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God is up and devil is down: mortality salience increases implicit spatial-religious associations

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ABSTRACT

Most Christians in Western cultures associate God with upper space and devil with lower space. Measuring this spatial association captures the implicit metaphorical representations of religious concepts. Previous studies have shown that implicit measurements of the belief in God increase when people are confronted with their own mortality. Here we investigated the effect of mortality salience on implicit metaphorical representations of religiosity. Using a repeated measurement design, we found that implicit associations between God-up and devil-down increase when people think about their own death, but not when they think about a tooth treatment (control condition). The effect was moderated by self-esteem; only people with low and medium self-esteem were influenced by mortality salience. Our results show that mortality salience automatically activates religious contents and their cognitive representations that embody these abstract contents.

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⚠ Watch for the devil. When there's a God, there's always a legion of devils. ⚠ (Stiefvater, 2012)

Most Christian people in Western cultures associate God with upper space and devil with lower space. Michelangelo portrayed God in his fresco *The Creation of Adam* as a man hovering in space. Also, biblical texts state that “The Lord is high over all nations, and his glory is higher than the heavens” (Coogan et al., 2010, Psalm 114:4). In contrast, the devil is associated with lower space. The Bible portrays the devil as the angel Lucifer, “fallen from heaven” (Coogan et al., 2010, Isaiah 14:12) who is “brought down to Sheol, to the depths of the Pit” (Coogan et al., 2010, Isaiah 14:15). In the end of *Faust* (von Goethe, 1808/1992), Margaret remarks that Mephisto (the devil) is “rising up out from the ground” (p. 151). Associations of the devil with lower space also appear in pop music like in Madonna's (2015) song *Devil Pray*, where she stated “the ground beneath my feet's getting warmer – Lucifer is near.”

The systematic use of vertical space when expressing religious contents is not merely an artistic feature but rather reflects a strategy of knowledge representation. According to the conceptual metaphor theory (Lakoff & Johnson, 1980, 1999), verticality is a basic aspect of human life, and is therefore co-opted for various metaphorical associations such as valence, power, numerosity, or religious values (Hartmann et al., 2012; Meier et al., 2007b; Meier & Robinson, 2004; Schubert, 2005). This means that abstract and often not directly experienceable concepts are represented by concrete sensory experiences (e.g., Barsalou, 2008; Cian, 2017). The target-domains of a metaphor are the abstract concepts and the source-domains of a metaphor represent these concepts in an

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experienceable format that can be shared with other individuals by means of a common and shared representation. These representations are implicit and result from automatic cognitive mechanisms (e.g., Barsalou, 2008; Cian, 2017).

55 People make use of metaphors to represent religious concepts. A core aspect for many religions includes the existence of one or multiple supernatural agents. These agents are often conceptualized as humans with supernatural powers (Jong & Halberstadt, 2016). The anthropomorphization of God represents a metaphor: The concept of human figure is used as a source-domain for the target-domain of God. The metaphorical representation of supernatural agents is central to many religions and highlights the importance of metaphors in religious belief.

60 Previous studies by Meier et al. (2007a) have measured the metaphorical representations of religious concepts using the association of God and the devil as target-domains for the spatial verticality as source-domain in an implicit association test (IAT). The IAT measures a person's associative strength between concepts and attributes by using reaction times (Greenwald et al., 1998). For this, participants have to categorize synonyms of contrary concepts on two buttons while simultaneously
65 categorizing congruent or incongruent attributes with the same buttons. Based on the reaction time, an IAT score can be calculated, reflecting the strength of a person's association of the concepts with the respective attributes. The stronger the score diverges from zero, the higher the respective associations of the concepts with the attributes.

70 Meier et al. (2007a) showed that the strength of the implicit association between supernatural religious entities and vertical space is related to the belief in God. As such, people with a high belief in God showed stronger associations of God and the devil with synonyms of the words "up" and "down". This suggests that an implicit measurement of the vertical association with God and devil is able to capture the belief in God.

75 A person's belief in the existence of a supernatural entity like God is part of the broader concept of a person's religious belief. Religious beliefs also include attitudes towards other religious concepts and phenomena (Jong & Halberstadt, 2016). One of these concepts is literal immortality, which is promised by most religions in form of an afterlife (Jackson et al., 2018). Accordingly, death is not the end of one's own existence, but rather a transition into another spiritual context. Different religions promise different forms of an afterlife (e.g., reincarnation, nirvana or heaven) but most of
80 them suggest a continued form of existence. Thus, religion provides a possibility for successfully coping with existential concerns about one's death (see Vail et al., 2010).

85 Terror Management Theory (TMT; Pyszczynski et al., 2015; Rosenblatt et al., 1989) suggests that knowledge of one's own death in combination with the desire for self-preservation results in inner fear. Even though people are not always consciously aware of their own death, some situations can elicit thoughts about mortality. *Mortality salience* (MS) is the result of situations that trigger thoughts of death and consequently lead to a cascade of explicit and implicit cognitive strategies.

90 The dual process-model of TMT distinguishes between proximal and distal defense mechanisms (Kosloff et al., 2019; Pyszczynski et al., 1999). Proximal mechanisms unfold immediately after MS and aim at reducing the thought of one's death, either by downplaying one's vulnerability to mortality, or by unconscious thought suppression. Wegner et al. (1987) showed that transient suppression of thoughts leads to a later rebound effect which leads to an increased accessibility of the suppressed thought. This mechanism was shown numerous times in TMT studies by using the concept of a heightened death thought accessibility (DTA) after MS, and meta-analysis provided evidence that DTA is indeed higher following a short delay after MS (Burke et al., 2010).

95 Distal processes rely on bolstering the cultural anxiety buffer, consisting of cultural worldviews and a person's self-esteem (Pyszczynski et al., 1999). The cultural anxiety buffer helps people to preserve the impression of being immortal. Being reminded about one's own death triggers a need for self-esteem, as well as a desire to maintain a conception of the world as a predictable, orderly and meaningful place (Pyszczynski et al., 2015). In line with this view, several studies showed that people
100 strongly affirm values that are consistent with their worldview and evaluate criticism of this worldview more negatively when reminded about mortality (e.g., Greenberg et al., 1992; Rosenblatt et al.,

1989). This worldview defense mechanism was also shown in religious contexts. For example, Greenberg et al. (1990) demonstrated that Christians under MS evaluated members of their own religion more favorably than members of other religions. Additionally, people under MS had more difficulties in misusing a crucifix as a hammer compared to a control group (Greenberg et al., 1995).

Jong et al. (2012) found a change in religious beliefs following MS. As expected by the worldview defense hypothesis, MS increased the believe in God for religious people and decreased the believe in God for atheists when measured on an explicit level.¹ However, when measured on an implicit level by means of a single target IAT (association of the attributes “real” and “imaginary” with the concept “religious supernatural entities”), the believe in God increases under MS not only for religious people but also for atheists (Jong et al., 2012). These points towards a dissociation between implicit and explicit religious cognition following MS. Specifically, these results suggest that an implicit measurement captures more directly the effect of MS on automatic processes that underlie religious cognition, rather than the explicit measurements that are prone to motivational biases in self-report and other higher-order cognitive processes (e.g., Hofmann et al., 2005).²

The aim of this study was to further assess the effect of mortality priming on religious cognition. Specifically, if MS increases implicit belief in God (Jong et al., 2012), then the metaphorical structures representing this belief (e.g., God is up, devil is down) should also become stronger. Moreover, the association of God and devil with upper and lower space reflects a cultural symbol. Cultural symbols become more important under MS (Greenberg et al., 1995) because they are part of one’s cultural worldview and therefore also included in the cultural anxiety buffer. As such, these symbols provide meaning and values. When confronted with one’s own mortality, these values provide a way to cope with the resulting existential fear. Therefore, we hypothesized that MS increases the implicit association between religious supernatural entities (God and devil) and vertical space.

It has to be pointed out that an increase in the vertical spatial association of God and the devil also reflects a worldview defense independent of one’s belief in God. While religious people and atheists would disagree on the existence of both God and the devil, both would agree that, culturally, God is represented in upper space while the devil is allocated in lower space. Thus, the vertical alignment represents a culturally transmitted metaphor and is part of the cultural worldview both for atheists and religious people. As MS bolsters these cultural worldviews (Greenberg et al., 1992) the vertical spatial association is expected to increase under MS.

Apart from one’s own worldview, the cultural anxiety buffer also relies on a person’s self-esteem. TMT defines a high self-esteem as living up to the standards of values set by the worldview (Pyszczynski et al., 2015). A high self-esteem can bolster death concerns or disruptions of one’s cultural worldview (e.g., Harmon-Jones et al., 1997; Solomon et al., 1991). People with a high self-esteem do not show the typical worldview defense behavior induced by MS (Harmon-Jones et al., 1997). Consequently, we expected that high self-esteem will reduce the effect of MS on the vertical representation of the deity.

Taken together, the implicit vertical association of God and the devil is connected to one’s belief in God measured on an explicit level (Meier et al., 2007a). According to conceptual metaphor theory, this vertical association is used to convert the abstract concept of the deity into the experienceable concept of verticality that we can share with other people. As such, this metaphorical understanding of the deity is part of one’s cultural worldview that is expected to get bolstered under MS for all members of one’s culture. An exploration of people’s implicit vertical association of religious concepts under MS hints at cognitive mechanisms that underly the connection between implicit belief in supernatural agents and MS.

In this study, we will investigate the impact of MS on metaphorical-spatial associations. While earlier studies showed that MS increases implicit belief in God (Jong et al., 2012), this study will show that this effect also applies to metaphorical-spatial associations under MS and it will provide

new evidence about the cognitive structures that represent religious concepts. In addition to this, the role of self-esteem as moderator for the effect of MS on cognitive processes will be investigated.

Method

Participants

One hundred and fifty undergraduate psychology students from the university of Bern took part in this experiment in exchange for course credit. The sample consisted of 126 women and 24 men with a mean age of 22.1 years ($SD = 4.02$). 134 students participated in the main experiment (counter-balanced for the MS and the control condition). 16 students participated in an additional follow-up control experiment with no priming (see results). The Ethics Committee of the Faculty of Human Sciences of the University of Bern approved the study. All participants provided informed consent prior to the study.

Measures

Implicit association test (IAT)

The IAT measures the association between a concept and an attribute on an implicit level (Greenwald et al., 1998). In its typical form, the IAT consists of seven different blocks (Greenwald et al., 2003), each consisting of a two-alternative categorization task. In the first block—the *initial target-concept discrimination*—the participants have to categorize different target-words into two categories by pressing either a left or a right button. For example, people have to categorize different words like “Lord,” “Creator,” “Lucifer” or “Satan” to the categories “God” or “Devil.”

In the second block—the *associated attribute discrimination*—the participants have to categorize different attributes into two categories by using the same buttons as in the previous task. For example, participants have to categorize different words like “Top,” “High,” “Bottom” or “Low” to the categories “Up” and “Down.”

In the third and fourth block—the *initial combined task*—the participants are asked to categorize both target-words and attributes. As such, these blocks combine the first and the second block. Participants are therefore presented with words like “Almighty,” “Lucifer,” “Top” or “Bottom” and they have to categorize them into the categories “God” or “Up” with one button and “Devil” or “Down” with the other button. The third block is used for practice and the fourth block as the main run.

The fifth block—the *reversed target-concept discrimination*—repeats the first block using a reversed key assignment. Therefore, participants once again have to categorize words like “Lord,” “Creator,” “Lucifer” or “Satan” to the categories “God” or “Devil” but now with the reversed key assignment.

The sixth and the seventh block—the *reversed combined task*—combine the fifth block with the second block. Participants are therefore presented with words like “Almighty,” “Lucifer,” “Top” or “Bottom” and they have to categorize them into the categories “God” or “Down” with one button and “Devil” or “Up” with the other button. The sixth block serves again for practice using the reversed combined task and the seventh block serves as the main run.

Typically, the concepts and the attributes that are associated with the respective concept are initially discriminated with the same button. Therefore, there is a supposed congruency between the key assignment for the discrimination of the concept and its attributes. For example, the concept “God” is congruent to the attribute “Up” and the concept “Devil” is congruent to the concept “Down.” The reversed key assignment starting from the fifth block on then leads to a discrimination task where incongruent concept-attribute associations are tested (e.g., “God”-“Down” and “Devil”-“Up”).

Greenwald and Nosek (2001) showed that participants generally perform better on the first combined task. This effect was discussed in the context of the associations-switch between the two

combined blocks (Mierke & Klauer, 2001). In order to demonstrate that the results are not caused by some sort of associations-switch, block orders of the IAT were counterbalanced in the present study. Therefore, half of the participants were first presented with an IAT learning the congruent association of God with upper space and devil with lower space and then switching to the incongruent association of God with lower space and the devil with upper space. The other half of the participants used an inverted IAT where they first learned the incongruent association of God with lower space and the devil with upper space and then switching to the congruent association of God with upper space and the devil with lower space (Figure 1).

The stimuli of the present IAT consisted of the German version of the words used by Meier et al. (2007a) in their IAT. These words belong either to the target-word category God and devil or the attributes up and down. Table 1 lists all the words used and their translations.

Mortality salience

Following Pyszczynski et al. (2003), the following instructions were used for the MS: “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 will happen to you as you physically die and once you are physically dead.” For the control group, the following instructions were used: “Please, briefly describe the emotions that the thought of a tooth root treatment arouses in you” and “Jot down, as specifically as you can, what you think will happen to you as you undergo a tooth root treatment.”

Self-esteem

The German version of the Rosenberg self-esteem scale (RSES) was used to measure participants’ self-esteem with 10 statements (Rosenberg, 1965; von Collani & Herzberg, 2003). Participants

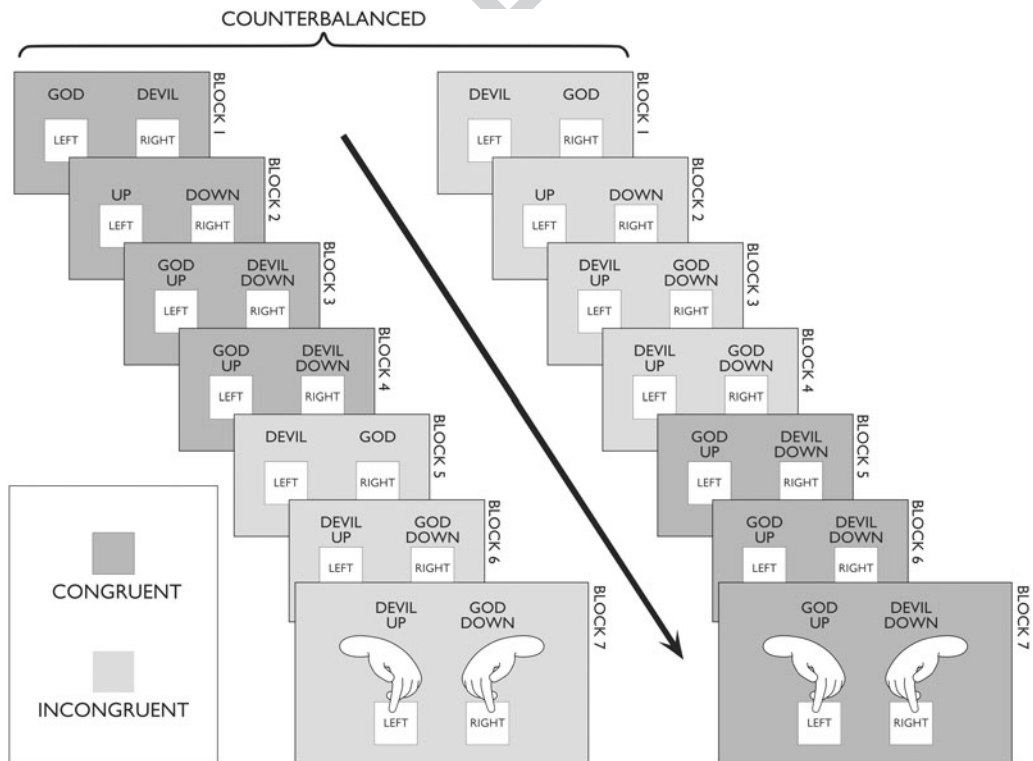


Figure 1. The two different block orders.

Table 1. Synonyms used for the different categories and German translations in brackets.

God	Devil	Up	Down
Almighty [Allmächtiger]	Lucifer [Lucifer]	High [Hoch]	Low [Tief]
Creator [Schöpfer]	Antichrist [Antichrist]	Top [Spitze]	Bottom [Boden]
Lord [Herr]	Demon [Dämon]	Above [Über]	Below [Unter]
Deity [Gottheit]	Satan [Satan]	Ascend [Aufstieg]	Descend [Abstieg]

evaluated these statements on a five-point Likert-scale³ (“Do not agree at all”, “Don’t agree”, “Neither nor”, “agree”, “Completely agree”). Half of the items are reversely coded.

Affect measurement

The German positive and negative affect schedule (PANAS) was used to measure participants affect after priming. Typically, MS effects are thought to be independent of any affective changes. Therefore, people in the MS should differ neither in positive nor in negative affect from people in the control condition. The PANAS can be used to measure either the momentary or dispositional positive and negative affect. For the purpose of this study, only the momentary affect was assessed. The questionnaire consists of ten positive and ten negative emotions that were rated on a 5-point scale, labeled with “very slightly or not at all”, “a little”, “moderately”, “quite a bit” and “extremely” (Breyer & Bluemke, 2016).

Procedure

Participants were seated in front of a computer, entered their demographic data, and conducted an electronic version of the RSES. Next, the first session of the IAT started. Half of the participants started with the congruent IAT blocks followed by the incongruent IAT blocks, and vice versa for the other half of participants.

During the IAT, words were presented (Arial with a size of 25 pixels) in the middle of the screen in green color on a black background. The words appeared as long as participants made a discrimination. Answers for the left categories were made by pressing the q-button and answers on the right were made by pressing the p-button. The intertrial interval was 150 ms but when participants gave a wrong answer “FALSE” was presented in red color for 1500 ms in 20 pixels size. Each word was presented two times per block, except for the practice runs where each word was presented only once.

Afterwards, the participants were given a sheet of paper and they answered two priming-questions. Participants were randomly assigned to the MS or tooth treatment condition. The participants could take as much time as they wanted to write the text.

When participants finished answering the questions two distraction tasks were used. This is commonly used in TMT studies (Burke et al., 2010) because distal defense mechanisms start to work only after the thought of one’s own death is out of focal awareness (Pyszczynski et al., 1999). The first distraction task consisted of a word search puzzle, where participants had to find up to 12 target words in a letter matrix within 3 min. The second distraction task consisted of the PANAS questionnaire.

After the distraction tasks, the second session of the IAT was administered. Upon completion participants were informed about the purpose of the study and thanked for their participation.

Data analysis

The IAT score was calculated for each participant, separately before and after the priming. The IAT score was computed following the suggestion by Greenwald et al. (2003). Accordingly, data from block 3, 4, 6 and 7 were used and trials above 10 s were eliminated. For computing the IAT

effect, the mean reaction times were divided by its standard deviation for the congruent and the incongruent blocks separately. The values from the congruent block were then subtracted from the incongruent blocks. Higher values reflect a higher implicit spatial association with God and devil.

The effect of MS on the IAT effect was assessed by means of a repeated measure analysis of variance (ANOVA) with the between-subjects variable priming (MS, control) and the within-subjects variable time (before priming, after priming). In addition, the moderating effect of RSES was assessed. A linear mixed effect model was conducted with the fixed effects time (before priming, after priming), RSES (mean centered), and the interaction between time and RSES as the critical moderator term. In addition, a random intercept was introduced for participants in order to account for the repeated measurement design. We further analyzed the moderating role of RSES by planned simple slope tests for participants with low (-1 SD), medium (M), and high RSES ($+1$ SD) (see Aiken et al., 1991).

Results

ANOVA with the between-subjects variable priming (MS, control) and the within-subjects variable time (before priming, after priming) effect revealed no main effect of priming on the IAT, $F(1,132) = .98$, $p = .325$, $\eta_p^2 = .01$, ($M_{MS} = 0.836$, $SEM = 0.034$; $M_{Control} = 0.789$, $SEM = 0.034$) and no main effect of time, $F(1,132) = .11$, $p = .747$, $\eta_p^2 < .01$ ($M_{before\ priming} = 0.817$, $SEM = 0.027$; $M_{after\ priming} = 0.808$, $SEM = 0.027$). Most importantly, the two variables interacted, $F(1,132) = 12.82$, $p < .001$, $\eta_p^2 = .09$. Pairwise comparisons revealed that there was no difference in IAT effect between the two groups before priming ($M_{MS} = 0.794$, $SEM = 0.038$; $M_{Control} = 0.840$, $SEM = 0.038$; $p = .394$), but the two groups differed significantly after priming ($M_{MS} = 0.878$, $SEM = 0.039$; $M_{Control} = 0.738$, $SEM = 0.039$; $p = .011$). As expected, there was an increase in IAT effect after MS. The IAT effect for the two groups (MS, control) before and after the priming is shown in Figure 2(a). The

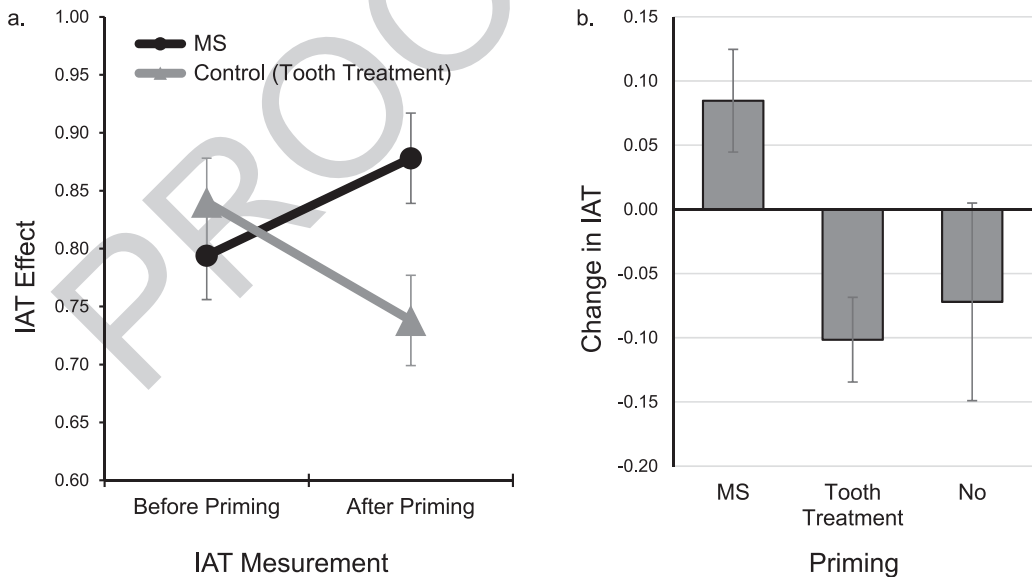


Figure 2. The left panel (a) shows the IAT effect before and after the priming for the mortality salience (MS) and control group (tooth treatment). Higher scores represent a stronger association between the vertical space with God and devil. The right panel (b) shows the change in the IAT effect from the first to the second IAT assessment with the additional no-priming control group. Positive values show reflect a stronger association of God and devil with the vertical space during the second session while negative values reflect a weaker association during the second session. Error bars depict ± 1 SEM.

increase in the IAT effect in the MS group was significant, as revealed by an additional paired t -test (before priming vs. after priming), $t(66) \triangle 2.12, p = .039$. In contrast to the MS group, the control group showed a reduced IAT effect after priming, $t(66) \triangle -3.07, p = .003$.

The reduction in the IAT effect in the control group was not expected, and it is not clear whether this reduction reflects an effect of practice, or rather a specific effect induced by the control priming (tooth treatment to induce pain-related thoughts). In order to explore this further, we recruited another sample ($n = 16$) who performed both IAT measurement with the same time delay between the two measurements as the MS and control group but with no priming between. Participants were asked to copy a neutral text. Participants were not instructed to generate self-related thoughts as in the previous priming conditions. Thus, a potential change in the IAT effect in this group would reflect an effect of practice. The change in IAT effect for the three groups is shown in Figure 2 (b). Importantly, the change in IAT effect of the additional control group with no priming is similar to that of the original control group, suggesting that the reduction in the IAT effect in this group can be attributed to an effect of practice.

The PANAS showed no systematic differences in positive ($M_{MS} = 2.96, SEM = 0.08; M_{Control} = 3.09, SEM = 0.08; p = .829$) or negative affect ($M_{MS} = 1.30, SEM = 0.04; M_{Control} = 1.40, SEM = 0.05; p = .209$) following the MS or control text. Consequently, it is unlikely that the difference in the IAT effect between the two groups can be attributed to affective processes.

Q3 Effect of self-esteem

RSES scores in the MS group varied between 2.75 and 4.9 ($M = 3.86, SD = 0.51$). The IAT effect before and after MS depending on (mean centered) RSES is shown in Figure 3. Even though the moderator effect as such (interaction between RSES and time) was not significant, $t(65) \triangle 1.48, p$

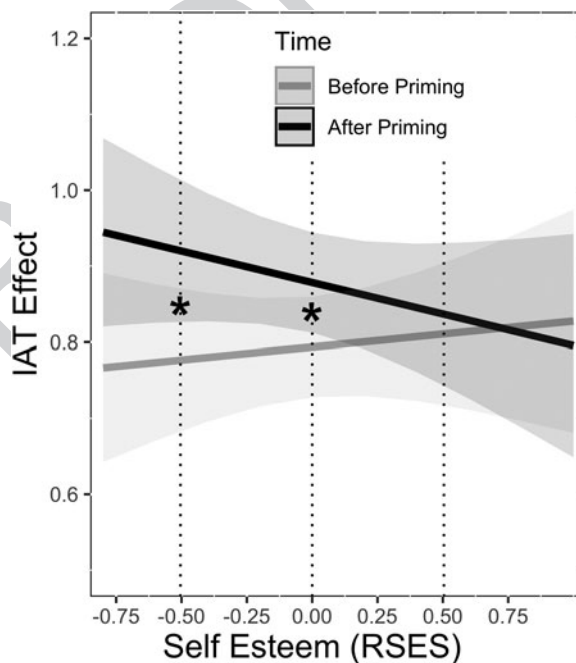


Figure 3. IAT effect before and after MS as a function of (mean centered) self-esteem (RSES). Higher scores represent a stronger association between the vertical space with God and the devil. Asterisks indicate significant differences before and after priming for participants with low (-1 SD, left dotted line) and medium (central dotted line) RSES. No effect of MS was present for participants with high RSES (right dotted line). Area around the line depicts 95% confidence interval.

= .145, the planned simple slope tests for low ($-1SD$), medium (M) and high ($+1SD$) confirmed the expected pattern: There was a significant effect of MS for participants with low RSES (estimated difference = 0.14, $p = .013$) and also for participants with medium RSES (estimated difference = 0.09, $p = .037$), but not for participants with high RSES (estimated difference = 0.03, $p = .649$).

Discussion

The aim of this study was to further investigate the effect of MS on implicit metaphorical-spatial associations of God and devil. We found that MS increased the implicit association between religious supernatural entities and vertical space (God is up, devil is down). Specifically, the IAT scores in the MS group increased for people with a lower self-esteem, whereas they decreased in a control group that thought about a tooth treatment or in a group that had no intervention at all.

The results are in line with earlier evidence that MS automatically increases religious belief on an implicit level (Jong et al., 2012). In addition to this, the results provide insights into the cascade of cognitive processes triggered by MS. Specifically, the results show that the activation of the target-concepts (God and devil) by MS automatically activates the spatial association of these concepts (i.e., the source-concept).

Moreover, the results are in line with the conceptual metaphor theory (Lakoff & Johnson, 1980, 1999) and suggest that the spatial association is an inherent part of the concept of religious supernatural entities. The spatial associations allow to connect the abstract concepts to the physically experienceable world in order to facilitate its conceptual understanding and mental representation (Barsalou, 2008; Cian, 2017; Lakoff & Johnson, 1980, 1999). God and devil are prime examples for abstract source-concepts since they cannot be perceived through the senses, thus sensory-based spatial metaphors might be inescapable when thinking about these concepts (DesCamp & Sweetser, 2005; Meier et al., 2007a).

The increase in the IAT effect found in this study was limited to participants with medium or low self-esteem. We were therefore able to replicate the moderating role of self-esteem for the effect of MS, and demonstrated, to our knowledge for the first time, such a moderating effect also for implicit religious cognition. Our results suggest that self-esteem influences not only processes related to self-image or explicit cognition on cultural values (e.g., Harmon-Jones et al., 1997), but also automatic and unconscious responses elicited by MS, such as the activation of metaphorical spatial representations.

Our finding is in line with TMT, according to which people with a high self-esteem are less concerned about their own death because they are living up to the values of their cultural worldview. People can rely on their self-perspective as valuable members of their own culture in order to deal with their own mortality (Harmon-Jones et al., 1997). Therefore, they do not need to bolster their worldview or religious beliefs, and no change in implicit associations of religious entities is found before and after priming.

Participants in the control condition showed an effect of practice as their IAT score decreased for the second session of the IAT after the intervention. Associations of God and the devil with the vertical space became weaker for these people. This is likely a result of practice and participants become faster in responding to incongruent combinations. This is supported by the results from the additional control group with no intervention. Again, we found a decreased IAT score in the second part, thus showing an effect of practice rather than a specific effect due to the tooth treatment condition. Participants under MS showed higher IAT scores during the second session. Unlike to the control group, MS strengthened their associations of God with upper space and the devil with lower space and this effect was strong enough to undermine a possible effect of practice.

Meier et al. (2007a) showed that the implicit spatial association of the deity is connected to a person's belief in God. As such, the increased IAT effect following MS might be connected to a temporary increase of the belief in God. Such an effect, at least on an explicit level, could so far only be shown in participants who believe in God (Jong et al., 2012). Since we do not have an explicit

measurement regarding the belief in God from our sample, we can only assume that there were some believers that could have driven the effect, as the proportion of people who believe in God in Switzerland is around 40–50% (Swiss Federal Statistical Office, 2019). Nevertheless, the explicit belief in God is not a necessary precondition for an increase in implicit belief in God: Jong et al. (2012) found an increased implicit association between supernatural religious entities and the concepts of “real” (vs. “imaginary”) for atheists. Thus, it is by all means possible that MS increased implicit belief in God, which in turn strengthened the metaphorical spatial associations used to represent these religious concepts.

Alternatively, MS could have increased the vertical association of God and the devil independent of the implicit belief in God: While people differ in the extent to which they believe in God (Maiello, 2005; Okulicz-Kozaryn, 2010), there is a large agreement within and across different religions regarding the vertical association of deity (Haidt & Algoe, 2004; Previc, 2006). As such, the vertical association of God and the devil is a part of one’s own culture. A reinforcement of this cognitive structure would therefore represent a typical worldview defense under MS instead of an increase in implicit belief in God. In this case, people would not rely on the existence of God but on the idea that God is up in the sky and not down in hell— independent of its existence. However, this stands in contrast to earlier results showing a connection between the spatial association of God and devil and one’s own belief in God (Meier et al., 2007a).

Future studies could investigate whether the stronger increased spatial association of the deity under MS reflects a metaphorical worldview defense or an effect of an increased implicit religiosity. The measurement of people’s belief in God could be included in future studies in order to better understand whether changes in the strength of a person’s spatial association of the deity dissociates from changes of a person’s belief in God under MS. A dissociation or association of people’s metaphorical representations of the deity and the belief in God under MS could provide more insights into the role that metaphors play in religiosity.

Since the vertical spatial association is not exclusive for religious concepts, other factors might have contributed to our findings. Particularly, also the concepts of valence, power and morality are represented by means of the vertical space (Cian, 2017; Meier et al., 2007a; Meier & Robinson, 2004; Schubert, 2005). It is possible that MS increased the dualism between good and bad, and as such also the spatial association of God and devil. Therefore, the findings of this study lead to a range of new questions such as whether spatial association of other concepts (e.g., morality or valence) would also increase under MS or whether this effect is limited to the concept of deity. Indeed, the upper vertical space might contain a special association with positive values relevant for the way humans deal with MS. Cohen et al. (2011) showed that the fantasy of flying leads to lower DTA after MS. As human beings are naturally bound to the ground, the idea of flying also represents the idea of overcoming the natural forces and bodily limits that bind human existence to the ground. Thus, positive emotional values can be associated with the upper vertical space.

In this study, we were able to show that MS increases the vertical association of God with the upper space and the devil with the lower space and draws insights in the cognitive structure of metaphorical based cultural ideas that could play a role in further amplifications of religious ideas under MS. It would be interesting to investigate cultural differences in the metaphorical representation of the deity using verticality. Even though Meier et al. (2007a) suggest that the vertical association of the deity is universal, its increase under MS could differ depending on the religion. Therefore, future research on the amplification of metaphorical-based vertical associations of the deity should address differences between different cultures and different religions.

To conclude, this study extends previous findings regarding the effect of MS on implicit religiosity by showing that enhancing effect of MS generalizes to implicit metaphor-based religious associations. Thus, the effect of MS is not restricted to religious concepts alone, but it also affects the “embodied” cognitive mechanisms related to the metaphorical representation of these concepts, at least for participants with a medium to low self-esteem.

Notes

- ~~1. The authors suggest this relationship might follow a curvilinear function with people extremely high or extremely low in religiosity being less afraid of death than moderately religious people.~~
- ~~2. Symbolic immortality can be achieved by being part and contribute to a larger enduring that will prevail after one's death (see Jackson et al., 2018). This can be achieved in different ways, such as contribute one's gene to the next generation by reproduction, by being remembered by other persons after one's death or by leaving cultural art that will be present even after one's death.~~
3. Note that the original scale applied a four-point Likert scale. We increased the scale in order to increase the individual variance. Since the focus of this study was on individual differences (e.g., correlations within the sample) and not the comparison of the sample values to a norm, we did not consider the chance in scale as critical. Von Collani and Herzberg could show an internal consistencies from $\alpha = .72$ to $\alpha = .85$ in different samples. In this study, we found an internal consistency of $\alpha = .83$.




Disclosure statement

No potential conflict of interest was reported by the author(s).

Data availability statement

The authors confirm that the data supporting the findings of this study are available within the article's supplementary materials.

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Q4 References

- Aiken, L. S., West, S. G., & Reno, R. R. (1991). *Multiple regression: Testing and interpreting interactions*. Sage.
- Barsalou, L. W. (2008). Grounded cognition. *Annual Review of Psychology*, 59(1), 617–645. <https://doi.org/10.1146/annurev.psych.59.103006.093639>
- Breyer, B., & Bluemke, M. (2016). Deutsche version der positive and negative affect schedule PANAS (GESIS Panel). *Zusammenstellung Sozialwissenschaftlicher Items und Skalen*.
- Burke, B. L., Martens, A., & Faucher, E. H. (2010). Two decades of terror management theory: A meta-analysis of mortality salience research. *Personality and Social Psychology Review*, 14(2), 155–195. <https://doi.org/10.1177/1088868309352321>
- Cian, L. (2017). Verticality and conceptual metaphors: A systematic review. *Journal of the Association for Consumer Research*, 2(4), 444–459. <https://doi.org/10.1086/694082>
- Cohen, F., Sullivan, D., Solomon, S., Greenberg, J., & Ogilvie, D. M. (2011). Finding everland: Flight fantasies and the desire to transcend mortality. *Journal of Experimental Social Psychology*, 47(1), 88–102. <https://doi.org/10.1016/j.jesp.2010.08.013>
- Coogan, M., Brettler, M. Z., Newsom, C., & Perkins, P. (2010). *The new Oxford annotated Bible with the Apocrypha*. Oxford University Press.
- DesCamp, M. T., & Sweetser, E. E. (2005). Metaphors for God: Why and how do our choices matter for humans? The application of contemporary cognitive linguistics research to the debate on God and metaphor. *Pastoral Psychology*, 53(3), 207–238. <https://doi.org/10.1007/s11089-004-0554-5>
- Greenberg, J., Porteus, J., Simon, L., Pyszczynski, T., & Solomon, S. (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(11), 1221–1228. <https://doi.org/10.1177/01461672952111010>
- 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(2), 308–318. <https://doi.org/10.1037/0022-3514.58.2.308>

Greenberg, J., Simon, L., Pyszczynski, T., Solomon, S., & Chatel, D. (1992). Terror management and tolerance: Does mortality salience always intensify negative reactions to others who threaten one's worldview? *Journal of Personality and Social Psychology*, 63(2), 212–220. <https://doi.org/10.1037/0022-3514.63.2.212>

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology*, 74(6), 1464–1480. <https://doi.org/10.1037/0022-3514.74.6.1464>

Greenwald, A. G., & Nosek, B. A. (2001). Health of the implicit association test at age 3. *Zeitschrift für Experimentelle Psychologie*, 48(2), 85–93. <https://doi.org/10.1026/0949-3946.48.2.85>

Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the implicit association test: I. An improved scoring algorithm. *Journal of Personality and Social Psychology*, 85(2), 197–216. <https://doi.org/10.1037/0022-3514.85.2.197>

Q5 Haidt, J., & Algoe, S. (2004). Moral amplification and the emotions that attract us to saints and demons. In *Handbook of experimental existential psychology* (pp. 322–335).

Harmon-Jones, E., Simon, L., Greenberg, J., Pyszczynski, T., Solomon, S., & McGregor, H. (1997). Terror management theory and self-esteem: Evidence that increased self-esteem reduced mortality salience effects. *Journal of Personality and Social Psychology*, 72(1), 24–36. <https://doi.org/10.1037/0022-3514.72.1.24>

Hartmann, M., Grabherr, L., & Mast, F. W. (2012). Moving along the mental number line: Interactions between whole-body motion and numerical cognition. *Journal of Experimental Psychology: Human Perception and Performance*, 38(6), 1416–1427. <https://doi.org/10.1037/a0026706>

Hofmann, W., Gawronski, B., Gschwendner, T., Le, H., & Schmitt, M. (2005). A meta-analysis on the correlation between the implicit association test and explicit self-report measures. *Personality and Social Psychology Bulletin*, 31(10), 1369–1385. <https://doi.org/10.1177/0146167205275613>

Jackson, J. C., Jong, J., Bluemke, M., Poulter, P., Morgenroth, L., & Halberstadt, J. (2018). Testing the causal relationship between religious belief and death anxiety. *Religion, Brain & Behavior*, 8(1), 57–68. <https://doi.org/10.1080/2153599X.2016.1238842>

Jong, J., & Halberstadt, J. (2016). *Death anxiety and religious belief: An existential psychology of religion*. Bloomsbury Publishing.

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*, 48(5), 983–989. <https://doi.org/10.1016/j.jesp.2012.03.005>

Q6 Kosloff, S., Anderson, G., Nottbohm, A., & Hoshiko, B. (2019). Proximal and distal terror management defenses: A systematic review and analysis. In *Handbook of terror management theory* (pp. 31–63).

Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. University of Chicago Press.

Lakoff, G., & Johnson, M. (1999). *Philosophy in the flesh: The embodied mind and its challenges to Western thought*. Basic Books.

Madonna. (2015). Devil Pray [Song]. On *Rebel Heart*. Interscope Records.

Maiello, C. (2005). Degrees of belief in God: A measure of belief for use in cross culture. *Mental Health, Religion & Culture*, 8(2), 87–95. <https://doi.org/10.1080/13674670410001702371>

Meier, B. P., Hauser, D. J., Robinson, M. D., Friesen, C. K., & Schjeldahl, K. (2007a). What's "up" with God? Vertical space as a representation of the divine. *Journal of Personality and Social Psychology*, 93(5), 699–710. <https://doi.org/10.1037/0022-3514.93.5.699>

Meier, B. P., & Robinson, M. D. (2004). Why the sunny side is up: Associations between affect and vertical position. *Psychological Science*, 15(4), 243–247. <https://doi.org/10.1111/j.0956-7976.2004.00659.x>

Meier, B. P., Sellbom, M., & Wygant, D. B. (2007b). Failing to take the moral high ground: Psychopathy and the vertical representation of morality. *Personality and Individual Differences*, 43(4), 757–767. <https://doi.org/10.1016/j.paid.2007.02.001>

Mierke, J., & Klauer, K. C. (2001). Implicit association measurement with the IAT: Evidence for effects of executive control processes. *Zeitschrift für experimentelle Psychologie*, 48(2), 107–122. <https://doi.org/10.1026/0949-3946.48.2.107>

Okulicz-Kozaryn, A. (2010). Religiosity and life satisfaction across nations. *Mental Health, Religion & Culture*, 13(2), 155–169. <https://doi.org/10.1080/13674670903273801>

Previc, F. H. (2006). The role of the extrapersonal brain systems in religious activity. *Consciousness and Cognition*, 15(3), 500–539. <https://doi.org/10.1016/j.concog.2005.09.009>

Pyszczynski, T., Greenberg, J., & Solomon, S. (1999). A dual-process model of defense against conscious and unconscious death-related thoughts: An extension of terror management theory. *Psychological Review*, 106(4), 835–845. <https://doi.org/10.1037/0033-295X.106.4.835>

Pyszczynski, T., Solomon, S., & Greenberg, J. (2003). *In the wake of 9/11: Rising above the terror*. American Psychological Association.

Pyszczynski, T., Solomon, S., & Greenberg, J. (2015). Thirty years of terror management theory: From genesis to re-velation. In *Advances in experimental social psychology* (Vol. 52, pp. 1–70). Academic Press.

Q7 Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton University Press.

Rosenblatt, A., Greenberg, J., Solomon, S., Pyszczynski, T., & Lyon, D. (1989). Evidence for terror management theory: I. The effects of mortality salience on reactions to those who violate or uphold cultural values. *Journal of Personality and Social Psychology*, 57(4), 681–690. <https://doi.org/10.1037/0022-3514.57.4.681>

Schubert, T. W. (2005). Your highness: Vertical positions as perceptual symbols of power. *Journal of Personality and Social Psychology*, 89(1), 1–21. <https://doi.org/10.1037/0022-3514.89.1.1>

Solomon, S., Greenberg, J., & Pyszczynski, T. (1991). A terror management theory of social behavior: The psychological functions of self-esteem and cultural worldviews. In *Advances in experimental social psychology* (Vol. 24, pp. 93–159). Academic Press.

Q8

Stiefvater, M. (2012). *The Raven boys (The Raven Cycle, Book 1)*. Schloastic Press.

Swiss Federal Statistical Office. (2019). *Religionen*. <https://www.bfs.admin.ch/bfs/de/home/statistiken/bevoelkerung/sprachen-religionen/religionen.html>

Vail, K. E., Rothschild, Z. K., Weise, D. R., Solomon, S., Pyszczynski, T., & Greenberg, J. (2010). A terror management analysis of the psychological functions of religion. *Personality and Social Psychology Review*, 14(1), 84–94. <https://doi.org/10.1177/1088868309351165>

von Collani, G., & Herzberg, P. Y. (2003). Eine revidierte Fassung der deutschsprachigen Skala zum Selbstwertgefühl von Rosenberg. *Zeitschrift für Differentielle und Diagnostische Psychologie*, 24(1), 3–7. <https://doi.org/10.1024/0170-1789.24.1.3>

von Goethe, J. W. (1992). *Faust: A tragedy, Part One* (M. Greenberg, Ed. & Trans.). Yale University Press. (Original work published 1808).

Wegner, D. M., Schneider, D. J., Carter, S. R., & White, T. L. (1987). Paradoxical effects of thought suppression. *Journal of Personality and Social Psychology*, 53(1), 5–13. <https://doi.org/10.1037/0022-3514.53.1.5>

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