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Age-Related Positivity Effects and Autobiographical Memory Detail: Evidence from a Past/Future Source Memory Task

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Abstract

This study investigated whether the age-related positivity effect strengthens specific event details in autobiographical memory. Participants retrieved past events or imagined future events in response to neutral or emotional cue words. Older adults rated each kind of event more positively than younger adults, demonstrating an age-related positivity effect. We next administered a source memory test. Participants were given the same cue words and tried to retrieve the previously generated event and its source (past or future). Accuracy on this source test should depend on the recollection of specific details about the earlier generated events, providing a more objective measure of those details than subjective ratings. We found that source accuracy was greater for positive than negative future events in both age groups, suggesting that positive future events were more detailed. In contrast, valence did not affect source accuracy for past events in either age group, suggesting that positive and negative past events were equally detailed. Although aging can bias people to focus on positive aspects of experience, this bias does not appear to strengthen the availability of details for positive relative to negative past events.

Older adults tend to more positively remember the events of their lives than younger adults. When asked to generate autobiographical memories in response to retrieval cues, the number of positive relative to negative events tends to increase with age (Dijkstra & Kaup, 2005; Ros & Latorre, 2010), and older adults also tend to rate retrieved events more positively than younger adults (Comblain, D'Argembeau, & Van der Linden, 2005; Rubin & Schulkind, 1997). This age-related positivity effect also has been found when participants involuntarily retrieve autobiographical memories during the course of a day (Schlagman, Schulz, & Kvavilashvili, 2006; Schlagman, Kliegel, Schulz, & Kvavilashvili, 2009), and has been found when participants explicitly try to remember self-evaluations that they had previously recorded in surveys or diaries (Kennedy, Mather, & Carsensen, 2004; Levine & Bluck, 1997; Ready, Weinberger, & Jones, 2007). For example, Kennedy et al. (2004) tested a group of individuals that had taken a personal health survey 14 years prior, asking them to retrospectively evaluate their earlier health from memory. They found that retrospective

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We also analyzed source scores that were adjusted for item recognition (e.g., [p“future”] / [p“future” + p“past”]), source scores that were adjusted for errors to nonstudied items (via subtraction), and confidence judgments that were given to correct source responses. Each of these analyses yielded a similar overall pattern of results as the unadjusted scores.

As an example, for the cue “cheer” an older adult initially generated “In the past I remember an event where I…gave a very good performance and the audience cheered.” In the second session, they misattributed “cheer” to the future condition and generated “I will perform and the audience will appreciate it and cheer.”

As noted by a reviewer, another factor that may have increased the level of detail for positive over negative future events was emotional intensity or arousal. This is a reasonable hypothesis, but we cannot test it because we did not measure emotional intensity. However, D'Argembeau and Van der Linden (2004) reported that emotional intensity did not differ between positive and negative future events in younger adults, which is inconsistent with an intensity explanation.

evaluations were more positive than initial evaluations in the oldest individuals. Although the age-related positivity effect is not always obtained in memory tasks (for reviews see Kensinger, 2009; Murphy & Isaacowitz, 2008), it has been found in a variety of measures of autobiographical memory.

Socioemotional selectivity theory (SST) is an influential framework that has been used to explain the age-related positivity effect in autobiographical memory, as well as in other aspects of cognition and emotion (for review see Carstensen, Mikels, & Mather, 2006). According to SST, aging is associated with the perception of shrinking time horizons (i.e., limited remaining lifespan), and this perception motivates people to shift their goals towards optimizing emotional regulation and focusing on more positive aspects of experience (Charles & Carstensen, 2009; Mather & Carstensen, 2005). Of course, many autobiographical memory studies have demonstrated preferences for positive over negative events even in younger adults (e.g., Fotopoulou, Conway, & Solms, 2007; Walker, Skowronski, & Thompson, 2003; Wilson & Ross, 2003), potentially owing to the biasing effects of a positive self-concept (see Conway, 2005). In these cases an age-related positivity effect would be operationalized as a larger positivity effect in older adults compared to younger adults.

Although aging has been associated with more positive autobiographical memories, the extent that this positivity effect influences the availability of specific episodic details for autobiographical events remains an open question. Do older adults have better storage or access to specific details for positive over negative events in memory (a strength effect), or do they simply prefer to focus on positive events at retrieval (a biasing effect)? Either position is tenable given existing research. On the one hand, if older adults are more likely than younger adults to reminisce about positive memories in their daily lives, then this additional rehearsal might strengthen the availability of associated details in autobiographical memory. In younger adults, Ritchie, Skowronski, Walker and Wood (2006) found a link between autobiographical memory rehearsal and subjectively reported details, and other studies have found that positive events are more likely than negative events to be personally rehearsed (Walker, Skowronski, Gibbons, Vogl, & Ritchie, 2009) or socially reminisced (Rasmussen & Berntsen, 2009). Less work along these lines has been conducted in older adults, but the reminiscence of positive events has been associated with increased positive emotions with aging (Pasupathi & Carstensen, 2003, see also Bohlmeijer, Roemer, Cuipers, & Smit, 2007). Based on SST, one might predict that this emotional benefit would exaggerate the rehearsal of positive events with aging, potentially strengthening these memories. On the other hand, there is evidence that older adults do not always rehearse or reminisce positive events more than negative events compared to younger adults (Alea, 2010). This finding suggests that aging might not affect the proportion of specific details that are available for positive relative to negative events, even if older adults have less specific autobiographical memories overall.

Only a few aging studies have investigated the potential effects of emotional valence on autobiographical memory specificity or detail, and they have not provided definitive evidence for a corresponding positivity effect. Comblain et al. (2005) had participants subjectively rate the level of detail in their generated memories along several dimensions (e.g., vividness, visual details, location, objects, persons, etc.), but did not find consistent age differences between positive and negative events. Interestingly, older adults were overall more likely than younger adults to rate their autobiographical memories as vivid and detailed (see also Schlagman et al., 2009). This finding is at odds with findings of age-related decline in the amount of episodic detail in overtly reported autobiographical memories (e.g., Levine, Svoboda, Hay, Winocur, & Moscovitch, 2002; Piolino, Desgranges, Benali & Eustache, 2002) as well as findings of age-related decline in the accuracy of

memories created in the laboratory (e.g., Nilsson, Backman, Erngrund, et al., 1997; Pierce, Simons, & Schacter, 2004). This discrepancy suggests that different age groups may use different criteria when making subjective ratings about autobiographical memories, so that converging evidence from more objective measures of the specific detail in autobiographical memories is desirable.

Analysis of overtly generated autobiographical memories provides one such measure, but it too has failed to provide evidence for an age-related positivity effect in specific details. St. Jacques and Levine (2007) used the Autobiographical Interview technique to study emotional autobiographical memories in aging. This technique emphasizes the overt retrieval of as much detail as possible. St. Jacques and Levine found that older adults produced fewer details for emotional memories relative to younger adults, and these declines were equivalent for positive and negative events (see also Singer, Rexhaj, & Baddeley, 2007). It is important to note, though, that several factors other than the availability of specific details could affect overt self-reports with aging. To the extent that aging enhances emotional regulation (Carstensen et al., 2006), older adults may be more reluctant than younger adults to share personally sensitive details with the experimenter, details that are especially likely for emotional autobiographical memories. Aging also might affect narrative style and encourage more gist-based processing (Baron & Bluck, 2009; James, Burke, Austin & Hulme, 1998; Tun, Wingfield, Rosen & Blanchard, 1998), making self-reports more general even if specific details are available (cf. Rudoy, Weintraub, & Paller, 2009). These factors can complicate analyses of overtly generated autobiographical memories across age groups (see Addis, Musicaro, Pan & Schacter, 2010, for additional discussion), again suggesting the need for converging evidence from other measures.

Current Study

For the current study we developed a new way to objectively assess the availability of specific autobiographical memory details, one that does not heavily rely on subjective ratings or on overt report. The task had two phases. The first phase used a variant of the popular Galton-Crovitz technique, whereby a list of cue words was presented to broadly trigger the most available autobiographical memories (Galton, 1879; Crovitz & Schiffman, 1974). Similar to prior studies (e.g., Comblain et al., 2005), we cued participants for neutral, negative, and positive events, and we also had them record a brief description of the event and rate it along various subjective dimensions (described more below). However, in addition to having participants retrieve past events in response to some of the cue words, we also had them imagine future events in response to the other cue words. Research shows that imagining future events involves overlapping cognitive processes and brain networks as retrieving past events (Schacter, Addis, & Buckner, 2007; Spreng & Levine, 2006; Szpunar, Watson & McDermott, 2007), and that imagining future events shows similar age-related decline as remembering past events (Addis, Wong, & Schacter, 2008; Addis et al., 2010). Including both past and future events in our task therefore provided two qualitatively similar autobiographical conditions for the subsequent source memory task. It also allowed us to test for an age-related positivity effect on the generation of future events, a topic that is theoretically important but, as described below, has received little attention.

In the second phase of our task, cue words were re-presented and participants attempted to recollect their previously generated events and whether these events had been associated with the past or the future condition. We assumed that, like other source memory tests (Johnson, Hashtroudi & Lindsay, 1993), this test should depend on the recollection of specific details that differentiated the two sources (past and future). This recollection, in turn, should depend on the level of specific detail in the initially generated autobiographical events, as well as the retrieval of these same events on the subsequent source memory test.

Although past and future events share many similarities (Hassabis & Maguire, 2007), past events tend to be more perceptually and contextually detailed, whereas future events tend to elicit more cognitive operations involved in their imagination (D'Argembeau & Van der Linden, 2004; McDonough & Gallo, 2010). Thus, the generation of specific and detailed events in the first phase should minimize source memory confusions in the second phase, providing a measure of autobiographical event detail that is independent from subjective ratings and overt reports.

The primary goal of this study was to test for an age-related positivity effect on past and future event details using the autobiographical source memory test. We expected overall source accuracy to be reduced in older adults, not only owing to difficulties generating detailed past and future events in the initial phase (Addis et al., 2008), but also owing to age-related decline in source memory that may be independent from these autobiographical effects (i.e., failures to associate the cue words with the particular conditions of our task, cf. Groninger & Groninger, 1984; Naveh-Benjamin, 2000). Of more central interest was the within-group comparison of source memory accuracy for positive relative to negative events. To the extent that positive cues are associated with the generation of more detailed autobiographical events than negative cues in the first phase of our task, this positivity effect should be mirrored in accuracy differences on the subsequent source memory test. Thus, if the age-related preference for positive information affects the amount of specific autobiographical details that are retrieved from past memories, or imagined for future events, then an age-related positivity effect should be found in source memory accuracy. In contrast, if the age-related positivity effect reflects a bias to process positive information, but does not affect the amount of specific details that are available in autobiographical memory, then an age-related positivity effect might not be found in source memory accuracy.

A secondary goal of this study was to test for an age-related positivity effect in various subjective ratings for both past and future events. At least two previous studies have reported an age-related positivity effect on ratings of emotionality in voluntarily retrieved past memories (Comblain et al., 2005, Rubin & Schulkind, 1997), but two more recent studies have failed to find this effect (Fernandes, Ross, Wiegand, & Schryer, 2008; Schlagman et al., 2009), indicating the need for additional research. Moreover, to our knowledge no studies have investigated an age-related positivity effect on future event generation. To the extent that imagining future events draws on similar constructive processes as retrieving past events, we expected that any age-related positivity effect observed for past events also would be found for future events. In fact, because future events are less constrained than past events (i.e., they have not yet happened), future events might be even more sensitive to motivational preferences to focus on positive information (cf. Shao, Yao, Ceci & Wang, 2010). In addition to subjective ratings of emotionality, we also collected subjective ratings of detail and difficulty. For these ratings, a positivity effect was operationalized as greater ratings of detail or reduced ratings of difficulty for positive relative to negative events.

Method

Participants

Participants were 24 undergraduates (mean age = 20 years, *SD* = 1.6), and 24 high-functioning older adults (75 years, *SD* = 6.9; education = 15.9 years, *SD* = 4.2; Mini Mental State Exam [Folstein et al., 1975] mean = 28.7, *SD* = 1.3). The two groups were roughly matched on gender (21 younger females, 19 older females). Undergraduates were recruited from psychology classes and a department-maintained volunteer list, whereas older adults were recruited from local newspaper advertisements and outreach efforts in the surrounding Hyde Park community. Using a mood rating scale administered prior to the memory task (1–

7 scale, negative to positive), older adults had higher average mood ratings (Day 1 = 6.13, *SD* = .87, Day 2 = 5.71, *SD* = 1.12) compared to younger adults (Day 1 mean = 4.39, *SD* = .99, Day 2 = 4.52, *SD* = .99). Participants were tested individually in a private room.

Materials

We used the Affective Norms for English Words (ANEW, Bradley & Lang, 1999) to draw 24 positive cue words (e.g., cheer, wink, respect) and 24 negative cue words (e.g., divorce, cancer, roach). Based on these norms, positive and negative cue words differed in valence (means = 7.60 and 2.41, respectively), but were equated on arousal (means = 5.97 and 6.02) and frequency (50.75 and 52.08). A set of 24 neutral cue words also was included. These were common object words (e.g., ladder, orange, camera) drawn from a previous autobiographical study by McDonough and Gallo (2010). Because we did not plan direct comparisons in source memory performance for the neutral and emotional words (see below), we did not match characteristics of the neutral words to the emotional words.

Procedure

On the first day, participants were presented with 16 neutral cue words, 16 positive cue words, and 16 negative cue words (blocked). The block of neutral cue words always was presented first, before the blocks of emotional cue words, because we wanted to test for an age-related positivity effect on neutral cues before introducing the emotional manipulation (i.e., the intentional retrieval of emotional events to emotional cue words might have induced an emotional mindset, and we did not want this mindset to bias the events generated for the neutral cues). The order of the positive and negative blocks was counterbalanced, in order to allow a direct test of valence effects on subsequent source memory accuracy. The order of the past and future blocks was counterbalanced within each valence block. Cue words were presented on a computer screen.

For each cue word participants had one minute to generate an associated past event (half of the cues) or a hypothetical future event (the other half of the cues). Each cue word was explicitly prompted for a specific event using a fill-in-the-blank prompt (i.e., “In the [past/future], I [remember/imagine] an event where I…”). Whereas neutral prompts did not make reference to emotional valence, the emotional prompts explicitly instructed participants to generate an emotional event that was congruent with the emotion of the cue word (avoiding events with mixed emotions). For all events, participants were instructed that the cue word did not have to be the most central aspect of the event, but it did have to be strongly associated to the event, so that they could later remember the same event in response to the cue word alone. They also were instructed to make sure that each event was specific, occurring in a certain place and with a duration of less than 1 day. We placed no other constraints on the to-be-generated events (e.g., importance or time frame, cf. Rubin & Schulkind, 1997).

After participants generated each event they wrote a brief description of it along with the cue word on a sheet of paper (1 to 2 sentences). They then rated the event for difficulty, details, and valence, each using a 1–7 scale presented on the computer. Difficulty reflected the “amount of difficulty generating the event” (1 = very difficult, 7 = very easy), detail reflected the “amount of detail in the event” (1 = low detail, 7 = high detail), and valence reflected the “valence or strength of the associated emotion” (1 = very negative, 7 = very positive). The recording of these brief descriptions and subjective ratings was not required for our source memory analysis, but these measures helped to assess consistency with previous autobiographical studies (e.g., Comblain et al., 2005; Rubin & Schulkind, 1997), and also to exclude alternative explanations of our source memory data (see Results).

On the second day participants were given a source memory test. The cue words that were initially presented were randomly intermixed with new words. For each of these test words, participants were given one minute to recall as closely as possible the event that they had generated the previous day, again writing a brief description of it (or writing "none" for new words). They then made a source memory judgment for the word ("past," "future," or "new") plus a confidence rating in this judgment (1–5 scale, where 1 signified "not at all confident" and 5 signified "very confident"). Within each emotional category, the test words were counterbalanced across the studied past, studied future, and nonstudied conditions.

Results

Subjective Rating Analyses

Table 1 summarizes the subjective ratings given to the autobiographical events that were generated on the first day. The results for each rating were analyzed using a 3 (valence: negative, positive, neutral) × 2 (time: past, future) × 2 (group: younger, older) analysis of variance (ANOVA). Unless noted otherwise, all results reported were significant at the conventional $p < 0.05$ (two-tailed), and effect sizes used $\eta_{p>}^2$ (F-tests) or Cohen's d (t-tests).

As expected, valence ratings differed for positive (5.76), neutral (4.76), and negative (2.61) events, $F(2, 92) = 197.33$, $MSE = 1.25$, $\eta_p^2 = .81$. These differences indicate that participants followed instructions and generated the appropriately valenced events to the appropriate cues. More importantly, older adults rated each kind of event more positively (4.60) than younger adults (4.15), $F(1, 46) = 8.20$, $MSE = 1.83$, $\eta_p^2 = .15$, with no effect of time and no interactions. These findings replicate the age-related positivity effect for ratings of emotionality for past events (Comblain et al., 2005; Rubin & Schulkind, 1997), demonstrating that this effect can be obtained with neutral cues as well as with cues for emotional events, and they extend this effect to future events.

Detail ratings were greater for past (4.78) than future events (4.29), $F(1, 46) = 27.68$, $MSE = .65$, $\eta_p^2 = .38$, replicating prior results in younger adults (D'Argembeau & Van der Linden, 2004) and older adults (Addis et al., 2010). There was a marginal interaction with age, $F(1, 46) = 3.66$, $MSE = .65$, $p = .06$, $\eta_p^2 = .07$, as this effect was somewhat larger for younger than older adults, albeit significant in both age groups. There also was an effect of valence, $F(2, 92) = 4.74$, $MSE = .62$, $\eta_p^2 = .09$, which interacted with time, $F(2, 92) = 5.11$, $MSE = .43$, $\eta_p^2 = .10$. The interaction was driven by lower detail ratings for negative future events (3.91) than positive future events (4.48) or neutral future events (4.47). There were no valence effects between the past events, and no age effects. Thus, although both age groups reported the fewest details for negative future events (cf. D'Argembeau & Van der Linden, 2004), we found no evidence for an age-related positivity effect on subjective ratings of details for past events.

Difficulty ratings were greater for future (3.15) than past events (2.71), $F(1, 46) = 11.70$, $MSE = 1.20$, $\eta_p^2 = .20$, again replicating prior results in younger adults (McDonough & Gallo, 2010) and extending them to older adults. There also was a valence effect, $F(2, 92) = 4.19$, $MSE = .67$, $\eta_p^2 = .08$, and a marginal interaction with time, $F(2, 92) = 2.67$, $MSE = .45$, $p = .07$, $\eta_p^2 = .05$. Difficulty ratings were greater for negative than positive events, and this effect was only significant for future events. Thus, both age groups reported difficulty generating negative future events. The only age effect was lower overall difficulty ratings in older adults (2.65 vs. 3.21), $F(1, 46) = 4.73$, $MSE = 4.84$, $\eta_p^2 = .09$. This effect was unexpected, but it potentially was caused by the generation of less specific event details in older adults, which might have made the task subjectively easier for them relative to younger adults.

Source Memory Analyses

Results from the source memory test are presented in Table 2. For our primary analysis we compared correct attributions of studied cues to their appropriate studied source (past or future). Emotional events were analyzed separately from neutral events, because the neutral events may have benefitted from primacy effects in the first session. Figure 1 shows the source data for emotional events. A 2 (valence: negative, positive) × 2 (time: past, future) × 2 (group: younger, older) ANOVA revealed a large effect of age, $F(1, 46) = 56.94$, $MSE = .09$, $\eta_p^2 = .55$, as younger adults were more accurate than older adults. This age effect interacted with time, $F(1, 46) = 6.35$, $MSE = .05$, $\eta_p^2 = .12$, as it was larger for future than past events, albeit significant in each case. There was no effect of valence and no interactions, although in younger adults the difference between positive and negative future events was significant, $t(23) = 2.54$, $SEM = .02$, $d = .52$, potentially because negative future events were less detailed. Analysis of neutral events revealed an effect of age, $F(1, 46) = 26.58$, $MSE = .05$, $\eta_p^2 = .37$, time, $F(1, 46) = 22.12$, $MSE = .03$, $\eta_p^2 = .33$, and an interaction, $F(1, 46) = 9.67$, $MSE = .03$, $\eta_p^2 = .17$. The age effect again was larger for future than past events, albeit significant in each case. As a whole, these analyses provided no evidence for a positivity effect in past events, although a positivity effect did emerge for future events in younger adults.[1]

Analyses of source misattributions (e.g., mistakenly attributing a future cue to the past condition) were consistent with the previous analyses of correct attributions. For studied items, analysis of emotional events revealed an age effect, $F(1, 46) = 30.64$, $MSE = .05$, $\eta_p^2 = .40$, as older adults made more errors (.23) than younger adults (.05). There also was an effect of valence, $F(1, 46) = 4.86$, $MSE = .01$, $\eta_p^2 = .10$, with no other effects. This valence effect was primarily driven by greater misattributions for negative compared to positive future events (.17 and .10, respectively), with little effect on past events (.15 and .14). This effect tracks the reduced accuracy for negative future events that was previously described. Analysis of neutral items revealed an effect of age, $F(1, 46) = 21.91$, $MSE = .05$, $\eta_p^2 = .32$, time, $F(1, 46) = 9.08$, $MSE = .03$, $\eta_p^2 = .17$, and an interaction, $F(1, 46) = 6.67$, $MSE = .03$, $\eta_p^2 = .13$. The interaction suggested that the effect of time was greater in older adults than in younger adults, although younger adults were at floor. Source misattributions for nonstudied items were rare in younger adults, and there were no effects of source or valence for nonstudied items in older adults.

Matching Analyses

We also analyzed the ability of participants to retrieve the same events in response to the same cues across the two testing sessions. An event was considered a match if the brief description provided across the two sessions contained similar objects and actions, while ignoring past/future attributions, using two coders that were blind to participant age (98% coder agreement, Kappa = .94, $p < .001$). Analysis of emotional events revealed a large effect of age, $F(1, 46) = 72.48$, $MSE = .12$, $\eta_p^2 = .61$, as younger adults made more matches (.84) than older adults (.42). There were no age interactions, but there was an interaction between valence and time, $F(1, 46) = 5.91$, $MSE = .02$, $\eta_p^2 = .11$. For the past condition, negative events (.68) were matched more often than positive events (.62), $t(47) = 1.98$, $SEM = .03$, $p = .05$, $d = .21$, providing no evidence for a positivity effect in past events. However, for the future condition, positive events (.64) were matched more often than negative events (.60), $t(47) = 1.97$, $SEM = .02$, $p = .05$, $d = .14$, indicating a positivity effect in future events for both age groups. Analysis of neutral events revealed an effect of age, $F(1, 46) = 25.23$, $MSE = .07$, $\eta_p^2 = .35$, as matching again was greater for younger adults (.95) than older adults (.68), as well as an effect of time, $F(1, 46) = 6.43$, $MSE = .02$, $\eta_p^2 = .12$, as matching for past events (.85) was more accurate than future events (.78).

Reduced matching accuracy in older adults might reflect reduced detail in the originally generated events, but it also might reflect a failure to associate the cue word with the originally generated event. These associative failures could reduce subsequent source memory accuracy independent from the level of event detail. To control for this possibility, we conducted a conditional analysis of source memory accuracy, including only those events with matching descriptions across the two sessions. Whereas younger adults approached perfect source memory for matching events (overall mean = .98), older adults did worse (.84), $F(1, 42) = 18.33$, $MSE = .05$, $\eta_p^2 = .30$. Thus, even when some matching content was retrieved, older adults were less likely to recall whether it had originated in the past or future condition, likely owing to age-related decline in the amount of specific detail.[2] Importantly, analysis of matching events in older adults did not yield a valence effect on source accuracy for past events (positive = .91, negative = .84, $t < 1$), again providing no evidence for a positivity effect on past event details. However, there was a significant effect for future events (.88 and .69), $t(22) = 2.52$, $SEM = .08$, $d = .55$. Similar to the positivity effect for future events observed in overall source memory accuracy (younger adults) and in matching accuracy (both groups), this effect suggests that negative future events were less detailed than positive future events in older adults.

Specificity Analysis

As a final analysis, the same two coders from the matching analysis also rated the event descriptions from the first session for specificity. This coding scheme used a 1–3 scale (91% coder agreement, Kappa = .73, $p < .001$). On this scale, a “1” indicated that the description did not obviously describe a specific event (i.e., occurring in a certain place within a limited time frame), a “2” indicted that the description possibly referred to a specific event, and a “3” indicated that the description clearly referred to a specific event. Note that participants were instructed to be brief with their event descriptions, so that they may have retrieved more specific details about the event than were actually provided for coding. Thus, this coding scheme represented a conservative measure of the level of specificity of the generated events.

Similar to the source accuracy results, analysis of the emotional event descriptions revealed a large effect of age, $F(1, 46) = 26.25$, $MSE = .31$, $\eta_p^2 = .36$, as these descriptions were more specific in younger adults (2.92) than in older adults (2.55). There were no effects of time (past, future) or valence (positive, negative) and no interactions. Analysis of neutral events revealed an effect of age, $F(1, 46) = 16.67$, $MSE = .14$, $\eta_p^2 = .27$, along with an effect of time, $F(1, 46) = 5.02$, $MSE = .03$, $\eta_p^2 = .10$, and an interaction, $F(1, 46) = 4.39$, $MSE = .03$, $\eta_p^2 = .09$. The age effect was larger for past events (means = 2.94 [younger] and 2.56 [older]) than for future events (2.95 and 2.71), albeit significant in each case. These analyses provide additional evidence for age-related reductions in autobiographical event specificity, for both past and future events, and they replicate the more elaborate analysis of event descriptions provided by Addis et al. (2008). Importantly, we again found no evidence for an age-related positivity effect in the generation of specific details for past events, although for this particular analysis there was no positivity effect for future events either.

Discussion

When considering positivity effects in autobiographical memory, an important distinction is between motivations or preferences to process positive information (a bias effect) and the actual memorability or availability of the events themselves (a strength effect). Whereas the former is potentially flexible and sensitive to retrieval context, the latter suggests more lasting changes in the quality of stored memories. Given the dynamic nature of autobiographical memory (Cohen, 1988; Conway, 2005), we reasoned that these two factors might interact. If older adults are motivated to differentially rehearse positive over negative

autobiographical information, then this bias might eventually strengthen the availability of specific details for positive events. Research has demonstrated an age-related positivity effect in the generation of autobiographical events and in corresponding emotional evaluations (e.g., Kennedy et al., 2004), but there is little evidence that this positivity effect extends to the actual availability of specific event details. In the current study we investigated this possibility using subjective ratings as well as a subsequent source memory task that was designed to provide a more objective measure of the level of specific details available in memory. We also investigated the generation of future events, which we reasoned should be at least as sensitive to motivational preferences for positive information as past events.

We found that older adults subjectively rated past events more positively than younger adults, replicating Comblain et al. (2005) and Rubin and Schulkind (1997). We also found that these effects extended to future events. These findings are broadly consistent with socioemotional selectivity theory (SST), which predicts an age-related positivity effect especially when participants are allowed to self-regulate or preferentially process emotional information (Carstensen et al., 2006). We found the same sized positivity effect in subjective ratings of past and future events, and we also found the same sized positivity effect in subjective ratings of neutral and emotional events. These findings suggest that older adults focused on more positive aspects of experiences overall, potentially because the generation of both past and future autobiographical events is a relatively unconstrained task that is highly sensitive to motivational preferences.

Although we found an age-related positivity effect in subjective ratings of emotion, our other results provided no evidence that aging affected the relative amount of specific details that were available for positive relative to negative events. Consider the past events first. There were no differences between positive or negative events for subjective ratings of detail or difficulty in either age group. Subjective ratings can be difficult to interpret (see below), but analogous results were obtained from our subsequent source memory test. There were no emotional valence effects on source memory accuracy for past events, on the specificity of the past event descriptions, or in the ability to generate matching descriptions for past events across the two testing sessions. If the initial retrieval of positive past events had been associated with more specific details than negative past events, then these differences should have translated into superior performance on these subsequent measures of memory accuracy.

To our knowledge only one prior study has used a subsequent memory task relevant to an age-related positivity effect for past events. Fernandes et al. (2008) had participants generate recent autobiographical events in response to neutral, positive, or negative cue words. Two weeks later, the participants were asked to recall the same autobiographical events that they had previously generated. Unlike our source memory task, this recall task was not designed to assess the relative amount of specific details in the originally generated events. Nevertheless, the pattern of results in our study was consistent with this earlier study, in that there was no age-related positivity effect on subsequent memory accuracy for previously generated autobiographical events. Instead, younger adults were more likely than older adults to show a positivity effect in the correct recall of the events from the prior session, and older adults made more recall errors for positive events. Our results for past events also are consistent with other methods that have failed to find an age-related positivity effect on specific autobiographical details, including subjective ratings of details (Comblain et al., 2005) and more elaborate analyses of overtly generated details (St. Jacques & Levine, 2007).

In contrast to these results for past events, there was evidence for a positivity effect for future events in our study. In both age groups, subjective ratings of detail were greater for positive than negative future events, and ratings of difficulty were lower for positive than negative future events. Similarly, positive future events were better remembered than negative future events on the subsequent memory test, including our measures of source memory accuracy as well the ability to generate event descriptions that matched across the two sessions. These findings are methodologically important, as they demonstrate that our subsequent memory measures were sensitive to positivity effects. However, none of these effects interacted with age, providing no evidence for an age-related positivity effect. These findings instead suggest that negative future events were harder to generate than positive future events in both age groups, potentially because both younger and older adults preferred to be optimistic about their futures. This positivity effect for future events could be due to a preference to imagine positive future events in the context of our generation task, as well as a preference to imagine some of the positive future events outside the lab (i.e., prior to our experiment), either of which could have increased the amount of detail that was generated for future events.[3]

Implications and Future Directions

In addition to the pattern of positivity effects that we observed on past and future events, our study also demonstrated an important discrepancy between subjective and objective measures of autobiographical detail. Whereas older adults rated their autobiographical events as equally detailed and less difficult to generate compared to younger adults, there was significant age-related decline in our objective measures of specific detail (i.e., subsequent memory accuracy and overtly generated descriptions). These more objective results suggest that older adults were less effective at generating specific event details than younger adults (Addis et al. 2008; Levine et al., 2002), and they raise concern about using subjectively rated details as an absolute index of actually retrieved details. Older adults may have been unaware of their autobiographical memory decline when making subjective ratings, or they may have differentially anchored their subjective ratings of details compared to younger adults. This ambiguity highlights the need to compliment subjective ratings with more objective measures of autobiographical memory detail in aging, such as the autobiographical source memory test developed here.

Several factors may contribute to the age-related decline in specific autobiographical detail that we observed on our objective measures. Aging might cause the loss of details stored in memory and/or it might cause reduced access to stored details during event construction. These alternatives are difficult to disentangle, but the similarity of age-related decline on both past and future events that we and others have observed may be more consistent with a reduced access account, at least to the extent that future events are not themselves stored. According to some accounts (Schacter et al., 2007), future events are flexibly constructed during the generation stage using whatever details can be accessed from memory and imagined as new events. Age-related reductions in online cognitive resources (e.g., speed or working memory, see Light, 1991) might impair this event construction process, resulting in the generation of less specific events overall. It is possible that tasks like our might exaggerate this age-related decline, by requiring the generation of multiple events in a short time span. However, the timing of our task (one minute per memory) seems comparable to at least some instances of autobiographical memory retrieval in everyday life (e.g., conversations, daydreaming, viewing photo albums, etc.). Future work might investigate the extent that these and other task constraints interact with aging effects on autobiographical memory specificity.

Future work also might investigate the possibility of an age-related positivity effect in autobiographical memories from specific time frames or from specific types of events. Older adults tend to generate more distant past events and more proximal future events than younger adults (Spreng & Levine, 2006), and positive events tend to be over-represented relative to negative events in the distant past (Berntsen & Rubin, 2002). These tendencies might affect the relationship between positivity, detail, and aging. The type of event or the content of the memory also may matter. For example, an age-related positivity effect has been reported for self-defining or landmark memories (Singer et al., 2007; Webster & Gould, 2007), but not for relationship-defining memories (Alea & Vick, 2010). Additional work might investigate whether the age-related positivity preference affects the specific details within these or other types of autobiographical events.

In conclusion, the current findings suggest that the age-related positivity effect in autobiographical memory is best conceptualized as a biasing effect, one that does not necessarily affect the strength or availability of positive relative to negative event details in memory. This interpretation of the age-related positivity effect does not undercut its potential implications for subjective well-being, and in fact, it might augment such implications. We found that older adults were more likely to rate both past and future events more positively than younger adults. To the extent that this bias sustains a positive sense of self and influences productive plans for the future, the lack of a concurrent positivity effect on autobiographical details could present an optimal situation. Older adults might benefit from a general preference to process positive autobiographical information, without a concurrent distortion in the relative availability of positive and negative event details should they be needed in certain situations.

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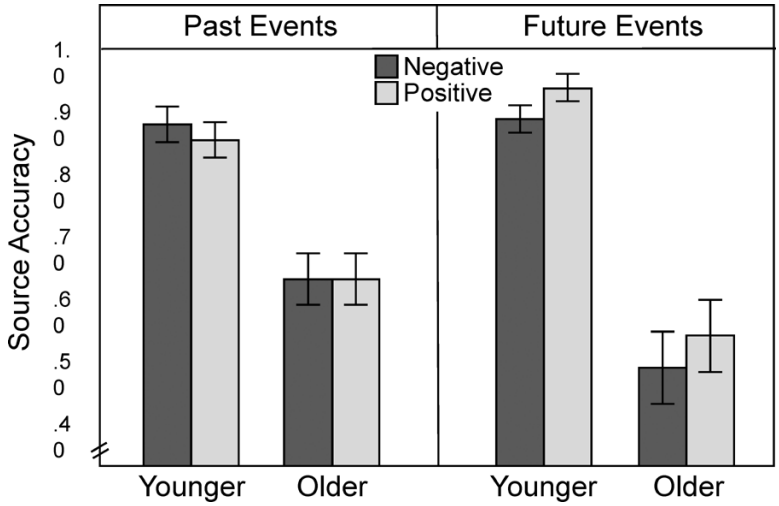

Figure 1.
Source memory accuracy (correct responses to studied items) for emotional events (means + standard errors).

Table 1

Mean subjective ratings of valence, detail, and difficulty for the events generated in each cue condition by younger adults (YA) and older adults (OA).

	Valence		Detail		Difficulty	
	YA	OA	YA	OA	YA	OA
Positive Cues						
Past	5.58	5.95	4.93	4.77	3.08	2.33
Future	5.63	5.86	4.34	4.61	3.13	2.65
Negative Cues						
Past	2.50	2.73	4.82	4.70	2.95	2.71
Future	2.17	3.06	3.78	4.05	3.65	3.18
Neutral Cues						
Past	4.59	5.05	4.68	4.82	2.88	2.31
Future	4.41	4.97	4.26	4.67	3.58	2.70

Note. Ratings used a 1–7 scale (negative to positive for valence; low to high for details and difficulty).

Table 2

Mean source memory judgments for the events in each cue condition by younger adults (YA) and older adults (OA). Correct responses are in highlighted.

	"Past"		"Future"		"New"	
	YA	**OA**	**YA**	**OA**	**YA**	**OA**
Positive Cues						
Past	**.86**	**.63**	.07	.21	.07	.16
Future	.01	.20	**.94**	**.54**	.05	.26
Negative Cues						
Past	**.88**	**.63**	.08	.21	.04	.16
Future	.05	.30	**.89**	**.49**	.07	.21
Neutral Cues						
Past	**.97**	**.83**	.02	.14	.01	.04
Future	.04	.34	**.92**	**.57**	.05	.09
Nonstudied Cues						
NA	.02	.09	.02	.06	**.96**	**.85**

Note. Neutral cues were studied prior to emotional cues, and so may have benefitted from primacy. Results for nonstudied cues are collapsed across the positive, negative, and neutral items (NA = not applicable).