Aging and Attentional Bias for Death related and General Threat-related Information: Less Avoidance in Older as Compared With Middle-Aged Adults

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Objectives. The aging literature suggests that life satisfaction and affective well being stabilizes or even increases during the aging process, and that death anxiety would decrease with aging. Experimental psychology literature shows that emotions play a critical role in information processing. The aim of the current study was to investigate whether death related versus nondeath-related threat words would lead to differential attentional processing in middle aged versus older adults.

Method. Twenty-seven older adults between 74 and 90 year and 31 middle-aged adults between 40 and 50 years participated in the study. We used questionnaires to assess death anxiety and an exogenous cueing task to measure attention toward death related versus general threat words.

Results. Our results showed no age-related differences in self-reported death anxiety, but less attentional avoidance of threat in older adults. We failed to demonstrate differences between general and death-related threat.

Discussion. This is the first study investigating attentional processing of both death- and threat-related information in older versus younger adults. Less avoidance from threat suggests that with aging, death becomes less of a concern, which might be indicative of acceptance of the own finiteness at old age.

Key Words: Aging—Attentional bias—Death anxiety—Threat.

According to many studies, life satisfaction and affective well being stabilizes or even increases during the aging process (e.g., Kessler & Staudinger, 2009), which is surprising given that aging entails the confrontation with ever more reminders that the end of life is drawing nearer, such as physical health problems and loss of significant others (Wrosch, Schulz, & Heckhausen, 2004).

One explanation for this paradox may be motivational differences in older as compared to younger populations with regard to emotion regulation. The current formulation of Socioemotional Selectivity Theory (Carstensen, Isaacowitz, & Charles, 1999) postulates that older adults have a more limited time perspective, with a heightened focus on emotion regulation because current emotional goals associated with well being become more important than long-term goals. This change might be related to a differential information processing style for emotional information, as shown by both an attentional bias toward positive material (Isaacowitz, Wadlinger, Goren, & Wilson, 2006) and less interference and inhibition regarding negative information (Goelven, De Raedt & Dierckx, 2010).

Attention plays an important role in selecting input from the vast amount of sensory information available at any given time that deserves further processing in function of current task demands or other motivational purposes (Desimone & Duncan, 1995). A wealth of research examined the influence of individual differences variables (e.g., trait anxiety) on attentive processing of emotional information (Cisler & Koster, 2010). However, research on influences of aging on attention for emotional information is new. Given that attentional biases in processing emotional information are implicated in emotional disorders (De Raedt & Koster, 2010), this research endeavor is particularly relevant because aging is often marked by threatening life events and the knowledge that one is moving closer to death.

Although there is already substantial research on attentional biases for emotional information at old age, these studies yield mixed results (see Murphy & Isaacowitz, 2008). It can be concluded that the positivity effect is highly dependent on the nature of the information processing task and its specific experimental parameters. One important experimental parameter is the type of stimulus material. For instance, an absence of age-related differences in attentional bias for threatening information (Mather & Knight, 2006; Wurm, Labouvie-Vief, Aycock, Rebucal, & Koch, 2004) is not surprising because fast processing of this type of material might be important for young as well as older individuals. One specific type of information that a priori may be associated with a different attentional response in older versus younger people are death-related stimuli, because these may be related to death anxiety.

Importantly, although mixed findings have been reported, it can be concluded based on recent studies using psychologically sound multidimensional questionnaires that death anxiety might decrease with aging (Neimeyer, Wittkowski, & Moser, 2004). The reason behind this finding might be...
assimilative and accommodative immunizing self-processes, which are well established in old age (Brandstädter, 1999), and could be related to acceptance of the finiteness of life. A study by Maxfield and colleagues (2007) showed differences in the way older versus younger people responded to a mortality salience manipulation, which led these authors to speculate that increased proximity to death and more frequent reminders of mortality might reduce the potential for anxiety among older adults and enable them to come to a better acceptance of their inevitable mortality. In this perspective, less interference from death-related stimuli would be expected in older adults. In one of the few studies investigating attentional processing of death-related material, De Raedt and Van der Speeten (2008) found interference of death-related words only for a young age group, whereas no interference effects were observed in older adults, using a Stroop paradigm with death-related words. In the present study, we further investigated age-related differences in the attentive processing of death-related words in comparison to neutral words. To determine the specificity of attentive processing for death-related words, we also included non-death-related threatening words. These words were presented as cues in an affective modification of the exogenous cueing paradigm. In this task (Posner, 1980) participants are asked to detect a target presented at the left or right side of a fixation cross. On half of the trials, a peripheral cue precedes the target at the same spatial location (valid trials). On the remaining trials, the target is presented at the opposite spatial location of the cue (invalid trials). Cues that are presented for a short duration facilitate responding to target stimuli on valid trials, whereas on invalid trials a reaction time cost is observed. The magnitude of this cue validity effect indicates how much attention is drawn to or held at the spatial location of the cue. Previous work has indicated that the affective modification of this task is a sensitive measure of attentional bias for emotional information (Koster, Crombez, Van Damme, Verschuere, & De Houwer, 2004; Leyman, De Raedt, Schacht & Koster, 2007).

The following differential prediction could be made: In middle-aged participants, we expect a smaller cue validity effect for death related as compared to neutral words, indicative of avoidance of death stimuli. If there is acceptance of death in older adults, attention for death-related and neutral words would not be different (similar cue validity effects for neutral and death-related) or this difference would be smaller as compared to the middle-aged people. Given that attention for general threat information might be important for young as well as older individuals, we would not expect age differences for this information. Because religious belief might have an influence on death anxiety (Cicirelli, 2002; Fortner & Neimeyer, 1999), we also investigated the relationship between our attention measure and religiosity. Because attentional bias for death-related stimuli is indicative for the salience and threatening value of these stimuli, differences between the younger and the older age cohort concerning their belief in an afterlife might explain age-related differences in this bias. Moreover, because general anxiety levels can have an influence on attentional bias, we measured whether state and trait anxiety were different between the age groups.

**Method**

**Participants**

The sample consisted of 27 independently living older adults (17 females, 10 males; M<sub>age</sub> = 79.2 years; SD = 3.8; range = 74–90 years) and 31 middle-aged adults (18 females, 13 males; M<sub>age</sub> = 46.6 years; SD = 2.09; range = 40–50 years), who volunteered to participate in the study. These participants fulfilled the inclusion criteria of no general cognitive impairments (for the older adults, >24 on the Mini-Mental State Examination [MMSE]; mean MMSE score = 28.19; SD = 1.50; range = 25–30) and no elevated depression scores (<6 on the Geriatric Depression Scale for the older adults or <14 on the Beck Depression Inventory for the middle-aged adults). All participants were Caucasian and native Dutch speaking.

In the older adult sample, all participants were retired. Their occupations were varied: 40.7% had laborers (n = 11), 14.8% house workers (n = 4), 14.8% farmers (n = 4), 14.8% independent business managers (n = 4), 11.1% clerks (n = 3), and 3.7% teachers (n = 1).

In the middle-aged adult sample, 29.0% is laborers (n = 9), 22.6% house workers (n = 7), 3.3% soldiers (n = 1), 6.5% independent business managers (n = 2), 22.6% clerks (n = 7), 9.7% teachers (n = 3), 3.3% government officials (n = 1), and 3.3% executive managers (n = 1).

**Materials**

**Mini-Mental State Examination.—**The MMSE (Dutch translation by the authors) is a brief-structured method to assess general cognitive status in an older population with good psychometric properties (Folstein, Folstein, & McHugh, 1975).

**Multidimensional Fear of Death Scale.**—The Multidimensional Fear of Death Scale (MFODS; Hoelter, 1979) is a 42-item instrument consisting of eight subscales. The items are scored on 5-point Likert scales ranging from 1 (agree) to 5 (do not agree), with lower scores indicating a higher level of death anxiety. The MFODS has good psychometric properties and can be considered as an internal consistent and valid instrument to assess death anxiety in both adult and older adult populations (e.g., DePaola, Griffin, Young, & Neimeyer, 2003). We used only the total MFODS score for our purposes (Cronbach’s alpha .93 for the older adults and .90 for the middle-aged adults in our sample with the Dutch translation developed by the authors).
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with good psychometric properties ( Folstein, Folstein, &
translated by the authors). The MFODS, consisting of 30 items
(yes/no answers), was developed as a basic screening instru-
ment for depressive symptoms in older adults.

State and Trait Anxiety.—To measure anxiety, the state
and trait version of the State and Trait Anxiety (STAI) were
administered ( Spielberger, Gorsuch, Lushene, Vagg, &
Jacobs, 1983; Dutch translation by Van der Ploeg, Defares, &
Spielberger, 2000). The two versions of the questionnaire
each consist of 20 statements to be rated on a 4-point scale.
The reliability and validity of the STAI is well documented.
Cronbach’s alpha in a Dutch-speaking sample of older adults is .92 for the Trait Anxiety subscale and .95 for the
State Anxiety subscale (Van der Ploeg et al., 2000).

Postcritical Belief scale.—To investigate the level of
religious belief, we used the Postcritical Belief scale (PCB;
Hutsebaut, 1996). This 33-item questionnaire (each scored on
a 7-point Likert scale) is based on the conceptualization of
Wulf (1991), measuring four basic attitudes toward religious
belief (see Table 1). Internal consistency (Cronbach’s alpha) of
the subscales (Dezutter et al., 2009) is satisfactory (α = .88 for
Literal Affirmation, .85 for Literal Disaffirmation, .80 for
Symbolic Affirmation, and .75 for Symbolic Disaffirmation).

Stimulus words.—As cue stimuli, 15 neutral (e.g., book), 15
threatening (nondeath-related, e.g., sneaky), and 15 death-
related (e.g., graveyard) words were used, matched on word
length. Moreover, based on prior validation, death-related
and nondeath-related words that had similar arousal and
valence ratings were selected. Because this validation was
performed on undergraduate students, we also asked our
participants to rate all words.

Modifi ed Exogenous Cueing Task.—The task was pro-
grammed in INQUISIT Millisecond software, and presented
on a 60 Hz, 15.4-inch color monitor.

All stimuli in the ECT were presented against a black
colored background. Every trial started with a 1,500 ms pre-
sentation of two white rectangles, presented on the left
and right location of the screen (4 cm high by 10 cm wide).
The middle of these rectangles was 7.5 cm from the middle of
the screen. In the middle of the screen, a white fixation cross
was presented which remained on screen for the entire trial.
Then, a word cue (death-related, threatening, neutral) appeared
for 300 ms (followed by a 17 ms mask), within one of the
two white rectangles. The target, a small black square (1.1 cm
height by 1.1 cm width) was presented immediately after
cue offset in the middle of one of the two white rectangles
and remained on the screen until a response was made.
Responses had to be made by pressing one of two keys (target
left: “q”, target right: “s”) with the left and right index
finger on an AZERTY keyboard. Upon responding the next
trial started.

Instructions were presented on the computer screen and
were explained verbally to the participants. Participants
were instructed to respond as quickly as possible to the
location of the target without sacrificing accuracy. They
were informed that a cue preceded the presentation of the
target and that the cue was not predictive for the target
location. It was emphasized that after each response they should
return attention to the fixation cross. Participants practiced
the attentional task during 12 trials. The test phase consisted
of 180 trials. Each word category was presented 60 times
with an equal number of valid (left cue/left target and right
cue/right target) and invalid (left cue/right target and right
cue/left target) trials. The words (death, threat, and neutral)
were presented at random at the left or right hemifield with
an equal number of presentations.

Table 1. Group Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Middle aged</th>
<th>Older adults</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>MFODS</td>
<td>126.47</td>
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</tr>
<tr>
<td>BDI-II</td>
<td>6.58</td>
<td>6.04</td>
</tr>
<tr>
<td>GDS</td>
<td>/</td>
<td>1.44</td>
</tr>
<tr>
<td>PCB literal affirmation</td>
<td>20.16</td>
<td>9.55</td>
</tr>
<tr>
<td>PCB literal disaffirmation</td>
<td>35.52</td>
<td>10.64</td>
</tr>
<tr>
<td>PCB symbolic affirmation</td>
<td>35.11</td>
<td>9.18</td>
</tr>
<tr>
<td>PCB symbolic disaffirmation</td>
<td>37.30</td>
<td>7.89</td>
</tr>
<tr>
<td>Trait anxiety (STAI-T)</td>
<td>35.71</td>
<td>7.95</td>
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<tr>
<td>State anxiety (STAI-S)</td>
<td>32.19</td>
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</tr>
<tr>
<td>Health status</td>
<td>8.45</td>
<td>1.50</td>
</tr>
</tbody>
</table>

Notes. MFODS = Multidimensional Fear of Death Scale; BDI = Beck Depres-
sion Inventory; GDS = Geriatric Depression Scale; PCB = Postcritical Belief;
STAI = State Trait Anxiety Inventory.

Word ratings.—Individuals rated all words presented in the
spatial cueing tasks on three dimensions: Death relatedness,
threat relatedness, and arousal value. These ratings were
made with a 10-point Likert scale for the relatedness items
ranging from 0 (not at all related) to 9 (strongly related) to
the death, threat, or neutral category. A 6-point scale was
used for arousal value, ranging from 0 (not arousing) to 5
(very arousing).

Procedure
The experiment was approved by the local ethics com-
mittee. Participants were tested individually at their homes.
Individuals were informed about the purpose of the study and the nature of the stimuli and then provided informed consent. In the older adults, the MMSE was administered before the onset of the experiment. Then, a demographic questionnaire was administered. The participants were also asked to rate their general health status on a scale from 1 to 10. Participants were told that, if a question or a word was not clear to them, they should ask clarification. All participants perfectly understood all questions and words used in the questionnaires.

To perform the spatial cueing task, participants were seated at a distance of 60 cm from the laptop screen. After the experiment, the questionnaires were administered (in a counterbalanced order) to avoid any mood priming effects on attention. Finally, the word ratings were administered. At the end of the experiment, participants were fully debriefed.

Data Analysis
Word ratings were analyzed separately for death relatedness, threat relatedness, and arousal value, using 3 (Word Category: death-related, threat-related, and neutral) × 2 (Age Group: middle-aged and older) mixed Analysis of variances (ANOVAs), to validate whether the selection of death-related, threat-related, and neutral words was confirmed by our older and middle-aged participants.

Reaction Times (RT) were subjected to a 3 (Word Category: death-related, threat-related, and neutral) × 2 (Cue Validity: valid and invalid) × 2 (Age Group: older and middle-aged) mixed ANOVA. All variables were within-subjects except for Age Group. If the higher-order interactions including cue validity were significant, cue validity indices were calculated (RT invalid cue − RT valid cue), which provide a measure of overall attention for the different cue types. Positive scores indicate attention toward a cue, whereas negative scores indicate attentional avoidance from the cue. Significant ANOVA omnibus effects were followed-up by planned comparison t tests, testing our specific hypotheses.

For the correlational analyses between the attention measures and PCB, MFODS, STAI, BDI, GDS, MMSE, and word ratings, we also calculated delta scores (Cue validity neutral − Cue validity emotional), a positive score indicates enhanced cue validity (increased attention) for emotional stimuli in comparison with neutral control stimuli. We performed these analyses for the group as a whole (except for BDI, GDS, and MMSE because these measures were only administered to one group), as well as for the age groups separately.

Results
Group Characteristics
Importantly, there were no group differences in gender distribution (χ² < 1), death anxiety, trait and state anxiety, and perceived general health status (t < 1.6). With regard to the postcritical beliefs scale there were between-group differences in literal affirmation, t(56) = 5.14, p < .001, and symbolic affirmation, t(56) = 2.49, p < .05, with higher scores for the older adults, but not on literal disaffirmation, t < 1, and symbolic disaffirmation, t < 1 (for means, see Table 1).

Word Ratings
A first ANOVA with death relatedness as the dependent variable showed a main effect of Word Category, F(2, 55) = 1.411.49, p < .001, η² = .98, confirming that the death-related words were rated as more death related (M = 8.03, SD = 0.77) than the threat related (M = 1.05, SD = 1.07), t(57) = 37.91, p < .001, and neutral words (M = 0.26, SD = 0.52), t(57) = 54.07, p < .001. Moreover, threat-related words were also rated as more death related than neutral words, t(57) = 6.31, p < .001. There also was a main effect of Age Group, F(1, 56) = 10.11, p < .05, η² = .18, with the older adults rating the words overall as more death related (M = 3.31) than the middle-aged participants (M = 2.95). However, the interaction between Word Category and Age was not significant (F < 1).

A second ANOVA was performed with threat relatedness as the dependent variable. A main effect of Word Category was found, F(2, 55) = 68.29, p < .001, η² = .71, indicating that both the threat-related words, (M = 2.44, SD = 1.67), t(57) = 10.66, p < .001, and the death-related words, (M = 2.80, SD = 2.43), t(57) = 8.58, p < .001, were perceived as more threatening than the neutral words (M = 0.18, SD = 0.38). Death-related words were not rated as more threat related than threat-related words, t < 1. There also was a main effect of Age Group, F(1, 56) = 4.59, p < .05, η² = .08, with the older adults rating the words as more threatening (M = 2.17) than the middle-aged adults (M = 1.49). Again, the interaction was not significant (F < 1.6).

A third ANOVA with arousal ratings as the dependent variable again revealed a main effect of Word Category, F(2,55) = 16.29, p < .001, η² = .37, indicating that both the words in the death related, (M = 2.00, SD = 1.09), t(57) = 5.40, p < .001, and threat-related category (M = 1.74, SD = 0.78), t(57) = 5.15, p < .001, were perceived as more arousing than the neutral words (M = 1.21, SD = 0.39). The death-related words were also perceived as slightly more arousing than the threat-related words, t(57) = 2.44, p < .05. There was no main effect of Age Group, F < 1, but there was a significant interaction between Word Category and Age Group, F(2, 55) = 4.30, p < .05, η² = .14. However, follow-up t tests showed no significant group differences for any of the word categories (all ts < 1.6 all ps > .1).

In summary, compared with the middle-aged adults, older adults rated the words as more threatening and death related.

Reaction Time Data

Data preparation.—Trials with errors were discarded from analyses (M = 1.14%). The number of errors was
slightly higher in the older adults ($M = 1.72\%$) compared with the middle-aged ones ($M = 0.63\%$), $t(56) = 3.42, p < .01$. On inspection of reaction time distributions using bar and whisker plots, RTs < 200 ms and RTs > 1,250 ms were considered outliers, reflecting anticipatory responding and delayed responding, respectively. As with the errors, the number of outliers differed between the older adults ($M = 3.26$) and middle-aged ($M = 0.55$), $t(56) = 3.48, p < .01$. Statistical analyses were run on 97.1% of the data.

Overall effects.—The 3 (Word Category) × 2 (Cue Validity) × 2 (Age Group) ANOVA on reaction times revealed a significant main effect for Age Group, $F(1, 56) = 22.78, p < .001, \eta^2_p = .29$, with faster responding in the middle-aged ($M = 474$ ms) compared with the older adults ($M = 589$ ms). A significant main effect was also found for Cue Validity, $F(1, 56) = 48.10, p < .001, \eta^2_p = .46$, showing the typical cue validity effect with faster responding to valid ($M = 516$ ms) compared with invalid cues ($M = 547$ ms). Moreover, there was a main effect of Word Category, $F(2, 55) = 39.67, p < .001, \eta^2_p = .59$, due to slower responding to trials containing neutral words ($M = 545$ ms) compared with trials containing threat related ($M = 523$ ms) and death-related words ($M = 525$ ms).

There were several significant two-way interactions: Word Category × Cue Validity, $F(2, 55) = 27.28, p < .001, \eta^2_p = .50$; Word Category × Age Group, $F(2, 55) = 6.16, p < .01, \eta^2_p = .18$; Cue Validity × Age Group, $F(1, 56) = 6.58, p < .05, \eta^2_p = .11$. These two-way interactions can be subsumed under the crucial significant three-way interaction of Word Category × Cue Validity × Age Group, $F(2, 55) = 7.07, p < .01, \eta^2_p = .21$. Because this three-way interaction directly related to our hypotheses, cue validity index (CVI) scores (see Table 2 for means) were calculated for further analysis. Positive scores indicate attention toward a cue, whereas negative scores indicate attentional avoidance of the cue.

Within-group effects.—In the middle-aged participants, there was a significant effect of Word Category, $F(2, 29) = 36.61, p < .001, \eta^2_p = .72$, with paired $t$ tests showing a larger cue validity for neutral words compared with both threat-related, $t(30) = 7.14, p < .001$, as well as death-related words, $t(30) = 8.60, p < .001$ (To take into account individual differences in baseline performance, we also performed the analyses with ($RT_{\text{invalid cue}} - RT_{\text{valid cue}})/RT_{\text{valid cue}}$ as dependent variable. All the effects based on these analyses were similar or more significant). Only the cue validity effect for neutral words was significantly larger than zero ($0 = \text{no cue validity effect}$, $t(30) = 7.30, p < .001$, all other $t$ $s > 1$. There was no significant difference between the cue validity effect for death- and threat-related material ($F < 1$).

In the older group, there was only a trend toward a significant effect of Word Category on cue validity scores, $F(2, 25) = 2.75, p = .08, \eta^2_p = .18$. One sample $t$ tests indicate that the cue validity effects for all word types were significantly larger than zero (CV neutral: $t(26) = 5.68, p < .001$; CV death: $t(26) = 5.08, p < .001$; CV threat: $t(26) = 4.01, p < .001$). However, comparing the CVI for neutral and threatening information, paired $t$ tests showed a larger cue validity effect for neutral compared to death related, $t(26) = 2.27, p < .05$, and threat-related words, $t(26) = 2.11, p < .05$.

Between-group effects.—Planned comparison $t$ tests comparing the cue validity effect for each word category between the middle-aged and the older adult groups indicated no significant differences between cue validity for trials containing neutral words ($t < 1$). To take into account individual differences in baseline performance, we also performed the analyses with ($RT_{\text{invalid cue}} - RT_{\text{valid cue}})/RT_{\text{valid cue}}$ as dependent variable. All the effects based on these analyses were similar or more significant). However, the older group displayed a significantly larger cue validity effect for death related, $t(56) = 3.82, p < .001$, as well as threat-related information, $t(56) = 3.29, p < .01$. This pattern of findings is depicted in Figure 1.

Correlations between attentional bias and questionnaire data.—No correlations reached significance (all $p s > .05$), both for the total group and for the age groups separately. In addition, there were no significant correlations between the word ratings and the CVI indices (all $p s > .05$).

<table>
<thead>
<tr>
<th>Word category</th>
<th>Cue Validity</th>
<th>Adults</th>
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</tr>
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<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
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<tr>
<td>Neutral</td>
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<td></td>
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</table>

Figure 1. Mean cue validity indices and standard error (in ms) as a function of word category and age group.
Discussion

The current study investigated whether death related versus nondeath-related threat information would lead to differential attentional processing in middle-aged versus older adults. The results show more attentional avoidance of death- and threat-related words in middle-aged participants as compared to older adults.

First, all participants rated the words used in the exogenous cueing task. The data show that, compared with the middle-aged adults, the older adults rated all words as more threatening and death related, but there was no association between these word ratings and our attention measures. Moreover, in spite of these differences in word ratings, the questionnaires measuring death anxiety and trait-state anxiety revealed no significant differences between the age groups. The absence of a difference in death anxiety between our middle aged and older adults is in line with former research (e.g., De Raedt & Van der Speeten, 2008) and shows that, in spite of an increased confrontation with death in the environment and with increasing probability of being confronted with one’s own death, self-reported death anxiety is not higher in older adults. Although many studies have found lower death anxiety in older adults, a large review reveals that studies on age-related changes in death anxiety yield mixed results, with many studies also reporting no changes (Neimeyer et al., 2004).

Interestingly, concerning the attention measures, we observed a higher CVI for neutral words compared with both general threat-related and death-related words in the middle-aged adults, which is indicative of avoidance of threat. Indeed, there was, in contrast to the normal cue validity effect for neutral words, no such effect for threat words. In the older group, the cue validity effect was also different between neutral words and both death-related and general threat-related words, but in contrast to the middle-aged group, we observed a normal cue validity effect for all word categories. Moreover, there was no difference between the middle aged and older group concerning the cue validity effect of neutral words, whereas the older group showed a larger cue validity effect for both death-related and general threat-related information. The latter confirms less avoidance of threat in the older adults as compared to the middle-aged people. This finding corroborates a previous Stroop study on attention for death-related information where similar effects were observed (De Raedt & Van der Speeten, 2008).

The higher attentional avoidance effect for death- and threat-related material in middle-aged participants is an interesting finding. Considering attention processes in a goal pursuit framework, it might be that younger people are more avoidant of death-related information because a focus on the finiteness of their existence would interfere with their future-oriented goal pursuit. In general, healthy participants tend to show attentional avoidance of information that is negative and threatening if the threat level of such information is low to moderate (e.g., Koster, Crombez, Verschuere, Vanvolsem, & De Houwer, 2007), which, based on the ratings, was the case for the threat- and death-related words used in this study. Thus, the pattern of findings obtained in the middle-aged participants is in line with previous studies, which attests to the reliability of the present data.

The level of attentional avoidance of threat in the older adults is clearly different from that of the middle-aged group. First, given the absence of any correlation between attention for threat- or death-related information and death anxiety scores, and also the absence of group differences in death anxiety (and general anxiety), it is unlikely that enhanced attention to this information in older versus middle-aged adults is due to increases in anxiety levels. Instead, the lower level of fast attentional avoidance of threat might be due to a specific age-related process. That is, attentional avoidance can be considered as an emotion regulation strategy that one can apply in confrontation with information that contrasts ones goals (Cisler & Koster, 2010). As such, it can be a component of general avoidance of information related to mortality (cf. terror management theory, Greenberg et al., 1990), which seems to decrease in old age. This means that death-related information would be less threatening for older people as compared to a younger cohort, which can be considered a positivity effect, in line with Socioemotional Selectivity Theory. This theory proposes that constraints of time perspective shift motivational priorities in such a way that the regulation of emotional states becomes more important than other goals (Carstensen, 2006). When considering the absence of attentional avoidance of threat as a positivity effect, several aspects require some discussion. These results seem in contrast with former research, showing that, compared with young adults, older people showed more avoidance of threatening information, with an advantage in disengaging from angry faces (e.g., Hahn, Carlson, Singer, & Gronlund, 2006). However, we posit that the differential findings may be caused by the inclusion of death-related information in our study. As argued in the introduction, death-related information could specifically trigger an age-related differential pattern, indicative of less death concern in older adults. Being confronted more often with the finiteness of life, older people could have accepted the inevitable character of death and inserted it in their worldview, leading to less avoidance of death-related information because there is no need to repress it (McCoy, Pyszczynski, Solomon, & Greenberg, 2000). Many questionnaire studies suggest that old age is not necessarily a period of anxious preoccupation with personal death (Neimeyer et al., 2004). In a recent study using another paradigm (Negative Affective Priming), less interference and a reduced inhibition for negative stimuli was also found in older adults (Goeleven et al., 2010).

However, the fact that we found no differences between general threat information and death-related information warrants further discussion. One could argue that this compromises any account of the present findings in terms of
death anxiety. However, this result may also be explained by carryover effects from the death-related words to the threat-related words. Indeed, we observed, in our rating data, that the older adults rated both the threat and the death-related words as more death related, which could have driven the overall effect. Because we randomized both words in the same task, the death-related task context might have concealed differences between the two stimulus categories (the correlation between the CVI for death-related and general threat-related words, controlling for neutral words, was .75 for the whole group). Future research should investigate this possibility, using a between-subjects design, randomizing tasks with death-related versus nondeath-related words over older versus younger populations. Another possible limitation is that we did not assess vocabulary level of our participants, which might be different between the age groups. However, the participants were encouraged to ask clarification if necessary.

Notwithstanding these limitations, a particular strength of the study is that we used middle-aged people as a younger comparison group. In many other studies, undergraduate samples are used, which limits generalizability (e.g., Lee & Knight, 2004).

In our study, we also examined influences of religious belief on attentive processing of death-related information. Although the relationship between religiosity and death attitudes is far from straightforward (Neimeyer et al., 2004), cohort differences in religiosity and a belief in an afterlife might explain the difference between the older and middle-aged adults. Although religious attitudes were different between the age groups, they did not correlate with the attention effects.

Another intriguing finding is the lack of correlation between the attention and the questionnaire data. Importantly, self-report measures are susceptible to social desirability, conscious denial of death anxiety (Pyszczynski, Greenberg, & Solomon, 1999), or even a lack of awareness about one’s own negative implicit death attitudes. This may explain why, in the context of a threatening and difficult topic such as death anxiety, there are only small correlations between self-reported and performance-based measures, which is a common finding both in death-related studies (e.g., Lundh & Radon, 1998) and in other domains (Karpinski & Hilton, 2001).

To summarize, our results indicate less avoidance of both death-related and general threat words among older adults as compared to those in middle age. Less avoidance of threat suggests that with aging, death becomes less of a concern. Importantly, to the best of our knowledge, this is the first study investigating attention for both threat- and death-related information in older versus middle-aged adults.

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