Viewing Instructions Impact Emotional Memory Differently in Older and Young Adults

Lisa Emery, Thomas M. Hess

ABSTRACT

The current study examines how the instructions given during picture viewing impact age differences in incidental emotional memory. Previous research has suggested that older adults' memory may be better when they make emotional rather than perceptual evaluations of stimuli and that their memory may show a positivity bias in tasks with open-ended viewing instructions. Across two experiments, participants viewing photographs either received open-ended instructions or were asked to make emotionally focused (Experiment 1) or perceptually focused (Experiment 2) evaluations. Emotional evaluations had no impact on older adults' memory, whereas perceptual evaluations reduced older adults' recall of emotional, but not of neutral, pictures. Evidence for the positivity effect was sporadic and was not easier to detect with open-ended viewing instructions. These results suggest that older adults' memory is best when the material to be remembered is emotionally evocative and they are allowed to process it as such.
The traditional focus in the study of memory and aging has been on determining which basic cognitive factors may account for age-related declines or differences in memory performance. More recently, however, the field has seen a surge of interest in the impact of noncognitive factors, such as emotion and motivation, on age differences in memory (Carstensen, Mikels, & Mather, 2006; Hess, 2005). Research on the impact of emotion on older adults' memories has taken two courses, one more cognitively focused and intended to determine the impact of emotionally evocative stimulus material on subsequent memory, and one more motivationally focused, intended to determine how older adults' motivational state may impact the qualitative aspects of what they remember.

From a cognitive perspective, most studies examining the relationship between emotion and memory have examined what we will refer to as the emotionally enhanced memory (EEM) effect (see Talmi, Schimmack, Paterson, & Moscovitch, 2007). Broadly speaking, this is the finding that emotionally evocative material is “better” remembered than emotionally neutral material. This basic EEM effect has been demonstrated in studies of young adults with a variety of materials (e.g., Kensinger & Corkin, 2003; Ochsner, 2000; Talmi et al., 2007) and generally is found to remain intact in older adults (Comblain, D'Argembeau, Van der Linden, & Aldenhoff, 2004; Denburg, Buchanan, Tranel, & Adolphs, 2003; Gruhn, Smith, & Baltes, 2005; Kensinger, Brierle, Medford, Growdon, & Corkin, 2002). Although the impact of emotion on memory may occur at any stage (see LaBar & Cabeza, 2006, and Phelps, 2006, for reviews), the current study focuses on the effect of emotion during (incidental) encoding. Previous research has suggested that an emotionally evocative stimulus obtains a privileged status at presentation (e.g., Öhman, Flykt, & Esteves, 2001; Phelps, Ling, & Carrasco, 2006), directing attention to the emotional relevant material and thus making it more memorable (e.g., Kensinger, Piguet, Krendl, & Corkin, 2005). Note that in this case, it is an external stimulus that evokes the emotion and captures attention. That is, it is a bottom-up process that presumably occurs quickly and without the use of cognitive resources and, as such, may be expected to show little relationship to age.

From a motivational perspective, studies of emotion and memory have focused on how the different motivational goals of young and older adults may change the nature of what people remember. Here, the focus has been on determining whether older adults remember qualitatively different things than do young adults in support of (or as a result of) emotionally relevant goals. In this view, emotionally relevant goals exert top-down influence on memory that may or may not require the use of cognitive resources. Much of the recent research into the impact of emotion-driven motivational factors on memory has been done from the perspective of socioemotional selectivity theory (SST; see Mather & Carstensen, 2005). Among these studies, there has been a focus on what SST proponents refer to as the positivity effect in older adults' memory, in which older adults show a larger proportion of positive than negative material in their recollections, whereas young adults show the opposite pattern (e.g., Charles, Mather, & Carstensen, 2003; Mather & Carstensen, 2003; Mather & Knight, 2005). This can result in a situation in which the EEM effect for negative stimuli is reduced in older adults, as indicated by an Age × Valence interaction in the memory measure that is primarily driven by older adults' reduced memory for negative pictures.
Among the studies conducted from a more cognitive perspective, however, there is less systematic support for the positivity effect in older adults' memory, as typically no Age × Valence interaction is seen in the memory measures (e.g., Comblain et al, 2004; Denburg et al., 2003; Gruhn et al., 2005; Kensinger et al., 2002; but see Leigland, Schulz, & Janowsky, 2004). One possibility for the discrepancy is that the studies conducted from the SST motivational perspective typically have relatively open-ended viewing instructions, simply telling participants to watch the stimuli as if they were “watching them on television,” rather than giving specific orienting or memorization instructions (such as asking participants to rate the pictures, focus on their feelings, or simply remember the pictures for later recall). Such open-ended instructions may increase the impact of age-related chronic goals on performance and make the positivity effect more robust and easier to detect. Although this explanation has been suggested by SST researchers (Mather & Carstensen, 2005; Mather & Knight, 2005), to our knowledge it has not been directly tested.

Putting aside for a moment the notion of positivity, two broader questions can be asked about the effect of viewing instructions on memory for emotional and neutral stimuli: (a) Does asking participants to focus on a particular aspect of the stimuli influence the size or nature of the EEM effect, and (b) Do different viewing instructions have the same effect on older and young adults?

With respect to the first question, research conducted on young adults suggests that varying the level of processing through the viewing instructions has little influence on the presence of the EEM effect (e.g., Ochsner, 2000). However, to our knowledge, no one has compared emotional viewing instructions with an open-ended viewing condition (as is used in the SST studies), and this manipulation has never been tested in older adults.

There are several recent studies of aging that suggest that the type of viewing instructions given might impact older adults differently than young adults. For example, two recent studies in the source memory literature suggested that older adults may have better source memory when the information to be remembered is linked to an emotional cue at encoding than when it is linked to a perceptual cue (May, Rahhal, Berry, & Leighton, 2005; Rahhal, May, & Hasher, 2002). May, Rahhal, and colleagues have suggested that this may be because the emotional cue engages older adults more than the perceptual cue does. Similarly, Mikels, Larkin, Reuter-Lorenz, and Carstensen (2005) found that when participants were asked to focus on and maintain the emotional feelings evoked by a picture, older and young adults performed more similarly than when they were asked to focus on and maintain the perceptual aspects (brightness) of a picture. It is possible, therefore, that asking participants to rate stimuli for emotion may result in young and older adults performing similarly, whereas asking participants to rate stimuli for perceptual aspects may impair older adults specifically.

The main goal of the current study, then, was to examine how viewing instructions might influence age differences in emotional memory. Within this context and given discrepancies among previous studies, we also hoped to better delineate under what circumstances the positivity effect may emerge. Across two experiments, older and young participants watched a series of negative, neutral, and positive pictures. In Experiment 1, participants were asked either to view the pictures as if they were watching them on television or to rate the pictures for
emotionality; in Experiment 2, participants were asked either to view the pictures as if watching them on television or to rate the pictures for visual complexity. After a delay, participants were given surprise recall and recognition tests for the pictures. In Experiment 1, we hypothesized that requiring participants to rate the pictures for emotionality would result in the elimination of the Age × Valence interaction that would be found in the “watching” condition and that this would specifically be due to increased memory for negative pictures in the older adults. In Experiment 2, we hypothesized that requiring participants to rate the pictures for a perceptual characteristic (visual complexity) would have little influence on young adults’ memory but might be detrimental for older adults’ memory.

**EXPERIMENT 1**

**Method**

**Participants**

Older adult participants (N = 58) were recruited from the Raleigh, North Carolina, metropolitan area via newspaper advertisements and received $20 for participation. Young adults (N = 59) were recruited from introductory psychology classes at North Carolina State University and received course credit for participation. During the course of the study, participants were screened for possible memory problems with the Short Blessed Orientation–Memory–Concentration Test (Katzman et al., 1983) and for possible depression with the short version of the Geriatric Depression Scale (GDS; Sheikh & Yesavage, 1986). Following conventional suggestions (Lezak, Howieson, & Loring, 2004), participants who scored above 6 on the Short Blessed test or above 9 on the GDS were excluded from analysis. This resulted in the exclusion of 1 young and 3 older participants, with 58 young adults (27 women and 31 men) and 55 older adults (29 women and 26 men) composing the final study sample.

Participant characteristics for each age group are presented in Table 1. Our sample showed typical age differences in education, physical and mental health (SF–36 Health Survey; Ware, 1993), verbal ability (Vocabulary Test 2 from the Kit of Factor-Referenced Cognitive Tests; Ekstrom, French, Harman, & Derman, 1976), and processing speed (Letter and Pattern Comparison Tests; Salthouse & Coon, 1994), as well as commonly found age differences in positive and negative affect (Positive and Negative Affect Schedule [PANAS] Watson, Clark, & Tellegen, 1988). Interestingly, our participants did not show age differences in working memory (an Operation Span test; Turner & Engle, 1989) or in reported use of the emotion-regulation strategies of reappraisal and suppression (Emotion Regulation Questionnaire; Gross & John, 2003). Note that there were no differences across conditions within each age group (ps > .10) on any of these characteristics, indicating successful random assignment to the study conditions.
Participant Characteristics in Experiment 1 and Experiment 2

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<th>Young SD</th>
<th>Older M</th>
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*Note. SF–36 = SF–36 Health Survey; ERQ = Emotion Regulation Questionnaire; PANAS = Positive and Negative Affect Schedule.

<sup>a</sup> Age difference significant at *p* < .05.

Participant Characteristics in Experiment 1 and Experiment 2

**Apparatus**

All computer-administered portions of the experiment were run on a desktop microcomputer using E-Prime software (Version 1.1, Psychology Software Tools, Pittsburgh, PA).

**Materials**

Negative, neutral, and positive pictures were chosen from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2001). Prior to picture selection, three raters (two undergraduate research assistants and Lisa Emery) coded the entire set of IAPS pictures for
content (i.e., whether the picture contained people, animals, scenery, and so on) and evoked emotion (i.e., sadness, disgust, happiness). For pictures that contained people, the raters further coded the apparent age group of the people in the pictures into four categories: babies/children, teens/young adults, middle-aged adults, and older adults. Each picture could, of course, contain more than one type of content or age group and evoke more than one emotion. At least two of the three raters had to agree on a categorization for a picture to be considered for inclusion in the study.

The pictures were then selected with the following constraints. First, all pictures had to contain a person. Second, the positive pictures were picked to evoke “happiness,” and the negative pictures were picked to evoke “sadness.” Third, within each level of valence, four pictures were selected from each of the four age categories. Fourth, positive and negative pictures were selected so that the absolute difference of their IAPS valence rating from the center of the scale was the same. Finally, the pictures were selected so that the IAPS arousal ratings were statistically the same for the positive and negative pictures.

The list of IAPS pictures used in the study is presented in the Appendix. The IAPS valence ratings for the pictures used were significantly different across picture categories, $F(2, 45) = 477.24, p < .05$, with positive pictures ($M = 7.36, SD = 0.32$) rated more highly than neutral pictures ($M = 5.02, SD = 0.49$), $t(30) = 16.16, p < .05$, which in turn were rated more highly than negative pictures ($M = 2.63, SD = 0.49$), $t(30) = 14.06, p < .05$. The IAPS arousal ratings also differed across picture valence, $F(2, 45) = 17.80, p < .05$, with positive pictures ($M = 4.51, SD = 0.77$) and negative pictures ($M = 4.57, SD = 0.47$) being equally arousing, $t(30) = .26, p > .10$, but each being more arousing than neutral pictures ($M = 3.41, SD = 0.56$), $t(30) = 6.30, p < .05$, for negative versus neutral pictures, and $t(30) = 4.57, p < .05$, for positive versus neutral pictures.

For the recognition test, these 48 pictures from the IAPS were combined with another 48 pictures, some of which were taken from the IAPS and some of which were taken from other sources (i.e., magazines, Web sites). To avoid ceiling effects in recognition, we showed participants a 3 × 3 inch fragment of each picture, rather than the entire picture as presented. Each fragment was formed by choosing a thematically and emotionally central element of the picture. For example, IAPS Photo 7325 is of a young girl in a green hat eating a slice of watermelon, and the segment was chosen to include the child’s face and a portion of the hat and the watermelon. Once the fragment of the original picture was chosen, a second picture that contained a similar element was chosen as the foil and was cropped to the same (3 × 3 inch) size. For example, the foil for Photo 7325 was a photograph of a different girl eating watermelon and included her face and the watermelon. The foils were chosen to match the valence and the apparent age of the people in the segment of the original picture.

Procedure

After filling out some background questionnaires, participants completed the PANAS, with the instruction to indicate to what extent they felt that emotion “today.” Participants were then given
the instructions for the picture-viewing tasks, with half of the participants in each age group being assigned to each study condition. Before starting the picture-viewing task, participants in the rating condition were told they would be rating each of the pictures “in terms of how it made you feel while viewing it”; participants in the watching condition were told simply to “watch [the pictures] as you would a television.”

During the picture viewing, each picture was presented on the screen for 5 s followed by a blank screen. When the blank screen was shown, participants in the rating condition indicated their ratings using a 5-point scale (1 = very negative, 3 = neutral, 5 = very positive) by pressing a labeled five-button response box; participants in the watching condition were told to press the middle button on the unlabeled response box to view the next picture when they were ready. In both conditions, participants had as much time as they wanted to press the button; after the button press, there was a 2,000-ms pause before the next picture was presented. The pictures were presented sequentially in a different random order for each participant. Besides the rating/watching instruction, other aspects of the procedure and timing were identical across conditions, with each group receiving the same amount of picture-viewing time.

Following picture presentation, participants completed the battery of cognitive tests. Picture memory was assessed following these tests, with the testing interval serving as a delay between study and recall. Differences in the time to complete the cognitive tests resulted in slightly longer delays for older than for young adults ($M = 30.1$ min, $SD = 6.0$ for older adults, $M = 26.6$ min, $SD = 4.4$ for young adults, with 1 missing data point), $t(110) = 3.51$, $p < .05$, but entering delay time as a covariate into the memory analyses did not alter any effects of age group on the memory tests reported below.

For the free recall test, participants were told to think back to the pictures they were shown at the beginning of the session, and to write down a “brief, one- or two-sentence description of all the pictures” they could remember. They were told to write their description so that “someone else who saw the pictures would recognize which picture” they were describing. Participants were given as much time as they needed to recall the pictures.

Participants then completed the recognition memory test. The 48 pictures and 48 matched foils were presented one by one on the computer screen, in a different random order for each participant. Participants were told to press the right-hand button (labeled “OLD”) if the fragment was part of a picture they had seen before and the left-hand button (labeled “NEW”) if the fragment was part of a new picture they had not seen before. Participants had as much time as they desired to respond to each picture.

Finally, participants in the watching condition were again shown the original set of pictures and were asked to rate the pictures on how the pictures made them feel while viewing them. After the debriefing, all participants were asked if they had suspected that they would be tested for their memory of the pictures while they were viewing the pictures the first time. The number of participants who had expected a memory test did not differ by age group (5 young adults and 7 older adults suspected a memory test), but participants in the watching condition were slightly more likely to suspect a memory test than participants in the rating condition (10 for watching
and 2 for rating). Excluding these participants from the analysis did not change any of the effects of age group on the memory tests reported below.

Results and Discussion
Manipulation Check

Because of a programming error, rating responses were not recorded for 17 young adults (7 in the watching condition, 10 in the rating condition) and 2 older adults (both in the watching condition). The ratings given to each picture by each age group are presented in the Appendix. In general, there was good agreement between the mean ratings assigned to pictures across age groups ($r = .98$), although older adults had a slight tendency to rate the pictures more positively than the young adults ($M = 3.12, SD = 0.23$ for older adults, $M = 3.00, SD = 0.20$ for young adults), $F(1, 90) = 7.12, p = .01, \eta^2_p = .07$. This effect of age did not interact with valence, $F(1, 90) = 1.28, p = .28, \eta^2_p = .01$. As expected, all participants rated the negative pictures ($M = 1.8, SD = 0.5$) lower than the neutral pictures ($M = 3.1, SD = .3$), $F(1, 90) = 621.11, p < .001, \eta^2_p = .87$, and the neutral pictures lower than the positive pictures ($M = 4.4, SD = 0.5$), $F(1, 90) = 742.45, p < .001, \eta^2_p = .89$.

Memory Data

Both dependent variables (recall and recognition) were analyzed with a $2 \times 2 \times 3$ (Age Group [Old vs. Young] × Viewing Condition [Watching vs. Rating] × Valence [Negative vs. Neutral vs. Positive]) analysis of variance (ANOVA), with the significance level set to .05. For all analyses, ANOVA results with $p$ values between .05 and .10 are reported as trends to aid comparison with previous studies.

Recall

All recall responses were first entered into the computer, and any identifying information was removed. Three raters, who were blind to the condition and age of each participant, then either matched each response to a picture or indicated that the response could not be uniquely matched to any of the pictures. Each response was coded by two raters, with a third rater being used in the event of a disagreement. Any responses for which all three raters disagreed were discarded; this type of situation resulted in only a small percentage of discarded responses (1.2%) that did not differ between young and older adults, $t(111) = 0.36, p = .72$. Relative to young adults, the older adults did have significantly more responses that the raters agreed could not be uniquely matched to a picture, $F(1, 109) = 22.53, p < .001, \eta^2_p = .17$: older adults had an average of 2.4 ($SD = 2.2$) unmatched responses compared with the young adult average of 0.8 ($SD = 1.2$). Most unmatched responses were too vague to be matched to a specific picture (e.g., "sad child," "old people"). It should be noted that this effect of age did not vary across conditions, $F(1, 109) = 1.28, p = .26, \eta^2_p = .01$. 
An ANOVA on the recall responses yielded main effects of age group, $F(1, 109) = 23.52, p < .001, \eta_p^2 = .18$, and valence, $F(2, 218) = 51.15, p < .001, \eta_p^2 = .32$, and a trend toward an Age Group × Valence interaction, $F(2, 218) = 2.50, p = .08, \eta_p^2 = .02$; no other two-way interactions were significant. As may be seen in Figure 1 (top panel), young adults recalled more pictures than did older adults, and contrast tests showed that participants recalled more negative and positive pictures than neutral pictures: $F(1, 109) = 95.46, p < .001, \eta_p^2 = .47$, for negative pictures and $F(1, 109) = 11.18, p = .001, \eta_p^2 = .09$, for positive pictures. Consistent with previous findings on the positivity effect, young adults recalled more negative than positive pictures, $t(58) = 2.13, p = .04$, whereas older adults recalled equal numbers of negative and positive pictures, $t(55) = 0.28, p = .28$. 
A significant Age Group × Viewing Condition × Valence interaction was also obtained, $F(2, 218) = 3.51, \ p = .03, \ \eta^2_p = .04$. [1] To decompose this interaction, we conducted separate Age Group × Valence ANOVAs within each viewing condition. Consistent with the hypothesis that age differences in emotional memory are found only with open-ended viewing instructions, the Age Group × Valence interaction was significant in the watching condition, $F(2, 108) = 5.80, \ p = .004, \ \eta^2_p = .10$, but not in the rating condition, $F(2, 110) = 0.69, \ p = .50, \ \eta^2_p = .01$. As may be
seen in Figure 1, however, this did not appear to be the result of changes in the number of positive and negative pictures remembered by either age group (all ps > .10). Rather, the number of neutral pictures recalled by young adults was greater when participants had to rate the pictures than when they had to simply view the pictures, \( t(56) = 2.77, \ p = .008 \). [2]

**Recognition**

The average proportions of hits and false alarms, along with mean corrected recognition scores (hits − false alarms) for the recognition test, are presented in the top portion of Table 2. All analyses were conducted on the corrected recognition scores. Two young participants were excluded from these analyses due to their apparent reversal of the “OLD” and “NEW” buttons on the response box (e.g., corrected recognition rates of nearly −1.00).

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<tr>
<th>Table 2</th>
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**Mean Proportions of Hits, False Alarms, and Corrected Recognition in Experiment 1 and Experiment 2**

An ANOVA on the corrected recognition data revealed main effects of age group, \( F(1, 107) = 51.11, \ p < .001, \ \eta_p^2 = 0.32, \) viewing condition, \( F(1, 107) = 8.08, \ p = .005, \ \eta_p^2 = .07, \) and valence, \( F(2, 214) = 9.48, \ p < .001, \ \eta_p^2 = .08; \) an Age Group × Valence interaction, \( F(2, 214) = 9.70, \ p < .001, \ \eta_p^2 = .08; \) and an Age Group × Viewing Condition interaction, \( F(1, 107) = 4.34, \ p = .04, \ \eta_p^2 = .04. \) No other effects were significant (ps > .10). As may be seen in Table 2, the main effects indicate that (a) young adults had better corrected recognition than did older adults; (b) participants in the rating condition had better corrected recognition than participants in the
watching condition; and (c) somewhat surprisingly, neutral pictures were better recognized than negative pictures, $F(1, 107) = 16.02, p < .001, \eta^2_p = .13$, but not positive pictures, $F(1, 107) = 0.63, p = .63, \eta^2_p = .01$. To clarify the two-way interactions, we conducted separate analyses of viewing condition and valence in each age group. These analyses indicated that the described effect of valence was only significant in the older adults, $F(2, 106) = 13.22, p < .001, \eta^2_p = .20$, and the effect of viewing condition was only significant in the young adults, $F(1, 54) = 15.45, p < .001, \eta^2_p = .22$.

As with the recall data, the recognition data indicate that only the young adults' memory was affected by the viewing instructions, with young adults showing more accurate memory for the pictures if they had rated them for emotion during viewing. Unlike the effects in the recall data, this effect was similar for all pictures, not just neutral ones; in fact, young adults showed no difference in their recognition memory for negative, neutral, and positive pictures. As may be seen in Table 2, this was driven primarily by the higher false alarm rates for positive and negative pictures compared with the rates for neutral pictures, which in effect “cancelled out” the higher hit rates for the emotional compared with the neutral pictures. Older adults were once again unaffected by the viewing instructions, and although older adults showed particularly poor recognition memory for negative pictures, this effect did not interact with viewing condition as we had initially predicted. As may be seen in Table 2, the poor recognition memory for negative pictures emerged because older adults showed the same pattern of false alarms as the young adults, but showed less of an effect of emotion on their hit rates, with somewhat lower hit rates for negative than for neutral or positive pictures.

In summary, our initial hypothesis that age differences in the EEM effect would only be found in the open-ended watching condition was supported, but the proposal that this difference would be due to older adults' decreased memory for negative pictures relative to the rating condition was not supported. In fact, older adults were unaffected by making emotional ratings, whereas young adults' recall of neutral pictures and overall recognition was improved by making emotional ratings. The improvement in the performance of the young adults may be due to a “levels-of-processing” type of effect (Craik & Lockheart, 1972), in that rating stimuli for emotion is a relatively deep processing task that typically improves memory. It is particularly relevant that the effect in recall was only seen for neutral pictures, which would not normally evoke an emotional evaluation. That is, imposing a top-down focus on the neutral pictures caused an emotional evaluation of stimuli that would not naturally evoke that evaluation. It is not entirely clear, however, why recognition improved equally across all three valence conditions, whereas recall improved only in the neutral condition; this issue will be revisited in the discussion of Experiment 2.

Why did the emotional evaluation instructions not affect the older adults as we had initially predicted? After reconsidering the research reviewed in the introduction, we hypothesized that perhaps older adults were already performing an emotional evaluation of the pictures in the watching condition and thus asking them to make the ratings in the rating condition would not change their performance. Because previous research has suggested that older adults' memories may be more impaired when they are asked to make a perceptual evaluation than when they make an emotional evaluation, we hypothesized that having older adults rate the
pictures on a perceptual characteristic might be detrimental for their memory. This hypothesis was tested in Experiment 2.

**EXPERIMENT 2**

**Method**

**Participants**

Older adults ($N = 51$) and young adults ($N = 46$) were recruited as in Experiment 1. As before, participants were screened during the course of the study for possible depression or memory problems. This resulted in the exclusion of 9 older participants, with 46 young adults (24 women and 22 men) and 42 older adults (22 women and 20 men) composing the final study sample. Participant characteristics for each age group are presented in the bottom portion of Table 1. The pattern of age differences was similar to that seen in Experiment 1, with the exception of results of the Operation Span test, which in this experiment was significantly different between age groups. Once again, there were no differences across conditions within each age group ($p > .10$), indicating successful random assignment to the study conditions.

**Apparatus, Materials, and Procedure**

The apparatus and materials were identical to those used in Experiment 1. The procedure was nearly identical to that used in Experiment 1, with two exceptions. First, participants in the rating condition were given the following instructions:

Rate each picture to indicate how visually complex you think the picture is. For example, a very simple picture might be a single object or person with a plain background. A very complex picture might be a crowded scene with lots of detail in the background.

The participants rated the pictures along a 5-point scale (1 = simple, 5 = complex) using a five-button response box. Second, after the recognition test, all participants rated the pictures for emotion for a manipulation check.

**Results and Discussion**

**Manipulation Check**

The emotion ratings given to each picture by each age group are presented in the Appendix. The emotion ratings for the pictures were similar to those of Experiment 1 (see Figure 1, bottom panel), with the correlation between older and young adults’ mean ratings of the pictures again at .98. As before, older adults had a slight tendency to rate the pictures as more positive than did young adults ($M = 3.08$, $SD = 0.24$, for older adults; $M = 2.99$, $SD = 0.16$, for young adults), $F(1, 84) = 5.46$, $p = .02$, $\eta^2_p = .06$, but this effect did not interact with valence, $F(1, 84) = 0.25$, $p = .78$, $\eta^2_p = .00$. Negative pictures ($M = 1.69$) were rated lower than neutral pictures ($M = 3.02$),
$F(1, 84) = 647.80, p < .001, \eta^2_p = .89$, which were in turn rated lower than positive pictures ($M = 4.40$), $F(1, 84) = 928.28, p < .001, \eta^2_p = .92$.

**Memory Data**

As in Experiment 1, all data were analyzed using a $2 \times 2 \times 3$ (Age Group [Old vs. Young] × Viewing Condition [Watching vs. Rating] × Valence [Negative vs. Neutral vs. Positive]) ANOVA. Because the power in the current study was decreased somewhat due to an unusually large percentage of older adults who were screened out (17.6% of the original sample), there were a few effects that did not yield significant interactions but showed age differences when the age groups were analyzed separately. Because these effects may have been significant with enough power, we report and comment on them as well.

**Recall**

The recall responses were scored as in Experiment 1. Once again, a small number (1.6%) of responses were discarded because of rater disagreement; this time, slightly more responses were discarded from older adults ($M = 0.28$) than from young adults ($M = 0.11$), $F(1, 83) = 4.37, p = .04, \eta^2_p = .05$. As before, more responses from older adults ($M = 1.49$) than from young adults ($M = 0.59$) could not be uniquely matched to a picture, $F(1, 84) = 9.19, p = .003, \eta^2_p = .10$. Neither of these effects varied across viewing condition ($p$s > .10).

An ANOVA on the recall responses indicated main effects of age group, $F(1, 84) = 27.95, p < .001, \eta^2_p = .25$, and valence, $F(2, 168) = 15.64, p < .001, \eta^2_p = .16$. As before, young adults recalled more pictures than did older adults, and negative pictures were recalled more often than neutral pictures, $F(1, 84) = 23.67, p < .001, \eta^2_p = .22$, as were positive pictures, $F(1, 84) = 5.42, p = .02, \eta^2_p = .06$. Neither the effect of condition nor any of the two-way interactions reached significance ($p$s > .10).

The three-way interaction was once again significant, $F(2, 168) = 3.27, p = .04, \eta^2_p = .04$, [3] but separate Age Group × Valence ANOVAs within each viewing condition did not clarify this effect: The Age Group × Valence interaction did not reach significance in either condition ($p$s > .10). Separate Viewing Condition × Valence ANOVAs within each age group, however, indicated a significant interaction in the older adults, $F(2, 80) = 5.51, p = .006, \eta^2_p = .12$, but not in the young adults, $F(2, 88) = 0.29, p = .75, \eta^2_p = .01$. As may be seen in the bottom portion of Figure 1, older adults in the rating condition recalled significantly fewer emotional (positive and negative) pictures than did older adults in the watching condition, $t(40) = 3.49, p = .001$ for negative, $t(40) = 2.17, p = .04$ for positive, but recalled the same number of neutral pictures, $t(40) = 0.42, p = .68$. Difference contrasts, however, indicated that the Viewing Condition × Valence interaction was significant for the negative versus neutral contrast, $F(1, 40) = 10.37, p = .003, \eta^2_p = .30$, but not for the neutral versus positive contrast, $F(1, 40) = 0.08, p = .78, \eta^2_p = .00$, suggesting that the effect of viewing condition had a much larger impact on memory of negative pictures than of positive pictures.[4]
It was somewhat surprising that the Age Group × Valence interaction was not significant in the watching condition, although this condition was nearly identical to that of Experiment 1. The difference between conditions appears to be due to differences in recall of the neutral pictures between young adults in Experiment 1 and those in Experiment 2 and may reflect random variation in the young adult population. It may be noted that the young adults in Experiment 2 were slightly older and further along in their education than the young adults in Experiment 1, but no other demographic or cognitive differences were significant. In addition, in both Experiment 1 and Experiment 2, there were no demographic or cognitive differences between the individuals randomly assigned to each condition, as previously reported. Although it is unclear why there are differences between the two watching conditions, some caution is warranted for our interpretation that young adults' memory is improved by instructions to view pictures for emotional ratings. It may be more accurate to say that memory in some young adults is improved by such viewing instructions. We do point out, however, that previous levels of processing research would predict a memory improvement in young adults when they were asked to make a meaningful judgment like emotionality.

**Recognition**

The mean proportions of hits and false alarms, as well as the corrected recognition data, are presented in the bottom portion of Table 2. An ANOVA on the corrected recognition data indicated main effects of valence, $F(2, 168) = 3.93, p = .02, \eta_p^2 = .05$, and age, $F(1, 84) = 48.08, p < .001, \eta_p^2 = .37$, but no other significant effects ($ps > .10$). As before, neutral pictures were somewhat better recognized than negative pictures but not positive pictures, and older adults' corrected recognition was worse than young adults' corrected recognition. We do note that although the Age Group × Viewing Condition interaction was not significant, $F(2, 84) = 2.59, p = .11, \eta_p^2 = .03$, the corrected recognition of the older adults in the rating condition was significantly lower than that of the older adults in the watching condition, $F(1, 40) = 4.36, p = .04, \eta_p^2 = .10$, consistent with their reduced recall. As may be seen in Table 2, this was driven by a combination of decreases in the hit rates and increases in false alarm rates for older adults in the rating condition. Young adults' corrected recognition did not differ between conditions, $F(1, 44) = 0.05, p = .83, \eta_p^2 = .00$.

It may be noted that across both experiments, both hits and false alarms were greater for emotional than for neutral pictures. The increased false alarms for emotional pictures may be due to our foils being so closely matched to our original pictures, which, combined with our use of a yes/no recognition test, eliminated a memory advantage for the emotional pictures. We matched our foils to the original pictures on both valence and content. Because the neutral pictures are neither positively or negatively "valenced," however, this may have made the neutral foils easier to reject than the foils for the positive and negative pictures. In the case of the older adults (and the young adults in Experiment 2), hit rates for negative pictures were not higher than the hit rates for neutral pictures, resulting in better corrected recognition for neutral than for negative pictures. This result is not unprecedented in the literature: For example, Denberg and colleagues (2003) found that older adults had better recognition memory for
neutral than for emotional pictures in a recognition test that tested for detail memory. In any case, the net result was that any orienting influence of our viewing instructions was equally influential across picture valence in both experiments. If the pictures were matched only on content, not valence, the instructions may have differentially influenced recognition across valences and perhaps more closely mirrored the pattern seen in the recall results. It should be noted, however, that the general effect of condition on the hit rates mirrors the pattern of the corrected recognition results, although the Age × Condition interaction on the hits is only significant in Experiment 1, $F(1, 107) = 7.20, p = .008, \eta^2_p = .06$. This effect does not further interact with valence, $F(2, 214) = .01, p = .99, \eta^2_p = .00$, again suggesting that in Experiment 1, young adults’ ability to recognize the pictures improved across conditions regardless of valence.

**GENERAL DISCUSSION**

The overarching goal of this research was to examine the impact of the instructions given at viewing on subsequent age differences in incidental emotional memory, with a secondary goal of determining the circumstances under which positivity in older adults' memory may emerge. Across two experiments, the memory of participants who were given open-ended viewing instructions was compared with the memory of those who were asked to rate the pictures either for emotionality (Experiment 1) or for visual complexity (Experiment 2). The type of viewing instruction had a differential impact on the older and the young adults, with emotional viewing instructions improving young adults' recall of neutral pictures and overall recognition and perceptual viewing instructions diminishing older adults' recall of emotional pictures and overall recognition, relative to the open-ended viewing condition. The viewing instructions did not appear to systematically influence the ability to detect a positivity effect.

The differential impact of the viewing instructions on young and older adults' memories is reminiscent of the previously reviewed source memory effects (e.g., May et al., 2005). That is, older adults were better able to remember source information that was linked to an emotional cue than one that was linked to a perceptual cue. In the current study, older adults' recall for emotional pictures (and recognition for all pictures) was best when they either made an emotional evaluation or were left to view the pictures as they desired, but their recall was reduced when they were asked to make a perceptual evaluation. Although a definitive explanation of the effect cannot be derived from the current study, a consideration of both the bottom-up and top-down influences of emotion on memory may help provide a framework for future research.

When a participant is shown an emotional picture, the emotion evoked by the picture may trigger a reflexive allocation of attention to the picture that would enhance its encoding. Under “natural” conditions (reflected here by the watching condition across both experiments), this would result in easier recall of the emotional scenes than of the neutral scenes, which would not evoke this reflexive attention allocation. Attention to emotional information at encoding may also be influenced by top-down processes, either through motivational goals as suggested by SST or through instructional manipulations like the ones used in the current study. In the top-down case, attention may be intentionally allocated toward pictures that do not provide a reflexive
emotional trigger (e.g., the neutral pictures) or intentionally allocated away from the emotionally evocative pictures.

In Experiment 1, our instructions had a top-down influence in young adults, such that asking them to consider the emotional content of pictures increased their recall of (and presumably attention to) the neutral pictures, which had no inherently emotional pull. This is not particularly surprising, as emotional evaluations are a type of meaning-based encoding which typically improve memory (e.g., through a levels-of-processing type of effect; see Craik, 2002, for a review). There are a few possibilities why a concurrent top-down influence was not found in the older adults. It may be that older adults more naturally consider the emotion in everyday situations even when the environment does not elicit it, so asking them to consider emotion therefore has no further effects. Alternatively, older adults may be less flexible in their thinking and may be unable to consider emotion in instances when there is no environmental support, consistent with some evidence from the levels-of-processing literature that older adults do not benefit as much as young adults do from meaning-based (semantic) encoding of nonemotional information (Mason, 1979).

In Experiment 2, our instructions had a top-down influence in older adults, such that asking them to consider the perceptual content of the pictures decreased their recall of emotional pictures that would normally provide a strong emotional pull. It is possible that older adults in this case successfully blocked the reflexive allocation of attention to the emotional aspects of the pictures in order to focus on the perceptual aspects of the pictures and thus reduced the effect of emotion on their recall. This would imply that younger adults are less able to block this bottom-up influence, thus leaving intact the impact of emotion on their recall. Alternatively, it may be that older adults are not able to attend to both emotional and perceptual characteristics of a picture at the same time, perhaps because of a reduced focus of attention in working memory (Basak & Verhaeghen, 2003). This would imply that both older and young adults can override the initial orienting response to the emotional pictures but that younger adults have enough capacity left to process the emotional aspects of the picture while they are also processing the perceptual aspects.

Either of these explanations, however, complicates our initial interpretation of the lack of effect of the emotional viewing instructions on older adults' memory in Experiment 1. That is, if older adults naturally consider the emotion of any stimulus and if they cannot consider both emotional and perceptual characteristics at the same time, we would have expected older adults' recall of the neutral pictures to have been decreased in Experiment 2 when we took away the emotional focus. A third interpretation of the Experiment 2 results may resolve this discrepancy: Perhaps older and young adults both attempt to suppress the initial orienting response to the emotional pictures but that younger adults have enough capacity left to process the emotional aspects of the picture while they are also processing the perceptual aspects.

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Although our findings show that older and young adults are differentially affected by the type of orienting instructions given at viewing, we were mostly unsuccessful at replicating previous findings of the positivity effect. While it has previously been suggested that open-ended viewing instructions may allow age-related emotional goals to influence memory (and specifically to increase the ability to find a positivity effect), we did not find this to be the case. In Experiment 1, although older adults showed a trend toward a positivity effect in their recall of emotional pictures, this trend was not affected by the instructions they received. In Experiment 2, the only hint of a positivity effect in recall was in the structured viewing condition. In both experiments, older adults showed poorer recognition of negative compared with neutral pictures, but this did not vary by condition, nor did the effect interact with age in Experiment 2.

For future research, a more thorough evaluation of the qualities of the stimuli used across studies may help in identifying in what instances positivity may arise. One major difference between our study and previous studies was in the selection of the pictures we used. For example, our negative pictures were somewhat less arousing (M = 4.51) than the negative pictures used in research by Charles et al. (2003; M = 5.34) or by Mather and Knight (2005, Experiments 2 and 3; M = 5.46), two studies in which the same viewing instructions were used as in our watching condition. Because there is some evidence in the literature that age differences in attentional patterns are stronger at high than at low or moderate levels of arousal (Wurm, Labouvie-Vief, Aycock, Rebucal, & Koch, 2004), this could be a fruitful avenue for future research.

In addition to being relatively low arousal, the negative pictures that we selected were also more homogeneous in content than those used in previous studies, as they were selected to reflect sadness and to contain only people. This choice could have affected the results in several ways. The older adults in the current study appeared to have less detailed memory for the pictures, as indicated by the larger number of unmatched pictures and reduced recognition in older relative to young adults. It may be that because the pictures were very similar, older adults could only recall the gist of the pictures rather than specific details about each picture. The use of sadness could also have blunted possible age differences in memory for negative pictures. Although some studies have found that older adults orient away from sad faces (Isaacowitz, Wadlinger, & Goren, 2006a; Mather & Carstensen, 2005), the age effect does not appear to be as large as that for angry faces (Isaacowitz, Wadlinger, & Goren, 2006b).

In summary, the presence of age differences in the EEM effect in recall can be influenced by the type of viewing instructions, as emotional and perceptual viewing instructions have different influences on young and older adults’ memories. Older adults’ memory appears to be best when the material to be remembered is emotionally evocative and they are allowed to process it as such.
NOTES

1. Adding the operation span test score as a covariate did not change the Age × Valence × Condition interaction, \( F(2, 216) = 3.29, p < .05, \eta^2_p = 0.03 \); Adding PANAS scores as covariates also did not change the Age × Valence × Condition interaction, \( F(2, 162) = 3.14, p < .05, \eta^2_p = 0.04 \), but did eliminate the trend in the Age × Valence interaction, \( F(2, 162) = 0.07, p > .10, \eta^2_p = 0.00 \).

2. Consistent with this interpretation, the Age × Valence × Condition interaction becomes nonsignificant if the neutral pictures are left out, \( F(1, 109) = .002, p > .10, \eta^2_p = 0.0 \).

3. Adding the operation span test score as a covariate slightly reduced the Age × Valence × Condition interaction, but the interaction was still at the trend level and was of the same size as in Experiment 1, \( F(2, 166) = 2.90, p < .10, \eta^2_p = .03 \). Adding PANAS scores as covariates did not change the Age × Valence × Condition interaction.

4. As in Experiment 1, the Age × Valence × Condition interaction becomes nonsignificant if the neutral pictures are left out.

5. We have been asked why our watching condition would produce better memory than a perceptual rating condition when previous research has suggested that making judgments about stimuli should cause them to be processed more deeply. In our view, the memory produced in the perceptual (detail) rating condition should only be better than the memory produced in the watching condition if our participants were doing nothing in the watching condition, and we do not believe that to be the case. The pictures used here were no doubt engaging for the participants and naturally invited an emotionally based viewing (resulting in the EEM effect itself). Moreover, our recognition test specifically tests memory for the emotional focus of the picture. If we had instead tested for background perceptual detail, we may have seen improved recognition in the detail rating condition (see studies of transfer-appropriate processing vs. levels of processing, e.g. Morris, Bransford, & Franks, 1977, for example).

6. Post hoc analyses of the time that it took participants in the ratings condition(s) to make their ratings were consistent with our hypothesis that making detail ratings of emotional pictures was more difficult than making emotional ratings. Participants who made emotional ratings were faster to rate positive and negative pictures than were participants who rated the pictures for detail (for positive pictures: emotion \( M = 1,018 \) ms vs. detail \( M = 1,286 \) ms, \( t(97) = 3.01, p < .05 \); for negative pictures: emotion \( M = 1,153 \) ms vs. detail \( M = 1,367 \) ms, \( t(97) = 2.17, p < .05 \)). Participants’ reaction times were not significantly different when making detail and emotional ratings for the neutral pictures (detail \( M = 1,277 \) ms vs. emotion \( M = 1,339 \) ms, \( t(97) = -0.53, p > .10 \)). This Valence × Rating Type interaction was significant, \( F(2, 190) = 16.43, p < .05 \); the effect did not, however, interact with age group, \( F(2, 190) = 0.70, p > .10 \). Some caution in this comparison is warranted since the participants were not randomly assigned to rating conditions across the two experiments, and all participants had to wait to make their ratings until after a picture had left the screen. We thank an anonymous reviewer for suggesting this analysis.
REFERENCES


APPENDIX

APPENDIX A: International Affective Picture System (IAPS) Pictures Used in the Current Study and Ratings Given by Each Age Group

<table>
<thead>
<tr>
<th>IAPS no.</th>
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**Neutral pictures**

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**Positive pictures**

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a Scale from 1 to 9. b Scale from 1 to 5.