

Original Article

## The Effect of Age on Death Disgust: Challenges to Terror Management Perspectives

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**Abstract:** Proponents of Terror Management Theory (TMT) argue that many facets of disgust serve to defend against existential anxiety accompanying cognizance of one's mortality. Because the passage of time brings death closer, this view predicts that the intensity of disgust elicited by reminders of death should increase with age. Skeptical of TMT, we conducted Internet-based studies using the instrument created by TMT proponents. Results reveal that age is negatively, not positively, correlated with death disgust sensitivity, a pattern consistent with adaptive habituation rather than terror management. The same result was obtained using in-person administration of the instrument in Costa Rica, a society characterized by attitudes toward death that differ from those of the U.S. Additional work in Costa Rica demonstrated that, contrary to TMT predictions, attention to one's own death need not increase disgust reactions to the body or its products. Both the evocative power of death stimuli and the negative effects of age on death disgust are consistent with the argument that disgust is an adaptation motivating disease avoidance rather than a psychodynamic defense mechanism.

**Keywords:** disgust, death, age effects, Terror Management Theory, habituation.

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### The Terror Management account of disgust

Disgust, first systematically studied by Darwin (1872), is widely considered a universal emotion (Ekman, Friesen, and Ellsworth, 1982; Oatley and Johnson-Laird, 1987; Scherer and Wallbott, 1994). Though long neglected, within the last two

decades disgust has become the focus of rigorous investigation. Paul Rozin and Jonathan Haidt, the principal pioneers in this enterprise, have, together with their associates, generated a large body of empirical findings, shedding new light on disgust. Because their work constitutes a thematically coherent corpus, we refer to this team collectively as the Rozin School. The Rozin School proposes that a disgust-like emotion evolved to protect the body from the oral incorporation of pathogen- and toxin-bearing substances (Haidt, McCauley, and Rozin, 1994; Haidt, Rozin, McCauley, and Imada, 1997; Rozin and Fallon, 1987; Rozin, Haidt, and McCauley, 1993, 1999). However, being intimately linked to defending the body/self from contamination, disgust, the Rozin School argues, is readily extended to other domains.

A principal conceptual hazard that symbolically-mediated disgust ostensibly guards against is the recognition that humans are animals. Inspired by the work of anthropologist Ernest Becker (1973), and relying on the same premises as the theoretical framework now known as Terror Management Theory (TMT) (see Greenberg, Solomon, and Pyszczynski, 1997 for review), the Rozin School claims that knowledge of our own mortality induces existential anxiety, a condition that TMT proponents describe as a fitness-reducing paralytic state – consumed by an awareness of the inevitability of death, individuals are, it is postulated, unable to engage in the tasks that contribute to survival and reproductive success (Greenberg, Solomon, and Pyszczynski, 1997; Solomon, Greenberg, Schimel, Arndt, and Pyszczynski, 2004). Because humans are aware that animals are mortal, being reminded of our animality provokes this paralyzing anxiety. Disgust is thus purportedly adaptively employed as a defense against existential terror, an explanation invoked to account for the linkage between disgust and such stimuli as contact with animals, body products, violations of the body envelope, and the dead (Goldenberg, Pyszczynski, Greenberg, Solomon, Kluck, and Cornwell, 2001; Haidt, McCauley, and Rozin, 1994; Haidt, Rozin, McCauley, and Imada, 1997; Rozin, Haidt, McCauley, Dunlop, and Ashmore, 1999; Rozin, Haidt, McCauley, and Imada, 1997; Rozin, Haidt, and McCauley, 1993, 1999, 2000).

Consistent with the above reasoning, the Rozin School and allied Terror Management investigators hold that the application of disgust to the domain of sexual behavior is motivated by a panhuman need to distance oneself from the animality of mating (Haidt, McCauley, and Rozin, 1994; Haidt, Rozin, McCauley, and Imada, 1997; Rozin, Haidt, McCauley, Dunlop, and Ashmore, 1999; Rozin, Haidt, and McCauley, 1993, 1999, 2000; see also Goldenberg, Cox, Pyszczynski, Greenberg, and Solomon, 2002; Goldenberg, Pyszczynski, Greenberg, Solomon, Kluck, and Cornwell, 2001; Goldenberg, Pyszczynski, McCoy, Greenberg, and Solomon, 1999). Recently, we demonstrated that disgust sensitivity in the sexual domain, and only in the sexual domain, increases as a function of the likelihood of conception across the menstrual cycle (Fessler and Navarrete, 2003a). It is difficult to see how such patterned domain-specific changes in disgust sensitivity can be explained by the notion that sexual disgust derives from an intense need to avoid recognition of one's

own mortality. In contrast, these changes are exactly what should be expected if women's sexual disgust is an evolved adaptation that reduces the probability of biologically suboptimal sexual unions (e.g., incest, bestiality, etc.) during the fertile phase. This led us to question the Rozin School's oft-repeated claim that, rather than directly reflecting the workings of an evolved mechanism, many aspects of disgust experience instead constitute an attempt to avoid existential terror. We therefore sought to examine the domain in which the postulated phenomenon ought to loom most large, namely disgust reactions to stimuli that are overtly associated with death.

If, as TMT proponents argue (Goldenberg, Pyszczynski, Greenberg, Solomon, Kluck, and Cornwell, 2001; Haidt, McCauley, and Rozin, 1994; Haidt, Rozin, McCauley, and Imada, 1997; Rozin, Haidt, McCauley, Dunlop, and Ashmore, 1999; Rozin, Haidt, McCauley, and Imada, 1997; Rozin, Haidt, and McCauley, 1993, 1999, 2000), disgust responses to reminders of death constitute an attempt to avoid the anxiety attending the recognition that we are mortal, and if, as part of that recognition, each of us knows that the passage of time inexorably brings us closer to the day that we will die, then disgust sensitivity in the death domain should increase with age, since the motivation to deny our impending death should be enhanced as the fateful day draws closer.<sup>1</sup>

Although Quigley, Sherman, and Sherman (1997) noted that disgust sensitivity declines with age, their study focused only on young adults, and they report only overall disgust sensitivity, rather than disgust sensitivity by domain; similar considerations apply to Rozin, Haidt, and McCauley's observation that 'There are hints ... that disgust sensitivity declines after the teen years,' (2000, p. 648). In the course of our investigation of changes in disgust sensitivity over the menstrual cycle, using the same instrument employed by both Quigley, Sherman, and Sherman and the Rozin School, we also found a decline in overall disgust sensitivity with age (Fessler and Navarrete, 2003a); however, our study involved only reproductive-age women. In a very large sample spanning a wide age range, Curtis, Anger, and Rabie (2004) showed declines in disgust sensitivity with age; however, their study employed stimuli not directly related to death. As the literature thus does not illuminate the relationship between age and disgust sensitivity in the death domain, we sought to address this issue via three avenues. First, we reanalyzed data previously collected in two Internet-based surveys that employed the Disgust Scale (Haidt, McCauley, and Rozin, 1994), the instrument created by the Rozin School, the principal advocates of the Terror Management account of death disgust. Second, we conducted a new Internet-based survey using the Disgust Scale. Lastly, because attitudes toward death vary across cultures, in order to ensure that any patterns found were not the unique product of U.S. culture, we orally administered a translated version of the Disgust Scale in rural Costa Rica, a cultural environment in which individuals have greater familiarity with death, and in which death fears are more boldly confronted, than is generally true in the U.S.

## **Study 1 – Reanalysis of prior Internet-based administrations of the Disgust Scale**

### *Method*

In order to shed light on the relationship between age and death disgust, we revisited data collected previously in the course of two Internet studies conducted for other purposes. The first study, described to participants as ‘Surveys on Diet, Disgust, and Motion Sickness,’ consisted of a dietary inventory on the first web page, followed by the Disgust Scale on a second page, followed in turn by a questionnaire on susceptibility to motion sickness (see Fessler, Arguello, Mekdara, and Macias, 2003 for details). In the second study, titled ‘Body Awareness and the Self,’ the initial web page asked participants to rate how disgusting they found the prospect of transplantation of each of twenty different body tissues; the Disgust Scale was then presented on a separate page (see Fessler and Haley, in press, Study 3, for details). In both studies, participants were recruited through postings to clearinghouse web sites (e.g., Psychological Research on the Net, SocialPsychology.org) and listservs (e.g., Psych-L, Anthro-L). Participation was anonymous, and no compensation was offered.

### *Results and Discussion*

We pooled data from the two studies, limiting the analysis to adults who completed every item on each questionnaire and eliminating multiple entries from the same IP address. This produced a combined sample of 921 individuals (635 women and 286 men, aged 18 – 79;  $M = 29.5$ ,  $S.D. = 11.3$ ). To assess death disgust sensitivity, we examined responses to death-related questions on the Disgust Scale, including both true/false questions (e.g., “It would bother me to sleep in a nice hotel room if I knew that a man had died of a heart attack in that room the night before,” etc.) and scalar ‘how disgusting’ questions (e.g., “You accidentally touch the ashes of a person who has been cremated,” etc.) (see Haidt, McCauley, and Rozin, 1994). In a multiple regression analysis in which the independent variables were age, sex, and a dummy variable controlling for mean differences between the two samples,<sup>2</sup> we found a significant main effect for age in which increasing age predicted lower disgust sensitivity to death stimuli. As will be discussed later, a sizeable body of work demonstrates that, in many domains, women are generally more disgust sensitive than men. Consistent with this literature, we also found a main effect for sex, as, on average, men showed significantly less disgust sensitivity toward death stimuli than did women. (see Table 1 full regression statistics).

We explored sex-x-age interactions in a second step. However, adding these cross-products did not significantly increase the variance explained in the regression, and they were therefore removed from the model. This revealed that, although men were less disgust sensitive towards death stimuli than were women, the slopes predicting disgust sensitivity as a function of age did not differ between the sexes.

**Table 1.** Study 1. Summary of Multiple Regression Analysis for Variables Predicting Death Disgust. Values reflect standardized beta weights. *Dataset* dummy variable controls for mean differences between datasets.

Variable	$\beta$	S.E.	t	Sig.
DEATH DISGUST				
Age (Men)	-.22	.03	-6.82	$p < .0001$
Sex (Male)	-.23	.07	-3.28	$p < .001$
Dataset (Fessler and Haley)	-.49	.07	-6.66	$p < .0001$

## Study 2 – Internet-based administration of the Disgust Scale alone

### Method

Because the materials analyzed in Study 1 were not originally collected for the purpose of examining age effects on death disgust sensitivity, in both of the surveys, the Disgust Scale was preceded by a questionnaire addressing a different topic; likewise, in both cases, demographic information was collected at the beginning of the survey. These procedures raise the possibility that the pattern evident in the results reflects age-dependent priming effects produced by stimuli not directly pertaining to death disgust. To address this limitation, we conducted an additional Internet survey in which the Disgust Scale was presented in isolation. A link labeled ‘An Investigation of the Effects of Context on Emotional Reactions,’ posted on clearinghouse web sites, led to the Disgust Scale, followed by a separate page containing questions regarding age, sex, and the setting in which participation took place (the latter information was collected for reasons not relevant to the present discussion).

### Results

Employing the same criteria for inclusion as those used in Study 1 produced a sample of 692 individuals (506 women and 186 men, aged 18 – 81;  $M = 26.8$ ,  $S.D. = 11.7$ ). In a multiple regression analysis in which the independent variables were age, sex and their interactions, we found significant main effects for age and sex. Confirming previous results, death disgust sensitivity declined significantly with age, and men were less disgust sensitive than women (Table 2). A second step in which interaction terms were added once again revealed that, although men had a lower mean level of death disgust sensitivity than did women, the slopes predicting disgust sensitivity as a function of age did not differ between the sexes.

**Table 2.** Study 2: Summary of Multiple Regression Analysis for Variables Predicting Death Disgust. Values reflect standardized beta-weights.

<b>Variable</b>	<b><math>\beta</math></b>	<b>S.E.</b>	<b>t</b>	<b>Sig.</b>
<b>DEATH DISGUST</b>				
Age	-.29	.04	-8.15	$p < .0001$
Gender (Male)	-.32	.08	-3.95	$p < .0001$

### **Study 3 – In-person oral administration of the Disgust Scale in rural Costa Rica**

Participants for Studies 1 and 2 were recruited using web sites and listservs that are directed primarily at an English-speaking North American audience. It is therefore likely that many participants in Studies 1 and 2 either primarily identified with U.S. culture, or else were intimately familiar with it. Adherence to a cultural worldview plays a central role in TMT (Greenberg, Solomon, and Pyszczynski, 1997). Because attitudes toward death vary substantially across cultures (Counts and Counts, 1991), we therefore felt it important to demonstrate that the effects of age on death disgust sensitivity documented in Studies 1 and 2 are not unique to those who are well-versed in North American culture.

Rural Costa Rica differs along many important dimensions from the dominant culture of the U.S. (Hofstede, 1991), and numerous traditions, practices and beliefs remain relatively unadulterated by North American influences (Biesanz, Biesanz, and Biesanz, 1999). As in other agricultural areas in the Developing World, people in rural Costa Rica are frequently exposed to the death of animals, as animals are killed for food, pests and predators are exterminated, and farm animals die of injuries or age. In addition to the general exposure to the cycle of life and death typical of rural dwellers, Latin Americans are noteworthy for the degree to which they appear to have normalized death. Many Hispanic authors have noted that mortality concerns are expressed openly in Latin American cultures, rather than repressed as they often are in the U.S. (e.g. Delibes, 1966; Fierro, 1980). Likewise, death themes have been staples of Hispanic written and oral traditions for centuries, and may have pre-Columbian roots in both the Spanish and the Mayan and Aztec traditions (Siefken, 1993). Consistent with these generalizations, practices in rural Costa Rica reflect an easy familiarity with death. Dying relatives usually pass away in the home, not in hospitals, and surviving family members are present at the moment of death. In the immediate aftermath, family members often remain in close proximity to the deceased, sometimes embracing and kissing the corpse. More generally, people frequently visit relatives' graves and memorials, and picnics at a loved one's tomb are common, particularly during religious holidays; food is sometimes left at the grave for the deceased to consume. Correspondingly, with regard to overarching attitudes

toward death and dying, rural Costa Ricans are more open about their anxieties, more familiar with the death process, and much more fatalistic in their attitude toward death than is typical in the U.S. (Biesanz, Biesanz, and Biesanz, 1999; Navarrete, 2004). Hence, because of the many relevant contrasts with contemporary U.S. culture, rural Costa Rica constitutes a promising setting in which to evaluate the degree of universality of patterns of emotional reactions to reminders of death.

In addition to examining the effects of age on death disgust in rural Costa Rica, we also used this opportunity to test a related prediction promulgated by proponents of a Terror Management approach to disgust. Goldenberg, Pyszczynski, Greenberg, and Solomon (2000) and Goldenberg, Pyszczynski, Greenberg, Solomon, Kluck, and Cornwell (2001) argue that, because disgust defends against fitness-reducing existential anxiety, reminders of death should intensify the disgust reaction to stimuli, such as the body and its by-products, which remind people that they are animals, and hence are mortal. Goldenberg, Pyszczynski, Greenberg, Solomon, Kluck, and Cornwell (2001, Study 1) tested this hypothesis in a North American university sample by administering the Disgust Scale following contemplation of one's own death; results revealed that, relative to a control condition, mortality salience increased scores on the body products and animal disgust sensitivity subscales. The authors interpret this finding as supporting the Rozin School's notion that disgust responses serve as a symbolic, distal defense against death by differentiating humans from animals.

In previous research, we found that, contrary to the core predictions of TMT, reminders of death failed to increase worldview defense among Costa Rican participants (Navarrete, 2004; Navarrete, Kurzban, Fessler, and Kirkpatrick, 2004). We hypothesized that these null effects were due to cultural differences, as overt death fears may not be particularly salient to individuals in societies such as Costa Rica in which beliefs, practices, and fatalistic attitudes make exposure to death themes less problematic than is true for people living in societies that emphasize secular life and control over one's own destiny. Rural Costa Rica was thus a useful location for a test of the TMT claim that, due to evolved panhuman features of mind, mortality salience should enhance disgust sensitivity toward the corporeal aspects of human animality.

### *Method*

Study participants were 82 Costa Rican citizens (29 men and 53 women) living in the community of Cariari, in the Limón Province of the Republic of Costa Rica—a region with a primarily agricultural economy in which bananas are the principal export. Participants were recruited door-to-door in their homes to participate in a survey on personality and social attitudes, and ranged in age from 16 to 73 (Mean Age: 28, S.D. = 11.1). Education ranged from 0 to 15 years (Mean 7.9, S.D. = 2.5) with the modal education level at the completion of primary school (6 years).

Because rural Costa Ricans have little or no familiarity with written surveys,

we employed an in-person structured interview format. With the aid of literate local assistants, the second author translated the Disgust Scale into colloquial Costa Rican Spanish. The resulting translation was then inspected by two faculty members at the D'Amore Language School in Quepos, Costa Rica, who edited the translation for clarity. Finally, the edited version was presented to local assistants, who substituted familiar colloquial terms for any formal phrases. The survey was then administered by a male research assistant who was naïve to the hypotheses being tested.

Participants were given a mortality salience prime, the Positive And Negative Affect Schedule (PANAS) (Watson, Clark, and Tellegen, 1988), the Disgust Scale, and an assay of several demographic items. The mortality salience prime, similar to that used in typical TMT research, asked participants to describe the feelings that the thought of their own death aroused in them, and to describe what happens when one physically dies. Participants in the treatment condition were given the mortality salience prime before the administration of the Disgust Scale, while participants in the control condition were given the prime after the Disgust Scale. Following Terror Management protocols (Greenberg, Pyszczynski, Solomon, Simon, and Breus, 1994), the PANAS was administered as a delay and distraction before administration of the Disgust Scale.

### *Results and Discussion*

In evaluating the effects of age and sex on death disgust sensitivity, we conducted a regression analysis similar to those described above. A dummy variable coded for whether participants were exposed to the mortality salience prime before or after administration of the Disgust Scale.

Analysis revealed a main effect for age, a marginally significant effect for sex, and no effect for mortality salience on death disgust sensitivity (see Table 3). Interaction terms were not significant and were removed from the model. As in our Internet studies, death disgust decreased as a function of age, and men showed less death disgust than did women. Mortality salience failed to produce a significant change in disgust sensitivity toward death stimuli.

**Table 3.** Rural Costa Rica: Summary of Multiple Regression Analysis for Variables Predicting Death Disgust. Values reflect standardized beta-weights.

<b>Variable</b>	<b><math>\beta</math></b>	<b>S.E.</b>	<b>t</b>	<b>Sig.</b>
DEATH DISGUST				
Age	-.29	.04	-8.15	$p < .0001$
Gender (Male)	-.32	.08	-3.95	$p < .0001$

In assessing the TMT prediction that reminders of death should intensify the disgust reaction to animality and by-products of the body, we conducted a multivariate regression in which the animal and body products subscales of the Disgust Scale were the two dependent variables; mortality salience, sex, and age were the predictors. The analysis revealed no effect for mortality salience on either subscale, no age effects, and a main effect for sex, with men being less disgust sensitive toward animal and body-function disgust stimuli than women (see Table 4). Contrary to the predictions, and previous findings, of TMT researchers working in the U.S., in Costa Rica reminders of death failed to intensify the disgust reaction to those domains which blur the human–animal boundary.

**Table 4.** Rural Costa Rica: Summary of Multivariate Regression Analysis for Variables Predicting Animal and Body-Function Disgust. Values reflect standardized beta-weights

Variable	$\beta$	S.E.	t	Sig.
ANIMAL DISGUST				
Age	-.08	.10	-0.79	N.S.
Gender (Male)	-.49	.21	-2.29	$p = .03$
Death Reminder	.08	.21	0.41	N.S.
BODY-FUNCTION DISGUST				
Age	-.04	.09	-0.47	N.S.
Gender (Male)	-.90	.20	-4.59	$p < .0001$
Death Reminder	-.01	.19	-0.04	N.S.

### *Limitations*

Although the Disgust Scale incompletely predicts performance on behavioral measures of disgust sensitivity (Rozin, Haidt, McCauley, Dunlop, and Ashmore, 1999), given that the instrument was created for this purpose by the Rozin School, this limitation does not reduce the challenge that our findings pose to the latter’s explanation of death disgust. Nevertheless, additional studies using other means of measuring death disgust sensitivity are necessary before definitive conclusions can be reached regarding the effects of age on death disgust. Given our cross-sectional design, it is possible that the patterns we report are due to cohort effects rather than age-related changes in disgust sensitivity. However, we know of no evidence suggesting that death disgust sensitivity has increased among younger adults in recent years, and, given the increasingly realistic and graphic portrayals of death popular in

entertainment consumed by Western young people, it is more likely that, at least in our Internet samples, the opposite is true.

Several readers of a draft of this paper suggested that the age-related increases in death disgust predicted by Terror Management approaches to this emotion might be masked by overarching psychological changes such as the reduction in negative emotional reactivity with age (cf. Mather et al., 2004). We acknowledge that our methods do not allow us to rule out this possibility. Nevertheless, if, as Terror Management Theory claims, existential anxiety is truly fitness-reducing, and if, as asserted by the Rozin School and other proponents of TMT, death disgust is an important means of combating such paralytic anxiety, then one might reasonably expect that natural selection would have found a way to maximize, rather than constrain, individuals' emotion-mediated abilities to combat increasing paralysis as the end of life looms closer with the passage of time. By way of comparison, consider the threat posed by dangerous animals, a factor that has plausibly constituted a significant source of selective pressure over the course of human evolution. Fear of dangerous animals leads individuals to avoid activities that place them at risk of attack, and hence, within limits, such fear is fitness-enhancing today, and would have been in the ancestral past as well. Due to age-related changes in physical robusticity, older individuals are generally less able to fend off dangerous animals than are younger adults. Consistent with this pattern, older adults report greater fear of large carnivores (Roskaft, Bjerke, Kaltenborn, Linnell, and Andersen, 2003) and dogs (Boyd et al., 2004) than do younger adults. This suggests that, when the fitness costs are both real and evolutionarily recurrent, emotional responses vary in an adaptive fashion as a function of age despite the influence of overarching age-related changes in negative emotional reactivity.

## **General discussion**

A straightforward reading of Terror Management Theory suggests that defenses against existential anxiety should progressively increase as the inevitability of senescence, and hence death, becomes increasingly evident. The Rozin School and allied TMT researchers assert that disgust reactions to death are part of such defenses, generating the prediction that death disgust should increase with age. Here, using the measure of disgust sensitivity devised by the Rozin School, we have shown that, contrary to this prediction, disgust sensitivity in the death domain declines with age. Recently, some proponents of TMT have argued that what they term 'successful aging' involves abandoning those defenses against death anxiety thought to be characteristic of younger adults, replacing them instead with coping mechanisms centering on what is described as 'self-transcendence' (McCoy, Pyszczynski, Solomon, and Greenberg, 2000). This revised formulation of TMT fares no better in our tests. If disgust reactions to death and reminders of death are a defense against existential anxiety characteristic of one stage of life, and if defenses of this type are later replaced by self-transcendence, then the relationship between age and death

disgust should shift sometime in old age. Younger individuals should exhibit a positive correlation between death disgust and age since, being still reliant on defense mechanisms involving denial and avoidance, with each passing year they should work harder to distance themselves from their approaching deaths. In contrast, older individuals should exhibit a negative correlation between death disgust and age since, the greater their age, the longer the opportunity they have had to work toward self-transcendence, and hence the less they should need to deny their mortality through disgust reactions to death. In each of our studies we found a significant main effect for age, indicating that the relationship between death disgust and age does not exhibit the inverted U-shaped function predicted by this version of TMT.

In addition to demonstrating that TMT is unable to predict the relationship between age and death disgust, our Costa Rican study reveals that, contrary to the predictions of Terror Management theorists, in at least one population, mortality salience induction does not enhance disgust responses to reminders of animality.

Although Terror Management Theory explicitly purports to provide an evolutionary account of human responses to death (Solomon, Greenberg, Schimel, Arndt, and Pyszczynski, 2004), viewed from the perspective of contemporary evolutionary psychology, TMT is premised on a number of questionable assumptions, including the view that anxiety is fitness-reducing, and the claim that all animals possess a domain-general survival instinct (for critiques see Boyer 2001, pp. 204-226; Buss, 1997; Leary, 2004; Leary and Schreindorfer, 1997; Matz, Evans, Geisler, and Hinsz, 1997; Navarrete and Fessler, 2005; Navarrete, Kurzban, Fessler, and Kirkpatrick, 2004). Elsewhere (Navarrete, Kurzban, Fessler, and Kirkpatrick, 2004) we have provided evidence that the experimental prime, mortality salience induction, employed in much TMT research lacks the uniqueness ascribed to it by TMT advocates. Together with the results presented above, these observations lead us to conclude that Terror Management Theory does not provide a solid foundation on which to construct theories of disgust.

Although Paul Rozin was one of the earliest proponents of a neo-Darwinian approach to behavior (cf. 1976), while noting the evolutionary origins of disgust as a motivator of behavioral prophylaxis, the Rozin School has nevertheless emphasized features of disgust, such as elicitation by culturally-defined morally objectionable behaviors, that deviate from this function (Haidt, Rozin, McCauley, and Imada, 1997; Rozin, Lowery, Imada, and Haidt, 1999). In contrast, following suggestions by Nesse and Williams (1995) and Pinker (1997), Curtis and Biran (2001) have sought to swing the pendulum back toward a more comprehensive evolutionary account of disgust, documenting that, across disparate cultures, this emotion is elicited by stimuli, such as feces, vomit, and spoiled food, that constitute avenues for pathogen transmission (see also Cosmides and Tooby, 2000; Wronska, 1990; compare with Kurzban and Leary, 2001). Consistent with this view, Curtis, Aunger, and Rabie (2004) recently showed that disgust elicitation is influenced by cues (wound type, color of liquids, etc.) that are discretely associated with sources of disease. In previous work, members of our research group have argued that a) the salience of

animals and animal parts as disgust elicitors reflects the hazards of pathogen transmission that such objects posed in ancestral environments (Fessler and Navarrete, 2003b); and b) the relative salience of various parts of the human body in disgust events is a function of both their vulnerability to biological contamination and their role in producing contaminants (Fessler and Haley, in press). Recently, we demonstrated that food disgust sensitivity is elevated during the first trimester of pregnancy, a period when, due in part to reproductive immunosuppression, the costs of food-borne illness are greatly elevated (Fessler, Eng, and Navarrete, 2005). While we acknowledge that disgust experiences are importantly shaped by cultural beliefs, we believe that this growing corpus of evidence indicates that many features of disgust are best explained in terms of the functional importance that avoiding sources of biologically relevant contamination held for our ancestors. Given that a) for most of human history, death was often caused by disease, and b) pathogens proliferate on corpses and carcasses, it follows that disgust reactions to death are parsimoniously explained as one facet of an emotion that evolved to decrease exposure to fitness-reducing contamination (Boyer, 2001, pp. 212-215).

Declines in disgust sensitivity with age may reflect habituation as a result of repeated exposure to death-related stimuli over time. Habituation can be viewed as part of the adaptive modulation of responses to indices of potentially harmful circumstances: because caution and avoidance are costly due to the time, energy, and missed opportunities that they entail, it is adaptive to reduce such responses when experience reveals that, in the given environment, the stimuli at issue do not index significant hazards. Note that the habituation explanation is incompatible with the Rozin School's claim that death disgust defends against existential terror -- defense mechanisms can be likened to mental calluses and, like their physical equivalents, they ought to become increasingly robust, rather than increasingly weak, with successive exposure to abrasive features of the environment. Our account of death disgust thus combines an acknowledgement of the evolutionary importance of disease avoidance with a recognition of the possible adaptive influence of habituation on response intensity. This perspective is both more parsimonious and better able to explain the influence of age on death disgust than the rather baroque psychodynamic processes postulated by Terror Management Theory.

### **Future directions**

In addition to a robust effect of age on death disgust, our results consistently reveal a sex difference in this area, with women exhibiting greater disgust sensitivity in the death domain in each of our studies. This pattern is in keeping with the sex difference in overall disgust sensitivity reported in numerous previous investigations (Arrindell, Mulken, Kok, and Vollenbroek, 1999; Curtis, Aunger, and Rabie, 2004; Davey, 1994; Druschel and Sherman, 1999; Haidt, McCauley, and Rozin, 1994; Huang and Wang, 1994; Mancini, Gragnani, and D'Olimpio, 2001; Marzillier and Davey, 2004; Oppliger and Zillmann, 1997; Quigley, Sherman, and Sherman, 1997;

Rozin, Haidt, McCauley, Dunlop, and Ashmore, 1999; Schienle, Walter, Stark, and Vaitl, 2002; Wronska, 1990). A number of factors may have favored the evolution of greater female disgust sensitivity. Fessler (2001) proposes that, as a result of the cyclical immunosuppression intrinsic to female reproduction, contamination imposes greater fitness costs on females than on males, a thesis congruent with the elevation of disgust sensitivity in the first trimester of pregnancy described earlier (Fessler, Eng, and Navarrete, 2005). Curtis, Aunger, and Rabie (2004) suggest that, because females were principally responsible for child care in ancestral environments, the enhanced vulnerability of infants and small children to disease favored greater female disgust sensitivity as a means of protecting offspring from pathogen transmission. Lastly, Fessler, Pillsworth, and Flamson (2004) propose that, for males, publicly evincing low disgust sensitivity can a) signal a willingness to take risks, thus both deterring potential rivals from transgressing against the actor and demonstrating the actor's value as an ally, and b) signal possession of locally optimal genes for immunological robusticity. At present, more work is needed to determine which, if any, of these factors are responsible for the sex difference in disgust sensitivity.

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### **Notes**

1. A reviewer of this paper questioned whether TMT advocates have explicitly articulated this prediction. To our knowledge, they have not. However, this objection is not germane -- because it is an obvious and logically necessary consequence of the core reasoning on which TMT is premised, testing this prediction is a legitimate means of examining the validity of TMT. If a theory is so underspecified that only its authors can determine what predictions it generates, then it is of no merit.
2. The two data sets presumably differ in mean disgust score because a questionnaire that likely primed disgust reactions preceded the Disgust Scale in the second study.

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