

# How emotion affects older adults' memories for event details

Elizabeth A. Kensinger

*Boston College, Boston, MA, USA*

As adults age, they tend to have problems remembering the details of events and the contexts in which events occurred. This review presents evidence that emotion can enhance older adults' abilities to remember episodic detail. Older adults are more likely to remember affective details of an event (e.g., whether something was good or bad, or how an event made them feel) than they are to remember non-affective details, and they remember more details of emotional events than of non-emotional ones. Moreover, in some instances, emotion appears to narrow the age gap in memory performance. It may be that memory for affective context, or for emotional events, relies on cognitive and neural processes that are relatively preserved in older adults.

## **AQ1** *Keywords:* .

Episodic memory complaints are frequent among older adults, even those who are ageing successfully (reviewed by Kausler, 1994; Kensinger & Corkin, 2003; Light, 1991). However, the magnitude of the deficits can vary widely depending on the mnemonic demands placed on participants. Older adults have particular difficulty remembering the spatiotemporal context in which an event occurred or the precise details that comprised the event. Thus, although older adults may remember that they ate dinner at a restaurant last week, they may be unable to remember the restaurant's name, the layout of the restaurant, or the particular meal that they ordered.

Dissociations between older adults' memories for general event information and their memories for event details have been demonstrated in a plethora of studies. For example, older adults tend to be relatively unimpaired at distinguishing which items have been presented previously and which items are new (as required on standard

recognition tasks; Bastin & Van der Linden, 2003). By contrast, they often show marked impairments when they must indicate not only which items they have seen previously, but also in what context they studied those items (e.g., which experimenter read the sentence or in what font the words were written). This difficulty remembering the context in which items are presented (termed "source memory") has been associated with the ageing process in a number of studies (reviewed by Spencer & Raz, 1995). Older adults also tend to show impairments when they must remember not only whether single items were presented (e.g., were "pig" and "fork" on the study list?) but also whether items were paired together earlier (e.g., were "pig" and "fork" presented at the same time?; Castel & Craik, 2003; Naveh-Benjamin, 2000). They are similarly impaired when they must remember not only the general type of item that was presented (e.g., that an image of a fork was shown) but also the

Address correspondence to: Elizabeth A. Kensinger PhD, McGuinn Hall, Rm. 510, 140 Commonwealth Ave., Chestnut hill, MA 02467, USA. E-mail: elizabeth.kensinger@bc.edu

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specific details of that item (e.g., when they must distinguish the studied fork from other, non-studied ones; e.g., Adams, Labouvie-Vief, Hobart, & Dorosz, 1990; Bayen, Nakamura, Dupois, & Yang, 2000; Gould, Trevithick, & Dixon, 1991; Koutstaal, 2003).

These studies make clear that older adults' memory impairments are often most notable when they are attempting to retrieve precise episodic details. What has been less certain is whether there are circumstances in which older adults' deficits in remembering these sorts of episodic details are reduced, or even eliminated. In this review I will present evidence that emotion can enhance older adults' abilities to remember detail. Moreover, although older adults' mnemonic benefit from emotion does not always exceed that derived by young adults, in some instances memories for emotional information seem to be less affected by ageing than memories for information without emotional content. I will describe findings from two somewhat distinct literatures that support these conclusions. The first line of research examines whether older adults are better able to remember the emotional aspects of an event (e.g., how the event made them feel) as compared to other aspects (e.g., the perceptual details of the event). Thus, this section focuses on older adults' memories for the affective *context* in which information is encountered. The second line of research examines whether older adults remember more contextual details about emotional events than they do about non-emotional events. Therefore this section focuses on how the emotional *content* of an event influences older adults' memories for non-emotional contextual details of that event. The critical questions asked in each of these sections are whether older adults receive mnemonic benefits from emotion, and if so, whether these conferred benefits close the age gap in memory performance.

## REMEMBERING AFFECTIVE CONTEXT

When we think back to a prior experience, we can remember any number of aspects of that experience. Thinking back to a dinner that we ate at a restaurant, we can remember the perceptual context (e.g., what the restaurant looked like or what the food tasted like), we can remember the semantic context (e.g., what we discussed over the meal), and we can remember the affective context (e.g., how we felt as we ate the food or as we

talked with others at our table). Not everyone will remember each type of detail; some people may remember the semantic context well but little about the perceptual context, whereas the reverse may be true for others.

A number of studies have investigated whether ageing influences the types of contextual details remembered about events, with particular emphasis on examining whether ageing influences the proportion of remembered details that are affective in tone. There is reason to expect that a lot of what older adults remember may be affective in nature. With ageing, emotion-related<sup>1</sup> goals become particularly salient and older adults become more focused on emotional information in their environment (e.g., Carstensen, Fung, & Charles, 2003; Gross et al., 1997). Thus, older adults place more importance on their personal values than young adults (Hasher & Zacks, 1988; Labouvie-Vief, 1982) and they are more likely than young adults to prefer spending time with close social partners who bring them emotional fulfilment (e.g., Fredrickson & Carstensen, 1999). This affective shift with ageing appears to have important consequences for memory. Older adults tend to remember more information when it is presented to them with an affective tone (e.g., they are more likely to remember advertisement slogans with emotional connotations such as "capture those special moments" than they are to remember slogans that focus on expansion of world knowledge such as "capture the unexplored world"; Fung & Carstensen, 2002). They also tend to remember the thoughts or feelings elicited by previous experiences far better than they remember other types of event details, such as the perceptual or semantic features of an event (Comblain, D'Argembeau, Van der Linden, & Aldenhoff, 2004; Hashtroudi, Johnson, & Chrosniak, 1990; Schaefer & Philippot, 2005), and they remember proportionally more emotional information from prose passages than do young adults (Carstensen & Turk-Charles, 1994; Yoder & Elias, 1987).

More broadly, older adults seem to show a particular benefit for remembering affect-relevant source information over other types of

<sup>1</sup> In this paper I use the term "emotion" to refer to short-lived cognitive and somatic reactions to specific environmental or cognitive events (e.g., Scherer, 2000) and the term "affect" to refer more broadly to either the short-lived emotional reaction elicited by an event or to a more sustained mood state felt during an event.

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contextual details. Thus, older adults can remember whether a name is associated with a “good person” or a “bad person”, whereas they have difficulty remembering whether the name was read by a male or female voice (Rahhal, May, & Hasher, 2002). Age deficits in memory for source information can even be eliminated when the source detail is emotionally relevant. For example, May, Rahhal, Berry, and Leighton (2005) asked young and older adults to remember whether food was “safe” or “unsafe” to eat (i.e., whether or not it was spoiled) and also to remember other, non-affective, characteristics of the food (e.g., whether it should be served hot or cold). They found that older adults were much better at remembering the affective context (i.e., whether food was safe to eat) than they were at remembering the other contexts (e.g., the temperature at which the food was to be served). Importantly, the benefit for the affective context exhibited by the older adults was not mirrored in the young adults; thus, the age-related decline in contextual memory was eliminated for the affective context.

As described earlier, affective information takes on additional meaning for older adults, giving it a salience above and beyond that perceived by young adults (Carstensen, Isaacowitz, & Charles, 1999). It would be logical that older adults would be best at remembering the contextual details that had the most salience and personal relevance to them, and this factor is likely to have a strong influence on their enhanced ability to remember the affective context in which information was studied. Indeed, older adults’ memory benefit for the affective seems intricately linked to the way in which they process and rehearse the experienced information. If older adults are encouraged to focus on the facts rather than on the affective tone of information, their source monitoring generally improves, and they no longer show a bias to remember affective information (Hashtroudi, Johnson, Vneck, & Ferguson, 1994). Thus it appears that the way in which older adults process incoming information has predictable effects in terms of the types of details most likely to be remembered.

Older adults’ affective focus, however, is likely to be influenced by their retrieval orientation as well as their encoding focus. At a cognitive level, it may take less effort to retrieve emotional information than to retrieve non-emotional information (Zajonc, 1980), making emotional information easier to retrieve than other types of

information. Because older adults tend to show the most difficulties on tasks with high retrieval demands (Kausler, 1994; Light, 1991), emotional information may make up a greater proportion of their recalled memories simply because that affective information is easier for them to retrieve (see Burke & Light, 1981, for further discussion). Thus, remembering the affective tone of information may be just another example of older adults’ reliance on memory for gist-based or schematic information, rather than on memory for precise details. This hypothesis aligns with the claims of Adams et al. (1990), who described how older adults may remember the moral or the gist of a story because memory for those aspects requires fewer information-processing resources than memory for the story’s specific details. However, the causal link could be in the opposite direction: It is possible that good memory for affective information does not arise from older adults’ reliance on memory for gist-based information but rather that their memory for affective information *causes* their focus on the gist. Indeed, there is some evidence to suggest that any adult (young or old) who focuses on the affective meaning of information is more likely to extract the gist and is less likely to remember the details (Hashtroudi et al., 1994). Thus older adults’ affective focus may lead them to extract the gist of an event easily but to fail to retrieve the details. Further research is needed to clarify the extent, and directionality, of the links between older adults’ reliance on schematic processing and their enhanced memory for affective details.

Although the results described so far have suggested that older adults’ enhanced memory for affective context may result from a relative preservation of affect-related processing, an alternate possibility is that this affective focus arises as a consequence of older adults’ failure to inhibit processing of information that is less relevant to the ongoing experience (Hasher, Stolzhus, Zacks, & Rypma, 1981; Hasher & Zacks, 1988). In many circumstances, attending to the affective tone of information will be counterproductive to remembering the content or broader context of the presented information. It is possible that older adults’ preserved memory for affective information, and reduced memory for other types of details, reflects the fact that older adults are less likely to filter out the task-irrelevant affective details. In other words, perhaps both young and older adults initially focus on affective context, but perhaps young adults soon realise that this

140 information is not the only information that they  
 should be remembering. They may therefore  
 switch strategies in order to boost their encoding  
 of other types of details. Given the difficulties  
 that older adults have with flexible deployment of  
 1 AQ6 attention (Braver & Barch, 2002; Gutchess et al.,  
 in press) and with inhibition of task-irrelevant  
 information (Zacks & Hasher, 1997), it is plau-  
 sible that older adults cannot strategically redirect  
 their attention once it is focused on the affective  
 context.

150 Some evidence to support this hypothesis has  
 come from studies examining the ease with which  
 young and older adults are able to shift their  
 attention from affective aspects of scenes or  
 sentences to non-affective aspects. Even for  
 155 young adults it appears difficult to disengage  
 attention from affective information; for example,  
 if young adults are shown a scene depicting a  
 snake in the forest, participants will look longer at  
 the snake than they will at the forest (Loftus,  
 Loftus, & Messo, 1987), and they will be more  
 likely to remember the snake than the forest  
 (reviewed by Reisberg & Heuer, 2004). However,  
 when young adults are encouraged to process the  
 non-affective elements of the scene (either by  
 165 warning them that their memories will be tested  
 for the non-affective context or by giving them  
 encoding tasks—such as telling a story about the  
 scene—that force them to attend to all aspects),  
 1 AQ7 they are able to do so (Kensinger et al., 2007;  
 Kensinger, Piquet, Krendl, & Corkin, 2005). They  
 no longer show impaired memory for non-affect-  
 ive details, such as the forest; rather, they appear  
 to be able to effectively disengage attention from  
 the emotional elements (e.g., the snake) and to  
 direct their processing resources towards the non-  
 emotional elements (e.g., the forest scene). Older  
 adults, in contrast, do not enjoy this flexibility in  
 attentional deployment. Regardless of the encod-  
 175 ing instructions given to them, older adults appear  
 to maintain focus on the emotional elements in  
 the scenes, leading them to have good memory  
 for those aspects, but poor memory for the non-  
 affective details (Kensinger et al., in press; Ken-  
 180 senger et al., 2005). This focus on the affective  
 occurs even when such a focus impedes successful  
 performance on the encoding task (Kensinger et  
 al., in press).  
 1 AQ8

190 Indeed, across a range of paradigms older  
 adults' memory for the affective has seemed to  
 come at a cost for memory for other types of  
 details. For example, Comblain, D'Argembeau,  
 and Van der Linden (2005) found that while older

adults remembered a lot of thoughts and feelings  
 elicited by pictures that they had viewed, they  
 remembered little perceptual or semantic detail.  
 Kensinger, Brierley, Medford, Growdon, and  
 Corkin (2002) also found that while older adults  
 were good at remembering the affective words  
 within a sentence, they did poorly at remember-  
 ing the non-affective words. Young adults, in  
 contrast, showed good memory not only for the  
 affective words but also for the non-affective  
 ones. Thus it seems that older adults' focus on  
 the affective can lead to decrements in memory  
 for other types of details. Although young adults  
 remember the perceptual and semantic details of  
 many of life's experiences just as well as they  
 remember the affective details (e.g., May et al.,  
 2005), for older adults the non-affective details  
 may never be attended to, or may not be the  
 target of retrieval processes, leaving them primar-  
 ily with a sense for the affective tinge of an event.  
 Thus, in thinking back to a dinner with friends,  
 young adults may remember the taste of the food,  
 the topics discussed, or the layout of the restau-  
 rant; older adults, in contrast, may primarily  
 remember the calm feeling elicited as they  
 enjoyed the meal.

## REMEMBERING DETAILS OF EMOTIONAL EVENTS

The research described above has suggested that  
 older adults are more likely than young adults to  
 process incoming information in an affect-rele-  
 vant way, and that they are more likely to  
 remember the affective qualities of prior experi-  
 ences. A related line of research has examined  
 whether older adults remember more contextual  
 details about emotional events than they do about  
 non-emotional events. When an event elicits  
 significant emotional reactions, do older adults  
 continue to display memory only for the general  
 affective tone of these events, or is there some-  
 thing about emotionally evocative events that  
 may cause older adults to remember other types  
 of contextual details as well?

Most investigations of this issue have focused  
 on older adults' abilities to form "flashbulb  
 memories" of highly surprising and emotional  
 public events. Because the hallmark of a flashbulb  
 memory is the vividness with which people  
 remember contextual details that are not inher-  
 ently affective in nature (e.g., what they were  
 wearing or what they were doing when they

195 learned of an event's occurrence), assessing the  
frequency of these memories across the adult  
lifespan provides a way to examine whether older  
adults, like young adults, are likely to remember  
contextual details about emotional events.

200 Initial reports were fairly inconclusive regard-  
ing the effects of ageing on flashbulb memory:  
Although some studies revealed that older adults  
retained flashbulb memories at least as frequently  
as young adults (e.g., Christianson, 1989; Otani et  
205 al., 2005; Wright, Gaskell, & O'Muircheartaigh,  
1998), other studies revealed that older adults  
demonstrated these vivid memories significantly  
less often than young adults (e.g., Cohen, Con-  
way, & Maylor, 1994; Tekcan & Peynircioglu,  
210 2002; Yarmey & Bull, 1978). Because these  
studies differed in methodologies—including dif-  
ferences in how memory was tested, in how  
flashbulb memory was defined, and in how long  
a delay there was between memory assessments—  
there were a number of possible reasons for the  
215 mixed findings. For example, Wright et al. (1998),  
who found no age effects on the frequency of  
flashbulb memory formation, measured memory  
via a marketing phone interview, asking partici-  
pants simply to respond "yes" or "no" to a series  
of questions. By contrast, Cohen et al. (1994) and  
220 Tekcan and Peynircioglu (2002), who found age-  
related declines in the frequency of flashbulb  
memories, used written questionnaires to assess  
participants' memories, suggesting that age defi-  
cits may be most apparent when memory is  
assessed via free recall of details. Whether age  
225 differences in recall are revealed may also depend  
on whether the consistency of a memory is taken  
into consideration: Tekcan and Peynircioglu  
(2002), who found age differences, considered  
any detailed memory to be indicative of a  
flashbulb memory, whereas Otani et al. (2005),  
230 who found no age differences, required flashbulb  
memories to be consistent over time. Taken  
together, these results suggest that age differences  
may be reduced when consistency of free recall is  
considered. However, Cohen et al. (1994), who  
required strict consistency of free recall, found  
235 that older adults formed flashbulb memories less  
often than young adults, drawing into question  
the generality of this conclusion. Thus, no simple  
explanation emerged from these studies to ac-  
count for when older adults do, and do not, form  
flashbulb memories as frequently as young adults.

240 A further difficulty with interpreting these  
studies arose because they did not include a  
control event to which memory for the emotional

event could be compared. Without a non-emo-  
tional control event, general effects of ageing on  
memory for all experiences could not be distin-  
guished from specific effects of ageing on memory  
for emotional events. An age difference could  
arise from global age-related decline in the  
amount of detail recorded about any event or  
from a specific difficulty that older adults have in  
forming detailed memories about emotional  
events—although Tekcan and Peynircioglu  
(2002) did reveal that older adults were able to  
retrieve more information about emotional  
events than non-emotional events that had oc-  
curred when the participants were young adults,  
demonstrating that ageing does not eliminate the  
memory enhancement for retrieval of emotional  
events.

To circumvent this problem, three recent  
studies have directly compared young and older  
adults' memories of an emotional event to their  
memories for a non-emotional event that oc-  
curred within a similar time period. Davidson  
and Glisky (2002) asked participants about the  
deaths of Princess Diana and Mother Theresa,  
and about a personal event that had occurred  
over Labor Day weekend (a weekend that  
occurred in close temporal proximity to the two  
deaths). Davidson, Cook, and Glisky (2006)  
asked older adults to remember the details of  
the September 11 terrorist attack and a control  
event from that same week. Kensinger, Krendl,  
and Corkin (2006b) asked young and older adults  
to recall details about two public events that  
occurred in close temporal proximity to one  
another: the *Columbia* Shuttle explosion, which  
all participants rated as a highly emotional event,  
and the SuperBowl game. Because participants  
were not avid fans of either team, they rated the  
game as having little emotional importance to  
them. Each of these studies converged on the  
same conclusions; in each study, older adults  
formed flashbulb memories as frequently as  
young adults and, like young adults, older adults  
remembered far more contextual details about  
emotional events than about non-emotional  
events. In fact, Kensinger et al. (2006b) found  
that age-related deficits in memory for contextual  
detail were greatly reduced for the emotional  
event as compared to the non-emotional one,  
suggesting that ageing has less of an impact on the  
ability to remember the details associated with  
emotional events.

245 Notably, all of these studies of "flashbulb  
memories" have assessed memory for negative

events. There has yet to be a study comparing young and older adults' memories for a highly positive public event, but recent investigations in young adults suggest that the likelihood that details are remembered accurately may be critically impacted by the valence of the event. Levine and Bluck (2004) asked young adults who were either pleased or displeased with the verdict in the O.J. Simpson trial to indicate whether or not particular events had occurred during the trial. They found that the young adults who were pleased with the verdict were more lenient in endorsing that something had occurred during the trial than were individuals who were displeased with the verdict. Thus, individuals pleased about the verdict falsely endorsed more statements than individuals upset by the verdict. Young adults who were happy about the verdict were also more confident in their inaccurate endorsements than were individuals who were unhappy about the outcome. Kensinger and Schacter (2006) assessed baseball fans' memories of the 2004 American League Championship series, in which the Red Sox defeated the Yankees. They found that Red Sox fans (who found the event positive) had less-consistent memories than Yankees' fans, yet the Red Sox' fans were more confident in the accuracy of their memories. Thus, these studies both converged on the same general conclusion that—for young adults—events that evoke negative emotional responses may lead to more accurate memories, and a more realistic perception of memory accuracy, than events that elicit positive affect.

Although no study has directly examined the effect of valence on young and older adults' memories for autobiographical experiences, a retrospective study by Bohn and Berntsen (2007) suggests that negative valence may confer a memory accuracy advantage for adults of all ages. The authors asked individuals from former East and West Germany to recall the details of the fall of the Berlin Wall; some of these individuals had found the event to be a highly positive one, and others had experienced it as a highly negative event. Just as in Levine and Bluck (2004) and Kensinger and Schacter (2006), those individuals who had found the event to be negative remembered it with more accuracy than those who had found it to be positive. Because the mean age of Bohn and Berntsen's participants was 55 (and ages ranged from 29–82), their data suggest that the benefit that negative

emotion confers on memory accuracy may be preserved across the adult lifespan.

A couple of laboratory studies have provided further evidence that the divergent effects of negative versus positive valence on the detail with which information is remembered may be maintained in older adulthood. In one set of studies (Kensinger et al., 2006; Kensinger, Garoff-Eaton, & Schacter, 2007), young and older adults were asked to distinguish *same* items (identical to those that they'd studied) from *similar* items (sharing the same verbal label as a studied item, but differing in visual details) and *new* items (not related to a studied item). One-third of the items were positive (e.g., a sundae, a dollar bill), one-third of the items were negative (e.g., a snake, a grenade), and one-third of the items were neutral (e.g., a cabbage, a barometer). Both young and older adults were more accurate at distinguishing *same* from *similar* items when those items were negative than when they were positive or neutral. These results suggest that across the adult lifespan, negative information may be more likely to be remembered with details than other types of information. A similar pattern of results was revealed in a reality-monitoring study that required young and older adults to distinguish items they'd seen from those they'd only imagined. Young adults showed better reality monitoring for negative information than for positive or neutral information (Kensinger & Schacter, 2006; Kensinger, O'Brien, Swanberg, Garoff-Eaton, & Schacter, in press b); similarly, older adults showed better reality monitoring only for negative items (not positive items) compared to neutral ones.

These findings suggest that older adults, like young adults, may be particularly good at extracting details about a negative event. Indeed, there is some evidence that older adults' memories for negative events may be even more vivid than young adults' memories, whereas the two age groups may not differ in the subjective vividness for positive events (Comblain et al., 2005). These findings follow logically from a vast literature suggesting that positive and negative affect lead to differences in the ways in which information is processed. Whereas negative information is processed in a detail-oriented and analytical fashion, positive information is processed in a more heuristic or schematic fashion (e.g., Bless et al., 1996; Gasper & Clore, 2002). This difference in processing seems to have widespread effects on memory, with negative information remembered

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with more vividness and contextual detail than positive or neutral information (e.g., Kensinger & Corkin, 2003; Ochsner, 2000), and with negative events remembered with less distortion (e.g., Kensinger & Schacter, 2006; Kensinger & Corkin, 2004; Storbeck & Clore, 2005). It appears that this difference in how negative versus positive information is remembered remains consistent across the adult lifespan.

These findings are particularly interesting in light of evidence suggesting that older adults are more likely than young adults to focus on positive information and that older adults retain proportionally more positive information in their memories than young adults (reviewed by Mather & Carstensen, 2005). It might have been expected that because older adults attend more to positive information than young adults, they would also show a greater advantage in remembering the details of positive events. However, the extant data suggest that despite age-related changes in the salience of positive compared to negative information, older adults do not show an advantage for extracting contextual details of positive items' presentations. It is likely that older adults, like young adults, process positive information in a more heuristic fashion than negative information; thus, devoting more attention towards positive items (perhaps leading to additional, heuristic processing) does not lead to benefits in memory for those positive items' details. Thus, young and older adults are no more likely to remember the details of a sundae (its exact visual details, or whether it was seen or imagined) than they are to remember the details of a cabbage.

Positive items are associated with some mnemonic advantages unique to older adults, however. In particular, when memory for the general theme of presented information—regardless of memory for the details—is assessed, young adults often show a memory advantage only for negative items as compared to neutral ones, whereas older adults sometimes show a broader memory advantage extending to negative and positive items as compared to neutral ones. For example, whereas young adults were no more likely to remember that positive items (e.g., a sundae) had been presented than that neutral items (e.g., a cabbage) had been presented, older adults were more likely to remember the positive items (Kensinger et al., 2007, in press; see also Charles, Mather, & Carstensen, 2003, and Comblain et al., 2005, for evidence of this age-related broadening of emotional memory enhancement). These results em-

phasise that the mnemonic influence of age-related changes in the processing of emotional information can differ depending on the way in which memory is assessed. Although older adults sometimes show a broader emotional memory enhancement in terms of item recognition, this broadening does not seem to extend to memory for details of the item's presentation. Thus, ageing does not impact the types of events that are most likely to be remembered with rich detail: Across the adult lifespan, negative events seem to be remembered with more contextual detail than positive or neutral ones.

### WHY EMOTION MAY HELP OLDER ADULTS TO REMEMBER THE DETAILS

As the sections above have highlighted, older adults' ability to remember the details of an event is linked to the event's affective importance. In the case of information studied in different contexts, older adults appear better able to remember the affective context in which information was presented, while they have greater impairments in remembering non-affective details. Part of these influences may arise from encoding processes: older adults' natural tendency to focus on (or failure to inhibit the processing of) affective information may help them to remember the affective context in which information was studied, although this affective focus may come at the cost of remembering other, non-affective details (discussed by Comblain et al., 2005; Kensinger et al., in press; Schaefer & Philippot, 2005). It also may be that retrieval of affective context requires fewer resources than retrieval of other types of details, thereby reducing age-related deficits.

At a neural level, it may be that the encoding and retrieval of affective context relies on distinct neural processes from the encoding and retrieval of other types of contextual details, and the neural processes that support memory for affective context may be relatively spared with ageing. For example, the amygdala, orbitofrontal cortex, and medial prefrontal cortex are regions often implicated in the encoding and retrieval of self-relevant and emotional information (Dolan & Morris, 2000; LaBar & Cabeza, 2006; Phelps & LeDoux, 2005). These regions are relatively spared in ageing, showing rates of decline no greater than that of the whole brain (reviewed by Chow & Cummings, 2000; Salat, Kaye, & Ja-

**AQ2****AQ11****AQ7****AQ8****AQ8**

355 nowsky, 2001; Tisserand, Visser, van Boxtel, &  
Jolles, 2000). In contrast, the lateral prefrontal  
360 **AQ12** regions often implicated in the encoding and  
**AQ13** retrieval of non-affective context (Paller &  
Wagner, 2000; Ranganath & Knight, in press)  
tend to undergo more significant structural and  
functional changes with ageing (Rajah & D'Espo-  
sito, 2005; Raz et al., 2004; Salat et al., 2004).  
Thus, it is plausible that older adults' abilities to  
365 retrieve affective context relate to a relative  
preservation of the neural processes recruited  
for such retrieval.

A recent neuroimaging study conducted in  
young adults (Smith, Stephan, Rugg, & Dolan,  
2006) has lent some support to this hypothesis,  
370 providing evidence for dissociable processes cor-  
responding with retrieval of affective context  
versus non-affective context. In particular, Smith  
and colleagues demonstrated that when young  
adults were asked to determine whether informa-  
375 tion had been studied in an affective context (i.e.,  
to decide whether information had been pre-  
sented in a negative or neutral context) there was  
increased connectivity between the orbitofrontal  
cortex and the amygdala as compared to a  
380 condition in which participants were asked to  
discriminate in which of two non-affective con-  
texts information had been studied (i.e., to decide  
whether information had been presented in a  
context with people or without people; Smith et  
385 al., 2006; see also Somerville, Wig, Whalen, &  
Kelley, 2006 for evidence that the amygdala is  
involved in retrieval of whether someone is a  
"good" or "bad" person). To the extent that  
orbitofrontal and amygdalar processing is rela-  
390 tively preserved with ageing (Salat et al., 2001;  
Wright, Dickerson, Feczko, Negeira, & Williams,  
2007), it would follow that older adults might be  
better at remembering affective contexts com-  
pared to non-affective ones.

In the case of emotional events, it appears that  
contextual details—even those not inherently  
affective in nature (e.g., what the weather was  
like on the day an emotional event occurred)—  
400 can be remembered well by older adults, and that  
age declines in remembering these details are  
reduced for emotional events as compared to  
non-emotional ones (e.g., Davidson & Glisky,  
**AQ9** 2002; Kensinger et al., 2006). Davidson and  
Glisky (2002), and more recently Davidson et  
405 al. (2006), have shed light on why there may be  
this relative preservation with ageing. Whereas  
memory for source information typically corre-  
lates strongly with older adults' performance on

measures of frontal lobe function and executive  
ability (Glisky, Rubin, & Davidson, 2001; Spencer  
& Raz, 1995), memory for the contextual details  
associated with a highly emotional event does  
not. In other words, older adults with low frontal  
function are just as likely to form "flashbulb  
memories" as are individuals with high frontal  
function. This result suggests that the processes  
that allow individuals to remember the details of  
emotional events may be different from those  
that allow individuals to remember the details of  
non-emotional ones; in other words, memory for  
the details of emotional events may be a special  
form of source memory that is less reliant on the  
typical lateral prefrontal mechanisms.

Neuroimaging data gathered in young adults  
provide evidence in support of Davidson and  
colleagues' hypothesis. In one study, Kensinger  
and Corkin (2004) revealed that non-arousing  
385 **AQ11** items that were vividly remembered were asso-  
ciated with enhanced lateral prefrontal and hip-  
pocampal activity during encoding, consistent  
with the results revealed in a number of subse-  
quent-memory neuroimaging studies (Paller &  
Wagner, 2002). By contrast, vivid remembering of  
arousing information was associated with en-  
hanced amygdalar and hippocampal activity dur-  
ing encoding, and was not influenced by the  
magnitude of prefrontal engagement during en-  
coding. Although this study did not examine  
memory for source information specifically, the  
results suggest that vivid memories for emotional  
events may be supported by encoding processes  
independent of those mediated by lateral pre-  
frontal regions.

More broadly, a large number of neuroimaging  
studies examining the neural processes involved  
in the successful encoding and retrieval of emo-  
tional information have implicated the amygdala  
and the hippocampus, as well as medial and  
orbital prefrontal regions (reviewed by Hamann,  
2001; LaBar & Cabeza, 2006; Phelps, 2004). By  
contrast, studies of emotional memory have not  
typically implicated the lateral prefrontal regions  
traditionally associated with memory for the  
details of non-emotional information. These re-  
sults provide tantalising evidence for a separation  
between the processes that support memory for  
the details of emotional events and those that  
support memory for the details of non-emotional  
events. Although it remains to be seen whether  
such a process dissociation will explain the  
pattern of results demonstrated in older adults,  
given the widespread age-related changes in the

410 engagement of lateral prefrontal regions during  
the encoding and retrieval of episodic detail  
(Cabeza, 2002; Rajah & D'Esposito, 2005), it  
seems a promising avenue for further research.

## FUTURE DIRECTIONS

415 The study of emotional memory in older adults is  
still at an early stage of inquiry, leaving open  
many questions. A couple of gaps in our knowl-  
edge have been alluded to in the sections above.  
420 As discussed in the first part of this review, there  
is reason to believe that older adults' focus on the  
"gist" of information may be tied to their  
tendency to focus on the affective meaning of  
information. However, the basis for such a link—  
if one does exist—is not known. Because the  
425 affective tone of material often is tied to the gist  
of the information, gist-based processing could  
lead a person to be good at remembering the  
affective qualities. Conversely, the fact that older  
adults focus on the affective nature of an experi-  
430 ence could lead them to process its gist at the  
expense of other event details. It also is possible  
that older adults' ability to remember affective  
and gist-based information is linked to slowed  
memory decay rates for these sorts of informa-  
435 tion. Even in young adults, gist information  
decays more slowly than detailed information  
(e.g., Bransford & Franks, 1971; Friedman &  
deWinstanley, 1998) and affective information is  
associated with a shallower forgetting curve than  
440 other types of information (LaBar & Phelps,  
1998; Sharot & Phelps, 2004; Sharot & Yonelinas,  
in press). Therefore it is possible that older adults'  
memories for many contextual details quickly  
degrade, whereas their memory for the affective  
gist remains intact over time. It will be important  
445 for future research to examine the basis for older  
adults' focus on the affective and the extent to  
which it stems from affect-specific processes  
versus domain-general processes that underlie  
memory for all gist information.

**AQ14**

450 More broadly, and as pointed out in the third  
section of this review, future research will do well  
to examine whether the encoding or retrieval of  
affective information (e.g., whether a name refers  
to someone good or bad) relies on distinct  
455 processes from the encoding or retrieval of non-  
affective information (e.g., whether a name refers  
to someone old or young). There is suggestive  
evidence of such a dissociation (e.g., Smith et al.,  
2006). However the nature of this distinction, and

the extent to which it explains older adults'  
relatively preserved ability to remember affective  
information, remain to be seen. This issue may  
turn out to be a fundamental one, by informing  
whether older adults focus on affectively mean-  
ingful information because of motivational shifts  
(i.e., older adults attend to the affective informa-  
tion because it has additional meaning for them)  
or because of age-related declines in other  
processes (i.e., older adults cannot bind or retain  
other details as readily, and therefore retain  
affective information).

In order for a complete understanding of age-  
related changes in emotional memory to be  
achieved, future research must also consider not  
only the affect–memory ties that hold across  
groups of older adults but also the potential  
importance of individual differences. It is likely  
that not all older adults are equally affectively  
focused, and important insights may be gained by  
understanding what cognitive, affective, or per-  
sonality variables influence the degree to which a  
person focuses on affectively meaningful infor-  
mation. It would seem particularly worthwhile to  
examine ties between older adults' cognitive  
control ability, emotion regulation ability, and  
memory for affective information. One explana-  
tion for older adults' good memory for affective  
information is that they are less good at emotion  
regulation than young adults and therefore have  
more affective details that they can remember.  
This hypothesis makes sense in light of older  
adults' generally reduced cognitive control ability  
(see recent reviews by Buckner, 2004; Verhae-  
ghen & Cerella, 2002) and the reliance of emotion  
regulation on those control processes (reviewed  
by Ochsner & Gross, 2005). However, in spite of  
this intuitive link, there is extensive evidence to  
suggest that older adults may be *better* at regulat-  
ing their emotions than young adults (reviewed  
by Mather & Carstensen, 2005). Based on these  
findings, an alternate explanation for older adults'  
good memory for affective information is that  
they devote more of their cognitive resources  
towards emotion regulation and fewer resources  
towards processing or binding together other  
event attributes, thereby leading to particularly  
good memory for affective information. Future  
research could adjudicate between these alterna-  
tives by taking an individual-differences approach  
to examining the links between an older adult's  
emotion regulation ability, cognitive control abil-  
ity, and ability to remember affective versus non-  
affective details.

460 These avenues for future research are likely to  
 intersect. For example, the alternatives just de-  
 scribed for possible ties between emotion regula-  
 tion, cognitive control, and memory link back to  
 465 the question of whether older adults' affective  
 focus stems from their enhanced motivation to  
 process affective information or from their di-  
 minished ability to process other sorts of informa-  
 tion. Thus, it seems likely that future research will  
 benefit from combining rigorous assessment of  
 470 group differences with neuroimaging investiga-  
 tions and with careful considerations of individual  
 differences. This combined approach may hold  
 the key to answering outstanding questions re-  
 garding how emotion affects older adults' mem-  
 475 ories for event details.

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