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Aging, Source Memory, and Emotion

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In 2 experiments we assessed younger and older adults' ability to remember contextual information about an event. Each experiment examined memory for 3 different types of contextual information: (a) perceptual information (e.g., location of an item); (b) conceptual, nonemotional information (e.g., quality of an item); and (c) conceptual, emotional information (e.g., safety of an item). Consistent with a large literature on aging and source memory, younger adults outperformed older adults when the contextual information was perceptual in nature and when it was conceptual, but not emotional. Age differences in source memory were eliminated, however, when participants recalled emotional source information. These findings suggest that emotional information differentially engages older adults, possibly evoking enhanced elaborations and associations. The data are also consistent with a growing literature, suggesting that emotional processing remains stable with age (e.g., Carstensen & Turk-Charles, 1994, 1998; Isaacowitz, Charles, & Carstensen, 2000).

Keywords: aging, source memory, emotion

Perhaps nothing so uniquely marks human experience, or pervades so many aspects of human life, as emotion. A large literature suggests that emotional processing can influence memory in dramatic ways, with individuals often showing heightened attention to and memory for emotional or affective material (e.g., words like *blood* or *victory* or images of rats or babies) relative to neutral material (e.g., words like *carpet* or *book* or images of buildings or furniture; e.g., Bock, 1986; Bradley, Greenwald, Petry, & Lang, 1992; Christianson, 1992; Christianson, Loftus, Hoffman, & Loftus, 1991; Hamann, Cahill, & McGaugh, 1997; Kanungo & Dutta, 1966). For example, individuals fixate faster and more often on emotional material than on neutral material (Christianson et al., 1991), report heightened interest in highly arousing information (e.g., Bradley, Cuthbert, & Lang, 1990), often have better recollection of emotional relative to neutral items (e.g., Bock, 1986; Bock & Klinger, 1986; Bradley et al., 1992; Kanungo & Dutta, 1966), and are better able to recall the source of emotional information (Doerksen & Shimamura, 2001).

The possibility that emotional cues may be used to enhance memory is particularly significant for older adults, both because they generally show deficits in memory relative to younger adults (e.g., Kausler, 1994; Light, 1991; Salthouse, 1985; Zacks, Hasher, & Li, 2000), and because growing evidence suggests that emotional functioning may be one of the few domains that is marked by relative stability and even continued growth with age (e.g., Carstensen, Pasupathi, & Mayr, 2000; Carstensen & Turk-Charles, 1994, 1998; Gross et al., 1997; Isaacowitz et al., 2000; Levine & Bluck, 1997; but see Wurm, Labouvie-Vief, Aycock, Rebucal, & Koch, 2004, for an exception). Older adults seem to place greater emphasis on and have more interest in emotionally salient information than in neutral information (e.g., Carstensen & Fredrickson, 1998; Fredrickson & Carstensen, 1990; Fung, Carstensen, & Lutz, 1999), and this differential interest may have important cognitive consequences, particularly for memory (Carstensen, Isaacowitz, & Charles, 1999; Carstensen & Turk-Charles, 1998; Fung & Carstensen, 2003; Isaacowitz et al., 2000). Several studies show that older adults demonstrate a memorial advantage for positive emotional relative to neutral material that is similar, and at times more robust, than that observed for young adults (Carstensen & Turk-Charles, 1994; Denburg, Buchanan, Tranel, & Adolphs, 2003; Fung & Carstensen, 2003; Kensinger, Brierley, Medford, Growdon, & Corkin, 2002; Mather & Carstensen, 2003). Some investigations show a similar pattern for negative emotional material (e.g., Denburg et al., 2003; Kensinger et al., 2002), although older adults do not always show the same memorial benefit as young adults for negative emotional information (see Charles, Mather, & Carstensen, 2003; Mather & Carstensen, 2003).

Recent evidence from the source-monitoring literature is also consistent with the possibility that emotional cues may indeed have a powerful effect on memory functioning in older adults. *Source memory* broadly refers to memory for the context in which information is conveyed, for example, the speaker, the location, and the timing of the information (e.g., Johnson, Hashtroudi, & Lindsay, 1993). Most investigations of source memory with older adults have shown significant age-related declines in the ability to recall contextual information, with older adults less effective than young adults at recalling voice, location, physical context, and temporal information (e.g., Benjamin & Craik, 2001; Brown,

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Jones, & Davis, 1995; Ferguson, Hashtroudi, & Johnson, 1992; Law, Hawkins, & Craik, 1998; McIntyre & Craik, 1987; Schacter, Kaszniak, Kihlstrom, & Valdiserri, 1991; Trott, Friedman, Ritter, & Fabiani, 1997; Trott, Friedman, Ritter, Fabiani, & Snodgrass, 1999). However, in a recent set of experiments that examined source memory and aging, Rahhal, May, and Hasher (2002) reported an exception to the typical age-related deficits in source. In that research, older adults were impaired relative to younger adults in their ability to recall perceptually based source information, but they were not impaired in recalling affective, value-based source information.

To be specific, participants in the Rahhal et al. (2002) study listened to two sources (i.e., John and Mary) present information. In one study, the speakers read trivia sentences, and in a second study, the speakers read biographical information (e.g., name, occupation, state of residence) about fictitious individuals depicted in photographs. In each study, the speakers were paired with conceptual information: In Experiment 1, one speaker read false trivia statements and the other speaker read true statements; in Experiment 2, one speaker described evil individuals and the other described good individuals. In both studies, younger and older adults were given one of two source tasks: either a perceptual source task that assessed memory for voice–speaker or a conceptual source task that assessed memory for truth (Experiment 1) or character (Experiment 2). Rahhal et al. (2002) found that older adults performed significantly worse than did younger adults in the voice-source conditions but were as competent as the younger adults in the truth-source and character-source conditions.

Rahhal et al. (2002) argued that the changes in age differences across perceptual and conceptual source tasks reflected an age difference in informational priorities, with younger adults emphasizing the perceptual aspects of an event and older adults focusing more heavily on emotional or value-based aspects (Fredrickson & Carstensen, 1990; Hashtroudi, Johnson, & Chrosniak, 1990; Johnson, 1995; Labouvie-Vief & Blanchard-Fields, 1982). This argument is consistent with recent evidence that suggests that older adults place relatively greater emphasis on subjective and interpretative aspects of an event than on factual details (Adams, Smith, Nyquist, & Perlmutter, 1997; Carstensen & Fredrickson, 1998; Hashtroudi et al., 1990). It is also supported by data that suggest that (a) older adults do not spontaneously orient to perceptual details during an event and (b) these biases against perceptual information at encoding are at least partially responsible for age-related source-memory failures observed (Glisky, Rubin, & Davidson, 2001; Hashtroudi, Johnson, Vnek, & Ferguson, 1994; Johnson, 1995).

Glisky et al. (2001), for example, conducted a series of studies to assess the impact of an encoding task on source performance. In two pairs of studies, they tested source memory for perceptual details (e.g., voice and location), following either an undirected or a directed encoding task. The undirected encoding tasks did not orient participants to any specific event information, and in these studies, younger adults showed reliably greater memory for voice and location information than older adults. The directed encoding tasks, by contrast, directly oriented participants to perceptual source information and encouraged participants to integrate that information with target items. In these studies, older adults performed as well as younger adults on the voice and location source tasks. These findings suggested that older adults do not spontaneously focus on perceptual details at encoding, and this neglect of perceptual information is responsible for age-related deficits in memory for that information. In related work, Hashtroudi and colleagues (Hashtroudi et al., 1990, 1994) found that older adults recalled more thoughts, feelings, and evaluative statements and fewer sensory and perceptual details of an event than did younger adults; however, when older adults were instructed to focus on factual or perceptual aspects of an event, age deficits in memory for those details were reliably attenuated.

Together, these findings suggest that (a) older adults do not place heavy emphasis on perceptual aspects of an event and (b) they instead spontaneously focus on meaningful, value-based or emotional dimensions when encoding information. Because emotional material is more engaging to older adults, it may evoke more elaborative, detailed processing. Thus, these data are consistent with the well-documented finding that the focus at encoding is an essential determinant of what is remembered and that successful recollection is tied to distinctive, elaborative processing (e.g., Craik & Lockhart, 1972; Hay & Jacoby, 1999; Mantyla & Backman, 1990; Morris, Bransford, & Franks, 1977; Tulving & Thompson, 1973). Finally, the findings suggest that age differences in source memory reflect, at least in part, age differences in processing priorities, with younger and older adults likely to emphasize and elaborate different aspects of an event. It is not clear from the existing data, however, exactly what aspects of an event receive processing priority for older adults, and more specifically whether emotion is an essential dimension of significance. For example, we know that older adults, in an undirected encoding task, are successful at recalling truth and character information (Rahhal et al., 2002), but it is not clear whether the advantage for that information stems from an emotional component of the information or simply from the fact that the information is conceptual (rather than perceptual) in nature. It is precisely this question that we sought to address in our investigation.

One goal of our research was to compare memory for three types of contextual information: (a) perceptual; (b) conceptual, but not emotional; and (c) conceptual, emotional material. To this end, we differentiated between contextual information that was simply conceptual or meaning based in nature and contextual information that was conceptual and included an emotional component as well. In doing so, we hoped to determine whether older adults' heightened source performance derives specifically from the addition of emotional cues or whether it extends more generally to all meaning-based contexts, even those that are relatively neutral in valence.

In Experiment 1, younger and older adults learned about food items that were to be served at a wedding. For all participants, two contextual cues, one perceptual and one conceptual, were linked with each item. Some participants learned about the location of the food (a perceptual cue) and its serving temperature (a conceptual, nonemotional cue); for example, they learned that the food on the left was to be served hot. Other participants learned about the location of the food (a perceptual cue) and its safety (a conceptual, emotional cue); for example, they learned that the food on the left was spoiled and would make guests ill. Thus, all participants learned about the location of the food. For half of the participants, location was linked with serving temperature, and for the other half of the participants, location was linked with food safety.

At test, participants completed one of three different source tasks: (a) a perceptual task that required a judgment of left, right, or new; (b) a conceptual, nonemotional task that required a judgment of hot, cold, or new; or (c) a conceptual, emotional task that required a judgment of safe, rotten, or new. We note that the perceptual and conceptual sources were always linked, and that each source test involved three optional responses. We adopted this design so that the number of sources, the perceptual and cognitive cues for the source, the manner in which the source information was conveyed, and the number of response options at test were identical across experimental conditions. Thus, the only difference across conditions was the nature (perceptual–conceptual–emotional) of the source task.

In Experiment 2, younger and older adults learned about fictitious automotive vehicles on the market. As in Experiment 1, two contextual cues, one perceptual and one conceptual, were linked with each item. Some participants learned about the color of the car (a perceptual cue) and its class (a conceptual, nonemotional cue); for example, they learned that the Horizon by Mazda was a red luxury car. Other participants learned about the color of the car (a perceptual cue) and its safety (a conceptual, emotional cue); for example, they learned that the Horizon by Mazda was red and was rated as dangerous. As in Experiment 1, participants completed one of three different source tasks: (a) a perceptual task that required a judgment of red, green, or new; (b) a conceptual, nonemotional task that required a judgment of luxury, economy, or new; or (c) a conceptual, emotional task that required a judgment of safe, dangerous, or new. Again, because the perceptual and conceptual sources were always linked, the number of sources, the manner in which the source information was conveyed, and the number of response options at test were identical across experimental conditions.

To preview the findings, we replicated a large literature showing age-related deficits in source memory for perceptual information (e.g., Benjamin & Craik, 2001; Brown et al., 1995; Ferguson et al., 1992; McIntyre & Craik, 1987; Schacter et al., 1991; Trott et al., 1997, 1999), as older adults in our studies were less able than younger adults to accurately report the location of food items or the color of automobiles. In addition, we found robust age differences in source memory for conceptual information that was not emotional in nature; specifically, older adults demonstrated relatively poor memory for the serving temperature of food items and the quality or class of automobiles. Older adults were successful, however, in reporting source information with an emotional component in both studies: They performed as well as younger adults in reporting whether food was fresh or spoiled and whether automobiles were safe or dangerous.

Experiment 1

Method

Participants. Eighty-four students (*M* age = 19.4 years, range = 17–24 years) from the College of Charleston participated as one way of earning extra credit for a psychology course. Eighty-four older adults (*M* age = 68.5 years, range = 60–78 years) also participated in the experiment. These older adults were healthy, community-dwelling volunteers who were reimbursed for their time and parking.

Design. This experiment used a 2 × 3 factorial design, with age (young vs. old) and test type (perceptual vs. conceptual vs. conceptual–emotional) varied across participants.

Materials. Materials for this study included 36 different food items that could be served hot or cold (e.g., oysters, artichoke dip, sesame carrot sticks), and these items ostensibly were to be served to guests at a wedding reception. For each participant, 24 of the food items served as target items in the learning phase and the remaining 12 items served as new foil items in the test phase. Two sets of contextual cues were linked to the items. In the perceptual plus nonemotional, conceptual condition (P-NEC), half of the learning-phase items were linked with one set of perceptual plus nonemotional, conceptual cues (e.g., the item was located on the right and served hot), and the other half of the items were linked with the contrasting set of perceptual plus nonemotional, conceptual cues (e.g., the item was located on the left and served cold). In the perceptual plus emotional, conceptual condition (P-EC), half of the learning-phase items were linked with one set of perceptual plus emotional, conceptual cues (e.g., the item was located on the right and was spoiled), and the other half of the items were linked with the contrasting set of perceptual plus emotional, conceptual cues (e.g., the item was located on the left and was safe). Within each age group and cue pairing, items were counterbalanced so that each food item appeared on the right, on the left, or served as a new item an equal number of times.

Procedure. At the start of the session, participants completed a consent form, a general health-education questionnaire, and a Morningness–Eveningness Questionnaire (MEQ; Horne & Ostberg, 1976). Normative studies indicate that the majority of young adults tend to be evening and neutral types, whereas most older adults tend to be morning types, and accumulating evidence suggests that morningness–eveningness tendencies can affect cognitive functioning (e.g., Hasher, Zacks, & May, 1999; May, 1999; May & Hasher, 1998). Consequently, all younger adults in this study were tested in the afternoon and evening (i.e., 1200–1800), and all older adults were tested in the morning (i.e., 0800–1200).

For the learning phase, participants were instructed that they would view a series of food items presented individually on either the left or the right side of the computer screen. Forty-two younger and 42 older adults participated in the P-NEC condition, and they were informed that item location was linked with serving temperature, for example, that items on the right were to be served hot. The remaining 42 younger and 42 older adults participated in the P-EC condition, and they were informed that item location was linked with safety, for example, that items on the right side were spoiled and would make guests ill if served. All participants were informed that they should remember both the perceptual context (i.e., location) and the conceptual context (i.e., temperature or safety) for each item.

When participants fully understood the instructions, the learning phase began. Each item was presented in the center of the computer screen for 4 s. Items were presented in a pseudorandom order, with the constraint that no more that two items appeared in the same location consecutively. When the learning phase was complete, participants engaged in a nonverbal distractor task. For this task, participants spent 5 min creating novel designs for different objects (e.g., lampshades and neckties).

After the distractor task, all participants completed one of three different source-memory tests. In all three source tests, participants viewed 36 food items (24 old items and 12 new foils), and made a 3-alternative forced choice decision for each. Half of the participants in the P-NEC condition as well as half of the participants in the P-EC condition completed a perceptual source task in which they decided whether each item had appeared on the right, had appeared on the left, or was new. In this way we were able to examine performance on a perceptual source test for those who had location paired with a nonemotional cue relative to those who had location paired with an emotional cue. The remaining participants in the P-NEC condition completed a conceptual, nonemotional source task in which they decided whether each item was served hot, served cold, or was new. The remaining participants in the P-EC condition completed the conceptual, emotional source task in which they decided whether each item was safe, spoiled, or new. All participants were given as much time as

Table 1
Demographic Information for Participants in Experiments 1 and 2 (n = 84)

	Age		YOE		ERVT		MEQ	
Group	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Experiment 1								
Young	20.4	2.1	14.2	1.3	17.1	6.0	41.3	11.7
Old	68.3	5.6	15.0	2.4	28.0	10.7	61.7	8.0
Experiment 2								
Young	19.4	1.4	13.6	1.2	18.9	7.0	41.3	9.0
Old	68.6	5.0	15.6	2.8	29.7	9.2	63.4	8.9

Note. YOE = Years of education; ERVT = Extended Range Vocabulary Test; MEQ = Morningness-Eveningness Questionnaire.

needed to complete the test. Following the source-memory test, all participants were given the Extended Range Vocabulary Test (ERVT; Educational Testing Service, 1976) and were debriefed.

Results and Discussion

Participants. Four younger and 7 older adults failed to follow instructions in the source-monitoring task (e.g., they reported that they only attended to stimuli on the right side of the computer screen). Their data were omitted from analyses and were replaced with that of new participants. Demographic information for the final 84 younger and 84 older participants is displayed in Table 1. A 2 (age) × 3 (test type) analysis of variance (ANOVA) was conducted to assess differences in vocabulary, years of education, and MEQ scores. Relative to younger adults, older adults reported significantly more years of education, $F(1, 167) = 4.42$, $MSE = 3.71$, and they scored reliably higher on the ERVT, $F(1, 167) = 48.90$, $MSE = 76.43$. In addition, the mean MEQ score for younger adults fell in the neutral-type range, whereas the score for older adults was reliably higher and fell in the morning-type range, $F(1, 167) = 65.63$, $MSE = 99.10$. There were no main effects and no interactions with test type (all Fs < 1).

Item recognition. Although the focus of this study was memory for contextual information rather than for item recognition, we did examine hit rates and false alarms for younger and older adults in each condition. Mean hit and false-alarm rates for each age group and condition are reported in Table 2.[1] Consistent with other findings in the literature, a 2 (age) × 3 (test type) ANOVA showed a main effect of age on hit rates, $F(1, 167) = 5.46$, $MSE = 0.01$, with younger adults showing a modest but reliable advantage over older adults. There was no effect of test type and no Age × Test Type interaction (Fs < 1) on hit rates. In addition, false alarms were equivalent across age groups and test types (all Fs < 1).

Source performance. To assess source memory, we examined whether participants could identify the correct source of an item (i.e., right vs. left, hot vs. cold, safe vs. toxic), given that they knew the item was in fact old. Thus, source-monitoring scores were calculated, as is often the case, by dividing the total number of old items correctly attributed to the appropriate source by the total number of old items correctly identified as old (hits; e.g., Ferguson et al., 1992; Johnson, De Leonardis, Hashtroudi, & Ferguson, 1995).

Table 2 displays younger and older adults' source-monitoring scores for each of the different source tests. Source scores were analyzed in a 2 × 3 ANOVA with age (young vs. old) and test type (P-NEC and P-EC) as between-participants variables. This analysis indicated a main effect of age, $F(1, 167) = 13.24$, $MSE = 0.01$, with younger adults generally showing higher source scores than older adults and a main effect of test type, $F(2, 167) = 5.30$, $MSE = 0.01$. These main effects were qualified, however, by a reliable Age × Test Type interaction, $F(2, 167) = 3.30$, $MSE = 0.01$. Further examination of this interaction showed that younger adults outperformed older adults on both the perceptual test, $F(1, 167) = 11.00$, $MSE = 0.01$, and the conceptual, nonemotional test, $F(1, 83) = 19.75$, $MSE = 0.01$. By contrast, there was no age difference in source performance on the conceptual, emotional test ($F < 1$).

We note that the lack of an age effect on the conceptual–emotional test was driven by changes in older rather than younger adults' performance. Younger adults showed no change in memory scores across test types ($F < 1$), suggesting that they were equally able to report contextual information that was perceptual in nature, conceptual but neutral in nature, or conceptual and emotional in nature. Older adults, by contrast, showed a reliable effect of test type, $F(2, 83) = 7.16$, $MSE = 0.01$, with reliably greater memory for conceptual, emotional contextual information than either perceptual, $F(1, 83) = 10.6$, $MSE = 0.01$, or conceptual, neutral material, $F(1, 83) = 10.83$, $MSE = 0.01$. Thus, emotional contexts appear to have a special status for older adults, as they are able to remember them as well as younger adults do.

In summary, this study showed that older adults were less able than younger adults to recall the location and serving temperature of food items at a hypothetical wedding reception. Older adults were just as successful as younger adults, however, in remembering whether the food items were fresh or rotten. This pattern of age differences across our three source-monitoring tasks suggests that, relative to younger adults, older adults are less likely to spontaneously orient to contextual details that are perceptual in nature or to contextual details that are meaning based but relatively neutral in

[1] For each age group, half of the participants in the P-NEC and half of the participants in the P-EC learning conditions were given a perceptual memory test in which they were to judge whether items appeared on the left, appeared on the right, or were new. Within each age group, performance on neither the item recognition test nor the source test differed across these two learning conditions (Fs < 1), and thus, for ease of presentation the data were collapsed for all further analyses.

Table 2
Mean and Standard Deviation Scores for Younger and Older Adults in Experiment 1

	Test Type					
	Perceptual		Nonemotional Conceptual		Emotional Conceptual	
Age Group	*M*	*SD*	*M*	*SD*	*M*	*SD*
Young						
Hits	91	8	87	9	87	12
False alarms	26	32	23	23	22	22
Source memory	83	8	82	8	84	8
Old						
Hits	84	11	83	15	85	14
False alarms	22	18	28	28	24	20
Source memory	74	8	74	12	84	8

Note. Hits = Total percentage of old items correctly identified as old; False alarms = Total percentage of new items identified as old; Source-memory score = Total number of old items attributed to the correct source/total number of old items correctly identified as old (hits).

valence. By contrast, older adults do seem to place substantial emphasis on emotional information and process affective material to such an extent that their memory for affective details is equivalent to that of younger adults.

Experiment 2

In Experiment 2, we sought to replicate and extend the findings from our first study by selecting different materials and different perceptual and conceptual contexts. We again compared younger and older adults' memory for three different types of contextual material: (a) perceptual; (b) conceptual, but nonemotional; and (c) conceptual and emotional. In this study, (a) our perceptual context was car color (red vs. green); (b) our conceptual, nonemotional context was car class (economy vs. luxury); and (c) our conceptual, emotional context was car safety (safe vs. dangerous). In all other respects the study was identical to Experiment 1.

Method

Participants and design. Eighty-four new students (*M* age = 19.4 years) from the College of Charleston participated as one way of earning extra credit for a psychology course. Eighty-four new older adults (*M* age = 68.4), drawn from the same population used in Experiment 1, also participated in the experiment and were reimbursed for their time and parking fees. This experiment replicated the 2 (age) × 3 (test type) factorial design used in Experiment 1.

Materials. Materials for the source task included the names of 36 fictitious car models, each paired with the names of actual car manufacturers (e.g., Vectra by Subaru). For each participant, 24 of the car model-maker pairs were presented during the learning phase, and the remaining 12 items served as new foils in the test phase. As in Experiment 1, two sets of contextual cues were linked to the items. In the P-NEC condition, half of the learning-phase items were linked with one set of perceptual plus nonemotional, conceptual cues (e.g., red and economy), and the other half of the items were linked with the contrasting set of perceptual plus nonemotional, conceptual cues (e.g., green and luxury). In the P-EC condition, half of the items were linked with one set of perceptual plus emotional, conceptual cues (e.g., red and dangerous), and the remaining items were linked with the contrasting set of perceptual plus emotional, conceptual cues (e.g., green and safe). Items were counterbalanced so that within each age group and condition, all model-maker pairs served red items, green items, and new items an equal number of times.

Procedure. As in Experiment 1, all younger adults in this study were tested in the afternoon and evening (i.e., 1200–1800), and all older adults were tested in the morning (i.e., 0800–1200).

All participants were tested individually, and at the start of the session participants completed a consent form and a general health-education questionnaire. In the learning phase, participants were instructed that they would view a series of car names presented individually on the computer screen and that the model-maker information would appear in one of two colors: red or green. Forty-two younger and 42 older adults participated in the P-NEC condition, and they were informed that item color was linked to item class, with the color green linked with luxury and the color red linked with economy cars. The remaining 42 younger and 42 older adults participated in the P-EC condition, and they were informed that car color was linked to safety, with green indicating a safe car and red indicating a dangerous car. All participants were informed that they should remember both the perceptual context (i.e., color) and the conceptual context (i.e., class or safety) for each item.

When participants fully understood the instructions, the learning phase began. Each item was presented in the center of the computer screen for 4 s. Items were presented in a pseudorandom order, with the constraint that no more that two items of the same color appeared consecutively. When the learning phase was complete, participants engaged in the same nonverbal distractor task used in Experiment 1.

After the distractor task, all participants completed one of three different source-memory tests, which were analogous to those used in Experiment 1. In all three source tests, participants viewed 36 car model-maker pairs (24 old items and 12 new foils), and they made a 3-alternative forced-choice decision for each. As in Experiment 1, half of the participants in the P-NEC condition as well as half of the participants in the P-EC condition completed a perceptual source task in which they decided whether each item had appeared in red, had appeared in green, or was new. The remaining participants in the P-NEC condition completed a conceptual, nonemotional source task in which they decided whether each car was a luxury car, was an economy car, or was new. The remaining participants in the P-EC condition completed the conceptual, emotional source task in which they decided whether each car was safe, dangerous, or new. All participants were given as much time as needed to complete the test. All participants then completed the ERVT (Educational Testing Service, 1976) and were debriefed.

Results and Discussion

Participants. Data from five younger and eight older adults had to be omitted from the analyses because of failure to follow instructions or an inability to complete the task. The data were replaced with those of new participants. Demographic information for the final 84 younger and 84 older participants is displayed in Table 1. A 2 (age) × 3 (test type) ANOVA was conducted to assess differences in vocabulary, years of education, and MEQ scores. Relative to younger adults, older adults reported significantly more years of education, $F(1, 167) = 37.90$, $MSE = 4.40$, and they scored reliably higher on the ERVT, $F(1, 167) = 73.5$, $MSE = 65.40$. In addition, the mean MEQ score for younger adults fell in the evening-type range, whereas the mean MEQ score for older adults was reliably higher and fell in the morning-type range, $F(1, 167) = 252.40$, $MSE = 80.70$. There were no main effects and no interactions with test type (all Fs < 1).

Item recognition. As in Experiment 1, we again examined hit rates and false alarms for younger and older adults in each condi-

tion, and means for these measures are reported in Table 3.[2] A 2 (age) × 3 (test type) ANOVA showed a main effect of age on hit rates, $F(1, 167) = 5.90$, $MSE = 7.90$, with younger adults showing a modest but reliable advantage over older adults. There was neither a main effect of test type, $F(2, 167) = 1.75$, $MSE = 7.90$, nor an Age × Test Type interaction ($F < 1$) on hit rates. False alarms were marginally higher for older relative to younger adults, $F(1, 167) = 2.85$, $MSE = 0.07$, but there was no effect of test type and no Age × Test Type interaction (Fs < 1).

Source performance. As in Experiment 1, source-monitoring scores were calculated by dividing the total number of old items correctly attributed to the appropriate source by the total number of hits. Mean source scores for each age group and test type are reported in Table 3.

Source scores were analyzed in a 2 × 3 ANOVA with age (young vs. old) and test type (P-NEC and P-EC) as between-participants variables. This analysis indicated a main effect of age, $F(1, 167) = 19.50$, $MSE = 0.01$, with younger adults generally showing higher source scores than older adults. There was also a significant Age × Test Type interaction, $F(2, 167) = 3.24$, $MSE = 0.01$. The pattern of performance driving this interaction was identical to that in Experiment 1: Younger adults outperformed older adults on both the perceptual test, $F(1, 167) = 19.80$, $MSE = 0.01$, and on the conceptual, nonemotional test, $F(1, 83) = 21.3$, $MSE = 0.01$, but there was no effect of age on the conceptual, emotional test ($F < 1$). Also as in Experiment 1, younger adults again showed no change in memory scores across test types ($F < 1$), suggesting that the nature of the contextual information did not influence their memory. Older adults, however, showed a reliable change in memory scores across test types, $F(2, 83) = 3.30$, $MSE = 0.01$, with reliably greater memory for conceptual, emotional contextual information than either perceptual, $F(1, 83) = 5.5$, $MSE = 0.01$, or conceptual, neutral material, $F(1, 83) = 4.90$, $MSE = 0.01$.

In summary, the data here are analogous to those from Experiment 1: Older adults were less able than younger adults to recall perceptual details (i.e., color) and nonemotional, conceptual details (i.e., class or quality) of fictitious car models, but they were successful at reporting safety information about those cars. These findings thus lend further support to the hypothesis that older adults fail to focus on perceptual details of an event, or even on conceptual details that do not carry emotional significance. Without external prompting, older adults seem to place greater emphasis on material that is affective in nature, showing heightened memory for emotional relative to neutral details and demonstrating recall that is equivalent to that of younger adults.

Table 3
Mean and Standard Deviation Scores for Younger and Older Adults in Experiment 2

	Test Type					
	Perceptual		Nonemotional Conceptual		Emotional Conceptual	
Age Group	*M*	*SD*	*M*	*SD*	*M*	*SD*
Young						
Hits	84	11	90	8	87	12
False alarms	28	25	30	28	28	29
Source memory	74	12	71	10	70	15
Old						
Hits	78	14	85	10	83	13
False alarms	34	34	35	33	38	35
Source memory	63	12	62	11	70	10

Note. Hits = Total percentage of old items correctly identified as old; False alarms = Total percentage of new items identified as old; Source-memory score = Total number of old items attributed to the correct source/total number of old items correctly identified as old (hits).

General Discussion

The present investigation examined whether the source-memory deficits typically observed with age might be attenuated if the source information contained a significant emotional component. Across two studies, we compared younger and older adults' memory for three different types of contextual details: perceptual details (e.g., location and color), conceptual or meaning-based details that were neutral in valence (e.g., automobile class), and conceptual details that were emotional in nature (e.g., the safety of food items). In each experiment, younger adults demonstrated reliably better memory than older adults for both perceptual details and conceptual, nonemotional details; however, the two age groups did not differ in their memory for emotional contexts. We note that the only difference across source conditions was the nature of the contextual material. The number of sources, the amount and quality of contextual cues, the way in which the contextual information was conveyed, and the number of response options at test were all identical across the perceptual, conceptual–nonemotional, and conceptual–emotional conditions. Thus, the benefit older adults demonstrated in source memory for food and vehicle safety appears to stem directly from the emotional nature of the information.

Our findings add to a growing literature that shows that older adults, like younger adults, experience a significant memorial advantage for emotional relative to neutral stimuli (Carstensen & Turk-Charles, 1994; Denburg et al., 2003; Fung & Carstensen, 2003; Kensinger et al., 2002). Although some studies show that the memorial advantage for negative and positive stimuli is similar across age groups (Denburg et al., 2003; Kensinger et al., 2002), others suggest that older adults show a smaller memorial advantage for negative stimuli than do younger adults (e.g., Charles et al., 2003). The present findings might be interpreted as evidence for enhanced memory of negative information with age, as older adults may have remembered food items that were rotten (Experiment 1) and vehicles that were dangerous (Experiment 2). However, it is also possible that the source-memory benefit demonstrated by older adults reflects a focus on the positive aspects of the emotional context, that is, they may have emphasized the safety of food items and vehicles. Although it is not clear from the present design whether the memorial advantage for emotional contexts stems from a focus on the negative, the positive, or both, it is clear that the advantage was robust for older participants.

These findings of enhanced memory for emotional material in older adults are consistent with neuroscientific studies of the amygdala, a region of the brain integral to the interaction between emotion and

[2] As it is in Experiment 1, the performance on the location test did not differ for those in the P-NEC versus the P-EC conditions. The data were thus collapsed for all analyses.

memory (e.g., Bianchin, Mello e Souza, & Medina, 1999; Cahill & McGaugh, 1998). Although the evidence regarding age-related changes in the amygdala is limited, preliminary data suggest that the amygdala may be relatively less vulnerable to the effects of aging than other brain regions, with only modest reductions in amygdaloid volume with age (e.g., Smith et al., 1999). The relatively moderate age-related changes in the amygdala may allow for relatively spared emotional capabilities later into the lifespan.

The present data also lend support to the socioemotional selectivity theory of aging (e.g., Carstensen, Gross, & Fung, 1997; Carstensen et al., 1999; Isaacowitz et al., 2000), which contends that emotional goals and information become increasingly salient and important as individuals age and time becomes more limited. The theory posits that as individuals come closer to the end of life, their priorities and objectives shift from knowledge-related goals (e.g., information seeking) to emotion-related goals (e.g., deriving meaning from life, feeling good). Because of this increased relevance of emotion to older adults, emotion becomes more central in all facets of cognitive processing (Carstensen et al., 1997; Isaacowitz et al., 2000). Consistent with this premise, evidence from other studies indicates that older adults naturally report more subjective, emotional details about an event than do younger adults (Hashtroudi et al., 1990, 1994; Smith, 1996). This heightened interest in emotional information may result in more elaborative, distinctive processing of the material. Emotional contexts may engage older adults to a greater extent than perceptual contexts, and this enhanced motivation may elicit more associations and elaborations, which in turn lead to better recall (Craik & Lockhart, 1972; Doerksen & Shimamura, 2001; Hay & Jacoby, 1999; Morris, Bransford, & Franks, 1977).

The possibility that age-related differences in source monitoring may be influenced by encoding processes challenges the notion that source memory relies to a great extent on the integrity of the frontal lobes, and that older adults, who generally suffer diminished frontal functioning relative to younger adults, will necessarily perform poorly on source-memory tasks (Coffey et al., 1992; Raz, 2000; Raz et al., 1997). There is now growing evidence from the present data and related studies (e.g., Glisky et al., 2001; Rahhal et al., 2002) that older adults can recall source information as well as younger adults in some situations. Clearly the processing performed at encoding and the nature of the source material play a significant role in the magnitude of age differences observed. We should note, however, that at least in our studies, older adults were all tested at their peak times of day, and thus, the heightened source-memory performance for emotional material may be limited to optimal times.

Finally, the present data add to a growing literature that suggests that older adults' memory for emotionally meaningful material may be relatively better than their memory for other types of material. Older adults, for example, report relatively more emotional and evaluative details than perceptual details about real and imagined events (Hashtroudi et al., 1990) and are more successful in identifying and reporting the underlying meaning of a passage than the factual details (Adams et al., 1997). They also show better memory for emotionally meaningful advertisements than for knowledge-related advertisements (Fung & Carstensen, 2001). These findings suggest that although general memory performance does decline with age, memory for affective or value-based information is relatively spared with age. As people age, they appear to be more motivated to remember information that is relevant to their primary goals, namely, goals that are emotionally meaningful.

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