



# Examining the effect of mortality salience on preference for anthropomorphic products

Fatih Sonmez<sup>1</sup> · Sima Nart<sup>2</sup> · Remzi Altunışık<sup>2</sup>

Accepted: 10 March 2023 / Published online: 22 March 2023

© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2023

## Abstract

Research has shown that anthropomorphic products can compensate for the lack of belongingness and control. These findings suggest that anthropomorphic products may also protect against mortality salience, which has been shown in numerous research studies to be closely related to both belongingness and control motives. In two high-powered experiments, the present research aimed to investigate the effect of mortality salience on preference for anthropomorphic products and test the moderating role of three relevant factors, namely, belongingness, self-esteem, and attachment style. In the first study, we conducted a 2 (mortality salience: yes vs. no) x 2 (anthropomorphism: yes vs. no) between-subjects factorial design experiment. In the second study, we conducted a 2 (mortality salience: yes, no) x 2 (anthropomorphism: yes, no) mixed design experiment, in which we manipulated mortality salience between subjects and anthropomorphism within subjects. We found no evidence for the effect of mortality salience on preference for anthropomorphic products, nor for the moderating roles of belongingness, attachment style, or self-esteem. However, we found that anthropomorphism had a large, positive main effect on attitudes toward the product only when a non-anthropomorphic comparison was available. Theoretical and practical implications are discussed.

**Keywords** Mortality salience · Thoughts of death · Product anthropomorphism · Threat compensation · Belongingness · Self-esteem · Attachment style

## Introduction

Firms often benefit from anthropomorphism for purposes such as persuading consumers, building a desirable image, or enabling consumers to connect with their products and brands. Research has shown that anthropomorphic products and brands are liked more (Aggarwal & McGill, 2007; Delbaere et al., 2011) and perceived as more reliable (de Visser et al., 2016; Waytz et al., 2014), and that advertisements with anthropomorphic elements are more memorable (Guido et al., 2019) and are perceived as more persuasive (Touré-Tillery & McGill, 2015).

In addition to the competitive advantage that anthropomorphism provides to brands, there is also evidence that it provides psychological benefits to consumers. Research has

shown that anthropomorphic products have the potential to satisfy individuals' needs for belongingness and control and are therefore preferred over their non-anthropomorphic alternatives in situations where these two needs are threatened or aroused (Chen et al., 2017; Epley et al., 2008; Mourey et al., 2017). In other words, anthropomorphic products can support individuals' well-being by helping them cope with belongingness and control threats.

Mortality salience, another pervasive psychological threat, has been shown to increase the need for belongingness (Plusnin et al., 2018; Schimel & Greenberg, 2013) and the need for control (Fritsche et al., 2008; Agroskin & Jonas, 2013), the two motivations that have been documented to be positively related to anthropomorphic product preference. These findings suggest that mortality salience may increase the preference for anthropomorphic products. In two high-powered experiments conducted during the early months of the COVID-19 pandemic, when thoughts of death were widespread and intense, the present research tested the hypothesis that mortality salience increases the preference for anthropomorphic products, and it also examined the

---

✉ Fatih Sonmez  
fsonmez.phd@gmail.com

<sup>1</sup> Muş Alparslan University, Muş, Turkey

<sup>2</sup> Sakarya University, Sakarya, Turkey

moderating roles of belongingness, self-esteem, and attachment style on this effect.

### SEEK model of anthropomorphism

Derived from the Greek words *anthrōpos* (human) and *morphē* (form), anthropomorphism refers to the attribution of human characteristics to nonhuman beings in its generally accepted definition (Epley et al., 2007; Guthrie, 1995) and is considered to be a universal human tendency (Brown, 1991; Guthrie, 1980, 1995; Mithen, 1996).

Although anthropomorphism is considered a universal phenomenon, people differ in their anthropomorphic tendencies. In their model named SEEK, Epley et al. (2007) identified three determinants of anthropomorphism. Elicited agent knowledge is the cognitive factor and refers to the activation of human schema at the time of judgment. The two other determinants, i.e., sociality and effectance, are motivational factors and have higher relevance to the hypotheses of the current research.

### Anthropomorphism and sociality motivation

Sociality motivation refers to the individual's need for social connection and belongingness (Baumeister & Leary, 1995). Drawing upon evidence for the human tendency to satisfy their social needs through connecting with nonhuman entities, such as pets and divine beings, and ascribing them human attributes, Epley et al. (2007) proposed that sociality motivation is a determinant of anthropomorphism. They identified two routes by which sociality motivation leads to anthropomorphism. The first route is by the increased accessibility of social cues resulting from sociality motivation, which then increases the likelihood of perceiving human-like qualities in nonhuman entities. The second is through the increased search for social connection, which facilitates the humanization of nonhuman entities in order to convert them into sources of social connection, helping individuals to satisfy their social needs.

Extant research supports the relationship between sociality motivation and anthropomorphism. For example, research shows that loneliness positively correlates with anthropomorphism and that inducing a sense of loneliness increases the tendency to anthropomorphize nonhuman entities such as deities, animals, and technological gadgets (Epley et al., 2008; Eyssel & Reich, 2013; Shin & Kim, 2020). Furthermore, research showed that the experience of social exclusion can increase the preference for anthropomorphic brands (Chen et al., 2017) and that engaging with

anthropomorphic products can satisfy the need for social connection (Mourey et al., 2017).

### Anthropomorphism and effectance motivation

The other motivational determinant of anthropomorphism proposed in the SEEK model is effectance motivation. Effectance refers to the individual's need to interact effectively with their environment (White, 1959). Drawing upon the evidence about how anthropomorphism makes it easier to make sense of nonhuman agents, Epley et al. (2007) proposed that when there is a lack or absence of information to make sense of the behavior of nonhuman agents, individuals rely on their agentic knowledge to gain a sense of predictability and controllability, resulting in the humanization of nonhuman agents. Thus, they proposed that effectance motivation is a determinant of anthropomorphism.

Research investigating the relationship between effectance motivation and anthropomorphism supports the relationship between the two. For example, Waytz et al. (2010) found that participants anthropomorphized technological gadgets more when they were described as unpredictable than when the same gadgets were described as predictable. The participants also anthropomorphized a robot more when it behaved unpredictably than when it behaved in a predictable manner, and they anthropomorphized a robot more when they were asked to predict its behavior. The researchers also found that anthropomorphizing entities increased their perceived predictability, which can potentially satisfy effectance motivation. Similarly, Chen et al. (2018) found that anthropomorphizing a consumer product restores the thwarted sense of control and increases vitality. Several other research studies also provided evidence for the relationship between effectance and anthropomorphism (Barrett & Johnson, 2003; Eyssel, Kuchenbrandt & Bobinger, 2011).

### Mortality salience, sociality, and effectance

Mortality salience (MS) refers to one's conscious awareness of their mortality. Individuals are frequently exposed to stimuli reminding them of their mortality and, consciously or not, engage with thoughts about death. The most prominent theory that explains and predicts the effects of death thoughts, terror management theory (Greenberg et al., 1986), proposes that these thoughts create a potential for overwhelming anxiety and that worldview and self-esteem provide protection against this threat.

In addition to worldview and self-esteem, a growing body of literature about MS suggests belongingness as an

alternative buffer against death anxiety (for reviews, see Plusnin et al., 2018; Schimel & Greenberg, 2013). This line of research suggested that thoughts of death increase the motivation to form and maintain social relationships (Florian et al., 2002; Hirschberger et al., 2002, 2003; Taubman-Ben-Ari et al., 2002), even at the expense of worldview defense, the primary defensive mechanism proposed by terror management theory (Wisman & Koole, 2003).

Another stream of research offered an alternative explanation for the effects of MS predicted by terror management theory. This line of research presented evidence that worldview defense following MS is accounted for by personal uncertainty or lack of control, which are closely related to effectance motivation. For example, van den Bos et al. (2005) found that uncertainty salience led to more vigorous worldview defense than MS and that MS led to stronger reactions if triggered uncertainty-related thoughts than not, suggesting that the effect of MS might be driven by the sense of uncertainty. Similarly, Fritsche et al. (2008) found that MS does not lead to worldview defense when participants have control over their death. Likewise, Agroskin and Jonas (2013) found that the effect of MS on ingroup defense is driven not by death-thought accessibility but by control motivation.

In sum, a large body of evidence suggests that MS can trigger sociality and effectance motivations, both of which are the motivational antecedents of anthropomorphism according to the SEEK model. Therefore, we anticipated that MS would increase preference for anthropomorphic products.

**H1** *Compared to participants in the control condition, participants in the mortality salience condition will have a higher preference for the anthropomorphic (vs. non-anthropomorphic) product.*

## Potential moderators

A large body of research about MS shows that close relationships are one of the most important factors that protect against thoughts of death (for a literature review, see Plusnin et al., 2018; Schimel & Greenberg, 2013). On the other hand, the SEEK model of anthropomorphism predicts that lower levels of belongingness increase the tendency towards anthropomorphism and anthropomorphic entities. Therefore, MS should affect participants with lower belongingness more than participants with higher belongingness; thus, increasing their tendency to prefer anthropomorphic products.

**H2** *The anticipated positive effect of mortality salience on preference for the anthropomorphic product will be more pronounced among participants with lower levels of belongingness compared to those with higher levels of belongingness.*

Studies examining the relationship between MS and sociality motivation explained their findings with attachment theory (Bowlby, 1969, 1973, 1980) and suggested that attachment style play a moderating role in this relationship (Florian & Mikulincer, 1998; Mikulincer & Florian, 2000; Hart et al., 2005; Mikulincer et al., 2003; Taubman-Ben-Ari et al., 2002). Although numerous studies in this field found that attachment style moderate the effects of MS, they failed to present a consistent pattern. For example, in some studies, participants with a secure attachment style were affected by MS (Mikulincer & Florian, 2000; Taubman-Ben-Ari et al., 2002), while in some other studies, only participants with an insecure attachment style were affected (Smith & Massey, 2013). There are also studies documenting that both attachment styles are affected by MS but in different ways (Cox et al., 2008). Given the mixed nature of the extant findings, it is expected that attachment style moderate the effects of MS, but no judgment can be made as to which attachment style leads to more vulnerability against death thoughts. Therefore, we opted to test the moderating effect of attachment style on the relationship between MS and preference for anthropomorphic products exploratorily.

**H3** *The effect of mortality salience on preference for the anthropomorphic product will differ based on the attachment style.*

Terror management theory proposes that self-esteem acts as a buffer against thoughts of death and predicts that individuals with higher self-esteem experience less anxiety in the face of mortality salience compared to individuals with lower self-esteem. Thus, individuals with higher self-esteem are less inclined to defensive behaviors resulting from death anxiety (Greenberg et al., 1986; Pyszczynski et al., 1999). Therefore, we anticipated that participants with lower self-esteem would have a higher tendency to prefer anthropomorphic products in the face of thoughts of death compared to individuals with higher self-esteem.

**H4** *The anticipated positive effect of mortality salience on preference for the anthropomorphic product will be more*

*pronounced among participants with lower self-esteem compared to those with higher self-esteem.*

## Present research

The current research consists of two experiments conducted during the early months of the COVID-19 pandemic. In both experiments, MS was manipulated using pandemic-related content. We think that conducting the research during the COVID-19 pandemic contributed to the ecological validity of the research, as the pandemic provided a natural setting for thoughts of death. We also think that priming thoughts of death with COVID-19-related content allowed for an unobtrusive manipulation that prevented participants from suspecting the purpose of the research, thereby increasing internal validity by reducing participant bias. Ethics approval was obtained from the Social and Humanities Ethics Committee of Sakarya University.

## Study 1

### Method

This study aimed to test the effect of MS on preference for anthropomorphic products and the moderating role of belongingness in this relationship. The study was a 2 (mortality salience: yes vs. no)  $\times$  2 (anthropomorphism: yes vs. no) between-subjects factorial design experiment, where the combination of product liking and willingness to buy served as the dependent variable.

### Participants

Participants were business faculty students at a public university in northwest Turkey and were older than 18 years of age. They were recruited via a letter enclosing the link to the associated survey on Qualtrics™, posted to the student information system. In the invitation letter, participants were told that the study aimed to investigate the general attitudes of college students, and they were informed that their participation was completely voluntary, with no monetary or course credit compensation. In total, 271 students took part in the study. After excluding 35 participants who dropped out before the DV measurement and five non-native and 12 inattentive participants, we were left with a sample size of 219 (69.9% females;  $M_{\text{age}} = 21.39$ ,  $SD = 2.32$ ), which affords 95.8% power to detect a medium-sized effect ( $f = 0.25$ ) in a  $2 \times 2$  factorial ANOVA (Faul et al., 2007). We replaced

missing values in a given construct with the participant's mean on other items of that particular construct.

## Materials

**Mortality salience manipulation** To manipulate thoughts of death, we employed a text about COVID-19 and an open-ended question from the Mortality Attitudes Personality Survey (i.e. the classic MS manipulation; Rosenblatt et al., 1989). MS participants first read a short paragraph regarding the lethality of the pandemic and the pervasiveness of death reminders during the pandemic. The text concluded with a closed-ended question inquiring how often participants had been thinking about death during the pandemic period. This question was intended to set the stage for the following open-ended question asking about the thoughts and feelings that contemplation of death evokes. Participants in the control condition went through a parallel process but engaged in a neutral topic on film awards (see Appendix).

**Anthropomorphism manipulation** As the stimuli for anthropomorphism manipulation, we used a coffee machine that had previously been validated as anthropomorphism manipulation in several research studies (Kwak et al., 2015; Puzakova & Kwak, 2017). The versions of the product used in the experimental and control conditions differ in the positions of the buttons. Participants in the anthropomorphism condition viewed the version of the coffee machine with the buttons positioned in parallel so that they can look like eyes, while the participants in the control condition viewed the version of the same coffee machine with the buttons positioned vertically. We centered the buttons to control for symmetry and removed the fictitious brand name to avoid any confounding effects that could arise from potential associations connected to the brand name. Lastly, to control for individual differences in tea and coffee preferences, we framed the product as a “tea & coffee machine”, that is, a product that can brew both tea and coffee (see Fig. 1).

**Belongingness** We measured belongingness using six items from the General Belongingness Scale (Malone et al., 2012), adapted to Turkish by Duru (2015). Half of the items measured inclusion, while the other half measured exclusion (Cronbach's  $\alpha = 0.80$ ). The response scale ranged from 1 (*strongly disagree*) to 7 (*strongly agree*).

**Preference tendency** We measured liking and willingness to buy to compute a preference index. Liking was measured using three items in the esthetic dimension of the new product design scale (Homburg et al., 2015) along with a fourth global item assessing how much participants liked the product overall (Cronbach's  $\alpha = 0.92$ ). Willingness to buy was



**Fig. 1** Manipulation of product anthropomorphism (left: anthropomorphic; right: non-anthropomorphic)

measured via three items adapted from Rubera et al. (2011) along with a fourth generic item assessing how much participants wanted to own the product (Cronbach's = 0.95). Participants rated all items on a scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). We combined the liking and willingness to buy measures and averaged them to obtain a preference index (Pearson's = 0.74; Cronbach's = 0.95).

**Delay and distraction** According to terror management theory, unconscious defensive reactions to thoughts of death arise after these thoughts are removed from focal attention (Greenberg et al., 1994, 2000). For this reason, MS research studies generally employ distracting tasks and measurements between the MS manipulation and the dependent variable of interest to help participants suppress thoughts of death. In the current study, we placed a life evaluation measure (Cantril, 1965) and the attention check question between the MS manipulation and the product evaluation task.

**Attention check** In order to check for participants' attentiveness and identify non-native students, we employed a 7-point question in which we asked participants to tick "6" if they were international students but not to make a choice otherwise. We identified those who ticked "6" as international students and those who ticked any other option as inattentive.

## Procedure

We collected data between May 23 and June 12, 2020, via Qualtrics™. Participants initially read the informed consent form and then continued to the survey if they agreed with

the terms. In the survey, participants first indicated their age and gender and responded to several measures for an unrelated study. Then, after responding to the belongingness measure, they were randomly assigned to either the mortality salience or the control condition and were presented with the respective materials. Following the experimental tasks, they engaged in the distractor task and responded to the attention check question. Then, to mask the purpose of the study, participants were informed that the study was over, and they were asked to proceed to the following page for a product evaluation task, ostensibly for an unrelated study. Participants were randomly assigned to either the anthropomorphism or the control condition and evaluated the respective versions of the coffee machine by indicating their liking and willingness to buy. After the product evaluation task, participants engaged with an unrelated task, and then they were debriefed and thanked.

## Results

**Manipulation check** To assess the success of manipulation, we screened the content of the responses given to the open-ended experimental questions. The death-relevance of MS participants' responses would suggest that they engaged in death-related thoughts. Similarly, the death-irrelevance of control participants' responses would suggest that they were free from such thoughts. This examination revealed that all participants in the MS condition provided death-relevant answers, whereas none of the participants in the control condition provided answers relevant to death, indicating the success of manipulation.

**Hypothesis tests** To test the hypothesis that MS will increase preference for the anthropomorphic product (H1), we conducted a two-way ANOVA on the preference tendency scores. This analysis revealed that neither MS ( $F(1, 215) = 0.21, p = .65, = 0.001$ ) or anthropomorphism ( $F(1, 215) = 0.69, p = .41, = 0.003$ ) alone, nor their interaction ( $F(1, 215) = 0.28, p = .60, = 0.001$ ) had a statistically significant effect on preference tendency.

To test the potential moderating role of belongingness in the relationship between MS and preference for the anthropomorphic product (H2), we ran a linear model on preference tendency scores using the PROCESS macro 3.1 (Hayes, 2017; Model 2). However, we found no evidence for the three-way interaction between MS, anthropomorphism, and belongingness ( $p = .90$ ; for correlations, see Table 1).

Lastly, we tested our auxiliary hypothesis, which draws upon the SEEK model and proposes an inverse relationship between the level of belongingness and the tendency to prefer the anthropomorphic product, by analyzing the data of

**Table 1** Correlations Among Variables in Study 1

	1	2	3	4	5	6	7
1 Gender [1 = F, 2 = M]							
2 Age	0.10						
3 Inclusion	-0.02	0.08					
4 Exclusion	-0.16**	-0.08	-0.45***				
5 General Belongingness	0.09	0.09	0.82***	-0.88***			
6 Product Liking	0.03	-0.02	0.14**	-0.06	0.11*		
7 Willingness to Buy	-0.00	-0.03	0.04	-0.11	0.09	0.74***	
8 Preference Tendency	0.01	-0.03	0.09	-0.09	0.11	0.92***	0.94***

Note:  $n = 219$ . \*  $p < .1$ ; \*\*  $p < .05$ ; \*\*\*  $p < .01$ .

**Table 2** Relationship Between Belongingness and Preference Tendency (AM Product)

	1	2	3	4	5
1 Inclusion					
2 Exclusion	-0.42***				
3 General Belongingness	0.80***	-0.88***			
4 Product Liking	0.17*	-0.11	0.16*		
5 Willingness to Buy	0.04	-0.21**	0.16*	0.73***	
6 Preference Tendency	0.11	-0.18*	0.17*	0.91***	0.95***

Note:  $n = 115$ . \*  $p < .1$ ; \*\*  $p < .05$ ; \*\*\*  $p < .01$ .

participants in the anthropomorphism condition ( $n = 115$ ). Contrary to the prediction of the SEEK model, results revealed a weak, positive relationship between the level of belongingness and the tendency to prefer the anthropomorphic product, with a  $p$ -value slightly above the conventional level of statistical significance ( $r = .17, p = .07$ ; for correlations, see Table 2).

### Discussion

The results obtained from the present study did not support either the hypothesis that MS would positively affect preference for the anthropomorphic product or the hypothesis that the level of belongingness would play a moderating role in this relationship. In addition, the results regarding the relationship between the attitudes towards the anthropomorphic product and level of belongingness, or the exclusion dimension of belongingness, contradicted one of the fundamental propositions of the SEEK model. The SEEK model predicts that individuals who have a lower sense of belongingness or feel excluded will have a higher tendency to prefer anthropomorphic products in order to meet their sociality needs. However, in the current study, we found that the tendency to prefer the anthropomorphic product decreased as the level of belongingness decreased (or the feeling of exclusion increased).

The deviation of the research results from those expected may be due to many different reasons. For example, the abundance of death-related stimuli during the pandemic (e.g., case reports, news, interpersonal communication,

precautions, warnings) may have rendered death thoughts cognitively accessible to almost everyone, impeding the success of the MS manipulation in differentiating the experimental and control groups in terms of death-thought accessibility. Similarly, the distractor material employed between the MS manipulation and dependent variable measurement might have been insufficient to distract participants from thoughts of death, preventing the emergence of defensive reactions to MS. Another possibility is that random assignment of participants across the experimental conditions was not successful, causing individual differences to confound the results. To address these issues, we conducted a second experiment.

### Study 2

The main purpose of this study was to retest the central hypothesis of the research with a statistically more powerful design that can also address the questions stemming from the limitations of the first study. In this study, we employed a mixed design experiment, which partly controls for individual differences and offers higher statistical power. Also, we employed a metric method to assess the success of the MS manipulation. Additionally, considering the possibility that the delay and distraction in the first study may have been insufficient in diverting the attention of MS participants away from thoughts of death, we used a different distractor task in the second study. Finally, instead of belongingness, we tested the potential moderating effects of self-esteem and

attachment style, which successfully moderated the effects of MS on numerous outcomes in past research.

## Method

This study was a 2 (mortality salience: yes, no) x 2 (anthropomorphism: yes, no) mixed design experiment in which product liking and product preference were measured as the dependent variables. MS was manipulated as between-subjects, while anthropomorphism was manipulated as within-subjects.

## Participants

Participants were students from the same school as those in the first study and were older than 18 years of age. As in the first study, participants were recruited via a letter posted to the student information system, in which they were told that the study was to investigate the general attitudes of college students and were provided with the link to the survey on Qualtrics™. In total, 231 people took part in the study. After excluding 40 participants who dropped out before the DV measurement, 11 non-native and eight inattentive participants, we were left with a sample size of 172 (58.1% females;  $M_{\text{age}} = 22.84$ ,  $SD = 4.43$ ), which affords 99.9% power to detect a medium-sized effect ( $f = 0.25$ ) in a  $2 \times 2$  mixed ANOVA (Faul et al., 2007). We replaced missing values in a given construct with the participant's mean on other items of that particular construct.

## Materials

**Mortality salience manipulation** We manipulated MS using the same materials from the first study.

**Anthropomorphism manipulation** We manipulated anthropomorphism using the same images of the “tea & coffee machine” from the first study.

**Self-esteem** To measure self-esteem we employed five items from the Rosenberg Self-Esteem Scale (Rosenberg, 1965), adapted to Turkish by Çuhadaroğlu (1986). Participants rated the items on a scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), and the scale demonstrated satisfactory internal consistency (Cronbach's  $\alpha = 0.86$ ).

**Attachment style** We assessed attachment style using 11 items from the Relationship Scales Questionnaire (Griffin & Bartholomew, 1994), adapted to Turkish by Sümer and Güngör (1999). We asked participants to rate the extent to which they thought each item described them on a scale

ranging from 1 (does not describe me at all) to 7 (completely describes me).

**Liking and product preference** We measured the extent to which participants liked the anthropomorphic and non-anthropomorphic designs of the product using the same liking items as in the first study, and then we asked participants which of the two designs they would prefer if they were to buy the product.

**Death-thought accessibility** We employed a word-fragment completion task to assess the death-thought accessibility (Greenberg et al., 1994). We presented participants with eight fragmented words with each of them missing two letters. Four of these words were death-neutral, while the other four could be completed either as death-related or as neutral words. For example, (Ö\_Ü\_) could be completed as *ölüm* (death) or as several neutral words, such as *özür* (excuse), *ödün* (compromise) or *öbür* (other). We asked participants to complete the words as quickly as possible. We regarded the number of words completed as death-related terms as a measure of the death-thought accessibility and used it to assess the manipulation's effectiveness.

**Delay and distraction** We employed a financial decision-making task to distract MS participants from thoughts of death and facilitate the suppression of these thoughts. Participants evaluated 11 financial offers, each consisting of two options.

**Attention check** To check for participant attentiveness, we used the same attention check question as in the first study.

## Procedure

We collected data between June 18 and July 4, 2020, via Qualtrics™. Participants initially read the informed consent form and then continued to the survey if they agreed with the terms. In the survey, participants first indicated their age and gender and responded to several items for an unrelated study. Then, after responding to the self-esteem and attachment style measures, they were randomly assigned to either the MS or the control condition and presented with the respective materials on the following page. After completing the experimental materials, participants engaged with the distractor task. Then, participants were informed that the study was over, and they were asked to proceed to the following page for a product evaluation task, ostensibly for an unrelated study. On the following page, the anthropomorphic and non-anthropomorphic versions of the coffee machine were presented side by side in a randomized

order. Participants were informed that the product was a tea & coffee machine and that there was no difference between the two designs other than the button positions. They were asked to examine both designs and proceed to the next page to evaluate the designs. Participants evaluated both designs in the order of presentation using the liking items and then indicated which of the two designs they would prefer if they were to buy the product. Then, participants responded to the attention check question and an unrelated measure. Finally, participants engaged with the death-thought accessibility task, and then they were debriefed and thanked.

### Results

**Manipulation check** To test whether MS manipulation was successful in differentiating experimental groups in terms of accessibility of death thoughts, we recorded the number of words completed as death-related terms in the word-fragment completion task for each participant. Then we conducted an independent samples *t*-test to compare the experimental groups in terms of death-related word counts. Results showed that the participants in the MS condition produced significantly more death-related words ( $M=1.02, SD=0.94$ ) than the participants in the control condition ( $M=0.67, SD=0.73$ ), confirming the success of manipulation,  $t(163)=2.74, p=.007, d=0.43$ .

**Tests of hypotheses** To test the hypothesis that MS will increase preference for the anthropomorphic product, we conducted a two-way mixed ANOVA on liking scores. The results of this analysis revealed that anthropomorphism had a large, statistically significant effect on liking, such that the anthropomorphic design was liked much more than the non-anthropomorphic one,  $F(1, 170)=59.07, p<.001, \eta^2=0.26$ . However, there was no significant interaction between MS and anthropomorphism, indicating that the effect of

anthropomorphism on liking emerged independently of MS,  $F(1, 170) = 1.60, p = .21, \eta^2 = 0.009$ . Testing the same hypothesis via test for product choice corroborated the above findings. A great majority of participants (83.1%) preferred the anthropomorphic version over the non-anthropomorphic one; however, the interaction between MS and AM was not significant,  $\text{Pearson}(1) = 1.34, \eta^2 = 0.25$ .

To test the moderating effect of belongingness on the relationship between MS and preference for the anthropomorphic product (H3), we conducted a three-way mixed ANOVA. Results showed that neither the two-way interaction between attachment style and anthropomorphism ( $F(3, 135)=1.78, p=.15, \eta_p^2 = 0.038$ ) nor the three-way interaction between attachments style, anthropomorphism and MS were significant ( $F(3, 135) = 1.31, p = .27, \eta_p^2 = 0.028$ ).

Finally, to test the moderating role of self-esteem (H4), we ran a hierarchical linear regression on the difference between the liking scores of the anthropomorphic and non-anthropomorphic designs. We entered MS (dummy-coded) and self-esteem (mean-centered) into the model in the first step, and then we introduced the interaction of these two variables in the second step. Results revealed that neither MS ( $p = .19, \eta_p^2 = 0.01$ ) or self-esteem ( $p = .41, \eta_p^2 = 0.004$ ) alone, nor their interaction ( $p = .80, \eta_p^2 = 0.0004$ ) had a significant effect on the difference between the liking scores of the anthropomorphic product and the non-anthropomorphic one (for correlations, see Table 3).

### General discussion and conclusion

This research is the first to test the effect of mortality salience on preference for anthropomorphic products. Given the widespread prevalence of thoughts of death, especially during stressful times such as pandemics, a potential relationship between mortality salience and preference for

**Table 3** Correlations Among Variables in Study 2

	1	2	3	4	5	6	7	8	9	10
<b>1</b> Mortality salience [0=No, 1=Yes]										
<b>2</b> Gender [1=F, 2=M]	0.08									
<b>3</b> Age	-0.01	0.14*								
<b>4</b> Secure attachment	0.08	-0.04	0.03							
<b>5</b> Fearful attachment	-0.01	-0.07	-0.08	-0.47***						
<b>6</b> Preoccupied attachment	-0.03	0.03	0.13*	-0.10	0.04					
<b>7</b> Dismissed attachment	-0.03	0.06	-0.09	-0.24***	0.43***	-0.28***				
<b>8</b> Self-esteem	0.09	0.21***	0.02	0.32***	-0.12	-0.12	-0.08			
<b>9</b> Liking (AM)	-0.05	-0.05	-0.07	-0.03	0.03	0.07	-0.01	0.09		
<b>10</b> Liking (non-AM)	0.08	-0.04	-0.01	0.01	-0.19**	-0.07	-0.07	0.01	0.20***	
<b>11</b> Product preference [1=non-AM, 2=AM]	0.09	0.07	0.03	-0.03	0.17**	0.06	0.12	-0.03	0.28***	-0.28***

**Note:**  $n = 172$ . \*  $p < .1$ ; \*\*  $p < .05$ ; \*\*\*  $p < .01$ .



anthropomorphic products could offer important psychological benefits to consumers. In two experimental studies with high statistical power, we examined the effect of mortality salience on preference for anthropomorphic products; however, we could not obtain sufficient evidence supporting this effect. The first study was a between-subjects experiment where we manipulated mortality salience and anthropomorphism and measured participants' liking and willingness to buy the product. This study found no evidence either for the main effects of mortality salience and anthropomorphism or their interaction. We also tested the moderating effect of belongingness but could not find evidence for this effect either. We designed a second study addressing the limitations of the first study and retested the effect of mortality salience on preference for anthropomorphic products. The main difference of the second study from the first one was that it manipulated anthropomorphism as within-subjects; as such, participants could compare and choose between the anthropomorphic and the non-anthropomorphic designs. This study found a large main effect of anthropomorphism; however, the main effect of mortality salience and its interaction with anthropomorphism was again non-significant. We also tested the moderating effects of attachment style and self-esteem, but we could not find evidence supporting these effects either.

In addition to examining the effect of mortality salience on preference for anthropomorphic products, the current research has also investigated the potential moderating effect of three relevant factors: self-esteem, attachment style, and belongingness. However, the current research did not find sufficient evidence for the moderating effect of any of these variables on the relationship between mortality salience and preference for anthropomorphic products.

There can be many reasons behind the failure to find support for the hypotheses. One of these reasons could be that, unlike the sociality and effectance threats, mortality salience may increase the desire for human rather than human-like contact. Another possibility is that the effect of mortality salience on preference for anthropomorphic products depends on the product type. We leave these inquiries for future research.

An alternative explanation for the null results could be that the theories and findings that the hypotheses draw upon are not generalizable. Relying on the large body of research presenting evidence for the effect of mortality salience on sociality motivation and the SEEK model's prediction that sociality motivation would increase preference for anthropomorphic entities, we predicted that mortality salience would increase preference for anthropomorphic products. Therefore, either the link between mortality salience and sociality or the link between sociality and anthropomorphism, or both, may not be generalizable. Indeed, the association

between belongingness and attitudes towards the anthropomorphic product was in the opposite direction of what the SEEK model predicts. According to the SEEK model, people with a lower sense of belongingness or higher perceived social exclusion would have more positive attitudes towards anthropomorphic entities. However, perceived social exclusion was negatively correlated with willingness to buy the anthropomorphic product in the first study. In other words, the higher the perceived social exclusion, the lower the preference for the anthropomorphic product.

Previous replication efforts for the sociality account of anthropomorphism also yielded inconclusive results. Although Bartz et al. (2016) successfully replicated a study from Epley et al. (2008), an open science initiative failed to replicate the same study (Open Science Collaboration, 2015). Similarly, recent large-scale replications showed that the most fundamental proposition of the terror management theory, which has served as the basis for hundreds of empirical studies on the effects of death thoughts, is not reproducible (Klein et al., 2019; Sætrevik & Sjøstad, 2019). Therefore, a potential reason why the hypotheses in the current research were not supported may be that they draw upon theories and findings that are not reproducible and generalizable.

Although we could not find evidence for the predicted effects, we discovered a boundary condition regarding the effect of anthropomorphism on the product/design liking. In the first study, where anthropomorphism was manipulated as between-subjects so participants viewed only one version of the product, there was no statistically significant difference between the anthropomorphic and the non-anthropomorphic products in terms of liking. However, in the second study, where anthropomorphism was manipulated as within-subjects so participants had the opportunity to view and compare both versions, we observed that a great majority of participants (83.1%) preferred the anthropomorphic version over the non-anthropomorphic one. Therefore, in cases where consumers can evaluate two alternatives with comparable specifications, the option with anthropomorphic characteristics may be more advantageous. However, in cases where consumers only have access to either of the alternatives, anthropomorphism may not significantly affect consumer evaluations.

**Funding** This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

**Data and code availability** The data that support the findings of this research and the SPSS syntax to reproduce the main results are openly available at <https://osf.io/mbtae>.

## Declarations

**Conflict of Interest** The authors state that there is no conflict of interest.

## References

- Aggarwal, P., & McGill, A. L. (2007). Is that car smiling at me? Schema congruity as a basis for evaluating anthropomorphized products. *Journal of consumer research*, 34(4), 468–479.
- Agroskin, D., & Jonas, E. (2013). Controlling death by defending ingroups—mediational insights into terror management and control restoration. *Journal of Experimental Social Psychology*, 49(6), 1144–1158.
- Barrett, J., & Johnson, A. H. (2003). The role of control in attributing intentional agency to inanimate objects. *Journal of Cognition and Culture*, 3(3), 208–217.
- Bartz, J. A., Tehalova, K., & Fenerci, C. (2016). Reminders of social connection can attenuate anthropomorphism: A replication and extension of Epley, Akalis, Waytz, and Cacioppo (2008). *Psychological science*, 27(12), 1644–1650.
- Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, 117(3), 497–529.
- Bowlby, J. (1969). *Attachment and loss: Volume 1. Attachment*. London: Pimlico.
- Bowlby, J. (1973). *Attachment and loss: Volume 2. Separation, anger and anxiety*. London: Pimlico.
- Bowlby, J. (1980). *Attachment and loss: Volume 3. Sadness and depression*. London: Pimlico.
- Brown, D. E. (1991). *Human universals*. New York: McGraw-Hill.
- Cantril, H. (1965). *The pattern of human concerns*. New Brunswick, NJ: Rutgers University Press.
- Chen, F., Sengupta, J., & Adaval, R. (2018). Does endowing a product with life make one feel more alive? The Effect of Product Anthropomorphism on Consumer Vitality. *Journal of the Association for Consumer Research*, 3(4), 503–513.
- Chen, R. P., Wan, E. W., & Levy, E. (2017). The effect of social exclusion on consumer preference for anthropomorphized brands. *Journal of Consumer Psychology*, 27(1), 23–34.
- Cox, C. R., Arndt, J., Pyszczynski, T., Greenberg, J., Abdollahi, A., & Solomon, S. (2008). Terror management and adults' attachment to their parents: The safe haven remains. *Journal of Personality and Social Psychology*, 94(4), 696.
- Çuhadaroğlu, F. (1986). Self esteem among adolescents. Unpublished dissertation, Hacettepe University.
- De Visser, E. J., Monfort, S. S., McKendrick, R., Smith, M. A., McKnight, P. E., Krueger, F., & Parasuraman, R. (2016). Almost human: Anthropomorphism increases trust resilience in cognitive agents. *Journal of Experimental Psychology: Applied*, 22(3), 331–349.
- Delbaere, M., McQuarrie, E. F., & Phillips, B. J. (2011). Personification in advertising: Using a visual metaphor to trigger anthropomorphism. *Journal of Advertising*, 40(1), 121–130.
- Duru, E. (2015). The psychometric properties of the general belongingness scale: A study of reliability and validity. *Turkish Journal of Psychological Counseling and Guidance*, 5(44), 37–47.
- Epley, N., Akalis, S., Waytz, A., & Cacioppo, J. T. (2008). Creating social connection through inferential reproduction: Loneliness and perceived agency in gadgets, gods, and greyhounds. *Psychological science*, 19(2), 114–120.
- Epley, N., Waytz, A., & Cacioppo, J. T. (2007). On seeing human: A three-factor theory of anthropomorphism. *Psychological review*, 114(4), 864.
- Eyssel, F., Kuchenbrandt, D., & Bobinger, S. (2011, March). Effects of anticipated human-robot interaction and predictability of robot behavior on perceptions of anthropomorphism. In Proceedings of the 6th international conference on Human-robot interaction (ss. 61–68).
- Eyssel, F., & Reich, N. (2013, March). Loneliness makes the heart grow fonder (of robots)—On the effects of loneliness on psychological anthropomorphism. In 2013 8th acm/ieee international conference on human-robot interaction (hri) (ss. 121–122). IEEE.
- Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G\* power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior research methods*, 39(2), 175–191.
- Florian, V., & Mikulincer, M. (1998). Symbolic immortality and the management of the terror of death: The moderating role of attachment style. *Journal of Personality and Social Psychology*, 74(3), 725–734.
- Florian, V., Mikulincer, M., & Hirschberger, G. (2002). The anxiety buffering function of close relationships: Evidence that relationship commitment acts as a terror management mechanism. *Journal of Personality and Social Psychology*, 82, 527–542.
- Fritsche, I., Jonas, E., & Fankhänel, T. (2008). The role of control motivation in mortality salience effects on ingroup support and defense. *Journal of personality and social psychology*, 95(3), 524.
- Greenberg, J., Arndt, J., Simon, L., Pyszczynski, T., & Solomon, S. (2000). Proximal and distal defenses in response to reminders of one's mortality: Evidence of a temporal sequence. *Personality and Social Psychology Bulletin*, 26(1), 91–99.
- Greenberg, J., Pyszczynski, T., & Solomon, S. (1986). The causes and consequences of a need for self-esteem: A terror management theory. In R. F. Baumeister (Ed.), *Public self and private self* (ss. 189–212). Springer, New York, NY.
- Greenberg, J., Pyszczynski, T., Solomon, S., Simon, L., & Breus, M. (1994). Role of consciousness and accessibility of death-related thoughts in mortality salience effects. *Journal of personality and social psychology*, 67(4), 627.
- Griffin, D., & Bartholomew, K. (1994). Metaphysics of measurement: The case of adult attachment. In K. Bartholomew & D. Perlman (Eds.), *Advances in personal relationships*, Vol. 5: Attachment processes in adulthood (ss.17–52). London: Jessica Kingsley.
- Guido, G., Pichierri, M., Pino, G., & Natarajan, R. (2019). Effects of face images and face pareidolia on consumers' responses to print advertising: An empirical investigation. *Journal of Advertising Research*, 59(2), 219–231.
- Guthrie, S. (1980). A cognitive theory of Religion. *Current Anthropology*, 21(2), 181–203.
- Guthrie, S. (1995). *Faces in the clouds: A new theory of religion*. Oxford University Press.
- Hart, J., Shaver, P. R., & Goldenberg, J. L. (2005). Attachment, self-esteem, worldviews, and terror management: Evidence for a tripartite security system. *Journal of personality and social psychology*, 88(6), 999.
- Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford publications.
- Hirschberger, G., Florian, V., & Mikulincer, M. (2002). The anxiety buffering function of close relationships: Mortality salience effects on the readiness to compromise mate selection standards. *European Journal of Social Psychology*, 32, 609–625.
- Hirschberger, G., Florian, V., & Mikulincer, M. (2003). Strivings for romantic intimacy following partner complaint or partner criticism: A terror management perspective. *Journal of Social and Personal Relationships*, 20(5), 675–687.
- Homburg, C., Schwemmler, M., & Kuehnl, C. (2015). New product design: Concept, measurement, and consequences. *Journal of marketing*, 79(3), 41–56.
- Klein, R. A., Cook, C. L., Ebersole, C. R., Vitiello, C., Nosek, B. A., Chartier, C. R., Ratliff, K. (2019, December 11). Many Labs 4: Failure to replicate mortality salience effect with and without

- original author involvement. <https://doi.org/10.31234/osf.io/vef2c>
- Kwak, H., Puzakova, M., & Rocereto, J. F. (2015). Better not smile at the price: The differential role of brand anthropomorphization on perceived price fairness. *Journal of Marketing*, 79(4), 56–76.
- Malone, G. P., Pillow, D. R., & Osman, A. (2012). The general belongingness scale (GBS): Assessing achieved belongingness. *Personality and Individual Differences*, 52(3), 311–316.
- Mikulincer, M., & Florian, V. (2000). Exploring individual differences in reactions to mortality salience: Does attachment style regulate terror management mechanisms? *Journal of personality and social psychology*, 79(2), 260–273.
- Mikulincer, M., Florian, V., & Hirschberger, G. (2003). The existential function of close relationships: Introducing death into the science of love. *Personality and social psychology review*, 7(1), 20–40.
- Mithen, S. J. (1996). *The prehistory of the mind: A search for the origins of art, religion and science*. London: Thames & Hudson.
- Mourey, J. A., Olson, J. G., & Yoon, C. (2017). Products as pals: Engaging with anthropomorphic products mitigates the effects of social exclusion. *Journal of Consumer Research*, 44(2), 414–431.
- Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. *Science*, 349(6251), aac4716.
- Plusnin, N., Pepping, C. A., & Kashima, E. S. (2018). The role of close relationships in terror management: A systematic review and research agenda. *Personality and social psychology review*, 22(4), 307–346.
- Puzakova, M., & Kwak, H. (2017). Should anthropomorphized brands engage customers? The impact of social crowding on brand preferences. *Journal of Marketing*, 81(6), 99–115.
- 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.
- Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press.
- Rosenblatt, A., Greenberg, J., Solomon, S., Pyszczynski, T., & Lyon, D. (1989). Evidence for terror management theory: I. The effects of mortality salience on reactions to those who violate or uphold cultural values. *Journal of personality and social psychology*, 57(4), 681–690.
- Rubera, G., Ordanini, A., & Griffith, D. A. (2011). Incorporating cultural values for understanding the influence of perceived product creativity on intention to buy: An examination in Italy and the US. *Journal of International Business Studies*, 42(4), 459–476.
- Sætrevik, B., & Sjøstad, H. (2019, May 17). Mortality salience effects fail to replicate in traditional and novel measures. <https://doi.org/10.31234/osf.io/dkg53>
- Schimel, J., & Greenberg, J. (2013). The birth and death of belonging. İçinde C. N. DeWall (Ed.), *Oxford library of psychology*. The Oxford handbook of social exclusion (ss. 286–300). Oxford University Press.
- Shin, H. I., & Kim, J. (2020). My computer is more thoughtful than you: Loneliness, anthropomorphism and dehumanization. *Current Psychology*, 39(2), 445–453.
- Smith, R., & Massey, E. (2013). Aspects of love: The effect of mortality salience and attachment style on romantic beliefs. *OMEGA-Journal of death and dying*, 66(2), 135–151.
- Sümer, N., & Güngör, D. (1999). Yetişkin bağlanma stilleri ölçeklerinin Türk örnekleme üzerinde psikometrik değerlendirmesi ve kültürlerarası bir karşılaştırma. *Türk Psikoloji Dergisi*, 14(43), 71–106.
- Taubman-Ben-Ari, O., Findler, L., & Mikulincer, M. (2002). The effects of mortality salience on relationship strivings and beliefs: The moderating role of attachment style. *The British Journal of Social Psychology*, 41, 419–441.
- Touré-Tillery, M., & McGill, A. L. (2015). Who or what to believe: Trust and the differential persuasiveness of human and anthropomorphized messengers. *Journal of Marketing*, 79(4), 94–110.
- Van den Bos, K., Poortvliet, P. M., Maas, M., Miedema, J., & Van den Ham, E. J. (2005). An enquiry concerning the principles of cultural norms and values: The impact of uncertainty and mortality salience on reactions to violations and bolstering of cultural worldviews. *Journal of Experimental Social Psychology*, 41(2), 91–113.
- Waytz, A., Heafner, J., & Epley, N. (2014). The mind in the machine: Anthropomorphism increases trust in an autonomous vehicle. *Journal of Experimental Social Psychology*, 52, 113–117.
- Waytz, A., Morewedge, C. K., Epley, N., Monteleone, G., Gao, J. H., & Cacioppo, J. T. (2010). Making sense by making sentient: Effectance motivation increases anthropomorphism. *Journal of personality and social psychology*, 99(3), 410.
- White, R. W. (1959). Motivation reconsidered: The concept of competence. *Psychological review*, 66(5), 297.
- Wisman, A., & Koole, S. L. (2003). Hiding in the crowd: Can mortality salience promote affiliation with others who oppose one's worldviews? *Journal of personality and social psychology*, 84(3), 511.

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.