*Teleological reasoning.* A second target dependent measure similarly consisted of 12 items assessing agreement with intuitive but logically unjustified/incorrect teleological statements ( $\alpha = .79$ ). A mean score was computed such that higher scores indicated greater teleological thinking.

*Manipulation checks.* One set of items were included to check stimuli processing ability (accuracy-check) across conditions, and two sets of items were included to check whether the manipulation successfully impaired System 2 processing. To check stimuli

processing ability, one set of four accuracy-check items instructed participants to select “strongly disagree,” “disagree,” “agree,” and “strongly agree,” respectively. To check whether the manipulation successfully impaired System 2 processing, one set of 6 items assessed agreement/disagreement with statements that were intuitive and logically correct ( $\alpha = .75$ ), and another set of 6 items assessed agreement/disagreement with statements that were counter-intuitive and logically incorrect ( $\alpha = .84$ ). Item mean scores were used. Whereas participants in the unspeeded condition should get the benefit of System 1 intuition as well as System 2 style reflective thought, and thus have stronger agreement/disagreement responses, those in the speeded condition were expected to have similarly biased—but weaker—responses due to the impairment of additional System 2 processing.

Participants were presented with items religious and teleological items and asked to indicate their agreement with those items using a 4-point Likert-type response scale (1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree)<sup>2</sup>, as listed in *Table 2*. Once they had selected their agreement with the item, the participants continued to the next item by pressing a NEXT button presented at the bottom of the screen. In the speeded condition, if the time ran out before the participants could press next, their answer was saved, and they were quickly presented with the next item. Timings were also recorded for all target block items, including time-to-first-click and time-to-item-submission. All dependent measure items are included in Appendix A.

---

<sup>2</sup> The Qualtrics multiple-choice item option required that participants click one of four small radio buttons, which pilot testing revealed to be exceptionally difficult to click/tap quickly in the speeded condition. Therefore, an image of a 1x4 bordered table showing the four Likert-type response options was created (see Appendix A); each item was coded in Qualtrics as a “hotspot” item, with the item statement presented above the image, and with four separate/independent hotspot response fields superimposed over the table cells so that clicking/tapping a particular table cell would toggle that particular response field’s data entry to “on” or “off”. After completion of the study, these verbal on/off data were cleaned by converting each item with a single valid hotspot response into a single 1-4 numeric rating.

**Demographics, religious/philosophical identification.** At the end of the survey, participants completed a demographic questionnaire. The demographics page asked about age, sex, race, ethnicity, education level, political orientation, and religious/philosophical identification. Regarding religious identification, response options were: “Christian”; “Muslim”; “Jewish”; “Buddhist”; “Hindu”; “Spiritual”; “Agnostic”; “Atheist” and “other.” Data from atheist respondents were retained for analysis.

## CHAPTER IV

### RESULTS

#### Preliminary Analyses

**Response Speed.** To measure and compare the speed-of-processing for each of the four target measures, time-to-first-click and time-to-item-submission were recorded and are analyzed below in seconds.

*Time to first click.* A 2 (MS vs. pain) x 2 (unspeeded vs speeded) x 3 (repeated measures: general religious/supernatural vs Christian supernatural vs Hindu supernatural vs teleological) mixed-model ANOVA found no main effect of measure ( $F(3, 1104) = .86, \eta_p^2 = .002, p = .46$ ), and no MS\*measure interaction ( $F(3, 1104) = .51, \eta_p^2 = .001, p = .67$ ) nor Speed\*measure interaction ( $F(3, 1104) = .79, \eta_p^2 = .002, p = .50$ ) nor three-way interaction ( $F(3, 1104) = .53, \eta_p^2 = .001, p = .66$ ), suggesting that any possible effects of the manipulations on time-to-first-click did not differ across the measures of faith in general, Christian, and Hindu supernatural concepts, and teleological statements. Also, there was no main effect of MS ( $F(1, 368) = 1.66, \eta_p^2 = .004, p = .20$ ) nor an MS\*Speed interaction,  $F(1, 368) = 1.78, \eta_p^2 = .005, p = .18$ . However, there did emerge the expected main effect of speed condition ( $F(1, 368) = 11.18, \eta_p^2 = .03, p = .001$ ), such that time-to-first-click was faster in the speeded condition ( $M = 1.45, SD = .27$ ) compared to the un-speeded condition ( $M = 4.31, SD = 11.66$ ).



*Time to item submission.* A 2 (MS vs. pain) x 2 (unspeeded vs speeded) x 3 (repeated measures: general religious/supernatural vs Christian supernatural vs Hindu supernatural vs teleological) mixed-model ANOVA found no main effect of measure ( $F(3, 1104) = 1.07, \eta_p^2 = .003, p = .36$ ), and no MS\*measure interaction ( $F(3, 1104) = .66, \eta_p^2 = .002, p = .58$ ) nor Speed\*measure interaction ( $F(3, 1104) = .84, \eta_p^2 = .002, p = .47$ ) nor three-way interaction ( $F(3, 1104) = .65, \eta_p^2 = .002, p = .58$ ), suggesting that any possible effects of the manipulations on time-to-item-submission did not differ across the measures of faith in general, Christian, and Hindu supernatural concepts, and teleological statements. Also, there was no main effect of MS ( $F(1, 368) = 1.43, \eta_p^2 = .004, p = .23$ ) nor an MS\*Speed interaction,  $F(1, 368) = 1.53, \eta_p^2 = .004, p = .22$ . However, there did emerge the expected main effect of speed condition ( $F(1, 368) = 11.15, \eta_p^2 = .03, p = .001$ ), such that time-to-first-click was faster in the speeded condition ( $M = 2.61, SD = .39$ ) compared to the un-speeded condition ( $M = 5.52, SD = 11.87$ ).

**Stimuli processing ability.** Given that some participants were responding quickly, we also checked whether participants were indeed able to read the items under each speed condition, by inspecting the overall accuracy rates across the four accuracy-check items embedded at random in the target block. Item 1 instructed a “strongly disagree” response; item 2 “disagree”; item 3 “agree”; and item 4 “strongly agree.” These items were not used as exclusion criteria, nor as covariates, because it was anticipated that the speeded condition would be demanding and therefore suppress response rates but also that response rates would be orthogonal to comprehension. Indeed, in the unspeeded condition, participants ( $n = 191$ ) faced 764 accuracy-check items and only had 4 missed responses for a non-response rate of .005%; whereas in the speeded condition,

participants ( $n = 181$ ) faced a total of 724 accuracy-check items and had 133 missed responses for a non-response rate of 18.37%. However, the accuracy rates were high in both conditions. In the unspeeded condition, of the 760 responses given, a total of 748 (98.42%) were able to accurately follow the item instructions; whereas in the speeded condition, of the 591 responses given, a total of 548 (92.72%) were able to comprehend the items and accurately follow the item instructions. These findings indicate that participants in both conditions were indeed able to read and comprehend the check items with high accuracy.

**System 2 processing manipulation check.** Next, we checked whether the speed manipulation had the desired effect of manipulating participants' ability to use System 2 processing to reflectively regulate their responses on items with a clearly correct/incorrect answer. First, we analyzed agreement/disagreement with 6 items that were intuitive and logically correct ( $\alpha = .75$ ); System 1 should produce an intuitive agreement bias, and System 2 should solidify that agreement further via reflective thought. Second, we analyzed agreement/disagreement with 6 items that were counter-intuitive and logically incorrect ( $\alpha = .84$ ); System 1 should produce an intuitive disagreement bias, and System 2 should solidify that disagreement further via reflective thought. Thus, if the time pressure in the speeded condition impairs System 2 processing, then agreement/disagreement should be less extreme than in the unspeeded condition where participants would get the benefit of System 1 intuition *as well as* System 2 style reflective thought.

*Intuitive and logically justified/correct items.* A 2 (MS vs. pain) x 2 (unspeeded vs speeded) ANOVA revealed no main effect of MS ( $F(1, 368) = 2.05, \eta_p^2 = .006, p = .15$ ),

nor a two-way interaction,  $F(1, 368) = .34$ ,  $\eta_p^2 = .001$ ,  $p = .56$ . However, there did emerge a significant main effect of speed condition,  $F(1, 368) = 8.92$ ,  $\eta_p^2 = .02$ ,  $p = .003$ , such that agreement with these statements was higher in the unspeeded condition ( $M = 3.56$ ,  $SD = .37$ ) compared to the speeded condition ( $M = 3.43$ ,  $SD = .52$ ), indicating that the ability to use System 2 reflective thought was impaired in the speeded condition.

*Counter-intuitive and logically unjustified/incorrect items.* A 2 (MS vs. pain) x 2 (unspeeded vs speeded) ANOVA revealed no main effect of MS ( $F(1, 366) = .81$ ,  $\eta_p^2 = .002$ ,  $p = .37$ ) nor two-way interaction,  $F(1, 366) = .005$ ,  $\eta_p^2 < .001$ ,  $p = .94$ . However, there did emerge a significant main effect of speed condition,  $F(1, 366) = 39.74$ ,  $\eta_p^2 = .10$ ,  $p < .001$  such that rejection of the logical-no statements was stronger in the unspeeded condition ( $M = 1.14$ ,  $SD = .31$ ) compared to the speeded condition ( $M = 1.44$ ,  $SD = .59$ ), indicating that the ability to use System 2 reflective thought was impaired in the speeded condition.

**Summary.** Together, these preliminary findings indicate that participants in the speeded (vs unspeeded) condition were effectively pressured to respond quickly, and that although they were still able to read and comprehend the items accurately under time pressure, the time pressure successfully impaired their System 2 style reflective ability.

### **Target Analyses**

Descriptive statistics for the target analyses, by condition, are listed in *Table 3*.

**Faith in religious/supernatural concepts.** A 2 (MS vs. pain) x 2 (unspeeded vs speeded) x 3 (repeated measures of faith in supernatural concepts: general vs Christian vs Hindu) mixed-model ANOVA revealed a main effect of measure ( $F(2, 736) = 46.24$ ,  $\eta_p^2 = .11$ ,  $p < .001$ ), such that atheists rejected Christian supernatural concepts ( $M = 1.22$ ,  $SD$

= .44) more strongly than Hindu supernatural concepts ( $M = 1.27$ ,  $SD = .45$ ) which were also rejected more strongly than general supernatural concepts ( $M = 1.41$ ,  $SD = .51$ ) (all  $t(370)s \geq 2.94$ ,  $p \leq .003$ ). However, there was no MS\*measure interaction ( $F(2, 736) = .96$ ,  $\eta_p^2 = .003$ ,  $p = .37$ ) nor Speed\*measure interaction ( $F(2, 736) = 1.73$ ,  $\eta_p^2 = .005$ ,  $p = .18$ ) nor three-way interaction ( $F(2, 736) = 2.17$ ,  $\eta_p^2 = .006$ ,  $p = .12$ ), suggesting that any possible effects of the manipulations did not differ across the measures of faith in general, Christian, and Hindu supernatural concepts<sup>3</sup>.

Also, there was no main effect of MS ( $F(1, 368) = .67$ ,  $\eta_p^2 = .002$ ,  $p = .41$ ) nor a main effect of speed condition ( $F(1, 368) = .80$ ,  $\eta_p^2 = .002$ ,  $p = .80$ ). However, there did emerge the predicted MS\*Speed interaction,  $F(1, 368) = 5.91$ ,  $\eta_p^2 = .01$ ,  $p = .02$  (see *Figure 1*). In the unspeeded condition, rejection of faith in supernatural/religious concepts was significantly stronger in the MS condition than the public speaking condition ( $t[189] = -2.34$ ,  $d = -.35$ , 95%CI  $[-.64, -.06]$ ,  $p = .02$ ). However, in the speeded condition, rejection of faith in supernatural/religious concepts was non-significantly reduced in the MS condition compared to the public speaking condition ( $t[179] = 1.13$ ,  $d = .17$ , 95%CI  $[-.12, .46]$ ,  $p = .26$ ).

**Intuitive but logically unjustified/incorrect teleological statements.** A 2 (MS vs. pain) x 2 (unspeeded vs speeded) ANOVA revealed no main effect of MS ( $F(1, 368) = 1.74$ ,  $\eta_p^2 = .005$ ,  $p = .19$ ), although there did emerge a significant main effect of speed condition,  $F(1, 368) = 11.60$ ,  $\eta_p^2 = .03$ ,  $p = .001$ , such that agreement with the intuitive but unjustified/incorrect teleological statements was higher in the speeded condition ( $M = 3.14$ ,  $SD = .47$ ) compared to the unspeeded condition ( $M = 2.96$ ,  $SD = .49$ ). There was no

---

<sup>3</sup> Interested readers can find supplemental analyses and figures for the three separate subscales in Appendix B.

significant 2-way interaction,  $F(1, 368) = .28, \eta_p^2 = .001, p = .60$  (*Figure 2*). In the unspeeded condition, agreement with the unjustified teleological statements was non-significantly stronger in the MS condition than the public speaking condition ( $t[189] = 1.33, d = .18, 95\%CI [-.10, .47], p = .19$ ). However, in the speeded condition, there was no difference in agreement with the unjustified teleological statements in the MS condition compared to the public speaking condition ( $t[179] = .56, d = .11, 95\%CI [-.19, .40], p = .58$ ).

## **CHAPTER V**

### **DISCUSSION**

First, I hypothesized that atheists in the un-speeded conditions would report low agreement with the teleological items, but that they would increase agreement in the speeded trials condition. This hypothesis was supported by the data; results revealed a significant main effect of the speed condition, indicating that agreement with the intuitive but unjustified/incorrect teleological statements was higher in the speeded condition compared to the un-speeded condition. Second, I hypothesized that atheists in the un-speeded conditions should similarly report low agreement with religious items, but that they should increase agreement in the speeded trials condition. This hypothesis was unsupported by the data; there was no Speed main effect nor Speed\*measure interaction, indicating that religious faith was not generally impacted by the speed manipulation. Third, we hypothesized that in the un-speeded condition, MS (vs. control) would have no impact on atheists' rejection of the religious and teleological items, whereas in the speeded condition MS (vs. control) would increase atheists' agreement with the religious and teleological items. This hypothesis received mixed support. MS led to increased rejection of faith in supernatural/religious concepts in the un-speeded condition, but not the speeded condition. Additionally, whereas there was a main effect of speed on

teleological reasoning, there was no main effect or interaction involving MS.

Implications are as follows.

### **Data In Context: Interpretations, Implications, and Future Directions**

First, the present work converges with prior research on the dual process model of cognition, suggesting that system 1 thinking is based on automatic/intuitive processing while system 2 thinking is more analytical (Evans, 2003; Evans, 2008; Morewedge & Kahneman, 2010). Previous work has found that intuitive processing can lead to the perception of teleological relationships between intuitively related objects, even when such inferences are illogical. For example, Finns and atheists in speeded conditions (restricting to System 1 processing) report higher teleological thinking compared to un-speeded conditions (allowing System 2 processing; Kelemen and Rosset, 2009; Jarnefelt, Canfield, & Kelemen, 2015). The present research replicated those findings; atheists increased their agreement with logically unjustified but intuitive teleological statements when in a speeded condition compared to an un-speeded condition.

Second, the present results were inconsistent with the idea that this teleological intuition is processed similarly to religious faith. That was an idea suggested by research on the cognitive science of religion (Barrett, 2000, 2004; Bering, 2006, 2010; Bloom, 2007; Boyer, 1994; Guthrie, 1993), in addition to research suggesting that atheism and analytical thinking are related (Gervais & Norenzayan, 2012). However, the results suggest that there was no increased agreement with religious items among atheists in the speeded condition compared to atheists in the un-speeded condition. This finding also perhaps diverges from previous work by Jarnefelt (2015) which suggested that atheists were more likely to increase their agreement with “creationist” items and explanations

when in a speeded compared to an unspeeded condition. This indicates that despite the fact that atheists may be more likely to endorse certain forms of teleological thinking when speeded and relying on system 1 processes (Kelemen and Rosset, 2009), they generally remained reluctant to endorse religious concepts when relying on their intuition. This raises potential questions for future research about the nature of atheists' vigilance about general teleological errors compared to specifically religious concepts. One possibility is that both teleological and religious concepts may indeed seem intuitive to atheists, but atheists may not be particularly "on guard" for mundane teleological statements (e.g., about the sun existing to sustain flowers) because they may not have previously decided to reject those ideas; in contrast, atheists may be more strongly vigilant about religious concepts because such concepts sit at odds with their expressed beliefs about the world. Another possibility is that atheists' particular belief systems or explicit logical deductions may have influenced their cognitive associations such that supernatural concepts no longer seem intuitive to them, in which case even a speeded condition would not have the effect of increasing religious faith per se.

Third, the present research also partially converges with prior research examining the effects of MS on atheists' possible religious beliefs. Previous research concerning these issues has provided different insights into atheist's religious beliefs when confronted with existential threat. In terms of explicit religiosity, Vail (2012) found that atheists made aware of their mortality *maintain* their explicit atheism, whereas Jong (2012) found that atheists *increase* their explicit atheism. Our data is more consistent with Jong's findings; in the unspeeded condition, MS led atheists to demonstrate an increased rejection of religious concepts. These findings add support to the *worldview*



*defense hypothesis* (Ardnt, Greenberg, Solomon, Pyszczynski, & Simon, 1997), suggesting that when made aware of their mortality, atheists will more strongly affirm their support for their non-religious worldview. Additionally, prior research (Jong et al., 2012) has also measured the effect of MS on religiosity when restricted to System 1 processing, by using an implicit association test (IAT) of activation of religious concepts—finding that MS led atheists to more strongly associate religious concepts as “real” (vs imaginary). However, in the speeded condition, which also presumably restricted to System 1 processing, MS did not lead to stronger expressions of religious faith. There was a pattern in the predicted direction, such that in the speeded condition MS tended to increase religiosity, but that directional trend was not strong enough to reach statistical significance in this well-powered study. It is not immediately clear whether methodological differences can possibly account for the difference between these and the prior results. However, it is worth noting that the Jong studies recruited participants who scored low on a religiosity scale (and were thus thought to be “non-religious”), whereas the present research recruited participants who were confirmed atheists; perhaps those samples represent meaningfully different populations.

Fourth, the present work diverges from prior research finding that MS increased teleological beliefs (Davis, Juhl, & Routledge, 2010), suggesting that teleological beliefs (the notion that events, actions, or the world have intentional causes with a purpose) help assuage the potential anxiety that can arise from the awareness of mortality. As above, the present work found a directional trend such that MS tended to increase agreement with teleological statements, but that trend was not strong enough to reach statistical significance. The current and prior work used similar methods; but again, it is worth

noting differences in the recruited samples; the prior work recruited a general sample, whereas the present work recruited confirmed atheists. It is not immediately apparent whether or why that difference should moderate the effect, but future research could investigate whether it does and—if so—further investigate possible mechanisms.

### **Limitations**

One of the possible limitations of the present research is the inability to monitor the participants in a controlled lab setting given the online nature of the study. The online setting, which was necessary to attain a sufficient number of atheist participants, leaves the researcher incapable of physically ensuring that accurate attention is being paid to the studies procedures throughout the duration of the experiment, although the present research methods did have certain attention check items in place that were designed to offset this potential problem and did indeed appear to verify sufficient attention throughout.

Another potential limitation of this study is that there may be methodological complications surrounding atheist's ability to recognize the religious content of religious items and tendency to associate them as false. In this case, speeding participants may be too crude of a way to measure atheists intuitive system 1 responses. While three seconds has been fast enough to lower atheist's inhibitions about teleological items (Jarnefelt, 2015), as mentioned previously, atheists may be more on guard for religious items and therefore may be quick enough to subvert any possible intuitive appeal. Previous research (Jong, et al 2012) has utilized implicit associations (IAT) to measure atheist's implicit responses toward religious concepts. Furthermore, rather than inhibiting participants ability to engage system 2 cognition by speeding them, an alternative method to deplete

system 2 cognition and measure system 1 cognition could be to implement a cognitive load (have participants keep an eight-digit number in their working memory therefore depleting their cognitive resources). This alternative was not available for the present study given its online nature, where participants could not be directly monitored to ensure they did not cheat during this method (writing the number down as opposed to holding it in their working memory). These alternative methods may play a useful role in future research.

Additionally, in terms of demographics, it worth mentioning that our sample of participants were also older than most participants in most of the previous literature. Due to the fact that our study was completed online and sampled atheists from across the country, the median age of our sample (38.38) is older than previous samples of participants due to their recruitment of undergraduate psychology students. Future research may take into consideration the role that age may play in existential threat and religious beliefs.

Another area that future research could address is the role that one's religious history may play in these circumstances. Although we did not assess the religious history of participants, atheists who were raised religious may be more likely to intuitively activate religious concepts given their past socialization or due to a reversion back to their prior defenses, than atheists who were raised in a more secular environment/household and have never been strongly exposed to religious doctrines. This kind of exploration in future research may bring to light individual factors in atheist's lives concerning this complex question.

## **Conclusion**

The atheist in the proverbial foxhole has served as a topic of discussion in conversations concerning religious convictions, decision making, and existential threat. In the case of Albert Camus novel, the atheist Meursault maintains his atheism even though his demise is near. The present research suggests, consistent with Meursault's decision and previous anecdotal evidence, that even when made aware of mortality atheists will stand steadfast in their convictions, maintaining their atheism despite their existential dilemma. While some have argued that atheists will ultimately succumb to the appeal of the afterlife and or a sympathetic God, others have argued that atheists will stand steadfast in their disbelief. While the anecdotal evidence of atheists on their deathbed and in combat have made it clear that atheists are capable of standing by their convictions in the face of death, empirical evidence has generally provided a more mixed answer, suggesting that atheists managing death awareness may maintain or even increase their disbelief when able to draw upon their beliefs (Jong et al 2012, Vail et al, 2012), but perhaps not when pressed to rely on their intuitions (Kelemen & Rosset 2009, Jarnefelt, 2015). However, the present work raises questions about whether even that picture may be more complicated and tentative than it might seem.

## REFERENCES

- 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*, Vol 73, 5-18.
- Barrett, J. L. (2000). Exploring the natural foundations of religion. *Trends in cognitive sciences*, 4, 29-34.
- Barrett, J. L. (2004). *Why would anyone believe in God?* AltaMira Press.
- Baumard, N., & Boyer, P. (2013). Religious beliefs as reflective elaborations on intuitions: A modified dual-process model. *Current Directions in Psychological Science*, 22, 295-300.
- Becker, E. (1973). *The Denial of Death*. New York: Free Press.
- Bering, J. (2006). The Cognitive Psychology of Belief in the Supernatural Belief in a deity or an afterlife could be an evolutionarily advantageous by-product of people's ability to reason about the minds of others. *American scientist*, 94, 142-149.
- Bloom, Paul. "Religion is natural." *Developmental science* 10.1 (2007): 147-151.
- Boyer, P. (1994). Cognitive constraints on cultural representations: Natural ontologies and religious ideas. *Mapping the mind: Domain specificity in cognition and culture*, 391-411.

- Burke, B., Martens, A., Faucher, E. (2010). Two decades of terror management theory: A meta-analysis of mortality salience research. *Personality and Social Psychology Review*, Vol 14, pp. 155-195.
- Camus, A. (1942). *The Stranger*. New York: Vintage International.
- Chaiken, S., & Trope, Y. (Eds.). (1999). *Dual-process theories in social psychology*. Guilford Press.
- Dawkins, R. (2006). *The God Delusion*. Boston, New York: Houghton Mifflin Company.
- Dechesne, M., Pyszczynski, T., Arndt, J., Ransom, S., Sheldon, K. M, van Knippenberg, A., & Janssen, J. (2003). Literal and symbolic immortality: The effect of evidence of literal immortality on self-esteem striving in response to mortality salience. *Journal of Personality and Social Psychology*, 84, 722-737.
- Evans, J. S. B. (2003) In two minds: Dual-process accounts of reasoning. *Trends in Cognitive Sciences*, Vol 7, pp. 454-459.
- Evans, J. S. B. (2008). Dual-processing accounts of reasoning, judgment, and social cognition. *Annu. Rev. Psychol.*, 59, 255-278.
- Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G\* Power 3.1: Tests for correlation and regression analyses. *Behavior research methods*, 41, 1149-1160.
- Gervais, W. M. & Norenzayan, A. (2012). Analytic thinking promotes religious disbelief. *Science*, Vol. 336, 493-496.
- Gervais, W. (2015). Override the controversy: Analytic thinking predicts endorsement of evolution. *Cognition*. 142, pp. 312-321.

- Greenberg, J., Pyszczynski, T., & Solomon, S., (1986). The Causes and Consequences of a Need for Self-Esteem: A Terror Management Theory. *Springer Series in Social Psychology. Public Self and Private Self*, pp. 189-212.
- 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, pp. 308-318.
- Greenberg, J., Porteus, J., Simon, L., Pyszczynski, T. (1995). Evidence of a terror management function of cultural icons: The effects of mortality salience on the inappropriate use of cherished cultural symbols. *Personality and Social Psychology Bulletin*, 21, pp. 1221-1228.
- Guthrie, S. E. (1995). *Faces in the clouds: A new theory of religion*. Oxford University Press.
- Jackson, J., Jong, J., Bluemke, M., Poulter, P., Morgenroth, L., Halberstadt, J. (2017). Testing the Causal Relationship Between Religious Belief and Death Anxiety. *Religion, Brain & Behavior*, Vol 7, pp. 296-298.
- Järnefelt, E., Canfield, C. F., & Kelemen, D. (2015). The divided mind of a disbeliever: Intuitive beliefs about nature as purposefully created among different groups of non-religious adults. *Cognition*, 140, 72-88.
- Jong, J., Halberstadt, J., & Bluemke, M. (2012). Foxhole atheism, revisited: The effects of mortality salience on explicit and implicit religious belief. *Journal of Experimental Social Psychology*. Vol 48, pp. 983-989.

- Kelemen, D., Rosset, E. (2009). The Human Function Compunction: Teleological Explanation in Adults. *Cognition*, Vol 111, pp. 138-143.
- Kesebir, P. (2011). Existential functions of culture: The monumental immortality project. *Cultural processes: A social psychological perspective*, pp. 96-110.
- Lambert, A. J., Eadeh, F. R., Peak, S. A., Scherer, L. D., Schott, J. P., & Slochower, J. M. (2014). Toward a greater understanding of the emotional dynamics of the mortality salience manipulation: Revisiting the “affect-free” claim of terror management research. *Journal of personality and social psychology*, 106, 655.
- Makris, N., & Pnevmatikos, D. (2007). Children's understanding of human and supernatural mind. *Cognitive Development*, 22, 365-375.
- Morewedge, C., Kahneman, D. (2010). Associative Processes in Intuitive Judgement. *Trends in Cognitive Sciences*, Vol 14, pp. 435-440.
- Norenzayan, A., Gervais, W. (2006). Belief in Supernatural Agents in the Face of Death. *Personality and Social Psychology Bulletin*. Vol 32, pp. 174-187.
- Norenzayan, A., Gervais, W. (2012) Analytic Thinking Promotes Religious Disbelief. *Science*. Vol 336, pp. 493-496.
- Norenzayan, A., Gervais, W. M., & Trzesniewski, K. H. (2012). Mentalizing deficits constrain belief in a personal God. *PloS one*, 7, e36880.
- Norenzayan, A., & Gervais, W. M. (2013). The origins of religious disbelief. *Trends in Cognitive Sciences*, 17, 20-25.
- Osarchuk, M., & Tatz, S. J. (1973). Effect of induced fear of death on belief in afterlife. *Journal of Personality and Social Psychology*, 27, 256–260.



- Pew Research Center. (2015). America's changing religious landscape: Christians decline sharply as share of population; unaffiliated and other faiths continue to grow. Retrieved from <http://www.pewforum.org/files/2015/05/RLS-08-26-full-report.pdf>
- Pyszczynski, T., Solomon, S., Greenberg, J. (1999). A dual-process model of defense against conscious and unconscious death-related thoughts: An extension of terror management theory. *Psychological Review*. Vol 106, pp. 835-845.
- Pyszczynski, T., Greenberg, J., Solomon, S., Arndt, J., Schimel, J., (2004). *Psychological Bulletin*, Vol 130, pp. 435-468.
- 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.
- Routledge, C., & Arndt, J. (2008). Self-sacrifice as self-defence: Mortality salience increases efforts to affirm a symbolic immortal self at the expense of the physical self. *European Journal of Social Psychology*, 38, 531-541.
- Russell, B. (1957). Why I am not a Christian. In P. Edwards (Ed.), *Why I am not a Christian, and other essays on religion and related subjects*. New York, NY: Simon & Schuster. (Original work published 1927)
- Schimel, J., Hayes, J., Williams, T. J., & Jahrig, J. (2007). Is death really the worm at the core? Converging evidence that worldview threat increases death-thought accessibility. *Journal of Personality and Social Psychology*, 92, 789-803.

- Silver, Christopher F., et al. "The six types of nonbelief: a qualitative and quantitative study of type and narrative." *Mental Health, Religion & Culture* 17.10 (2014): 990-1001.
- Smith-Stoner, M. (2007). *End of Life Preferences for Atheists*. *Journal of Palliative Medicine*, Vol 10, pp. 923-928.
- Solomon, S., Greenberg, J., & Pyszczynski, T. (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*.
- Tracey, J. L., Hart, J., & Martens, J. P. (2011). Death and Science: The Existential Underpinnings of Belief in Intelligent Design and Discomfort with Evolution. *PLoS ONE* 6: e17349. doi:10.1371/journal.pone.0017349
- Vail, K., Rothschild Z., Weise, M., Solomon, S., Pyszczynski, T., & Greenberg, J. (2010). A Terror Management Analysis of the Psychological Functions of Religion. *Personality and Social Psychology Review*. Vol 14, pp. 84-94.
- Vail, K. E., Arndt, J., & Abdollahi, A. (2012). Exploring the existential function of religion and supernatural agent beliefs among Christians, Muslims, Atheists and Agnostics. *Personality and Social Psychology Bulletin*, 38, 1288-1300.
- Vernon, G. M. (1969). The religious "nones." *Journal for the Scientific Study of Religion*, 7, 219-229.
- Zuckerman, P. (2008) *Society without God*, New York University Press



**Appendix B**  
[MANIPULATION #1: MORTALITY SALIENCE CONDITION]

The Projective Life Attitudes Assessment

1. PLEASE BRIEFLY DESCRIBE THE EMOTIONS THAT THE THOUGHT OF YOUR OWN DEATH AROUSES IN YOU.

---

---

---

---

---

---

---

---

2. JOT DOWN, AS SPECIFICALLY AS YOU CAN, WHAT YOU THINK HAPPENS TO YOU AS YOU PHYSICALLY DIE AND ONCE YOU ARE PHYSICALLY DEAD.

---

---

---

---

---

---

---

---

[MANIPULATION #1: PUBLIC SPEAKING CONDITION]

The Projective Life Attitudes Assessment

1. PLEASE BRIEFLY DESCRIBE THE EMOTIONS THAT THE THOUGHT OF PUBLIC SPEAKING AROUSES IN YOU.

---

---

---

---

---

---

---

---

---

2. JOT DOWN, AS SPECIFICALLY AS YOU CAN, WHAT YOU THINK PHYSICALLY WILL HAPPEN TO YOU AS YOU PHYSICALLY EXPERIENCE PUBLIC SPEAKING.

---

---

---

---

---

---

---

---

---

**Appendix C**  
**PANAS [REVISED; LAMBERT ET AL., 2014]**

This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way RIGHT NOW.

- | 1                        | 2 | 3 | 4                   | 5                     | 6                   |  |
|--------------------------|---|---|---------------------|-----------------------|---------------------|--|
| <i>Strongly Disagree</i> |   |   |                     | <i>Strongly Agree</i> |                     |  |
| 1. ____ afraid           |   |   | 10. ____ distressed |                       | 19. ____ serene     |  |
| 2. ____ comforted        |   |   | 11. ____ insecure   |                       | 20. ____ sad        |  |
| 3. ____ nervous          |   |   | 12. ____ soothed    |                       | 21. ____ worried    |  |
| 4. ____ happy            |   |   | 13. ____ irate      |                       | 22. ____ dejected   |  |
| 5. ____ anxious          |   |   | 14. ____ scared     |                       | 23. ____ calm       |  |
| 6. ____ at-ease          |   |   | 15. ____ satisfied  |                       | 24. ____ relaxed    |  |
| 7. ____ unsure           |   |   | 16. ____ fearful    |                       | 25. ____ frightened |  |
| 8. ____ irritable        |   |   | 17. ____ mad        |                       | 26. ____ uncertain  |  |
| 9. ____ tranquil         |   |   | 18. ____ angry      |                       |                     |  |

**Appendix D**  
[MANIPULATION #2: SPEEDED CONDITION]

*[Instructions for the PRACTICE BLOCK:]*

In the next task, you will be presented with a series of 8 statements, presented one at a time, and asked to indicate whether you agree or disagree. For example:

Chocolate is a delicious treat.

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

In this example, you would click/tap the appropriate box, and then click/tap "Next" to record your response and proceed to the next item.

**However, each item will be presented for only 3 seconds. This is a VERY short period of time, and means you will need to read the item and respond as quickly as you possibly can.**

When you're ready, please press "Next" to begin.

*[The following practice block items were presented in random order, using qualtrics survey flow randomizing feature.]*

1. Ferns grow in forests in order to provide ground shade
2. Trees produce oxygen so that animals can breathe
3. The sun radiates heat in order to nurture life
4. Rocks are sometimes jagged so that animals don't sit on them
5. Water freezes when the temperature drops
6. Stoplights change color in order to control traffic
7. Polar bears are white because the sun bleaches them
8. Animals grow ears in order to smell things

*[Instructions for the TARGET BLOCK:]*

Now that you have had some practice, we will do a main target task of 40 items.

As a reminder, you will be presented with a series of statements, presented one at a time, and asked to indicate whether you agree or disagree. For example:

Chocolate is a delicious treat.

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

In this example, you would click/tap the appropriate box, and then click/tap "Next" to record your response and proceed to the next item.

**However, each item will be presented for only 3 seconds. This is a VERY short period of time, and means you will need to read the item and respond as quickly as you possibly can.**

When you're ready, please press "Next" to begin.

*[The following 40 target block items were presented in random order, using qualtrics survey flow randomizing feature.]*

Item type	Item
<b>Faith in religious/supernatural concepts</b>	
General religious/ supernatural concepts	1. Religious beliefs are basically correct
	2. There is a higher power in the world
	3. People have immortal souls
	4. Supernatural beings exist (e.g., God, angels)
	5. An afterlife exists (e.g., Heaven)
	6. When I die my soul will live on
Christian supernatural concepts	7. The Christian God is real.
	8. The Christian God answers prayers.
	9. The Christian God sometimes intervenes in the world
Hindu supernatural concepts	10. The Hindu gods are real
	11. The Hindu gods answer prayers
	12. The Hindu gods sometimes intervene in the world
<b>Intuitive but logically unjustified/incorrect teleological items</b>	
	13. Finches diversified in order to survive
	14. Germs mutate to become drug resistant
	15. Parasites multiply to infect the host
	16. Earthworms tunnel underground to aerate the soil
	17. Mites live on skin in order to consume skin cells
	18. Moss forms around rocks to help stop soil erosion
	19. Earthquakes happen because tectonic plates must realign
	20. Geysers blow in order to discharge underground heat
	21. The earth has an ozone layer to protect it from UV light
	22. The sun makes light so that plants can photosynthesize
	23. Water condenses to moisten the air
	24. Molecules fuse in order to create matter
<b>Intuitive and logically justified/correct items</b>	
	25. Flowers wilt because they get dehydrated
	26. Bread rises because it contains yeast
	27. People get the flu because they catch a virus
	28. Children wear gloves to keep their hands warm
	29. Teapots whistle to signal the water is boiling
	30. People buy vacuums because they suck up dirt
<b>Counter-intuitive and logically unjustified/incorrect items</b>	
	31. Zebras have black stripes because they eat coal
	32. Gusts of wind occur because animals exhale together
	33. Clouds form because bits of cotton collect together
	34. Cars have horns to illuminate dark roads
	35. Eyelashes exist so that people can wear mascara



---

36. Mothers kiss babies in order to scare them

---

**Accuracy checks**

37. On this item please hit strongly disagree and hit next

38. On this item please hit disagree and hit next

39. On this item please hit agree and hit next

40. On this item please hit strongly agree and hit next

---

## Appendix E

### [MANIPULATION #2: UNSPEEDED CONDITION]

#### [Instructions for the PRACTICE BLOCK:]

In the next task, you will be presented with a series of 8 statements, presented one at a time, and asked to indicate whether you agree or disagree. For example:

Chocolate is a delicious treat.

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

In this example, you would click/tap the appropriate box, and then click/tap "Next" to record your response and proceed to the next item.

Each item will remain on the screen until you respond. This allows you to take your time, and means you may take your time to think about your responses.

When you're ready, please press "Next" to begin.

*[The practice block items described above were presented in random order, using qualtrics survey flow randomizing feature.]*

#### [Instructions for the TARGET BLOCK:]

Now that you have had some practice, we will do a main target task of 40 items.

As a reminder, you will be presented with a series of statements, presented one at a time, and asked to indicate whether you agree or disagree. For example:

Chocolate is a delicious treat.

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

In this example, you would click/tap the appropriate box, and then click/tap "Next" to record your response and proceed to the next item.

Each item will remain on the screen until you respond. This allows you to take your time, and means you may take your time to think about your responses.

When you're ready, please press "Next" to begin.

*[The 40 target block items described above were presented in random order, using qualtrics survey flow randomizing feature.]*

**Appendix F**  
**Demographic**

1.) What is your age? \_\_\_\_\_ 2.) What is your sex? \_\_\_\_\_ Male \_\_\_\_\_ Female

3.) Is English your native language?

4.) What is your ethnicity? \_\_\_\_\_ Hispanic or Latino \_\_\_\_\_ Not Hispanic or Latino

5.) What is your race? (check only one)

\_\_\_\_\_ 1. Caucasian \_\_\_\_\_ 4. Asian/Pacific Islander  
\_\_\_\_\_ 2. African American \_\_\_\_\_ 5. Native Hawaiian/Pacific Islander  
\_\_\_\_\_ 3. American Indian/Native Alaskan \_\_\_\_\_ 6. Other (specify): \_\_\_\_\_

6.) How many years of education have you completed? \_\_\_\_\_  
(e.g., if completed through sophomore year of high school, enter 10; if graduated from high school, enter 12; if four years of college, enter 16; and so on)

7.) Please rate your political orientation:

1      2      3      4      5      6  
Progressive                  Moderate                  Conservative

8.) How strongly do you identify with your political orientation, indicated in #5 above?

1      2      3      4      5      6  
Very Important                  Moderate                  Not at all important

9.) With which political party do you most strongly identify? (circle one)

Democratic party                  Green party                  Constitution party  
Republican party                  Libertarian party                  Other: \_\_\_\_\_

10.) How strongly do you identify with the political party indicated in #7 above? (circle one)

1      2      3      4      5      6  
Very Important                  Moderate                  Not at all important

11.) Please indicate your religious affiliation, if any (please circle one):

1. Christian                  6. Atheist (I do not believe supernatural beings exist)  
2. Muslim                  7. Spiritual (I believe supernatural beings exist, but I do not  
3. Jewish                                  follow a specific religion)  
4. Buddhist                  8. Agnostic (I'm not sure whether, or it is not possible to know  
5. Hindu                                  whether, supernatural beings do or do not exist)  
9. Other: \_\_\_\_\_

12.) Please indicate the strength of your religious/philosophical belief:

1      2      3      4      5  
Very strong   strong   moderate   weak   very weak

What do you think this study is about? \_\_\_\_\_

What thoughts/feelings do you have about this study? \_\_\_\_\_

## Appendix G: Supplemental analyses

### Supplemental analyses of target measure components

*General supernatural concepts.* A 2 (MS vs. pain) x 2 (unspeeded vs speeded) ANOVA revealed no main effect of MS ( $F(1, 368) = .76, \eta_p^2 = .002, p = .38$ ) nor a main effect of speed condition ( $F(1, 368) = .006, \eta_p^2 < .001, p = .94$ ). However, there did emerge the 2-way interaction,  $F(1, 368) = 7.33, \eta_p^2 = .02, p = .007$  (see *Figure S1*). In the unspeeded condition, rejection of general supernatural concepts was significantly stronger in the MS condition than the public speaking condition ( $t[189] = -2.57, d = -.38, 95\%CI [-.67, -.09], p = .01$ ). However, in the speeded condition, rejection of general supernatural concepts was non-significantly reduced in the MS condition compared to the public speaking condition ( $t[179] = 1.27, d = .15, 95\%CI [-.12, .46], p = .20$ ).

*Christian supernatural concepts.* A 2 (MS vs. pain) x 2 (unspeeded vs speeded) ANOVA revealed no main effect of MS ( $F(1, 368) = 1.49, \eta_p^2 = .004, p = .22$ ) nor a main effect of speed condition ( $F(1, 368) = 1.12, \eta_p^2 = .003, p = .29$ ), nor the 2-way interaction,  $F(1, 368) = 1.64, \eta_p^2 = .004, p = .20$  (see *Figure S2*). In the unspeeded condition, rejection of Christian supernatural concepts was non-significantly stronger in the MS condition than the public speaking condition ( $t[189] = -1.80, d = -.27, 95\%CI [-.55, .02], p = .07$ ). However, in the speeded condition, there was no difference in rejection of Christian supernatural concepts in the MS condition compared to the public speaking condition ( $t[179] = .05, d = .00, 95\%CI [-.29, .29], p = .97$ ).

*Hindu supernatural concepts.* A 2 (MS vs. pain) x 2 (unspeeded vs speeded) ANOVA revealed no main effect of MS ( $F(1, 368) = .002, \eta_p^2 < .001, p = .97$ ) nor a main effect of speed condition ( $F(1, 368) = 2.22, \eta_p^2 = .006, p = .14$ ). However, there did emerge the 2-way interaction,  $F(1, 368) = 5.35, \eta_p^2 = .01, p = .02$  (see *Figure S3*). In the unspeeded condition, rejection of Hindu supernatural concepts was non-significantly stronger in the MS condition than the public speaking condition ( $t[189] = -1.69, d = -.39, 95\%CI [-.68, -.10], p = .09$ ). However, in the speeded condition, rejection of Hindu supernatural concepts was non-significantly reduced in the MS condition compared to the public speaking condition ( $t[179] = 1.58, d = .09, 95\%CI [-.20, .38], p = .115$ ).

### Supplemental analyses of affect

The PANAS-L features Lambert et al.'s (2014) recommended measures of fear ( $\alpha = .92$ ) and anxiety ( $\alpha = .86$ ). Because the measure was presented after the MS manipulation and prior to the speed manipulation, a 2 (MS vs pain) group MANOVA was conducted, which revealed no effect on anxiety ( $F(1, 370) = 1.99, \eta_p^2 = .005, p = .16$ ) but did reveal an effect on fear ( $F(1, 370) = 5.69, \eta_p^2 = .02, p = .02$ ), such that fear was actually *lower* in the MS condition ( $M = 4.59, SD = 1.28$ ) than in the public speaking condition ( $M = 4.89, SD = 1.19$ ). These findings are inconsistent with Lambert and colleagues' (2014) suggestion that MS causes increased anxiety and fear affect, but is instead consistent with the vast majority of previous TMT research showing that MS does not influence explicit anxiety.

## Appendix H: Tables

Table I: Target block and dependent measure items

Item type	Item
<b>Faith in religious/supernatural concepts</b>	
General religious/ supernatural concepts	41. Religious beliefs are basically correct
	42. There is a higher power in the world
	43. People have immortal souls
	44. Supernatural beings exist (e.g., God, angels)
	45. An afterlife exists (e.g., Heaven)
	46. When I die my soul will live on
Christian supernatural concepts	47. The Christian God is real.
	48. The Christian God answers prayers.
	49. The Christian God sometimes intervenes in the world
Hindu supernatural concepts	50. The Hindu gods are real
	51. The Hindu gods answer prayers
	52. The Hindu gods sometimes intervene in the world
<b>Intuitive but logically unjustified/incorrect teleological items</b>	
	53. Finches diversified in order to survive
	54. Germs mutate to become drug resistant
	55. Parasites multiply to infect the host
	56. Earthworms tunnel underground to aerate the soil
	57. Mites live on skin in order to consume skin cells
	58. Moss forms around rocks to help stop soil erosion
	59. Earthquakes happen because tectonic plates must realign
	60. Geysers blow in order to discharge underground heat
	61. The earth has an ozone layer to protect it from UV light
	62. The sun makes light so that plants can photosynthesize
	63. Water condenses to moisten the air
	64. Molecules fuse in order to create matter
<b>Intuitive and logically justified/correct items</b>	
	65. Flowers wilt because they get dehydrated
	66. Bread rises because it contains yeast
	67. People get the flu because they catch a virus
	68. Children wear gloves to keep their hands warm
	69. Teapots whistle to signal the water is boiling
	70. People buy vacuums because they suck up dirt
<b>Counter-intuitive and logically unjustified/incorrect items</b>	
	71. Zebras have black stripes because they eat coal
	72. Gusts of wind occur because animals exhale together
	73. Clouds form because bits of cotton collect together
	74. Cars have horns to illuminate dark roads
	75. Eyelashes exist so that people can wear mascara
	76. Mothers kiss babies in order to scare them
<b>Accuracy checks</b>	
	77. On this item please hit strongly disagree and hit next
	78. On this item please hit disagree and hit next
	79. On this item please hit agree and hit next
	80. On this item please hit strongly agree and hit next

Table II: Item endorsement descriptive statistics  
 Table II. Item endorsement descriptive statistics, by condition.

	Unspeeded			Speeded		
	M	SD	n	M	SD	n
1. Faith in supernatural/religious concepts						
Mortality salience	1.21	.35	92	1.35	.44	98
Public speaking salience	1.35	.44	99	1.28	.38	83
2. Intuitive but unjustified teleology						
Mortality salience	3.01	.46	92	3.16	.54	98
Public speaking salience	2.92	.52	99	3.11	.38	83

Table III. Item endorsement descriptive statistics, by condition.								
		Unspeeded			Speeded			
		M	SD	n	M	SD	n	
1. General supernatural concepts								
	Mortality salience	1.31	.46	92		1.45	.57	98
	Public speaking salience	1.50	.53	99		1.36	.46	83
2. Christian supernatural concepts								
	Mortality salience	1.13	.36	92		1.24	.44	98
	Public speaking salience	1.25	.51	99		1.24	.43	83
3. Hindu supernatural concepts								
	Mortality salience	1.18	.39	92		1.36	.52	98
	Public speaking salience	1.29	.46	99		1.25	.40	83



## Appendix I: Figures

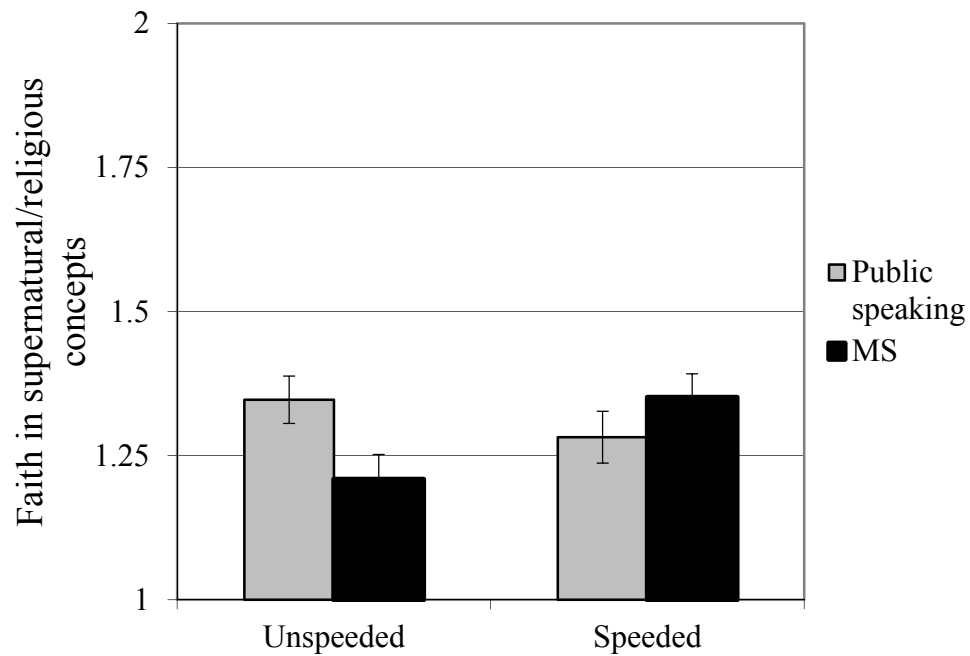


Figure 1. In the unspeeded condition, atheists' rejection of faith in supernatural/religious concepts was stronger in the MS condition than the public speaking condition. In the speeded condition, atheists' rejection of faith in supernatural/religious concepts was not statistically different in the MS condition than the public speaking condition. Note. Agreement was measured on a 4-point Likert-type scale (1 = strongly disagree, 4 = strongly agree).

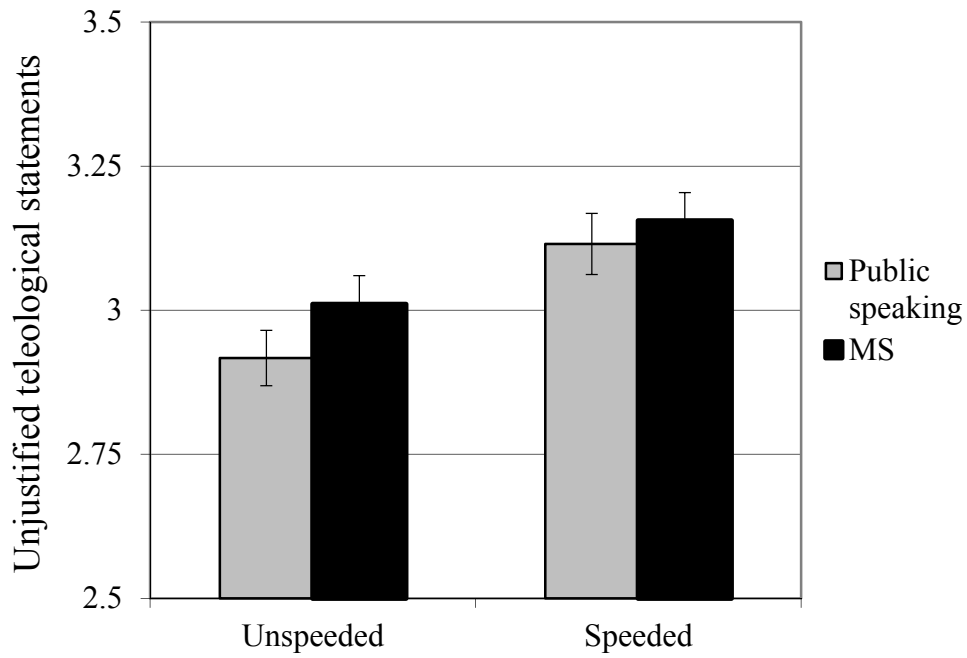


Figure 2. Atheists' agreement with unjustified teleological statements was stronger in the speeded (vs unspeeded) condition, regardless of MS manipulation condition. Note. Agreement was measured on a 4-point Likert-type scale (1 = strongly disagree, 4 = strongly agree).

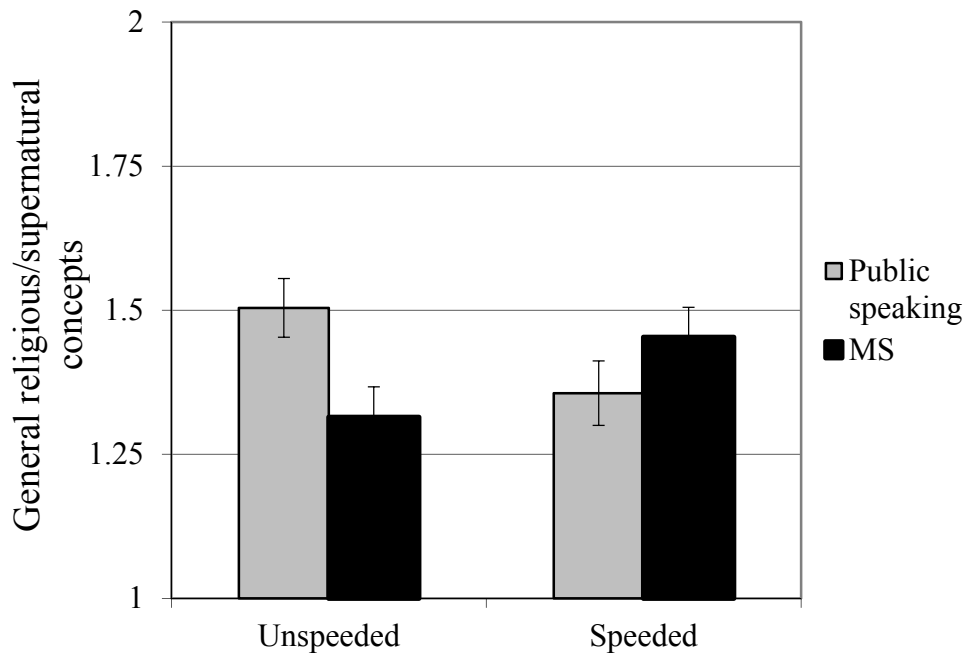


Figure 3. In the unspeeded condition, atheists' rejection of general religious/supernatural concepts was stronger in the MS condition than the public speaking condition. In the speeded condition, atheists' rejection of general religious/supernatural concepts was not statistically different in the MS condition than the public speaking condition. Note. Agreement was measured on a 4-point Likert-type scale (1 = strongly disagree, 4 = strongly agree).

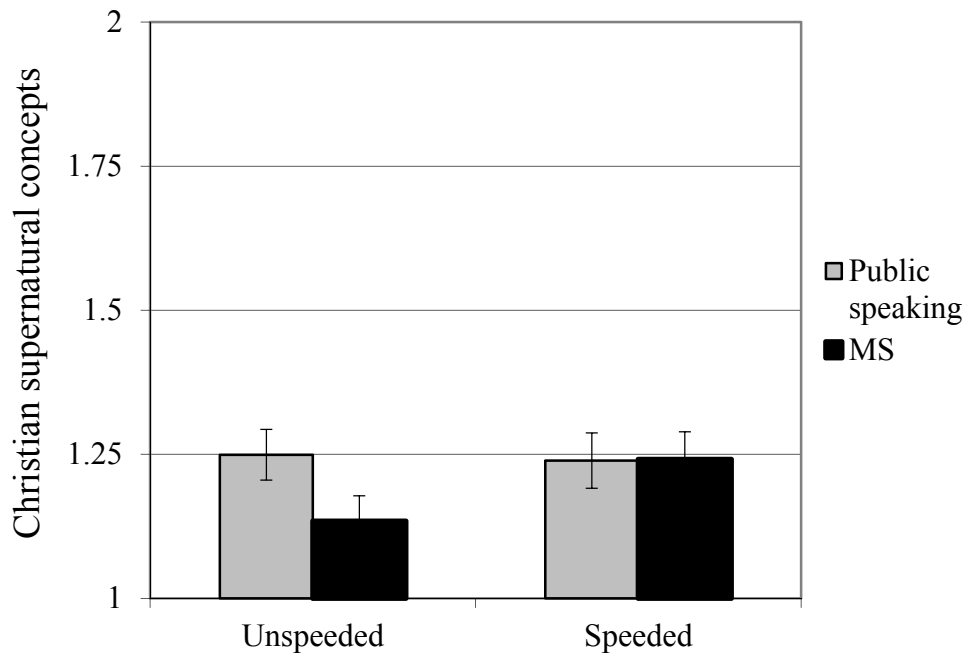


Figure 4. In the unspeeded condition, atheists' rejection of Christian supernatural concepts was (non-significantly) stronger in the MS condition than the public speaking condition. In the speeded condition, atheists' rejection of Christian supernatural concepts was not statistically different in the MS condition than the public speaking condition. Note. Agreement was measured on a 4-point Likert-type scale (1 = strongly disagree, 4 = strongly agree).

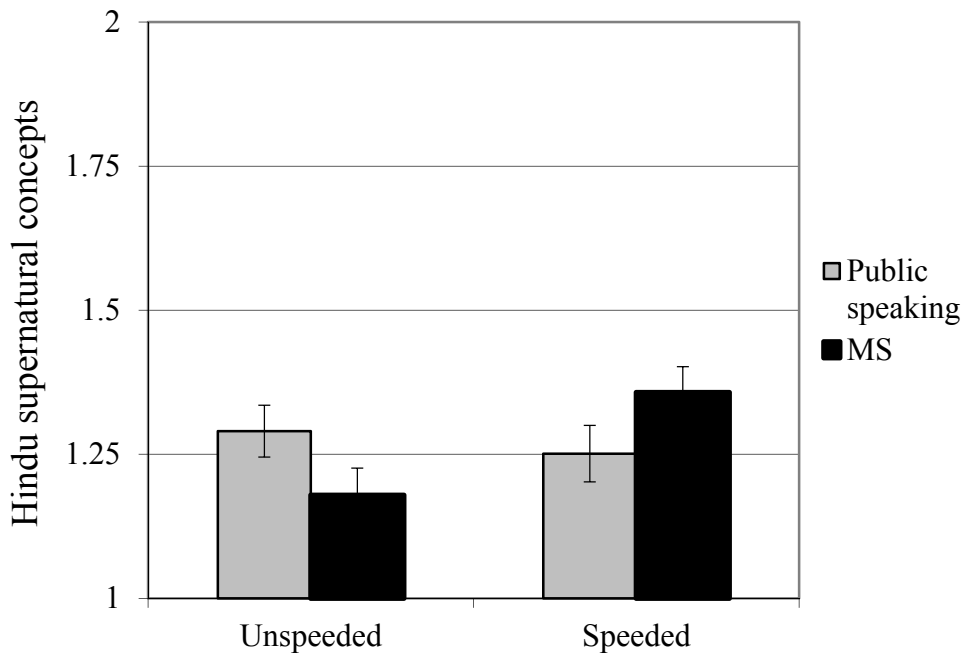


Figure 5. In the unspeeded condition, atheists' rejection of Hindu supernatural concepts was stronger in the MS condition than the public speaking condition. In the speeded condition, atheists' rejection of religiosity was not statistically different in the MS condition than the public speaking condition.

Note. Agreement was measured on a 4-point Likert-type scale (1 = strongly disagree, 4 = strongly agree).