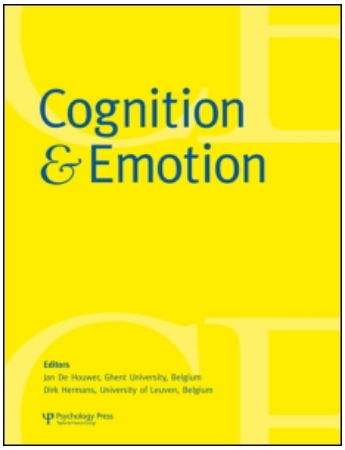

Cognition & Emotion
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713682755

Age differences in the automatic accessibility of emotional words from semantic memory

Lixia Yang[a]; Lynn Hasher[b]
[a] Ryerson University, Toronto, Ontario, Canada [b] University of Toronto and The Rotman Research Institute of Baycrest Centre, Toronto, Ontario, Canada

First published on: 04 October 2010

To cite this Article Yang, Lixia and Hasher, Lynn(2011) 'Age differences in the automatic accessibility of emotional words from semantic memory', Cognition & Emotion, 25: 1, 3 — 9, First published on: 04 October 2010 (iFirst)
To link to this Article: DOI: 10.1080/02699930903523348
URL: http://dx.doi.org/10.1080/02699930903523348

COGNITION AND EMOTION
2011, 25 (1), 3–9

Psychology Press
Taylor & Francis Group

Age differences in the automatic accessibility of emotional words from semantic memory

Lixia Yang
Ryerson University, Toronto, Ontario, Canada

Lynn Hasher
University of Toronto and The Rotman Research Institute of Baycrest Centre, Toronto, Ontario, Canada

Using a speeded word fragment completion task, we assessed age differences in the automatic accessibility of emotional versus neutral words from semantic memory. Participants were instructed to complete a series of single-solution word fragments as quickly as possible. The results demonstrate that older adults are biased against accessing both positive and negative words relative to neutral words, whereas young adults are biased against accessing positive words only. These findings suggest an arousal-based accessibility bias favouring neutral stimuli in older adults coupled with a valence-based bias accessing negative and neutral stimuli for young adults.

Keywords: Automatic accessibility; Semantic memory; Negativity effect; Positivity effect; Aging; Word fragment completion.

It has been widely reported that young adults have a general processing bias in favour of negative over positive and neutral information in cognitive tasks (e.g., Baumeister, Bratslavsky, Fickenauer, & Vohs, 2001; Dewhurst & Parry, 2000). This negativity bias appears to shift with age. Older adults show substantially reduced or even no negativity bias (e.g., Murphy & Isaacowitz, 2008; Wood & Kisley, 2006) and sometimes even demonstrate a bias favouring positive over negative and neutral information (e.g., Mather & Carstensen, 2003, 2005). The age-related shift away from negative or toward positive information has been seen in a variety of intentional memory tasks including working memory (Mikels, Larkin, Reuter-Lorenz, & Carstensen, 2005), autobiographical memory (Kennedy, Mather, & Carstensen, 2004), and episodic memory assessed by both recognition (e.g., Charles, Mather, & Carstensen, 2003; Grühn, Scheibe, & Baltes, 2007) and free recall (e.g., Carstensen & Charles, 1994). The positivity bias shown by older adults has recently been attributed to intentional or controlled processes (e.g., Kensinger, 2008; Mather & Knight, 2005; Petrican, Moscovitch, & Schimmack, 2008; Talmi, Schimmack, Paterson, & Moscovitch,

Correspondence should be addressed to: Lixia Yang, Ryerson University, 350 Victoria Street, Toronto, Ontario, M5B 2K3, Canada. E-mail: lixiay@ryerson.ca

This work was supported by the US National Institute on Aging Grant R37 AGO4306 to LH and the Natural Sciences and Engineering Research Council of Canada (NSERC) Discovery Grant (371762–2009) to LY.

We thank Carol Wong, Rachelle Ta-Min, Ji-A Min, and Ursula Wiprzycka for their assistance in data collection.

http://www.psypress.com/cogemotion
DOI:10.1080/02699930903523348

2007; Thomas & Hasher, 2006), in contrast with the claim that the negativity bias in young adults may occur at an involuntary or automatic processing level (Talmi et al., 2007).

The literature on age differences in automatic processing of valenced information typically uses selective attention and visual detection tasks (Isaacowitz, Wadlinger, Goren, & Wilson, 2006; Leclerc & Kensinger, 2008). The data presented a mixed pattern of results. Some studies reported an attentional bias toward positive information in older adults (Isaacowitz et al., 2006; Mather & Carstensen, 2003), but others did not find such a bias (e.g., Thomas & Hasher, 2006). Still other studies suggest that although young adults show a valence-specific automatic processing preference, this preference is largely arousal-based in older adults (Leclerc & Kensinger, 2008; Wurm, Labouvie-Vief, Aycock, Rebucal, & Koch, 2004). Nevertheless, we note that all these studies focus on the early automatic processing of fully presented emotional stimuli in which emotion is externally elicited by the stimuli.

To our knowledge, no study has examined the automatic accessibility of emotional stimuli using neutral cues for retrieval from semantic memory. Therefore, a major question that remains unanswered in this literature is whether there are age differences in knowledge structure or organisation such that (for example) negatively valenced knowledge becomes less accessible or positively valenced information becomes more accessible, or both in older adults. The present study addressed age differences in semantic knowledge of emotional information with neutral word fragments as cues to retrieve matching items from semantic memory. With a neutral cue, emotion could only possibly be elicited at a later stage when a response (if emotionally valenced) is being formulated. Thus, this approach should be ideal to assess how the target emotional words are stored and organised in semantic memory representation.

To ensure that automatic accessibility was assessed, we adopted a speeded retrieval task from the implicit memory literature (Ikier, Yang, & Hasher, 2008; Richardson-Klavehn & Gardiner, 1995). This paradigm has been successfully used to assess automatic retrieval. In the present study, participants viewed a series of single-solution word fragments (e.g., "A _ OR _ _ LE" for "adorable") and completed each fragment with the first word that came to mind and fitted the fragment. The solution words were positive (e.g., sunlight), negative (e.g., divorce), or neutral (e.g., museum) in valence. To maximally encourage the engagement of automatic processing and reduce reliance on controlled, strategic processing, we urged participants to complete each fragment as quickly as possible (Richardson-Klavehn & Gardiner, 1995; Wilson & Horton, 2002; Yang, Hasher, & Wilson, 2007). Our goal was to provide a snapshot of the organisation of emotional words in semantic memory and its age-related changes.

METHOD

Participants

A sample of 51 healthy older adults (ages 60–77 years, $M = 67.94$, $SD = 4.90$) and 55 young adults (ages 17–26 years, $M = 19.13$, $SD = 1.85$) participated in the study. Older adults had more years of education ($M = 16.75$, $SD = 3.46$) and higher vocabulary scores ($M = 36.25$, $SD = 2.81$) than young adults (education: $M = 13.08$, $SD = 1.53$; vocabulary: $M = 30.15$, $SD = 3.69$), $ts > 7.14$, $ps < .001$. Vocabulary was assessed with the Shipley vocabulary test (Shipley, 1940). Older adults were also screened with the Short Blessed Test (SBT; Katzman et al., 1983) for cognitive impairment. All of them scored below the cut-off score of 6 ($M = 0.47$, $SD = 0.86$).

Materials

A total of 120 6- to 8-letter words (40 positive, 40 negative, and 40 neutral) was selected from the Affective Norms for English Words (ANEW; Bradley & Lang, 1999). For each word, two different single-solution fragments were

developed, each including the first letter and 3 or 4 other letters from the word. Two sets of single-solution fragments were developed to minimise the effects of the specific fragment surface structure. Thirty older and 30 young adults were randomly assigned to complete the first set. The remaining 21 older and 25 young adults were assigned to complete the second set. The two samples assigned for the two sets did not differ in age, education or Shipley scores ($ts < 0.49$; $ps > .62$).

Based on the ANEW norms in which valence and arousal were rated using a 9-point Likert-type scale, words of the three valence categories had distinctive valence values: negative ($M = 2.23$, range = 1.25–2.98), neutral ($M = 5.25$; range = 4.15–5.92), and positive words ($M = 7.71$, range = 7.04–8.45). Positive ($M = 5.70$, range = 4.18–7.51) and negative words ($M = 5.84$, range = 4.53–7.25) were equally arousing, and both were more arousing than neutral words ($M = 4.10$, range = 3.14–6.93), $ps < .001$. The words of the three valence categories were also matched on word frequency (Kucera & Francis, 1967) and length.

Procedure

The word fragments were presented on a computer monitor in a pseudo-randomised order, with no more than three fragments of the same emotional category appearing consecutively. Each trial started with a fixation cross at the centre (500 ms) to direct the participants' visual attention to the upcoming fragment. The cross was then replaced by a word fragment presented for 5 seconds during which participants need to make a response, as quickly as possible, by speaking the first word that came to mind that fitted the fragment. At the end, participants completed the demographic questionnaire, the SBT and the Shipley vocabulary test.

RESULTS

The fragment completion rate (i.e., the proportion of fragments correctly completed) was calculated for each valence and participant (see Table 1). To specifically examine the accessibility of positive and negative words in comparison with neutral words in each age group, we calculated the positivity and the negativity bias scores by subtracting the fragment completion rate for neutral words or the response times (RTs) of correctly completed neutral words from the fragment completion rate for positive words and negative words or the RTs of correctly completed positive and negative words, respectively. The approach of using difference scores to define positivity and negativity bias is consistent with recent literature (Leclerc & Kensinger, 2008; Murphy & Isaacowitz, 2008). It is informative in this task as the overall completion rates were equivalent for young ($M = 0.59$) and older adults ($M = 0.61$).

Fragment completion rate

A 2 (Age: young vs. older) × 2 (Emotional Bias: positivity vs. negativity bias) mixed-model analysis of variance (ANOVA) was conducted on the

Table 1. *Fragment completion rates and response times (in milliseconds) for each age group across valence conditions*

	Fragment completion rates		*Response time (RT)**	
Valence	*Old (n = 51)*	*Young (n = 55)*	*Old (n = 50)*	*Young (n = 51)*
Positive	0.60 (0.15)	0.54 (0.11)	1898.68 (479.38)	1827.99 (456.91)
Negative	0.58 (0.14)	0.62 (0.13)	1874.67 (417.42)	1777.95 (424.45)
Neutral	0.66 (0.13)	0.60 (0.14)	1749.96 (505.13)	1792.17 (464.41)

Note: Each cell provides mean score, with standard deviation (*SD*) in the parentheses. *We only included participants who correctly completed at least 2 fragments in each valence condition for the RT analysis.

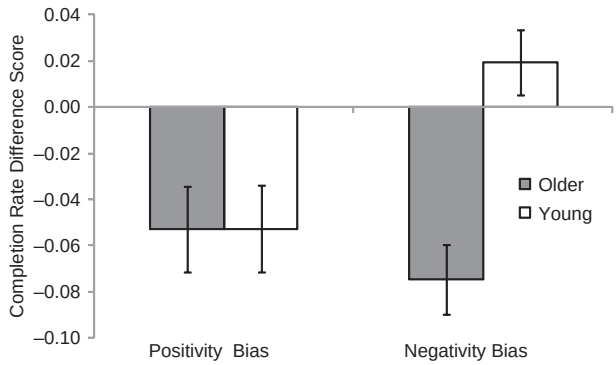

Figure 1. *The positivity and negativity bias scores in fragment completion rates as a function of age group and valence of words. Error bars refer to standard errors.*

difference scores (see Figure 1).[1] It revealed a significant Age effect, with older adults showing a larger bias against emotional words ($M = -0.06$; $SD = 0.10$) than did young adults ($M = -0.02$; $SD = 0.11$), $F(1, 104) = 5.32$, $MSE = 0.02$, $p < .05$. The effect of Emotional Bias was also significant, $F(1, 104) = 4.27$, $MSE = 0.01$, $p < .05$, with a larger bias against positive words ($M = -0.05$; $SD = 0.14$) than against negative words ($M = -0.03$; $SD = 0.12$). This effect is qualified by the Age by Emotional Bias interaction, $F(1, 104) = 15.01$, $MSE = 0.01$, $p < .001$. Post hoc comparisons showed no age differences in positivity bias, $t(104) = 0.004$, $p = .99$, with the two age groups being equally biased against accessing positive words ($ts > 2.81$, $ps < .01$). However, the two age groups differed in negativity bias, $t(104) = 4.54$, $p < .001$, with only older adults ($M = -0.07$; $SD = 0.11$, $p < .001$), but not young adults ($M = 0.02$; $SD = 0.10$, $p = .18$), being biased against accessing negative words. Taken together, these findings suggest that older adults are biased against accessing both positive and negative words, whereas young adults are biased against accessing positive words only.

Reaction times (RTs)

A 2 (Age) × 2 (Emotional Bias) mixed-model ANOVA conducted on RTs revealed no significant effect, $Fs < 2.34$, $ps > .12$. But visual inspection (Figure 2) and the corresponding *t*-tests suggested that only older adults took a longer time completing emotional words than neutral words, $ts > 2.07$, $ps < .05$.

DISCUSSION

In the current study, we used a speeded word fragment completion task to examine age differences in automatic retrieval of emotional versus neutral words from semantic memory. The results suggest an overall accessibility advantage for neutral over emotional words, particularly for older adults. This finding is strikingly at odds with the overall emotional enhancement effect widely reported in the literatures on intentional

[1] An initial overall analysis using the two sets of fragments as a factor showed that the reported Critical Age × Valence interaction in fragment completion rate was the same for both sets. Therefore we collapsed across the two sets in the analyses reported in the text.

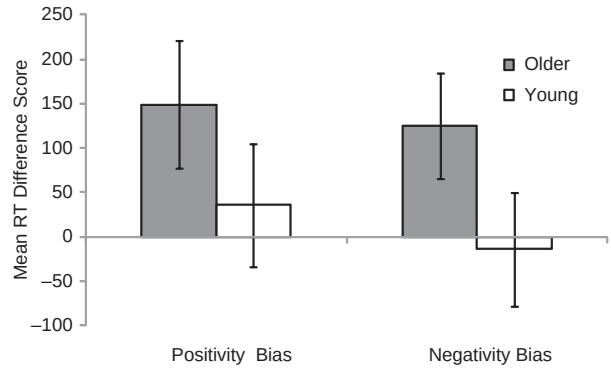

Figure 2. *The positivity and negativity bias scores in RTs as a function of age group and valence of words. Error bars refer to standard errors.*

memory, attention, and visual search (e.g., Leclerc & Kensinger, 2008; Murphy & Isaacowitz, 2008). Although the exact mechanism driving this result is unclear, we offer two interrelated speculations: First, in the literature on emotional processing, the stimuli are usually fully presented and thus the emotional reactivity to approach pleasant stimuli or avoid impending threat or danger is mainly externally elicited by the stimuli. This emotional reactivity will consequently enhance the processing of emotional stimuli (e.g., LeDoux, 1995). However, in the current study, the visual cues were word fragments that themselves carry no emotional meanings and thus will not elicit emotional reactivity until a participant formulates responses. We assume that performance here may primarily reflect how the target words are organised and stored in semantic memory. Second, the dominating self-protective emotional regulation strategy in older adults (Labouvie-Vief, 2008) may make them avoid high arousal levels to protect general well-being (e.g., Wurm et al., 2004). As a result, the accessibility of arousing words from semantic representation may diminish over adult life span. Consistent with these speculations, older adults have demonstrated an arousal-based processing bias in an automatic visual search task (e.g., Leclerc & Kensinger, 2008) and reduced amygdala activity while processing emotionally arousing stimuli (e.g., Gunning-Dixon et al., 2003).

An additional analysis of the present fragment-completion data also provides congruent findings. In particular, older adults completed more low-arousing words (the bottom one third of items, with arousal ratings ranging from 3.14 to 4.75, $M = 3.99$; M proportion of completions = 0.68, $SD = 0.18$) than high-arousing words (the top one third, with arousal ratings ranging from 5.80 to 7.51, $M = 3.99$; M proportion of completions = 0.56, $SD = 0.21$), $t(78) = 2.60$, $p < .05$, when collapsed across valence. Young adults did not show this pattern, $t(78) = 1.43$, $p = .16$. This suggests that older, but not younger, adults reduced accessibility to highly arousing words.

Young adults show a valence-specific processing bias favouring negative and neutral over positive words. Consistent with previous studies on attention (Eastwood, Smilek, & Merikle, 2001; Mather & Carstensen, 2003; Öhman, Flykt, & Esteves, 2001) or episodic memory (Talmi et al., 2007), this finding extends the widely reported negativity bias, at least the preference for negative over positive stimuli, and suggests that the negativity preference can operate at an automatic level. This may be because young adults are preoccupied with strong negative affect making them vigilant towards negative stimuli (Labouvie-Vief, 2003). Consistent with some earlier findings (Murphy & Isaacowitz, 2008; Wood & Kisley, 2006), the negativity preference is eliminated in older adults who instead equally avoid both positive and negative words. Both age

groups show a bias against accessing positive information. The absence of a positivity enhancement effect at least partially supports the arguments that the positivity enhancement is mediated by controlled processing (e.g., Mather & Knight, 2005; Talmi et al., 2007; Thomas & Hasher, 2006). The low accessibility of positive words may also reflect older adults' arousal avoidance and young adults' predominant negativity bias.

The current study is the first to examine age differences in the automatic accessibility of emotional words from semantic memory. The results suggest a valence-specific response pattern in young adults coupled with an arousal-based processing bias in older adults, as previously seen in work on attention selection and visual search (Leclerc & Kensinger, 2008; Wurm et al., 2004).

Manuscript received 17 December 2008
Revised manuscript received 17 October 2009
Manuscript accepted 24 November 2009
First published online 27 February 2010

REFERENCES

Baumeister, R. F., Bratslavsky, E., Fickenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of General Psychology*, *5*, 323–370.

Bradley, M. M., & Lang, P. J. (1999). *Affective norms for English words (ANEW): Instruction manual and affective ratings*. Technical Report C-1, The Center for Research in Psychophysiology, University of Florida.

Carstensen, L. L., & Charles, S. T. (1994). The salience of emotion across the adult life span. *Psychology and Aging*, *9*, 259–264.

Charles, S. T., Mather, M., & Carstensen, L. L. (2003). Aging and emotional memory: The forgettable nature of negative images for older adults. *Journal of Experimental Psychology: General*, *132*, 310–324.

Dewhurst, S. A., & Parry, L. A. (2000). Emotionality, distinctiveness, and recollective experience. *European Journal of Cognitive Psychology*, *12*, 541–551.

Eastwood, J. D., Smilek, D., & Merikle, P. M. (2001). Negative facial expression captures attention and disrupts performance. *Perceptual Physiology*, *65*, 352–358.

Grühn, D., Scheibe, S., & Baltes, P. B. (2007). Reduced negativity effect in older adults' memory for emotional pictures: The heterogeneity-homogeneity list paradigm. *Psychology and Aging*, *22*, 644–649.

Gunning-Dixon, F. M., Gur, R. C., Perkins, A. C., Schroeder, L., Turner, T., Turetsky, B. I., et al. (2003). Age-related differences in brain activation during emotional face processing. *Neurobiology of Aging*, *24*, 285–295.

Ikier, S., Yang, L., & Hasher, L. (2008). Implicit interference, age, and automatic versus controlled retrieval strategy. *Psychological Science*, *19*, 456–461.

Isaacowitz, D. M., Wadlinger, H. A., Goren, D., & Wilson, H. R. (2006). Is there an age-related positivity effect in visual attention? A comparison of two methodologies. *Emotion*, *6*, 511–516.

Katzman, R., Brown, T., Fuld, P., Peck, A., Schechter, R., & Schimmel, H. (1983). Validation of a short orientation-memory-concentration test of cognitive impairment. *American Journal of Psychiatry*, *140*, 734–739.

Kennedy, Q., Mather, M., & Carstensen, L. L. (2004). The role of motivation in the age-related positivity effect in autobiographical memory. *Psychological Science*, *15*, 208–214.

Kensinger, E. A. (2008). Age differences in memory for arousing and nonarousing emotional words. *Journal of Gerontology: Psychological Science*, *63B*, P13–P18.

Kucera, H., & Francis, W. N. (1967). *Computational analysis of present-day American English*. Providence, RI: Brown University Press.

Labouvie-Vief, G. (2003). Dynamic integration: Affect, cognition, and the self in adulthood. *Current Directions in Psychological Science*, *12*, 201–206.

Labouvie-Vief, G. (2008). When differentiation and negative affect lead to integration and growth. *American Psychologist*, *63*, 564–565.

Leclerc, C. M., & Kensinger, E. A. (2008). Effects of age on detection of emotional information. *Psychology and Aging*, *23*, 209–215.

LeDoux, J. E. (1995). Emotion: Clues from the brain. *Annual Review of Psychology*, *46*, 209–235.

Mather, M., & Carstensen, L. L. (2003). Aging and attentional biases for emotional faces. *Psychological Science*, *14*, 409–415.

Mather, M., & Carstensen, L. L. (2005). Aging and motivated cognition: The positivity effect in attention and memory. *Trends in Cognitive Science*, *9*, 496–502.

Mather, M., & Knight, M. (2005). Goal-directed memory: The role of cognitive control in older adults' emotional memory. *Psychology and Aging*, *20*, 554–570.

Mikels, J. A., Larkin, G. R., Reuter-Lorenz, P. A., & Carstensen, L. L. (2005). Divergent trajectories in the aging mind: Changes in working memory for affective versus visual information with age. *Psychology and Aging*, *20*, 542–553.

Murphy, N. A., & Isaacowitz, D. M. (2008). Preferences for emotional information in older and younger adults: A meta-analysis of memory and attention tasks. *Psychology and Aging*, *23*, 263–286.

Öhman, A., Flykt, A., & Esteves, F. (2001). Emotion drives attention: Detecting the snake in the grass. *Journal of Experimental Psychology: General*, *130*, 466–478.

Petrican, R., Moscovitch, M., & Schimmack, U. (2008). Cognitive resources, valence, and memory retrieval of emotional events in older adults. *Psychology and Aging*, *23*, 585–594.

Richardson-Klavehn, A., & Gardiner, J. M. (1995). Retrieval volition and memorial awareness in stem completion: An empirical analysis. *Psychological Research*, *57*, 166–178.

Shipley, W. C. (1940). A self-administering scale for measuring intellectual impairment and deterioration. *Journal of Psychology*, *9*, 371–377.

Talmi, D., Schimmack, U., Paterson, T., & Moscovitch, M. (2007). The role of attention and relatedness in emotionally enhanced memory. *Emotion*, *7*, 89–102.

Thomas, R. C., & Hasher, L. (2006). The influence of emotional valence on age differences in early processing and memory. *Psychology and Aging*, *21*, 821–825.

Wilson, D. E., & Horton, K. D. (2002). Comparing techniques for estimating automatic retrieval: Effects of retention interval. *Psychonomic Bulletin & Review*, *9*, 566–574.

Wood, S., & Kisley, M. A. (2006). The negativity bias is eliminated in older adults: Age-related reduction in event-related brain potentials associated with evaluative categorization. *Psychology and Aging*, *21*, 815–820.

Wurm, L. H., Labouvie-Vief, G., Aycock, J., Rebucal, K. A., & Koch, H. E. (2004). Performance in auditory and visual emotional Stroop tasks: A comparison of older and younger adults. *Psychology and Aging*, *19*, 523–535.

Yang, L., Hasher, L., & Wilson, D. E. (2007). Synchrony effects in automatic and controlled retrieval. *Psychonomic Bulletin and Review*, *14*, 51–56.