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Effects of task instruction on autobiographical memory specificity in young and older adults

Jaclyn Hennessey Ford[1], David C. Rubin[2], and Kelly S. Giovanello[1,3]

[1]Department of Psychology, UNC-CH, Chapel Hill, NC, USA
[2]Department of Psychology and Neuroscience, Duke University, Durham, NC, USA
[3]Biomedical Research Imaging Center, UNC-CH, Chapel Hill, NC, USA

Older adults tend to retrieve autobiographical information that is overly general (i.e., not restricted to a single event, termed the *overgenerality effect*) relative to young adults' specific memories. A vast majority of studies that have reported overgenerality effects explicitly instruct participants to retrieve specific memories, thereby requiring participants to maintain task goals, inhibit inappropriate responses, and control their memory search. Since these processes are impaired in healthy ageing, it is important to determine whether such task instructions influence the magnitude of the overgenerality effect in older adults. In the current study participants retrieved autobiographical memories during presentation of musical clips. Task instructions were manipulated to separate age-related differences in the specificity of underlying memory representations from age-related differences in following task instructions. Whereas young adults modulated memory specificity based on task demands, older adults did not. These findings suggest that reported rates of overgenerality in older adults' memories might include age-related differences in memory representation, as well as differences in task compliance. Such findings provide a better understanding of the underlying cognitive mechanisms involved in age-related changes in autobiographical memory and may also be valuable for future research examining effects of overgeneral memory on general well-being.

Keywords: Autobiographical memory; Specificity; Healthy ageing; Task demands; Overgenerality.

Recent research has demonstrated that age-related changes are apparent in autobiographical memory retrieval when the qualitative content of the memories is examined. Specifically, older adults tend to retrieve autobiographical information that is overly general (i.e., not restricted to a single event) relative to young adults' specific memories (see Piolino, Desgranges, & Eustache, 2009). This *overgenerality effect* in older adults' retrieval has been demonstrated in studies that measure the specificity of narratives as a whole (Piolino et al., 2006; Ros, Latorre, & Serrano, 2009), those that examine the episodic and semantic contributions to a single narrative (Addis, Wong, & Schacter, 2008; Levine, Svoboda, Hay, Winocur, & Moscovitch, 2002), and those that separately evaluate retrieval of specific and general information in individual questionnaires (Piolino et al., 2010; Piolino, Desgranges, Benali, & Eustache, 2002). The reduction in specificity manifests itself as reduced retrieval of relevant episodic details, as well as the increased retrieval of irrelevant and semantic information (Addis et al., 2008; Levine et al., 2002). In addition,

Address correspondence to: Jaclyn Hennessey Ford, Department of Psychology, Boston College, McGuinn 504B, Chestnut Hill MA 02467, USA. E-mail: JaclynHFord@gmail.com

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healthy ageing is associated with a reduction in the subjective sense of re-experiencing autobiographical events (Piolino et al., 2006).

Specific autobiographical memories (i.e., memories for events lasting no longer than a single day) involve a complex interplay of specific event details and abstract knowledge (Conway & Pleydell-Pearce, 2000; Rubin, 2006). Such specific memories include vivid imagery, mental time travel, and autonoetic consciousness (i.e., the ability to mentally re-experience the event; Tulving, 1985) typically associated with laboratory episodic memories (Piolino et al., 2009). Although many autobiographical memories are retrieved as specific events, it is also common to retrieve more general autobiographical information (Piolino et al., 2009). This information can be in the form of abstract knowledge about the self (i.e., *lifetime period knowledge*; Conway & Pleydell-Pearce, 2000), or an extended memory for a set of repeated events or a period of time longer than 1 day (i.e., *general event memory*; Williams et al., 2007). These general autobiographical memories are abstracted from multiple specific events and recalled as semanticised personal knowledge. Recent studies have established that older adults retrieve overly general autobiographical memories in place of specific memories (Addis et al., 2008; Baron & Bluck, 2009; Levine et al., 2002; Piolino et al., 2002, 2006, 2009, 2010; Ros et al., 2009). This is consistent with laboratory studies that have demonstrated that episodic memory is disproportionately affected by healthy ageing, causing older adults to compensate by relying on their relatively intact semantic memory (Mitchell, 1989).

Over the years researchers have been interested in gaining a better understanding of the underlying factors that contribute to overgeneral memory. Williams and colleagues (Williams, 2006; Williams et al., 2007) have reviewed the research examining overgeneral memory in individuals with emotional disorders, identifying three primary processes that contribute to this phenomenon: Capture and rumination, functional avoidance, and impaired executive control (the CaR-FA-X model). Capture and rumination refers to the tendency for participants to ruminate on conceptual self-relevant information during autobiographical memory retrieval. Functional avoidance occurs when specific autobiographical memories are avoided to help regulate emotions, possibly due to an early trauma. Finally, impaired executive control ability in a population can limit the ability to conduct the iterative memory search through autobiographical memory knowledge. Although these three factors have been shown to be important in overgeneral memory retrieval in individuals with emotional disorders, research is required to determine whether these processes work together to contribute to overgeneral memory in older adults.

Many studies that have examined the overgenerality effect explicitly require that participants retrieve a *specific* autobiographical memory (i.e., a memory of an event that occurred over minutes or hours, but no longer than a single day). In such tasks participants are required to maintain the "specificity" goal in mind and actively inhibit overly general information (Williams et al., 2006, 2007). As such, measures of overgenerality in these studies incorporate age-related differences in the underlying memory representations as well as any differences in how young and older adults follow task instructions. Previous studies have demonstrated that older adults have deficits in the inhibition of irrelevant information (Hasher, Stoltzfus, Zacks, & Rypma, 1991; West & Bell, 1997), self-initiated strategic operations (Craik & Grady, 2002; Craik, Morris, & Gick, 1990), the maintenance of information in working memory (Daigneault & Braun, 1993), and actively representing, updating, and maintaining task goals (Braver & Barch, 2002; Braver, Satpute, Rush, Racine, & Barch, 2005; Braver & West, 2008). As such, it is probable that older adults have a deficit following specific memory instructions, making it important to isolate age-related differences in the actual autobiographical memory representation and retrieval.

Two recent studies have demonstrated the importance of considering the effect of task instruction on measures of overgenerality (Dalgleish et al., 2008; Dalgleish, Rolfe, Golden, Dunn, & Barnard, 2007). These studies focused on two populations that typically exhibit the overgenerality effect (i.e., individuals with depression, Dalgleish et al., 2007; and individuals with post-traumatic stress disorder, Dalgleish et al., 2008). These studies used a reverse memory instruction (i.e., "Please retrieve a *general* autobiographical memory" where a "general" memory is defined as a memory for a category or cluster of similar events) in addition to the standard specific memory instruction. In the general memory condition increased depressive symptomology

was correlated with decreased general memory retrieval (or increased specific memory retrieval), suggesting that depression was primarily associated with difficulty following task instructions (Dalgleish et al., 2007). Post-traumatic stress symptoms, on the other hand, were still associated with increased general memory retrieval in the general memory condition, suggesting that overgenerality was actually driven by other factors (e.g., emotion regulation; Dalgleish et al., 2008). These studies were important, as they demonstrated that task instructions can have an influence on the overgenerality effect. In addition, these studies demonstrated that the overgenerality effect is not a unified pattern in all populations, but that there are many potential factors that may underlie the effect. The current study uses the general memory condition in older adults to examine how task instructions contribute to overgeneral memory retrieval in this population.

The current study extended prior research by examining the effects of task manipulations in healthy older adults. In addition, the *specific* and *general* retrieval instructions used in prior studies were compared to a third *unrestricted* retrieval instruction in which participants were not explicitly instructed to retrieve a certain type of memory. We hypothesised that young adults, compared to older adults, would retrieve a greater proportion of specific events in the specific memory condition, but a lesser proportion of specific events in the general memory condition. Music was selected as a personally meaningful retrieval cue that allowed for retrieval of autobiographical memories in all three instruction conditions.

Additionally, the current study utilised two different measures of memory specificity to determine whether memory-level ratings (i.e., evaluations of the entire narrative) produce the same pattern of results as detail-level ratings (i.e., proportion of details ratings as "internal"). First, each memory was evaluated as a single, holistic unit and rated based on the specificity of the entire narrative. Second, each narrative was scored using the scoring procedures in Levine's Autobiographical Interview (AI; Levine et al., 2002), an in-depth analysis that dissociates semantic and episodic components of a single narrative. We hypothesised that age-related differences would emerge using both measures of specificity.

METHOD

Participants

A total of 25 healthy young adults (mean age = 18.7, $SD = .76$; mean education = 12.32, $SD = .63$; 10 male) and 21 healthy older adults (mean age = 75.6, $SD = 5.97$; mean education = 17.14, $SD = 2.24$; 10 male) participated in the current study. Partial data were lost for one young adult (age = 19; edu = 12; male) due to technical problems. One additional young adult (age 18; edu = 12; female) and seven additional older adults (mean age = 76.8, $SD = 9.04$; mean education = 15.86, $SD = 2.34$; 1 male) were tested, but were excluded due to their voluntary termination of the study prior to completion. Participants were all right-handed native English speakers without a history of psychiatric illness, neurological disorder, or hearing impairment. Young adult participants were recruited using flyers posted on the UNC campus and received partial course credit for their participation. Older adults were recruited from the Cognitive Neuroscience of Memory Laboratory database and were paid for their participation. Before participating in the study all participants gave written informed consent in accord with the requirements of the Institutional Review Board at the University of North Carolina at Chapel Hill.

The Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) was employed to measure depressive symptoms in young and older adults. The BDI is a 21-item questionnaire resulting in potential scores from 0 to 63. Each item on the questionnaire corresponds to a specific category of depressive symptom and/or attitude. The BDI was used to ensure that age-related differences in memory specificity were not caused by higher rates of depressive symptomology in the older adult group, given the negative relationship between symptomology and specificity. However, young and older adults were equivalent on this measure of depression ($p = .215$).

In addition, older adult participants received a general health screen and completed a battery of neuropsychological tests to assess memory, language, attention, visuo-spatial abilities, and general intellectual functioning. These tests included the Mini Mental State Examination (MMSE), forward and backward Digit Span, immediate and

TABLE 1
Neuropsychological information for young and older adults

	Young adults	*Older adults*
Depression Scale (BDI)	6.59(7.53)	4.12(2.87)
Stroop	.20(.11)	.29(.19)
Working Memory Accuracy	.83(.26)	.78(.20)
Task Switching	.18(.12)	.19(.15)
MMSE		28.9(1.33)
Digit Span Forward		10.45(3.09)
Digit Span Backward		7.40(2.16)
Logical Memory Immediate		28.10(5.12)
Logical Memory Delay		23.70(5.21)
Trails A time		34.45(11.79)
Trails B time		74.35(19.46)
COWAT		42.30(13.43)
Vocabulary		55.90(8.90)

BDI = Beck's Depression Inventory; MMSE = Mini-mental state exam; COWAT = Controlled oral word association test. Group means, standard deviations in parentheses.

delayed logical memory test, Trail Making Test parts A and B, Controlled Oral Word Association Test (COWAT), and Vocabulary from the WAIS-III. Mean scores are listed in Table 1.

Materials

Musical stimuli

Retrieval cues consisted of 30-second musical clips (see Appendix). Music was selected as a retrieval cue for the current experiment for several reasons. It has been suggested that retrieval success is higher for musical cues compared to verbal cues (Schulkind & Woldorf, 2005). In other words, participants are able to retrieve more memories when presented with music than when they are presented with words. Importantly, the increase in retrieval success appears larger for older relative to younger adults (Schulkind & Woldorf, 2005). This differential increase leads to more equivalent performance between the two groups in the current study. Additionally, we have previously used music in studies with young adults to elicit detailed memories from various levels of specificity without explicit instruction (Ford, Addis, & Giovanello, 2011, 2012). Such variety allows for the inclusion of multiple retrieval conditions with fewer task demands. All songs were downloaded from the iTunes music store and converted into WAV files.

The primary experimental stimuli consisted of songs that were popular when participants were within the age range of 7 to 21 (2000s for young adults; 1950s for older adults). Presenting young and older adults with age-specific songs provided the opportunity to control for the age of encoding, an important variable to consider when comparing autobiographical memories. Previous research has demonstrated that songs from an individual's youth are remembered best and are associated with greater ratings of emotionality (Schulkind, Hennis, & Rubin, 1999; Schulkind & Woldorf, 2005), making these songs ideal for the current experiment. Of particular importance was that the songs act as salient cues for older adults. Because songs were selected based on high public appeal, many of these songs have remained popular over the years. Because we did not test participants on their semantic memory for the name of the song, the artist, or the time period in which the song reached popularity, subsequent exposure to these songs did not contaminate the memory processes of interest. In fact multiple experiences with a song allowed for a greater variety of events that could be retrieved during the task.

A third category of musical cues was selected to act as a control condition in the current study. This category consisted of songs from popular movies from the last 20 years. Specifically, these songs were those that were nominated for an Oscar Award in that time period (1989–2009). This condition served as a direct comparison between groups for memories elicited by the same stimuli. In addition it allowed us to compare memories encoded at the same time point. In other words, this comparison controlled for the amount of time that has passed since encoding. These songs were pilot tested to ensure equivalent familiarity, valence, and autobiographical saliency in the two age groups.

Executive control tasks

Stroop task. The Stroop task (1935; see also MacLeod, 1991) was used to measure each individual's capacity to inhibit irrelevant information. In this task participants were asked to name the ink colour of a stimulus. The stimulus was in the form of a string of Xs (neutral trials), the same colour word as the colour of the ink (e.g., the word "GREEN" in the colour green), or a different colour word (e.g., the word "RED" in the colour green). The measure of inhibition is the difference in retrieval times for the incongruent condition (i.e., the word "RED" in the colour

green) and the neutral condition (i.e., a string of X's in the colour green).

N-back test. The ability to update information that is being held in working memory was tested using an *n*-back test (Vaughan & Giovanello, 2010; adapted from McElree, 2001). In this task participants decided whether or not a current stimulus was identical to the item that was presented *N* items back (1 or 2). The measure of interest for the current analysis was the accuracy rate for the 2-back task.

Number-letter task. To measure the capacity to switch from one task to another, we utilised a number–letter paradigm (Rogers & Monsell, 1995). When letter–number pairs were presented in the top half of the screen, participants were required to make an odd/even judgement on the number. When pairs were presented in the bottom half of the screen, participants were required to make consonant/vowel judgements on the letter. All pairs appeared on the bottom for the first part and on the top for the second part, resulting in two "no switch" conditions. The third part was the "switch" condition, with pairs appearing at the top and the bottom. Within the switch condition, switch trials were those in which the prior trial was in the opposite position (e.g., bottom followed by top) and no-switch trials were those in which the prior trial was in the same position (e.g., bottom followed by bottom). The global task-switching cost was calculated by subtracting the retrieval times for the no-switch conditions from the switch condition (i.e., the average RT for part 3 minus the average RT for parts 1 and 2).

Procedure

Before beginning the experiment participants engaged in a 30-minute instructional session on the components of autobiographical memory. Specifically, participants learned the three levels of specificity (i.e., personal facts, general memory, and specific memory) described by Conway and colleagues (Conway & Pleydell-Pearce, 2000) and were instructed on the rating scales to be used during the study (i.e., familiarity, memory valence, song valence, and recency). The instruction period familiarised participants about the purpose of the study to ensure that they could effectively rate the qualities and level of each memory.

When participants felt comfortable with the ratings they began the study. The study consisted of experimental conditions that were identical for the age-specific songs and the movie songs. For each song type there were three instruction conditions. There was a specific memory condition, a general memory condition, and an unrestricted memory condition. This unrestricted instruction condition has been used in our previous research with young adults (Ford et al., 2011, 2012). Two lists of songs (i.e., age-specific and movie songs) were included for each instruction condition (i.e., general, specific, and unrestricted) resulting in six lists. The order of these lists was counterbalanced across participants. Each list consisted of 10 songs that were presented in random order at the time of testing.

During each memory trial participants were presented with a 30-second music clip and asked to retrieve personal memories associated with the cue, in accordance with the instruction condition (see below). Participants were given 45 seconds to verbally record the event on a digital audio recorder and were asked to identify the level of specificity that best fitted their memory by pressing the appropriate button upon retrieval (1 = personal facts, 2 = general, and 3 = specific). In addition participants identified the year in which the event took place and rated the memory valence (1 = highly negative, 2 = somewhat negative, 3 = neutral, 4 = somewhat positive, 5 = highly positive), song valence (1 = highly negative, 2 = somewhat negative, 3 = neutral, 4 = somewhat positive, 5 = highly positive), and song familiarity (1 = highly unfamiliar/ no familiarity, 2 = low familiarity, 3 = medium familiarity, 4 = high familiarity, 5 = very high familiarity). Participants had 6 seconds to make each response. After completing the ratings, participants were instructed to prepare for the next trial. Following all six lists of memory retrieval, participants completed the executive control tasks and the BDI.

Instruction conditions

Specific memory instruction: In the specific memory condition participants were presented with musical cues and asked to retrieve a *specific* autobiographical memory. Participants were instructed that the memory should be of a single event that occurred over minutes or hours, but no

longer than a day, and were given examples of acceptable and unacceptable responses.

General memory instruction: In the general memory condition participants were asked to retrieve a *general* memory associated with the musical cue. General memories were described as being memories of events that extend beyond a single day, either as categories of events (or repeated events) or a single event that extended beyond a single day. Participants were given examples of acceptable and unacceptable responses.

Unrestricted memory instruction: In the unrestricted condition participants were not given explicit instructions as to which level their memory should fit (i.e., specific or general). Instead participants were reminded of the levels and were encouraged to retrieve whatever memory felt the most natural during retrieval.

Data analysis

Ratings. Two independent researchers classified each memory as one of five types: (1) *No memory*: The participant retrieved no autobiographical information. (2) *Personal fact*: The participant retrieved autobiographical knowledge or factual information about themselves, but had no memories for any events (e.g., "This song was really popular in junior high."). (3) *Repeated event*: The participant had a memory for a cluster of personal events that all belonged to the same category (e.g., "When I was in high school we used to go to the community centre for dances on Friday nights."). (4) *Extended event*: The participant had a memory for a single event that extended beyond a single day (e.g., "When I was 15 we went on a road trip across the country and we listened to this CD the entire time. This song makes me think of being in the car with my family listening to this type of music."). (5) *Specific event*: The participant had a memory for a single event that lasted minutes or hours, but no longer than a day (e.g., "This song reminds me of this one night when I was studying in my dorm and this song was playing. It was raining and dark and I remember feeling like the song really matched the mood of the night.").

In addition to having two independent researchers rate the overall level of specificity for each memory, two additional researchers evaluated the narrative content of each memory utilising the scoring system within the Autobiographical Interview (Levine et al., 2002). The detailed instructions on scoring were meticulously followed in order to accurately replicate previous research performed by Levine and colleagues (2002). Each memory trial was transcribed and segmented into individual details (i.e., a statement that contributed a novel and unique piece of information). Raters scored each memory detail as "internal" or "external". Internal details were those that were central to a specific retrieved memory, whereas external details were those that referred to general events or contained semantic or unrelated information. Internal details were then categorised based on detail type (e.g., event, time, emotion, perception, and place). These categories allow for a comparison between young and older adults based on the type of internal and external details retrieved. Ratings were compared between raters and discussed to achieve agreement. Consistency between raters was evaluated on 60% of these analyses, using an intraclass correlation coefficient (one-way random effects model; McGraw & Wong, 1996). All raters were blind to the purpose and hypotheses of the study.

Statistical analysis. All variables of interest were entered into 3×2 ANOVAs with instruction (i.e., specific, general, and unrestricted conditions) as a within-participant factor, and age (i.e., young and older adults) as a between-participants factor. To further investigate significant main effects and interactions, follow-up *t*-tests were conducted.

RESULTS

Song stimuli

To examine differences in ratings of song familiarity and song valence, ratings were entered into a 3×2 ANOVA. There was no main effect of instruction condition or age on ratings of familiarity ($p > .1$ for both instruction and age group) and there was no interaction between age and instruction for familiarity ($p > .1$). There was no effect of instruction on song valence ($p > .1$), but there was a significant effect of age, $F(1, 42) = 6.54$, $p < .05$, with older adults rating their songs as more positive on average ($M = 3.92$) compared to young adults ($M = 3.55$). The interaction of age and instruction condition was not significant ($p > .1$).

Memory retrieval

The current analysis examined retrieval of specific and general autobiographical event memories. Successful retrieval was indexed by the number of events (both specific and general) retrieved during the task. There was no effect of instruction condition on memory success ($p > .1$) and no interaction of age and instruction condition ($p > .1$), suggesting that this pattern was the same in both age groups. Finally, young adults retrieved more event memories than older adults, $F(1, 43) = 32.79$, $p < .001$. To control for this difference in our measure of specificity, scores were calculated as a proportion out of the total number of event memories in each condition.

Effect of task instruction on autobiographical memory specificity

The inter-rater reliability coefficient for memory specificity ratings was high (.95), assessed using intraclass correlations (one-way random effects model; McGraw & Wong, 1996). The main effect of age was significant, with young adults retrieving a greater proportion of specific memories than older adults, $F(1, 42) = 26.28$, $p < .001$. The main effect of instruction was also significant, $F(2, 84) = 19.94$, $p < .001$, as was the instruction-by-age group interaction, $F(2, 84) = 25.94$, $p < .001$.[1] Follow up t-tests revealed that young adults retrieved a greater proportion of specific memories than older adults in the specific instruction condition, $t(43) = 8.55$, $p < .001$, but not in the general instruction condition ($p > .1$), with a trend towards a greater proportion in the unrestricted condition ($p > .1$; Figure 1).

Additional t-tests determined that older adults retrieved the same proportion of specific memories in all three instruction conditions ($p > .1$ for all paired contrasts), but young adults retrieved more specific memories in the specific instruction condition relative to the unrestricted condition, $t(23) = 6.10$, $p < .001$), and more specific memories in the unrestricted condition relative to the general instruction condition, $t(23) = 3.97$, $p < .001$). This finding suggests that young adults were using the instructions to modulate their retrieval process, but older adults were not. A follow-up analysis examined these relationships in events rated as positive only. The main effects of instruction, $F(2, 82) = 13.19$, $p < .001$, and age, $F(1, 41) = 9.38$, $p < .005$, were still significant, as was the age-by-instruction interaction, $F(2, 82) = 13.04$, $p < .001$, showing the same pattern as findings as the analysis using all events.

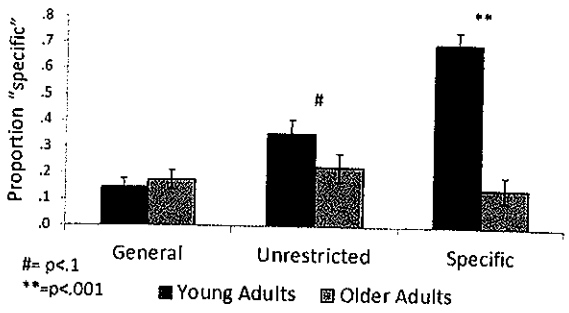

Figure 1. Proportion of specific memories (as measured by specificity ratings) as a product of age group and instruction condition.

Of note, the average number of specific memories was low in older adults, potentially creating a floor effect in our analysis. That is, it is possible that older adults were unable to modulate retrieval processes due to an overall low level of specific memory retrieval. To examine this possibility we compared the proportion of specific memories in the specific and general memory conditions for each individual participant. The greater the difference between the two conditions, the more the individual followed task instructions during retrieval. All 24 young adults in this analysis reported a greater proportion of specific events in the specific memory condition relative to the general memory condition, whereas nearly 50% of the older adults (10 of 21) reported a greater proportion of specific memories in the general memory condition relative to the specific memory condition. These data suggest that, individually, older adults reported sufficient numbers of specific events to vary between conditions, but that they were not consistently following task instructions. In addition, we reran the 3×2 ANOVA with participants who retrieved at least 20% specific memories in the specific memory condition (OA = 7, YA = 23). The main effect of instruction, $F(3, 56) = 15.11$, $p < .001$, and the age-by-instruction interaction, $F(2, 56) = 8.04$, $p < .001$, were still significant with this restricted sample, with significant age-related differences in the specific memory condition only, $t(28) = 4.19$, $p < .001$.

[1] Because education levels were significantly higher in older relative to young adults, we also ran this analysis with education as a covariate. The age main effect and age-by-instruction interaction were still significant at $p < .005$.

Although it is difficult to interpret the results with such a small number of older adults, this result further confirms that the pattern of findings in the current study were not driven by an overall low level of performance in the older adults.

An additional analysis examined the relationship between memory age and specificity. A 2 × 2 ANOVA was conducted with memory rating (i.e., specific and general events) as a within-participant factor and age (i.e., young and older adults) as a between-participants factor. As expected, there was a significant effect of age, $F(1, 39) = 575.91$, $p < .001$, with older adults reporting memories that were older than those of young adults. However, there was no effect of memory rating on memory age ($p > .1$) suggesting the specific and general event memories did not differ in recency. Importantly, the rating by age interaction was also insignificant ($p > .1$), demonstrating that older adults' specific memories were just as old as their general memories. This finding suggests that the reduction in specific memory retrieval was not simply a product of older adults' older memories.

Effect of task order on memory specificity

The three instruction conditions in the current study were counterbalanced so that participants received the instructions in different orders. To examine the effect of this counterbalance on memory specificity, we conducted a 3 × 3 × 2 ANOVA with instruction (i.e., unrestricted, general, and specific conditions) as a within-participant factor and counterbalance (i.e., unrestricted first, general first, and specific first) and age (i.e., young and older adults) as between-participants factors. As expected, we found main effects of instruction, $F(2, 78) = 32.87$, $p < .001$, and age, $F(1, 39) = 66.92$, $p < .001$, as well as an age by instruction interaction, $F(2, 78) = 34.4$, $p < .001$; (Figure 2).

Importantly, we found no main effect of counterbalance ($p > .1$) or an instruction by counterbalance interaction ($p > .1$). However, there was a significant age by counterbalance interaction, $F(2, 39) = 7.06$, $p < .005$, where counterbalance had a significant effect on specificity in young adults, $F(2, 21) = 5.316$, $p < .05$, but not in older adults ($p > .1$). Specifically, young adults who received the specific instruction first reported more specific memories overall than those who received the general instruction first ($p < .01$).

We also found a marginally significant age by instruction by counterbalance interaction, $F(4, 78) = 2.31$, $p = .065$, where there was a trend towards a counterbalance by instruction interaction in young adults ($p = .076$) but not older adults ($p > .1$). Unsurprisingly, the order of instructions appears to have had its greatest effect on retrieval during the unrestricted condition in young adults, $F(2, 21) = 7.23$, $p < .005$. In other words, the effect of prior retrieval conditions was greatest when young adult participants permitted to retrieve whatever memory came to mind. This finding suggests that young adults are so sensitive to task instructions that the associated changes in retrieval strategy can influence how they approach subsequent tasks with less explicit goals. Counterbalance also influenced young adults' specificity in the general instruction condition,

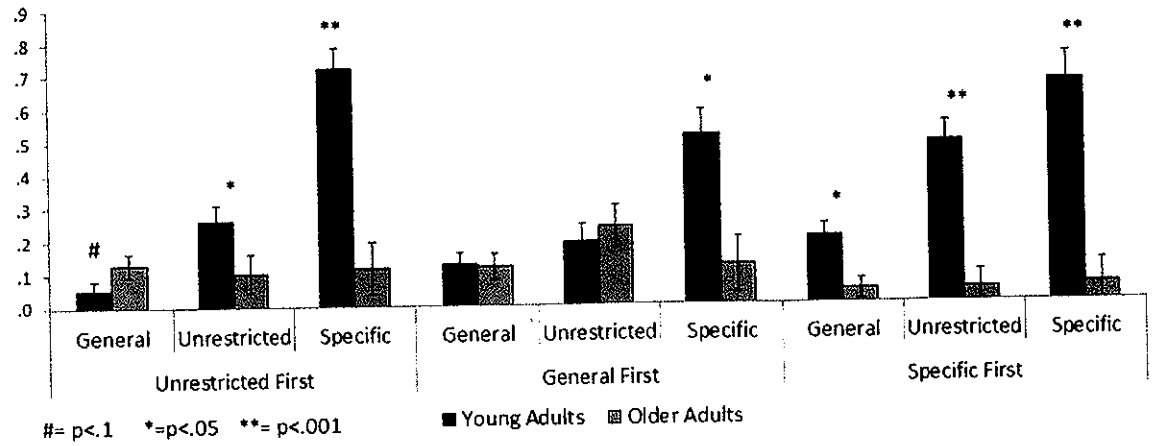

Figure 2. Proportion of specific memories (as measured by specificity ratings) as a product of counterbalance, age group, and instruction condition.

$F(2, 21) = 4.53$, $p < .05$, but not in the specific instruction condition ($p > .1$). Counterbalance did not influence older adults' retrieval in any condition ($p > .1$ in all three conditions), further demonstrating the reduced effect of task instructions on retrieval in this group.

Generalisation of pattern to other song types

The memories described above were elicited using age-specific songs. These songs were selected because they might have a unique ability to elicit strong and vivid memories from both age groups. However, it is possible that the unique nature of age-specific songs influenced the types of memories retrieved in the current study. In other words, it is important to consider the possibility that the pattern identified in the current study would not generalise to memories elicited by other songs. To test this possibility we included a control condition in which young and older adults received the same songs: Oscar-nominated songs from the last 20 years. These songs were rated as less familiar, $F(1, 42) = 919.70$, $p < .001$, and less positive, $F(1, 42) = 76.02$, $p < .001$, than age-specific songs, and led to reduced retrieval success, $F(1, 43) = 57.62$, $p < .001$. These results suggest that age-specific and movie songs were distinctly different in terms of familiarity and valence. More importantly, the pattern identified across instruction conditions in the age-specific songs persisted for these songs. Specifically, young adults retrieved a greater proportion of specific memories than older adults in the specific instruction condition, $t(37) = 3.28$, $p < .005$, but not the unrestricted ($p > .1$) or general instruction conditions ($p > .1$).

Generalisation to other measures of memory specificity (Autobiographical Interview)

In addition to generalising this pattern across song types we were interested in determining whether the pattern would generalise across measures of specificity. Our primary measure of specificity was a categorisation method in which each memory was assessed as a complete unit. Previous studies have also examined memory specificity by calculating the number of episodic (or "internal") details provided in the narratives. To more fully examine the age-related difference in specificity across instruction conditions we included this measure of specificity, which comes from a different theoretical perspective that determines specificity based on number of episodic details in a memory (Levine et al., 2002). The inter-rater reliability coefficient for memory specificity ratings was high (.87). The measure of specificity in this analysis was the proportion of specific (or *internal*) details reported in the event memory narratives.

As in the prior analysis, young adults retrieved a greater proportion of internal details than older adults in the specific instruction condition, $t(43) = 8.14$, $p < .001$, but not the general instruction condition ($p > .1$; Figure 3). In this analysis young adults also retrieved a greater proportion of internal details in the unrestricted instruction condition, $t(44) = 2.88$, $p < .01$. These results largely replicate the findings using ratings of memory specificity.

Using the Autobiographical Interview also allowed for the analysis of internal and external details within particular memory types. A 3×2 ANOVA was conducted to examine the proportion of internal details within *specific* memories only. The main effects of age was significant, $F(1, 17) = 6.69$, $p < .05$, with young adults reporting more internal details in their specific memories compared to older adults. Instruction condition was also significant, $F(2, 34) = 3.46$, $p < .05$, with specific memories in the specific memory condition including more internal details than those in the unrelated condition ($p < .05$) and a similar trend in the general memory condition ($p = .08$). The age by instruction interaction was not significant ($p > .1$), suggesting that young adults

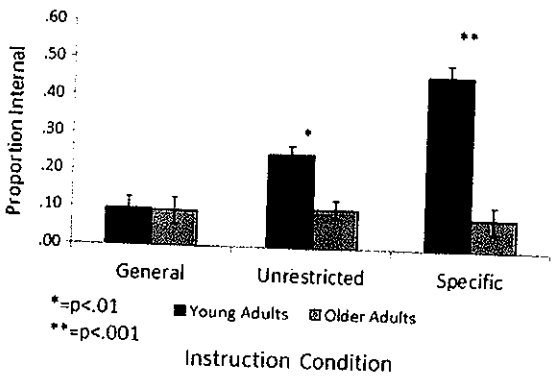

Figure 3. Proportion of internal details (as measured using the Autobiographical Interview scoring system) as a product of age group and instruction condition.

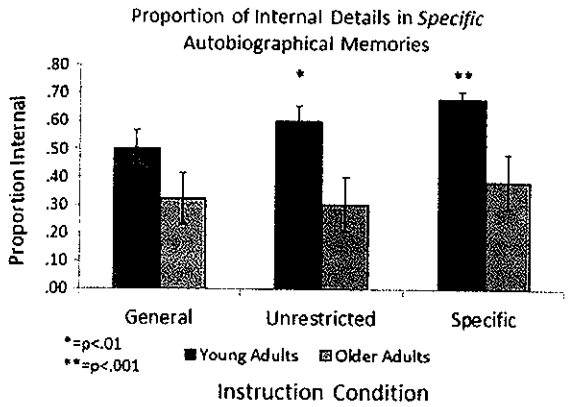

Figure 4. Proportion of internal details (as measured using the Autobiographical Interview scoring system) in specific autobiographical memories *only* as a product of age group and instruction condition.

report a greater proportion of internal details in their specific memories relative to older adults regardless of the instruction condition. However, it is notable that the main effect of instruction was significant in young adults, $F(2, 24) = 3.84$, $p < .05$, but not in older adults ($p > .1$; Figure 4).

The Autobiographical Interview analysis supports the prior analysis by showing that the overgeneral memory effect was greatest when participants were given a specific memory instruction when compared to a general or unrestricted memory instruction. In addition the Autobiographical Interview allowed us to examine age-related differences in the elaboration of specific memories. In other words, we were able to compare the proportion of internal detail reported by young and older adults when they successfully reported a specific memory. Young adults reported a greater proportion of internal details relative to older adults, and this difference was not influenced by retrieval instruction. However, further analysis demonstrated that young adults did produce the most internal details in the specific memory condition, suggesting that they, but not older adults, used the instruction condition to direct their selection of memory details.

The effect of executive control ability on autobiographical memory specificity

Young and older adults did not differ on our measures of executive control (i.e., inhibition, task-switching, and working memory; See Table 1). These three variables were considered independent measures of executive control ability, as they were not highly correlated with one another. Increased working memory accuracy on the 2-back task was associated with decreased response times on the Stroop task ($r = -.28$, $p < .05$). However, global task switching costs were not associated with performance on the 2-back task ($p > .1$) or the Stroop task ($p > .1$). When using the Benjamini-Hochberg procedure for correcting for multiple comparisons (Thissen, Steinberg, & Kuang, 2002; Williams, Jones, & Tukey, 1999), no correlations reached significance. When using an uncorrected p-value for our correlations ($p < .05$), high accuracy on the working memory task (i.e., the 2-back task) was significantly associated with increased retrieval of specific events in the specific instruction condition for age-specific songs ($r = .311$, $p < .05$).

DISCUSSION

The current study examined the cognitive mechanisms underlying age-related changes in autobiographical memory retrieval. Music was selected as a retrieval cue due to its unique capability to elicit specific emotional memories without explicit retrieval instructions. Three instruction conditions (specific, general, and unrestricted) were compared to determine the extent to which differences in instruction contribute to the overgenerality effect. The current study identified age-related differences in the effects of these instructions on memory retrieval and introduced a number of important questions that should be addressed in future studies. These findings are discussed below in relation to established age differences in memory.

Effects of task demands

The primary goal of the current study was to examine the effects of task instruction on the overgenerality effect in older adults. The overgenerality effect was identified in the standard "specific" instruction, as measured by both ratings of specificity and scores on the Autobiographical Interview coding system. For both ratings of specificity and the Autobiographical Interview coding system, instruction condition did not influence older adults' retrieval, suggesting that older adults were not maintaining and implement-

ing task instructions during retrieval. Young adults, on the other hand, had higher scores for specificity in the specific instruction condition relative to the unrestricted instruction condition, and higher scores in the unrestricted condition relative to the general instruction condition. This modulation in retrieval demonstrates that young adults are utilising task instruction during retrieval and alter their memory retrieval processes to match these instructions.

The *general* instruction condition was developed by Dalgleish and colleagues to evaluate the extent to which difficulty maintaining task instructions contributes to the overgenerality effect in a given population (Dalgleish et al., 2007, 2008). When given the general instruction condition, individuals with high executive control ability inhibit *specific* autobiographical memories, reducing their measures of specificity for that condition. Individuals with low executive control ability do not inhibit specific memories, resulting in the same level of specificity across conditions, as measured using a categorical rating system. In the current study young adults lowered their retrieval of specific memories in this condition whereas older adults did not, resulting in equivalent ratings of specificity in the two groups.

The unrestricted instruction condition was included to further examine this possibility by obtaining a measure of the overgenerality effect beyond age-related differences in the ability to maintain and implement task instructions. Although young adults retrieved more specific events than older adults in the unrestricted condition, this effect was not significant. This suggests that the effect measured in the specific memory condition is partially driven by differences in task compliance.

Multiple components of the overgenerality effect

The current study demonstrates that the traditional overgenerality effect may, in fact, be driven by multiple factors. The significant differences across instruction conditions suggest that age-related differences in following task instructions might play an important role in the effect. However, the trend towards a difference between young and older adults in the unrestricted condition suggests that an underlying difference may exist in the memories that young and older adults retrieve in a more naturalistic setting. In other words, older adults may have a natural tendency to select less specific memories to retrieve than young adults and, due to difficulties maintaining task goals, this difference is amplified in standard memory tasks.

The Autobiographical Interview analysis suggests a third factor contributing to the overgenerality effect in older adults. Even when they retrieved specific memories, older adults reported a smaller proportion of internal details relative to young adults. This difference suggests an age-related change in memory elaboration, where young adults provide more episodic details and older adults report more background information. The current analysis is unclear regarding the effect of task instructions on this effect, but it does not appear to be as strong as the effect on memory selection.

Additionally, there may be other factors that contribute to age-related decreases in specificity. Gaesser, Sacchetti, Addis, and Schacter (2011) recently included a picture description task along with a memory retrieval task to examine the underlying sources of age-related autobiographical memory impairments. Notably, they found that the typical overgenerality pattern extended to the picture description task. Moreover, performance on this task accounted for a majority of the age-related differences in memory performance. Recent research has examined age-related changes in narrative style and documented that older adults are less likely than young adults to report perceptual or contextual details because changes in focus encourage retrieval of memory gist (Bluck, Levine, & Laulhere, 1999). This research is consistent with the suggestion that age-related changes in autobiographical memory specificity might reflect a change in narrative style and an age-related tendency to incorporate individual events into a single history (Levine, 2004). In other words, older adults may retrieve overly general autobiographical memories due to a more integrative approach to viewing their personal past.

The effect of executive control ability on autobiographical memory specificity

The results detailed above suggest that task demands play a role in the overgenerality effect, but that there are other underlying mechanisms

involved. It is notable that none of our executive control measures predicted memory specificity, as has been reported previously (Addis et al., 2008; Birch & Davidson, 2007; Piolino et al., 2010; Ros et al., 2010). These null results do not necessarily suggest that executive control ability is not required in this condition, but rather that the measures we selected did not appropriately represent the executive control processes required for these tasks. Our measures were selected based on prior studies that have identified these relationships during memory tasks that utilise verbal cues. If music automatically triggers autobiographical memories, memories retrieved by young and older adults might involve more automatic processes. It is possible that retrieval of memories associated with musical cues relies on distinct executive control processes that are not reflected in the executive control measures utilised in this study.

The use of musical cues

The current project utilised popular music cues to elicit memories from young and older adults. Songs were selected to be highly familiar in order to increase successful retrieval in both populations. Movie songs were used as a control condition in which both young and older adults retrieved the same songs during the memory task. Age-specific songs were used to elicit memories from participants' adolescent years. Importantly, young and older adults rated their respective age-specific songs as equally familiar, suggesting that these songs were well matched in terms of exposure and prior knowledge.

Oscar-nominated movie songs were essential in the current study to determine whether the patterns we identified were unique to age-specific songs. The songs selected for the age-specific condition were emotionally connected to a highly significant period in the lives of our participants, potentially altering the retrieval mechanisms. However, the same patterns of specificity were identified for both song types, suggesting that the unique qualities of age-specific did not influence the retrieval patterns.

The use of musical cues did not alter the standard overgenerality effect in older adults. Additionally, we found that task demands play an important role in the overgenerality effect during retrieval of memories cued by music. Such findings suggest that musical cues may be useful in future studies examining this effect. However, our use of musical cues for autobiographical memory retrieval might have reduced the participants' reliance on executive control processes beyond those required for the maintenance of task instruction. It has been suggested that emotional and salient retrieval cues, such as music, can automatically trigger specific autobiographical memories (Berntsen, 2009). As such, musical cues might have reduced the executive control demands of the actual search process.

Musical stimuli were used for their unique ability to successfully evoke autobiographical memories in young and older adults. However, the use of such a unique cue might reduce the generalisability of our results. It has been demonstrated that retrieval success is higher for musical cues compared to verbal cues. Importantly, the increase in retrieval success is larger for older relative to younger adults (Schulkind & Woldorf, 2005). In addition, pathologic age-related memory impairments may be reduced for musical information (Cuddy & Duffin, 2005; Irish et al., 2006). It has been suggested that music enhances memory through reduced anxiety, attention capture, and increased emotional arousal (e.g., Foster & Valentine, 2001). Such mechanisms could have altered the pattern of results in the current study. In addition the popular music clips used in this study included segments with lyrics. It is possible that listening to lyrics taxed the phonological loop of older adults to a greater extent than young adults. Similarly, older adults might have been particularly affected by the requirement to retrieve memories while music was playing. Future studies are required to determine whether the pattern of results in the current study is unique to memories elicited by musical cues and whether stopping the musical cues before initiating memory retrieval would alter the results.

Conclusions

The current study served as an important step in understanding the underlying cognitive and neural mechanisms of age-related changes to autobiographical memory retrieval. The age-related overgenerality effect identified in the standard specific instruction condition primarily reflected older adults' impairment in the maintenance and implementation of task instructions. The results of this experiment provide an important and essential foundation for future studies examining the

age-related changes to autobiographical memory retrieval, leading to a better understanding of why these changes occur.

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