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False Memory in Aging: Effects of Emotional Valence on Word Recognition Accuracy

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Memory is susceptible to distortions. Valence and increasing age are variables known to affect memory accuracy and may increase false alarm production. Interaction between these variables and their impact on false memory was investigated in 36 young (18–28 years) and 36 older (61–83 years) healthy adults. At study, participants viewed lists of neutral words orthographically related to negative, neutral, or positive critical lures (not presented). Memory for these words was subsequently tested with a remember–know procedure. At test, items included the words seen at study and their associated critical lures, as well as sets of orthographically related neutral words not seen at study and their associated unstudied lures. Positive valence was shown to have two opposite effects on older adults' discrimination of the lures: It improved correct rejection of unstudied lures but increased false memory for critical lures (i.e., lures associated with words studied previously). Thus, increased salience triggered by positive valence may disrupt memory accuracy in older adults when discriminating among similar events. These findings likely reflect a source memory deficit due to decreased efficiency in cognitive control processes with aging.

Keywords: emotion, learning, memory deficit, response bias

Memory is susceptible to distortions. In real life, individuals claim to remember events that never happened or misremember portions of events that did take place. In the laboratory, false memory occurrence has been studied in experiments that use lists of words phonetically or semantically associated with specific target words (i.e., Deese–Roediger–McDermott, or DRM, task; Deese, 1959; Roediger & McDermott, 1995). At study, participants view or hear a list of words that are related to a target word (lure) that is not presented. Subsequent recognition memory testing of the studied words consistently gives rise to false recognition of the lure despite the fact that this word was never studied.

Production of false alarms is modulated by the emotional content of the stimuli. Pesta, Murphy, and Sanders (2001) studied false recognition of emotional and neutral words using the DRM paradigm. Their results demonstrated that the rate of false alarms varied according to the distinctiveness of the emotional lures: Participants were more likely to endorse emotional lures when the study list included other emotional words than when it did not. Regardless of the distinctiveness, however, false alarms to emotional lures were lower than to neutral lures, supporting an independent effect of emotion on memory accuracy. In contrast, Windmann and Kutas (2001) reported more false alarms to emotional than to neutral words during a recognition memory task. They proposed that emotion induced an attention bias, which resulted in an increased likelihood of recognizing an emotional stimulus, regardless of prior exposure to it.

Healthy aging is accompanied by significant changes in episodic memory. Overall, the age-related decline is particularly pronounced for correct responses that indicate a clear and vivid recollection of previously presented items (i.e., *remember* responses; Tulving, 1989) and less so for responses reflecting familiarity with the item in the absence of specific details associated with the experimental context (i.e., *know* responses). Aging also sees an increase in incorrect or inaccurate responses (Roediger & Geraci, 2007). During list-learning tasks, older adults are not as effective as young adults in differentiating between studied and unstudied items and are more likely to endorse an item as "old" rather than reject it (Bastin & Van der Linden, 2003; Jacoby, Bishara, Hessels, & Toth, 2005). Furthermore, manipulations of list presentations in which DRM paradigms, compound words, or recombined words are used consistently reveal increased false alarms in older adults compared with young adults (Jones & Jacoby, 2005; Reinitz & Hannigan, 2004; Watson, McDermott, & Balota, 2004). These results suggest that incorrect responses may be retrieval errors due to reduced monitoring systems and decreased efficiency in

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cognitive control processes in older adults (Rubin, van Petten, Glisky, & Newberg, 1999).

The conjoint effects of emotion and aging on episodic memory and false alarms production remain unclear. Although more prone to false alarms, healthy older adults, like their young counterparts, show fewer false memories for emotional than for nonemotional stimuli, such as lures (Kensinger & Corkin, 2004). Budson and colleagues (2006), however, reported a comparable liberal response bias to emotional words (i.e., increased likelihood to "recognize" an emotional stimulus, regardless of prior exposure) in older adults and young adults in a DRM task. Despite the overall episodic memory decline in healthy aging, aspects of emotional memory enhancement, which result in richer and more vivid details of emotional compared with neutral events, remain present in older adults (Denburg, Buchanan, Tranel, & Adolphs, 2003; Kensinger, Brierley, Medford, Growdon, & Corkin, 2002; Mather & Carstensen, 2003). Some studies have found equivalent memory for positive and negative stimuli in young and older adults (Denburg et al., 2003; Kensinger et al., 2002). It is interesting, however, that others have reported an age-specific bias for the emotional memory enhancement effect: older adults showing better memory for positive than for negative items and young adults exhibiting the opposite pattern (Mather & Carstensen, 2003). According to the emotional selectivity theory, this positive bias in older adults would reflect a shift in focus toward emotionally relevant information (Carstensen, 1995).

Thus, although existing evidence indicates that emotion improves memory performance, it may, in some circumstances, increase false alarm production in older adults. Whether this effect is a general effect of emotion or is valence specific is unknown. We expanded on previous studies and used lists of orthographically related items associated with negative, neutral, or positive lures to examine these issues. Within this context and under the conditions of a DRM paradigm with emotional and neutral critical lures, we aimed to test the following hypotheses: First, we hypothesized that, overall, older adults would experience a greater susceptibility to false recognition than young adults. Our second hypothesis was that, in both groups, positive valence would have an effect similar to negative valence. It would reduce false alarms to the emotional, relative to the neutral, critical lures by increasing stimulus distinctiveness. Third, in the light of Carstensen's (1995) emotional positivity theory, we also wanted to investigate whether older adults would show a greater reduction in false alarms to critical lures with positive valence in contrast to young adults who were expected to show a greater reduction in false alarms to critical lures with negative valence. Finally, these hypothesized effects of age and emotion on false alarms were predicted to affect remember responses more so than know responses, given the stronger age effect on responses reflecting vivid recollection than on those reflecting familiarity.

Method

Participants

The participants were 36 young (21 women, 15 men), and 36 older (17 women, 19 men) adults (Table 1). Most young adults were undergraduate and graduate university students. Older adults were recruited primarily from university alumni associations. Because they were still in the process of completing their formal education, young adults had significantly fewer years of education than older adults, $t(70) = 6.66$, $p < .001$. Medical history was recorded on the basis of a self-report questionnaire. Individuals with a significant medical history (e.g., history of depression, head injury, seizure, substance abuse, heart disease or stroke, untreated hypertension, elevated cholesterol, diabetes, and cancer) were excluded, as were those on medications with central nervous system effects. Older adults who scored below 26 points on the Mini-Mental State Examination (Folstein, Folstein, & McHugh, 1975) were also excluded. Participants were remunerated at the rate of $10/hr. This study was approved by the Massachusetts Institute of Technology Committee on the Use of Humans as Experimental Subjects, and all participants gave written informed consent to participate.

Table 1
Demographic Characteristics of the Study Samples

	Young adults (n = 36)			Older adults (n = 36)		
Variable	*M*	*SD*	Range	*M*	*SD*	Range
Age (years)	21.4	2.75	18–28	72.2	5.77	61–83
Education (years)	14.7	1.92	12–21	17.7	1.89	14–24
MMSE	29.1	0.80	27–30	29.0	0.91	27–30

Note. MMSE = Mini-Mental State Examination.

Task and Procedure

We created 18 lists (two sets of 9 lists) of 10 neutral words (see Appendix). Within each list, the words were all orthographically related to a lure that was either negative, neutral, or positive in valence. In each set, 3 lists were associated with a negative lure, 3 associated with a neutral lure, and 3 associated with a positive lure. The word lists associated with the negative and neutral lures were identical to those described in Pesta et al. (2001) with the following exception: In Pesta et al., the word *penis* was categorized as a negative lure. The *Affective Norms for English Words* (ANEW; Bradley & Lang, 1999), however, indicates that this word carries a positive, rather than a negative, valence rating in both women and men. As a consequence, the orthographic associates derived from the word *penis* were included as a list with a positive lure in this study. To construct the remaining lists, we selected 6 additional lures (5 positive and 1 negative) from the ANEW list. These words had similar word length and word frequency (Francis & Kucera, 1967) to the existing negative and neutral lures. The lists of orthographic associates related to the new lures were constructed by following the same guidelines described in Pesta et al. (2001): We first used immediate orthographic neighbors and then, if necessary, associates sharing phonemes with the target word. Mean ratings for negative and positive lures were significantly different for valence (2.1 ± 0.6 and 7.5 ± 0.8 respectively; $p < .0001$) but not for arousal (5.5 ± 1.1 and 6.1 ± 0.9, respectively; $p = .377$).[1]

The experiment comprised a study phase immediately followed by a recognition task. At study, participants viewed 90 words from one of the two sets in a pseudorandom order (no more than 2 words from the same list in succession). Study list words were displayed on a computer screen in yellow upper case Arial 32-point type against a dark background and presented at the rate of 1 word every 4 s. On-screen stimulus presentation was 2 s for young adults and 3 s for older adults.[2] To promote encoding, participants were instructed to categorize words as *abstract* or *concrete.* As a guide, participants were told that abstract words referred to ideas or concepts such as honor or loyalty, whereas concrete words referred to objects that they could hold or touch such as a pillow or biscuit. Study phase also included 10 buffer words (3 negative, 4 neutral, 3 positive) to compensate for primacy or recency effects. These items, which were also used to reduce the distinctiveness of valenced lures during the recognition task, were not shown at recognition. No lure was seen at study.

Immediately after presentation, participants performed a recognition test on 198 words. Test items included the 90 words seen at study and their associated critical lures (i.e., 3 negative, 3 neutral, 3 positive). Test items also included the alternate set of 90 words, which had not been seen at study, and their associated unstudied lures (i.e., 3 negative, 3 neutral, 3 positive). The recognition test used the remember–know procedure (Rajaram, 1993). Briefly, for each test item, participants were asked to indicate whether they had a vivid memory of the word (i.e., a *remember* response), a feeling that the word was in the study list but without a clear memory of it (i.e., a *know* response), or believed the word had not been seen before (i.e., a *new* response).

Scoring and Statistical Analysis

The proportion of remember and know responses were calculated for the following item types: studied words, unstudied words, critical lures, and unstudied lures. Because only studied word lists were actually seen prior to the recognition task, remember and know responses to unstudied words, critical lures, and unstudied lures reflect incorrect responses. We investigated the effects of emotion and aging on correct responses and false alarms using repeated-measures analysis of variance (ANOVA) with valence (negative, neutral, positive), and word type (studied, unstudied) or lure type (critical, unstudied) as within-subject factors and group (young, older) as a between-subject factor. Subsequent *t* tests were applied where appropriate. Because of the greater effect of aging and a stronger modulation effect of valence on remember than know responses (e.g., Ochsner, 2000), we analyzed each response type separately.[3]

Results

Remember and Know Responses to List Words

An ANOVA on remember responses to list items revealed a significant main effect of word type, $F(1, 70) = 2{,}408.45$, $p < .001$, $\eta^2 = .97$, and group, $F(1, 70) = 5.66$, $p = .020$, $\eta^2 = .08$, but not of valence ($F < 1$). In addition, a significant Valence × Word Type interaction, $F(1, 70) = 3.37$, $p < .037$, $\eta^2 = .05$, indicated similar remember responses to studied words across valence categories and fewer remember responses to unstudied words associated with positive lures than to those associated with neutral or negative lures. A significant Word Type × Group interaction was also present, $F(1, 70) = 11.28$, $p = .001$, $\eta^2 = .14$. In other words, young adults had higher recognition scores than older adults on all studied words (all ps $< .05$). Remember response scores for the unstudied words were similar across groups. With regard to know responses to list items, the ANOVA showed no significant main effects and no interactions (Figure 1).

False Alarm Remember Responses to Lures

An ANOVA on remember responses to lures revealed no significant main effects (all Fs < 1) but the following significant interactions: Valence × Group, $F(2, 140) = 7.51$, $p = .001$, $\eta^2 = .10$; Valence × Lure Type, $F(2, 140) = 16.09$, $p < .001$, $\eta^2 = .19$; and a marginally significant Valence × Lure Type × Group interaction, $F(2, 140) = 3.03$, $p = .052$, $\eta^2 = .04$. Subsequent *t* tests indicated that older adults made fewer false alarms to negative than to positive critical lures, $t(35) = 2.96$, $p = .006$. They also showed more false alarms to negative than to neutral, $t(35) = 3.60$, $p = .001$, or positive, $t(35) = 4.38$, $p < .001$, unstudied lures. False alarms to negative unstudied lures were also more common in older than in young adults, $t(70) = 4.04$, $p < .001$. Young adults, in contrast, showed more false alarms to neutral critical lures than to negative, $t(35) = 3.58$, $p = .001$, or to positive critical lures, $t(35) = 2.34$, $p = .025$, and more so than to neutral unstudied lures, $t(35) = 2.39$, $p = .022$ (Figure 2).

These analyses showed that older adults experienced a valence effect that varied according to the type of lures and translated into two opposite behaviors: increased false alarms to positive than to negative critical lures, accompanied by reduced false alarms to positive unstudied lures compared with negative unstudied lures. In young adults, however, valence reduced false alarms to negative and to positive critical lures but had no impact on false alarms to unstudied lures.

[1] As the ANEW ratings were originally collected on young adults, we verified these ratings on a subset of 11 older adults (mean age = 71.5 ± 5 years). Mean ratings between negative and positive lures were significantly different for valence (1.9 ± 0.9 and 6.2 ± 0.9, respectively; $p < .0001$) but not for arousal (4.7 ± 1.0 and 4.7 ± 1.4, respectively; $p = 1$). These results confirm that young and older adults tend to report similar experience of emotional stimuli, as previously reported (Wurm, Labouvie-Vief, Aycock, Rebucal, & Koch, 2004).

[2] Initial piloting revealed that some older adults were finding a 2-s stimulus presentation too challenging, likely due to the age-related decline in speed of information processing (e.g., Salthouse, 1996). Extending stimulus presentation to 3 s, however, led young adults to perform at or close to ceiling. We therefore adopted a longer stimulus exposure for older adults to minimize the impact of speed of information processing on task performance. Longer stimulus exposure has been shown previously not to result in increased false alarms in older adults (e.g., Watson, McDermott, & Balota, 2004).

[3] In the view of the significant difference in the level of education between young and older adults, we repeated analyses after entering education as a covariate in the statistical models. These additional analyses did not alter the pattern of results and are therefore not reported.

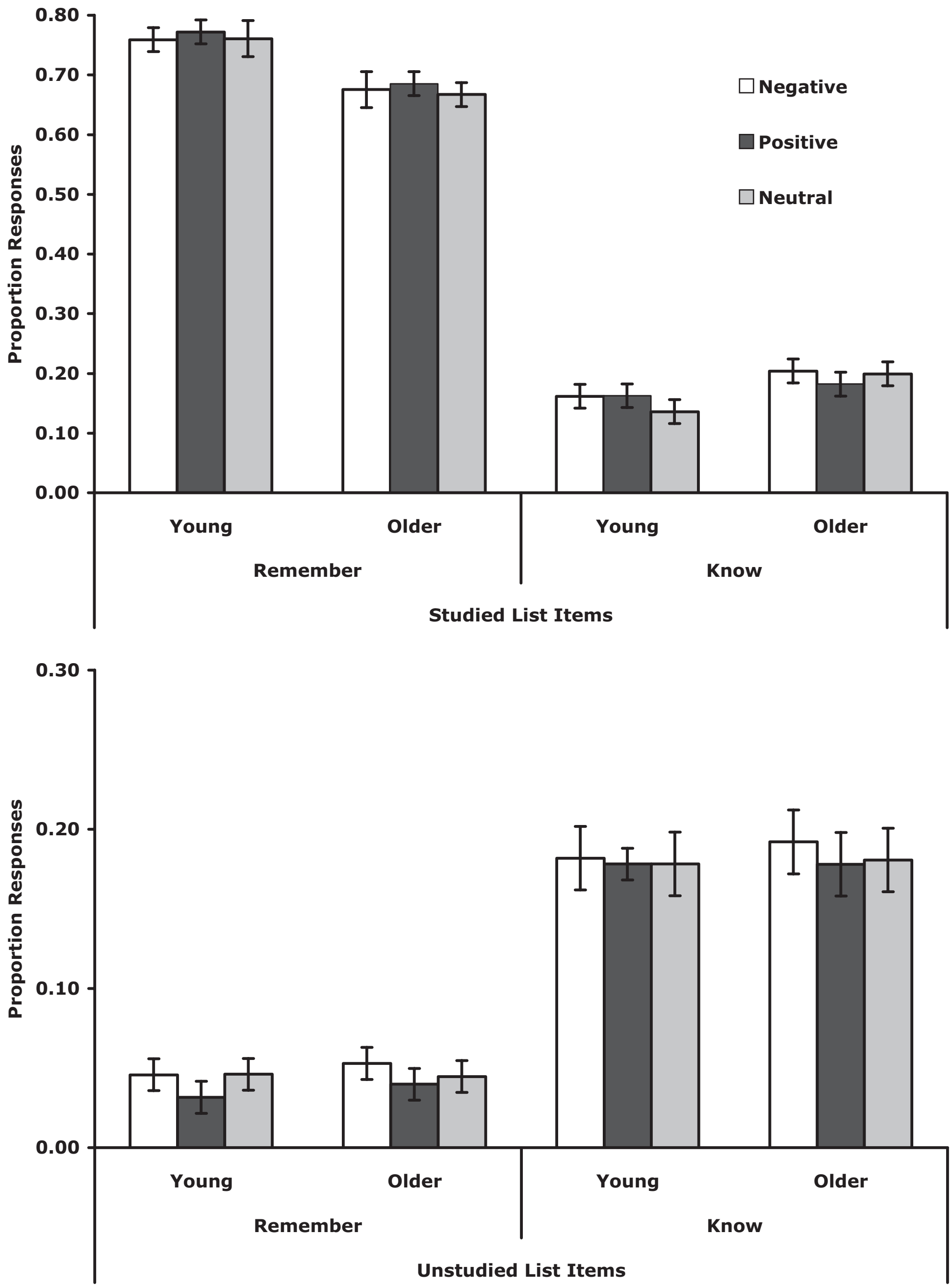

Figure 1. Mean proportions (and standard errors) of remember and know responses for young and older adults to studied and unstudied list items according to valence (negative, positive, neutral).

False Alarm Know Responses to Lures

An ANOVA on know responses to lures revealed a significant main effect of valence, $F(2, 140) = 18.08$, $p < .001$, $\eta^2 = .21$, and lure type, $F(1, 70) = 13.17$, $p < .001$, $\eta^2 = .16$, but not group, $F(1, 70) < 1$. In addition, a significant Valence × Lure Type interaction was also present, $F(2, 140) = 15.22$, $p < .001$, $\eta^2 = .18$. None of the interactions with group reached statistical significance. In other words, young and older adults showed a similar pattern of false-alarm know responses: Both groups showed fewer false alarms to negative than to neutral, $t(71) = 5.69$, $p > .001$, or to positive, $t(71) = 5.63$, $p < .001$, critical lures. In contrast, false alarms to neutral unstudied lures were more common than false alarms to negative, $t(71) = 2.78$, $p = .007$, or to positive, $t(71) = 4.37$, $p < .001$, unstudied lures. Examining the valence effect across lure types, we found that false alarms to positive critical lures were

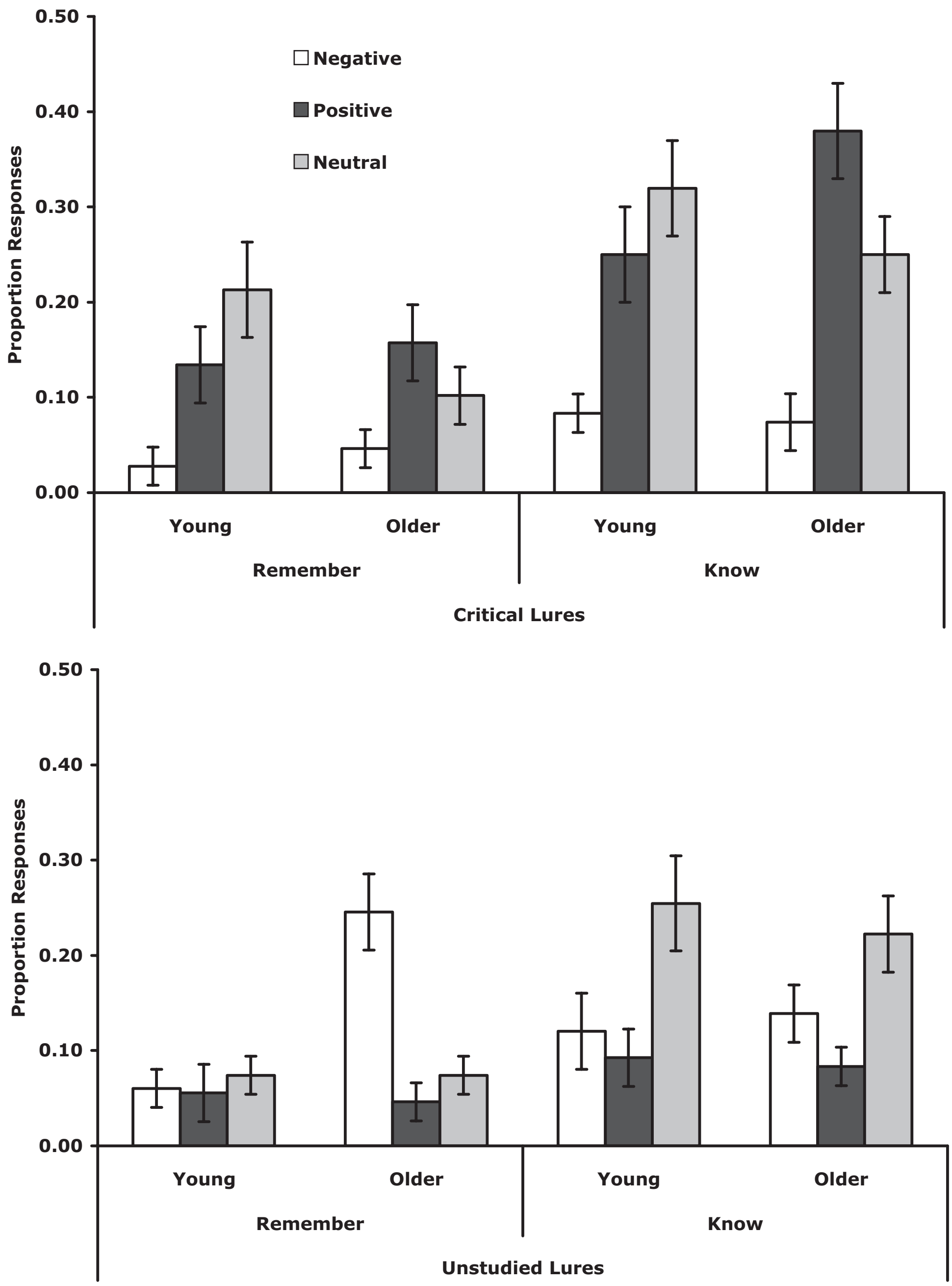

Figure 2. Mean proportions (and standard errors) of remember and know responses for young and older adults to critical lures and unstudied lures according to valence (negative, positive, neutral).

more common than those to positive unstudied lures, $t(71) = 6.10$, $p < .001$.

Visual inspection of the results (Figure 2) suggested that in both groups, the pattern of know and remember responses to critical lures was similar. To explore this similarity, we conducted an ANOVA on responses to critical lures with response type (remember, know) and valence (negative, neutral, positive) as within-subject factors and group (young, older) as between-subject factor. This analysis revealed a significant main effect of valence, $F(2, 140) = 39.33$, $p < .001$, $\eta^2 = .36$, and response type, $F(1, 70) = 12.66$, $p < .001$, $\eta^2 = .15$, but not group, $F(1, 70) < 1$. A significant Valence × Group interaction was also present, $F(2, 140) = 7.30$, $p = .001$, $\eta^2 = .09$. Interactions involving response type, however, failed to reach statistical significance. These analyses and subsequent *t* tests confirmed that for both remember and know responses, older adults showed more false alarms to positive than to neutral critical lures, $t(35) = 3.55$, $p = .001$, while young adults showed the reverse profile, $t(35) = 2.05$, $p = .048$, and both groups showed the least false responses to negative critical lures.

Discussion

In this study, we uncovered a novel effect of positive valence on the production of false memory reflecting a strong (but, in this instance, incorrect) feeling of clear recollection (i.e., remember responses) in older adults. This effect was found to manifest itself in two opposite ways: Following the presentation of orthographically related study list items, older adults showed the highest false alarms for the previously unseen positive critical lures. It is important to note, however, that they demonstrated the expected reduction of false alarms to negative critical lures compared with neutral critical lures. In contrast, the pattern of responses to unstudied lures was reversed, older adults showing the least false alarms in response to positive unstudied lures and highest to negative unstudied lures. Unlike their older counterparts, young adults exhibited a nonspecific emotional effect with fewer remember responses to emotional critical lures compared with neutral critical lures. In response to unstudied lures, however, no effect of emotion was observed with similarly low remember responses across all valence categories.

Our results indicate an effect of age and emotion on false alarm production but an effect different to that predicted by our hypotheses. Our first hypothesis, which posited a greater production of false alarms overall in older adults than in young adults, was not supported. Incorrect recollection of emotional and neutral lures was similar in both groups. The only exception was the older adults' remember responses to negative unstudied lures, which were significantly more frequent compared with young adults'. As anticipated, however, know–response performance was also similar across groups. Our second hypothesis, which proposed an effect of positive valence on critical lure recognition similar to that of negative valence, received only limited support. Although young adults showed a reduction in false alarms to positive critical lures relative to those to neutral critical lures, the magnitude of this change was smaller than that observed in response to negative critical lures. In stark contrast, as indicated above, older adults endorsed positive critical lures more often than either negative or neutral critical lures, regardless of whether the response type reflected vivid recollection (i.e., remember responses) or a more diffuse sense of familiarity (i.e., know responses). Our third hypothesis, which posited an age-specific valence effect in response to critical lures (i.e., young adults showing fewest responses to negative critical lures and older adults to positive critical lures), received partial support. Consistent with our prediction, young adults had fewer false responses to negative than to positive or to neutral critical lures. In contrast to our prediction, however, older adults also showed significantly fewer false responses to negative critical lures but, more important, showed the highest false response rate to positive critical lures. This pattern was observed for both remember and know responses. It is interesting that the predicted age-related effect of valence on response accuracy was observed in response to the unstudied, rather than the critical, lures. Reasons underlying the differences in emotional effect across groups and the discrepancy between responses to critical and unstudied lures are discussed in the following paragraphs.

Previous studies have reported that in some instances, older adults experience a bias toward positively valenced information (e.g., Mather & Carstensen, 2003). In this study, our findings indicated that this bias was both beneficial and detrimental to accurate memory performance. When exposure of the orthographic associates was absent at study, valence was sufficient to increase the distinctiveness of the positive unstudied lures, making the rejection of these items more straightforward. Crucially with the critical lures, the combination of previous exposure of the related associates and a positive valence bias gave rise to impaired discrimination and increased false alarms. One plausible explanation for this seemingly paradoxical finding is that the combination of valence and prior exposure of orthographically related words at study resulted in conflicting cognitive demands. In other words, the likelihood to endorse critical lures, already greater in older than in young adults (e.g., Watson et al., 2004), was further compounded by the liberal bias shown by older adults toward positive information. This interaction reduced the distinctiveness of the positive critical lures and increased their discrimination threshold. In this instance, the failure resulted in source monitoring errors. Older adults have been shown to experience increasing difficulty in engaging cognitive control processes effectively to resolve such conflicts (e.g., Grady, Springer, Hongwanishkul, McIntosh, & Winocur, 2006), most likely because of the vulnerability to the effects of aging of the brain frontal systems thought to mediate these cognitive processes (e.g., West, 1996). In contrast, young adults were able to assess successfully the respective bias of valence and prior exposure, resulting in increased accuracy.

These findings provide support for Carstensen and colleagues' emotional selectivity theory, which posits an emotional bias toward positive items with aging and a memory bias for positive information (Carstensen, 1995). Older adults' performance contrasted with that of young adults who showed a reduction in false alarms, although the effect of emotion in this group was present for critical lures but not for unstudied lures. Young participants, however, exhibited a global reduction in false alarms to emotional critical lures, rather than a reduction associated with one particular emotional valence. We did not observe an emotional bias toward negative information in this group as previously reported (Mather & Carstensen, 2003).

As anticipated, know responses to list items and to lures were similar in both groups. This finding confirmed that responses reflecting familiarity rely on cognitive processes that remain impervious to the effects of aging (Mäntylä, 1993). Not surprisingly, know responses were higher to unstudied than to studied words. In the absence of additional distinctive features (e.g., previous exposure, valence), a new item incorrectly recognized was unlikely to trigger a clear recollective process resulting in a remember response.

In both groups, false alarm know responses to critical lures differed from those to unstudied lures. With critical lures, negative, but not positive, valence increased the distinctiveness of the item resulting in reduced false alarms. Under this condition, emotion was only partly able to counteract the effect of prior exposure of orthographic associates to false alarm production. Again, as was the case with false-alarm remember responses to lures, it appears that older adults experienced conflicting cognitive demands between positive valence and the previous presentation of list items, resulting in impaired discrimination and increased incorrect responses. In response to negative and positive unstudied lures, however, false-alarm know responses were similarly reduced relative to know responses to neutral unstudied lures in young and older adults, indicating that in this instance, valence was sufficient to increase item discriminability and facilitate correct rejection.

Several aspects of this study need to be considered when one is interpreting the current results. First, the longer stimulus presentation time for the older adults at study may have increased the distinctiveness of the orthographic associates of the lures leading to a greater sensitivity to the critical lures at recognition. If this were the case, however, an increase in false alarms would be expected, regardless of valence. Our results showed that older adults' increase in remember false alarms was limited to positive critical lures and was not observed for negative or neutral critical lures. This pattern of results indicates that the conjunction of positive valence and prior exposure to orthographic associates, rather than the longer presentation time of study items, most likely explains the increased false alarms to positive critical lures in older adults.

Second, appraisal of the emotional value of the lures may have differed between young and older adults. In our study, valence and arousal ratings of the lures provided by a subset of older adults were almost identical to the ANEW ratings. In addition, Wurm, Labouvie-Vief, Aycock, Rebucal, and Koch (2004) also reported very high correlations between ANEW ratings and the ratings provided by their samples of young and older adults, and they found no valence and arousal rating differences across groups. These important findings indicate similar experience of emotional stimuli by young and older adults and suggest that the current results were not due to group differences in how emotional stimuli were perceived.

Third, while the 18 study lists comprised mostly neutral words, a few orthographic associates may have been perceived as negative or positive and thus may have biased the participants' subsequent recognition performance (e.g., shame or beach; see Appendix). Inclusion of valenced items at study, however, tends to decrease, rather than increase, the salience of emotional lures at test (Pesta et al., 2001). In addition, inclusion of emotional buffer words at encoding also minimized the possible salience of such emotional associates. Finally, remember and know responses to list items were very comparable across list types (i.e., whether associated with a negative, neutral, or positive lures) and across groups, for both studied and unstudied lists, arguing against a bias of emotion induced by associates potentially perceived as nonneutral.

In summary, in this study, we uncovered a modulation in the contribution of emotion to memory performance with aging. We demonstrated that the increased salience triggered by positive valence in older adults does not necessarily result in increased memory performance but may also give rise to false alarms depending on the context. We interpret this finding as reflecting a source memory deficit due to decreased efficiency in cognitive control processes that has been reported previously in aging, processes reported to be mediated by frontal systems (e.g., Rubin et al., 1999; Velanova, Lustig, Jacoby, & Buckner, 2007; West & Schwarb, 2006). Translating this finding into real-life situations, we believe that our results suggest that as individuals get older, they may experience increasing difficulty differentiating between the effects of prior exposure and valence, which determine the salience of an event. As a consequence, older adults may be more likely to "recognize" novel events incorrectly when these events have a positive content and resemble previous situations. Potential for future research includes investigation of false memory in real-life situations (other than generic memorization of word lists) to determine whether these effects persist.

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Appendix

Set 1

Negative	Neutral	Positive	Negative	Neutral	Positive	Negative	Neutral	Positive
RAPE (5)	HOOK (5)	THRILL (5)	BITCH (6)	SHAVE (6)	CHEER (8)	WHORE (2)	PEACH (3)	PUPPY (2)
cape	book	frill	ditch	slave	hear	chore	beach	peppy
nape	look	drill	hitch	stave	beer	bore	leach	yuppie
tape	cook	grill	batch	shove	near	wore	teach	poppy
ripe	nook	trill	pitch	share	spear	more	reach	pappy
rope	rook	april	itch	have	clear	tore	poach	preppy
race	took	shrill	botch	shade	veer	pore	peak	putty
rapt	hock	still	mitch	sake	deer	sore	perch	hubby
rake	honk	will	butch	shale	fear	horn	peace	puffy
rare	hood	mill	birch	shame	gear	shore	preach	pupil
raze	hoof	trail	witch	shape	jeer	core	peal	poopy

Set 2

Negative	Neutral	Positive	Negative	Neutral	Positive	Negative	Neutral	Positive
SLUT (1)	RINK (2)	MERRY (8)	HELL (95)	PARK (94)	KING (88)	TRASH (2)	DIGIT (1)	PENIS (0)
slug	link	sherry	bell	bark	bing	brash	widget	venus
slum	mink	berry	dell	dark	ding	cash	midget	genus
slur	sink	cherry	fell	hark	ping	clash	bridget	penal
slot	wink	ferry	jell	lark	ring	flash	fidget	peevish
slue	pink	dairy	sell	mark	sing	slash	divot	penance
shut	rank	airy	tell	nark	ting	smash	divvy	venice
slit	risk	bury	hall	pack	wing	splash	dimwit	zenith
smut	blink	hairy	hill	perk	zing	stash	digest	pennies
glut	rick	very	hull	pork	cling	dash	gidget	punish
scut	fink	wary	shell	spark	bring	bash	dig	pianist

Note. Lures are shown in capital letters with their word frequency in brackets.

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