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Beyond Episodic Remembering: Elaborative Retrieval of Lifetime Periods in Young and Older Adults

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Abstract

Relative to young adults, cognitively normal older adults commonly generate more semantic details and fewer episodic details in their descriptions of unique life events. It remains unclear whether this reflects a specific change to episodic memory or a broader alteration to autobiographical narration. To explore age differences across different types of autobiographical narration, we created a lifetime period narrative task that involves describing extended events. For comparison, participants also described unique life events. All autobiographical narratives were scored for episodic, semantic, and other detail generation. Relative to young adults, older adults generated more detailed narratives for remote and recent lifetime periods, which was driven by their increased retrieval of personal and general semantic details. Older adults also generated more semantic details for unique life event narratives, along with reduced episodic detail. More broadly, in both groups lifetime period narratives were largely based on semantic details, whereas episodic details were more prominent in the descriptions of unique life events. These findings indicate that the elevated generation of semantic details associated with normal cognitive aging is reflected in multiple types of autobiographical narration. We suggest that lifetime period narration is a spared aspect of autobiographical memory among older adults.

Keywords

Autobiographical memory; episodic memory; semantic memory; aging

Introduction

A remarkable feat of human memory is our ability to construct elaborative narratives about our life experiences. We create these narratives to describe episodic memories, which are memories of unique life events, and to tell our life story (Baddeley, 1992; Cermak & O'Connor, 1983; Tulving, 1985). These autobiographical narratives are believed to be primarily constructed on the basis of episodic details, personal semantics (i.e., knowledge about the self), and general semantics (i.e., shared or world knowledge) (Conway, 2005;

Prebble et al., 2013). Through the construction of autobiographical narratives, it is thought that we can engage in multiple communicative and self-reflective functions, including reminiscing on life events (Thomsen, 2009; 2015), considering what could have been (De Brigard, Addis, Ford, Schacter, & Giovanello, 2013), and contemplating what our future might hold for us (Schacter & Addis, 2007). The creation of autobiographical narratives is thus believed to serve a variety of self, social, and directive functions in our daily lives.

Episodic autobiographical memory retrieval and aging

A considerable amount of research has investigated how young and cognitively healthy older adults narrate unique life events, and this work has revealed several important insights into our ability to remember the past. From research on young adults, findings from a variety of paradigms and retrieval prompts indicate that individuals can access remote and recent episodic memories using a wide range of cues, including time (Levine, Svoboda, Hay, Winocur, & Moscovitch, 2002; St. Jacques & Levine, 2007), event, and place (Sheldon & Chu, 2017; Sheldon & El-Asmar, 2018). There also appear to be large individual differences in the quality of episodic remembering. Specifically, young adults typically describe unique events with a variety of episodic details, but the recollective quality can differ across individuals, possibly related to abilities in visual imagery, self-reflection, and affective processes (Palombo, Sheldon, & Levine, 2018). Another insight from this research is that episodic remembering in young adults usually is not exclusively event-specific in nature, but rather also includes semantic details, possibly to reflect the backstory of an experience. Finally, more recently it has become clear that one's ability to describe past life events with episodic details aligns with the quality of one's narration of future, specific events (Schacter & Addis, 2007).

In regard to research on cognitively healthy older adults, numerous studies have found that aging is associated with a semantic shift in the quality of episodic remembering (Devitt, Addis, & Schacter, 2017; Spreng et al., 2018; Turner & Spreng, 2015). For instance, in comparison to young adults, older adults more often retrieve overgeneral memories when directed to recollect unique, personal life events (Ford, Rubin, & Giovanello, 2014; Piolino et al., 2006; Ros, Latorre, & Serrano, 2009). Also, when older adults describe episodic memories, they generate fewer event-specific details relative to young adults, regardless of the remoteness or emotional quality of the event (Levine et al., 2002; St. Jacques & Levine, 2007, but also see Martinelli et al., 2013). Notably, the narratives of older adults are not impoverished in content per se, because older adults commonly generate more semantic details and other information relative to young adults (Devitt, Addis, & Schacter, 2017). This age-related reduction in episodic specificity has implications beyond episodic remembering, as similar reductions are seen in the context of problem solving and episodic future thinking (Addis, Wong, & Schacter, 2008; Vandermorris, Sheldon, Winocur, & Moscovitch, 2013).

Autobiographical memory and aging: beyond episodic remembering

While prior research has provided much insight into episodic remembering, we store autobiographical memories to do more than recall specific events (Conway, 2005; Thomsen, 2015). For instance, autobiographical memories can be retrieved to describe lifetime periods, or extended experiences that are part of our life story (e.g., growing up in Puerto Rico).

These lifetime periods are thought to have several adaptive uses that may overlap, or approximate, those of episodic remembering. For instance, narrating lifetime periods is believed to provide a broader context for social communication (Bluck, Alea, Barron-Lee, & Davis, 2016; Nelson, 2003). It also may be linked to one's experience of a continuous self, enabling an individual to create mini-stories of who one was, is, or could become (Conway, 2005; Prebble, Addis, & Tippet, 2013). Thinking about a future lifetime period also may alter the value of options in some forms of future-oriented thinking and sway decision making, although this remains relatively unexplored (for related work, see Kwan et al., 2015).

Given the potential functions of lifetime periods, the ability to construct such narratives may be of particular importance for older adults. That is, in the face of reduced episodic-specificity, older adults may depend more heavily on their ability to construct elaborate lifetime period narratives to serve the self, social, and decision-making functions of memory, albeit possibly in different ways from that of episodic memory. Yet, while prior research has investigated the content and meaning of lifetime periods (Thomsen, 2009; McAdams, 2001), whether there are age differences in the ability to construct detailed narratives of lifetime periods remains unclear. Closing this gap in knowledge could expand our understanding of the extent to which autobiographical memory narration is altered in normal aging, and to what degree non-episodic forms of narration might serve an adaptive, compensatory role.

Cognitive models of autobiographical memory raise the possibility that lifetime period narration is a type of retrieval that is spared, or possibly enhanced, with normal cognitive aging. Specifically, lifetime periods are thought to be organized around conceptual themes (Conway, 2005; Thomsen, 2015) that connect a range of semantic knowledge and personal life experiences. For instance, the lifetime period of "graduate school" could incorporate semantic knowledge of a diverse group of people and common experiences from work and social contexts. As such, this type of narration may primarily draw on semantic details that form a rich repository of knowledge, with unique events serving a secondary role. Based on this view, we could expect narratives of unique events and lifetime periods to be quite different in the quality of their content; although episodic specificity may be high for unique events, it should be low for lifetime periods. Older adults in particular may construct lifetime period narratives that are grounded in semantic detail, given their potential shift toward a semantic narrative style. If this were the case, it would suggest that not all forms of complex autobiographical narration are compromised among cognitively normal older adults, but rather young and older adults may be most adept at describing experiences using distinct retrieval styles.

Present study

To provide evidence relevant to this issue, we investigated the quality of lifetime period narratives in young and older adults. To do so, we developed a lifetime period narrative task that required participants to generate "life chapters," which are core autobiographical memory themes that are believed to anchor the life story (e.g., growing up in Puerto Rico; Thomsen, 2015; Thomsen & Berntsen, 2008), and then narrate these lifetime periods in an open-ended, time-unlimited task. In recent research, we have shown that autobiographical

memory retrieval prompts utilizing higher-order autobiographical information (e.g., core identity statements) tend to elicit more semantic memory retrieval relative to episodic memory retrieval (Grilli, 2017; Grilli & Verfaellie, 2015), as would be predicted by Conway's model of autobiographical memory organization (Conway, 2005). We have also shown that the generation of lifetime periods is largely spared in individuals with medial temporal lobe amnesia, suggesting that there is a minor role for episodic memory mechanisms in their retrieval (Grilli, Wank, & Verfaellie, 2018). We therefore viewed a lifetime period narrative task as an effective method for investigating the potential for a more dominant role of semantic memory in autobiographical narration. For the present study, we modified the lifetime period narrative task from our prior work and other research on the life story in order to match the narrative demands that have commonly been imposed on unique life events. Notably, prior research has investigated the generation of lifetime periods or chapters (Thomsen, 2009; Thomsen & Berntsen, 2008), and the types of themes that emerge from the life story (McAdams, 2001). However, we were interested in isolating lifetime periods, similar to how episodic memories are isolated, and exploring how these memories were elaborated. Specifically, in line with prior research on episodic remembering, we controlled the period of life from which lifetime periods were taken to account for age on remotely and recently constructed lifetime period narratives. Also, similar to how narrative quality has been measured in episodic autobiographical memory, we assessed the amount and type of content incorporated into each theme using the Autobiographical Interview (AI) scoring protocol (Levine et al., 2002). For comparison, we had participants elaborate on unique life events as well, using the same open-ended, time-unlimited framework, and we assessed the quality of event construction using the same AI content analysis method.

In addition to comparing lifetime period narratives and unique event narratives, we modified the AI scoring protocol to evaluate the type of semantic memories generated by young and older adults at a more fine-grained level. Recently, it has been suggested that personal semantics is not a unitary construct but rather consists of subtypes of knowledge that vary in their relationship to episodic memory and general semantics (Renoult et al., 2012; Szpunar, Spreng, & Schacter, 2014). We have proposed that personal semantics can be conceptualized as either experience-near, meaning episodic-like in quality, or experience-far, meaning more abstract (Grilli & Verfaellie, 2014). Furthermore, we have shown that experience-near autobiographical facts depend on the medial temporal lobe for retrieval, suggesting a connection between this sort of knowledge and episodic memory (Grilli & Verfaellie, 2016), whereas experience-far autobiographical facts depend on the anterior lateral temporal lobe, signaling overlap between such knowledge and general semantics (Grilli, Berzel, Wank, & Rapsak, 2018). Whether the age-related reduction in episodic detail generation carries over to the quality of semantic details is unclear. If it does, older adults may tend to produce personal knowledge that is more abstract relative to that of young adults, which would indicate that age-related episodic specificity reduction is fairly pervasive in autobiographical memory. To investigate this possibility, we applied this experience-near versus experience-far scoring method to the AI protocol by subcategorizing personal semantic details.

This approach and scoring protocol enabled us to investigate lifetime period narratives in both young and older adults. Given that lifetime periods are believed to be built around conceptual themes (Conway, 2005; Thomsen, 2015), we predicted that both young and older

adults would generate semantic details more than episodic details to elaborate on their lifetime periods. We also predicted that older adults would generate more semantic detail relative to young adults, because older adults may naturally use a more semantic narrative style and they have reduced access to episodic details. We expected that this age difference in the use of semantic details would either lead to older adults providing more elaborate lifetime period narratives, or young adults would make up for this difference in semantics by retrieving more episodic details relative to older adults. For episodic autobiographical memory, we expected to replicate prior research, showing that older adults generate more semantic details and fewer episodic details relative to young adults. Finally, if the age-related reduction in episodic specificity carries over to the quality of semantic details, we expected that older adults would tend to produce a disproportionate amount of abstract or experience-far knowledge relative to young adults.

Methods

Participants

Cognitively normal young and older adults ($n = 41$) were recruited from the Tucson, Arizona area. Participants had to report no cognitive concerns or current mental health issues, and they needed to be independent in activities of daily living, per self-report during a telephone screening. Older adults also had to perform above a cutoff for clinical impairment on a mental status screening in the laboratory (Mini-Mental Status Examination; $M = 29.2$, $Std = 1.1$; cutoff = 27; Folstein, Folstein, & McHugh, 1975). After screening, one young adult was excluded for a high number of depressive symptoms on the Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996; cutoff = 13). The resulting sample included 20 young adults (age: $M = 22.8$, $Std = 4.1$) and 20 older adults (age: $M = 78.7$, $Std = 6.4$) with no history of neurological or psychiatric illness. The groups were broadly matched on years of education ($M_{\text{young}} = 15.6$, $M_{\text{older}} = 16.3$) and gender (Young adults: 6 male/14 female; Older adults: 8 male/12 female). All participants provided informed consent approved by the Institutional Review Board of University of Arizona.

Power analysis

We based our power analysis on episodic autobiographical memory narrative tasks, and two studies that used a picture description narrative task and found elevated non-episodic detail generation among older adults (Gaesser et al., 2011; Madore et al., 2014). We identified 16 studies comparing young and older adults on episodic autobiographical memory for which we could calculate Cohen's d . Based on the mean effect size of the age-related disruption to episodic detail generation or specificity ($d = 1.07$), with parameters of $\alpha = .05$ and power ($1 - \beta$) = .80, the estimated required sample size for a two-tailed between group comparison was 15 per group. For the two studies using picture description as a narrative task, effect sizes for greater non-episodic detail generation among older adults were large ($d = 1.29$ and 1.8) and suggested that our group sizes were adequate. We opted for a slightly larger sample size (i.e., 20 per group) to account for possible differences in magnitude of effect for lifetime period narration.

Autobiographical memory tasks

Lifetime period narrative task—To measure lifetime period narrative construction, participants were asked to generate lifetime periods that they would be comfortable describing in detail. To prompt the retrieval of lifetime periods, participants were told “when we look back on our life we can divide our life story into chapters. For example, ‘college years’ and ‘living in Tucson’ are chapters in my life. In a moment, I am going to ask you to think about chapters from your life.” Participants also were told that we only wanted them to generate lifetime periods that spanned one to five years. We added this 1–5 year lifetime period time window to control for the types of lifetime periods generated and the amount of content likely associated with them. We note that a time window is typically placed on episodic autobiographical memory generation in the AI protocol (i.e., less than 24 hours). We had participants generate four lifetime periods. Similar to measures of episodic autobiographical memory, we selected lifetime periods that equated either encoding/developmental period or retention interval (Levine et al., 2002). Therefore, two of these lifetime periods were remote ones that ended before age 17, equating young and older adults on the developmental period of life when these chapters were formed. The other two lifetime periods were recent ones that began in the past five years and therefore broadly matched retention interval for young and older adults. Similar to the standard AI protocol, we did not constrain the phenomenology (e.g., emotional valence) of these lifetime periods; we also did not assess their phenomenology. For remote lifetime period narratives, participants were instructed to describe the lifetime period in detail, from beginning to when it ended. For recent lifetime period narratives, to more closely match retention interval, participants were instructed to describe only the past year of the lifetime period.

During lifetime period retrieval, participants were told to include everything they could think of that was related to this lifetime period, including relevant episodes and knowledge of people, activities, and places. Participants were told that we wanted them to take about five minutes to describe each lifetime period, but they did not need to speak for the entire time interval, nor did they need to stop at the five-minute mark. This time guideline was set because in piloting the task, we learned that five minutes usually was sufficient time to describe a lifetime period (as well as an episodic autobiographical memory). Also, in our piloting we learned that without being given a time guideline, participants reported uncertainty about how long they should speak about a lifetime period or unique event. In other words, the guideline gave participants the impression that they need not rush in their narrative responses, but they also should not feel obligated to continue beyond a natural ending point. We note that we used a time guideline in another study that investigated the life story narrative (Grilli, Wank, & Verfaellie, 2018). All participants were given one general probe on each trial (i.e., can you tell me more?). However, the specific probing from the original AI protocol, which asks follow up questions about the episodic quality of the event, was not used. Participants were informed when five minutes had passed for each lifetime period description.

Unique event narrative task—After describing the lifetime periods, each one was revisited in the order in which it was retrieved, and participants were asked to generate and describe a unique life event that came from that lifetime period. Using the AI protocol,

participants were instructed to recall an event that happened in a specific time and place and unfolded within 24 hours. To help generate unique events, we had available a list of common events provided by the AI protocol, but no participant required the list. Consistent with our lifetime period narrative task, we did not constrain or assess the phenomenology of the events. Similar to prior research (Levine et al., 2002), participants were instructed to focus on retrieving episodic details surrounding the unique event that was selected. However, we also informed participants that they should generate all the information that they could think of related to the event. This latter instruction is a departure from the original AI protocol. Our rationale was that, since we were using a 5-minute time guideline for the unique event narrative task, as opposed to a strict cutoff (e.g., four or five minutes are commonly used time cutoffs), we did not want participants to actively suppress semantic details and thus truncate their memory narratives. The general probe from the lifetime period narrative task also was used in the unique event narrative task.

Scoring protocol

Lifetime period narratives and unique event narratives were scored using a modified version of the AI protocol (Levine et al., 2002). Consistent with the standard scoring of the AI, the narratives were segmented into individual details/content elements and each detail was scored. Also consistent with the original AI, details were scored as episodic, personal semantic, general semantic, or some other type of information (i.e., other detail). We note that in the original AI scoring protocol, personal semantic, general semantic, and other details are included in a single detail category, because they are all “external” to the main episode being described. However, we kept these detail types separate as they may reflect distinct qualities (Strikwerda-Brown et al., 2018). Also, characterizing episodic details as internal and semantic details as external is not applicable to our lifetime period task, given that both episodic and semantic details could be internal to a lifetime period. Therefore, our categorization of details as one of these four subtypes was intended to provide insight into the quality of content rather than a distinction between information unique or not to one memory. Details were scored as episodic in the lifetime period narrative task if a specific episode was included in the narrative, and the details described the action/sequencing of the event (event detail), location of the specific event (event place), specific time of the event (event time), perceptual characteristics of the event (event perceptual), or emotions or thoughts related to the specific event (event thought). Similarly, the same types of details were scored as episodic in the unique event narrative task if they were associated with the primary event being described (in accordance with the original AI protocol). Consistent with the standard AI protocol, if additional or “secondary” specific episodes were generated during the unique event narratives, they were scored as an “external” detail. As noted, our personal semantic detail category had two subtypes, guided by recent research on the non-unitary nature of such knowledge (Grilli & Verfaellie, 2014; 2016; Renoult et al., 2012). One subtype was experience-near personal semantics, reflecting episodic-like facts about the action, perceptual, or spatiotemporal features of repeated and general/extended events, and the other subtype was experience-far personal semantics, which captured more conceptual knowledge about the self (e.g., preferences, traits, abstract facts such as names). General semantics related to world or shared knowledge. Other details included meta-comments about the task or the narrator and repetitions/re-phrasing statements of previously mentioned

content (as well as external events for the episodic task). Examples of each detail category are included in Table 1.

Reliability of scoring protocol

Consistent with established procedures (Grilli, Wank, & Verfaellie, 2018; Grilli, Wank, Bercel, & Ryan, 2018) a primary scorer, who was trained on the AI materials and sample narratives from the laboratory as well as our recent work on experience-near versus experience-far personal semantic scoring protocol (Grilli & Verfaellie, 2016), scored all of the lifetime period narratives and unique events. All participants were included in a single pool, which the primary scorer randomly selected from until scoring was complete. The primary scorer did not randomize the order in which these narratives were scored across participants. Inter-rater reliability for detail scoring was calculated based on a random selection of five young adults and five older adults (approximately 25% of the total memories) who were scored by another individual who was trained on the AI protocol. This secondary scorer also did not randomize the order in which these narratives were scored across participants. Both scorers were blind to group status but not hypotheses. With lifetime period narratives and unique event narratives analyzed separately, inter-rater reliability was excellent for total details (Cronbach's α 's range = .94 to .96), excellent for episodic details (Cronbach's α 's range = .95 to .96), excellent for personal semantic details (including both experience-near and experience-far subtypes when analyzed separately) (Cronbach's α 's range = .90 to .94), good to excellent for general semantic details (Cronbach's α 's range = .84 to .90), and good to excellent for other details (Cronbach's α 's range = .83 to .91).

Analyses

Details generated by participants during the lifetime period narratives and unique event narratives were separately submitted to analysis of variance (ANOVA) with factors of age (young vs. old), time period (remote vs. recent), and detail type (episodic vs. personal semantic vs. general semantic vs. other). We analyzed simple effects with t-tests. As a more fine-grained analysis of the quality of personal semantics, we also compared the groups on their use of experience-near versus experience-far factual knowledge in both chapters and episodes. Given group differences in overall use of personal semantics (as reported below), we compared the proportion of experience-near to total personal semantic details using independent samples t-tests. As follow-up analyses, we added task (lifetime period vs. unique event) to the ANOVA, specifically to examine whether there was a three-way interaction between task, detail type, and group. We also assessed whether the groups differed in total time taken per lifetime period and unique event, and total words generated. Given that older adults took more time and generated more words during the lifetime period task (as reported below), for this retrieval task we also analyzed the proportion of details that fell into each detail category using independent samples t-tests. All figures were created using GraphPad Prism version 8.0.2 for Mac OS X (GraphPad Software, La Jolla California USA, www.graphpad.com).

Results

Lifetime period narratives

Figure 1 depicts the results from the lifetime period narratives. The 2 (Age: young vs. old) x 2 (Time period: remote vs. recent) x 4 (Detail type: episodic vs. personal semantic vs. general semantic vs. other) ANOVA revealed a main effect of age group, $F(1, 38) = 15.92, p < .001, \eta_p^2 = .30$, such that older adults generated more detailed narratives relative to young adults. There also was a main effect of detail type, $F(1.1, 41.86) = 273.2, p < .001, \eta_p^2 = .88$, such that personal semantic details were generated more than all other detail types, $t's = 14.6, p's < .001, d's = 3.15$, which did not significantly differ from each other, $t's = 1.35, p's > .19, d's = .31$. Both main effects were qualified by a significant group by detail type interaction, $F(1.1, 41.86) = 11.6, p = .001, \eta_p^2 = .23$, in which older adults selectively generated greater amounts of personal semantic details, $t(38) = 3.65, p < .001, d = 1.15$, and general semantic details, $t(24.88) = 2.18, p = .04, d = .69$, than young adults. The groups did not differ in the generation of episodic details, $t(25.15) = 1.98, p = .06, d = .63$, or other details, $t(38) = 1.68, p = .10, d = .53$. There was not a main effect of time period, $F(1, 38) = 3.83, p = .06, \eta_p^2 = .09$. Time period did not interact with age group, $F(1, 38) = 1.31, p = .26, \eta_p^2 = .03$, or detail type, $F(1.29, 49.03) < 1$, and there was not a three-way interaction between these factors, $F(1.29, 49.03) < 1$. Calculating Cook's distance revealed one outlier in the lifetime period narrative data. Removing this outlier from the analyses did not alter the significance of any of the effects.

We also compared the proportion of experience-near personal semantic details generated by both groups in remote and recent life chapter narratives. As shown in Figure 2, the groups did not differ in the proportion of facts that were experience-near for remote, $t(38) < 1, p = .46, d = .20$, or recent life chapters, $t(30.07) = 1.38, p = .18, d = .43$.

Unique event narratives

Figure 3 depicts the results from the unique event narratives. The results of the 2 (Age: young vs. old) x 2 (Time period: remote vs. recent) x 4 (Detail type: episodic vs. personal semantic vs. general semantic vs. other) ANOVA did not reveal a main effect of group, $F < 1$. However, there was a main effect of detail type, $F(1.64, 62.15) = 97.26, p < .001, \eta_p^2 = .72$, along with a significant interaction between detail type and group, $F(1.64, 62.15) = 16.76, p < .001, \eta_p^2 = .31$. Older adults generated more personal semantic details, $t(38) = 4.10, p < .001, d = 1.3$, and general semantic details, $t(26.61) = 2.57, p = .02, d = .81$, whereas young adults generated more episodic details, $t(30.04) = 3.18, p = .003, d = 1.01$. The groups did not differ in the generation of other details, $t < 1, p = .65$. It also is noteworthy that whereas young adults generated episodic details more than all other detail types, $t's = 5.67, p's < .001, d's = 1.8$, for older adults the generation of episodic details and personal semantic details did not significantly differ, $t < 1, p = .47, d = .23$. Young adults also generated personal semantics more than general semantics and other details, $t's = 5.01, p's < .001, d's = 1.61$, and other details more than general semantics, $t = 4.96, p < .001, d = 1.3$.

Older adults similarly generated episodic details and personal semantics more than general semantics and other details, t 's = 9.23, p 's = .001, d 's = 2.82, but unlike young adults their generation of general semantics and other details did not differ, $t < 1$, $p = .83$, $d = .08$.

We also found a main effect of time period, $F(1, 38) = 13.04$, $p = .001$, $\eta_p^2 = .26$, such that recent unique event narratives were more detailed than remote unique narratives. This time period effect did not interact with group, $F(1, 38) < 1$, but it did interact with detail type, $F(1.5, 56.72) = 3.79$, $p = .040$, $\eta_p^2 = .09$. There was not a three-way interaction, $F(1.5, 56.72) = 3.36$, $p = .06$, $\eta_p^2 = .08$. The interaction between time period and detail type reflected that relative to remote unique event narratives, recent unique event narratives were accompanied by greater generation of episodic details, $t(39) = 2.46$, $p = .02$, $d = .38$, and personal semantic details, $t(39) = 2.18$, $p = .04$, $d = .30$. General semantics, $t(39) < 1$, $p = .74$, $d = .08$, and other details, $t(39) = -1.42$, $p = .161$, $d = .21$, did not significantly differ by remoteness. Calculating Cook's distance revealed one outlier in the unique event data. Removing this outlier from the analyses did not alter the significance of any of the effects.

We also compared the proportion of experience-near personal semantics generated by both groups for remote and recent unique event narratives. As shown in Figure 4, the groups did not differ for the proportion of facts that were experience-near in remote, $t < 1$, $p = .83$, $d = .05$, or recent unique event narratives, $t < 1$, $p = .54$, $d = .20$.

Follow-up analyses

Our lifetime period and unique event narrative analyses suggest that the two tasks are associated with distinct patterns of age differences in the generation of detail types. We therefore directly compared detail type generation across the two tasks with an ANOVA including narrative task (lifetime period vs. unique event) as an additional variable. In support of the idea that age differences in detail use vary by the type of narrative task, this analysis revealed a significant three-way interaction between age group, detail type, and task, $F(1.32, 49.98) = 4.07$, $p = .04$, $\eta_p^2 = .10$ (notably, there was not a four-way interaction with time period, $F < 1$).

Consistent with the finding that older adults provided more detailed narratives for lifetime periods, we found that they also took more time to narrate each lifetime period (Older: $M = 364.59$ seconds, $SD = 103.25$; Young: $M = 284.88$ seconds, $SD = 82.94$), and they generated more words while describing each lifetime period (Older: $M = 564.53$, $SD = 202.8$; Young: $M = 328.95$, $SD = 167$), t 's = 4.01, p 's = .001, d 's = .86. In contrast, in the unique event narrative task, the groups did not significantly differ for time taken per event (Older: $M = 223.43$ seconds, $SD = 75.87$; Young: $M = 199.42$ seconds, $SD = 68.31$) or word count per event (Older: $M = 404.33$ seconds, $SD = 156$; Young: $M = 403.23$, $SD = 196.58$), t 's < 1 , p 's = .34.

For the lifetime period narrative task, given that there was a group difference in total details generated (along with word count and time taken), we calculated proportional scores for each detail type relative to total details (e.g., personal semantics:total details) to better

understand how the quality of these narratives differed between groups. We found that while both groups relied largely on personal semantics, for young adults a slightly higher proportion of details were personal semantic in nature (Young: $M = .95$, $SD = .04$; Older: $M = .91$, $SD = .07$), $t = 2.49$, $p = .02$, $d = .73$. We also found that for older adults, a slightly higher proportion of details were general semantic (Older: $M = .02$, $SD = .03$; Young: $M = .01$, $SD = .01$), $t = 2.09$, $p = .046$, $d = .50$, although we must emphasize that both groups used general semantic knowledge sparingly. The groups did not significantly differ in their proportional use of episodic details (Older: $M = .04$, $SD = .06$; Young: $M = .01$, $SD = .03$), $t = 1.8$, $p = .08$, or other details (Older: $M = .03$, $SD = .02$; Young: $M = .03$, $SD = .02$), $t < 1$.

Discussion

Research on normal cognitive aging and autobiographical narration has largely focused on episodic memories, leaving uncertain the degree to which narrative construction is more broadly altered in cognitively healthy older adults. In the present study, we had young and older adults not only retrieve episodic memories, but also lifetime period narratives by describing remote and recent chapters. Critically, this novel combination of retrieval tasks revealed evidence suggestive that not all types of autobiographical narration are compromised by normal cognitive aging.

Consistent with theory of autobiographical memory organization (Conway, 2005; Thomsen, 2015), we found that lifetime period narratives were primarily elaborated with semantic details about people, places, and activities related to these themes. In regard to the semantic quality of these narratives, in both young and older adults the vast majority of details were personal semantics. Interestingly, despite the use of an open-ended, time-unlimited retrieval task, episodic details were retrieved sparingly to elaborate on both remote and recent lifetime periods, and young adults did not spontaneously draw on episodic details more than older adults to elaborate these narratives. These findings build on recent work in young and middle-aged adults showing that personal knowledge has a prominent role in the organization of autobiographical memory, and may be an optimal entry point into the retrieval and reconstruction of personal thoughts (Conway, 1996), with episodic memories retrieved relatively infrequently, at least spontaneously, to describe higher-order conceptual themes of the self and one's life history (Grilli, 2017; Grilli & Verfaellie, 2015). Our results also suggest that when the target of autobiographical memory shifts from a specific event to a broader lifetime period, personal knowledge is highly relevant to constructing the narrative.

In comparison to young adults, we found that older adults generated more detailed lifetime period narratives. This was not driven by the generation of extraneous details (repetitions, meta-comments), which arguably would not add to the richness of the narrative. Instead, the use of personal and general semantic details drove the age difference in total narrative content. Therefore, our results indicate that when the demands of autobiographical narration center on an extended experience, and no strict time limit for narrating is placed on the telling of one's story, the retrieval of personal semantics and general semantics is greater in cognitively normal older adults relative to young adults. Notably, when we accounted for differences in overall narrative length, we found that there was a subtle age difference in the

proportion of different details generated. Specifically, young adults generated a higher proportion of personal semantics compared to older adults, whereas older adults provided a higher proportion of general semantics relative to young adults. However, both groups relied almost entirely on personal semantics, with general semantics used sparingly. Therefore, we suggest that the subtle group differences in the proportional use of personal and general semantics are unlikely to reflect a meaningful age-related shift in the quality of lifetime period narratives. Young and older adults thus perform in roughly the same manner on the lifetime period narration task, utilizing personal semantics over other detail types. Older adults provide more detail, however, perhaps because they have a wider base of semantic knowledge that can be incorporated into lifetime period narratives.

In regard to the unique event narratives, we found that older adults also generated more personal semantics and general semantics to narrate episodic memories, which in this case was not accompanied by a significant difference in overall narrative length. This finding, which is consistent with prior studies, highlights the degree to which older adults rely on semantic memory for autobiographical retrieval. Recently, there has been increased interest in understanding the extent to which accumulation of knowledge and a shift in narrative style with cognitive aging may influence “default modes of thinking” (Andrews-Hanna et al., in press; Bluck et al., 2016; Madore & Schacter, 2014; Spreng et al., 2018). Prior research has shown that during event construction, older adults may have a preference for the use of knowledge and a narrative style that can be broadly described as based on meaning, regardless of whether those events are past- or future-oriented, or are atemporal descriptions of a depicted scene or event (James et al., 1998; Gaesser et al., 2011). Prior work showing that brief injections of relevant “story asides” are a more common feature among the personal narratives of older adults relative to young adults also can be taken as evidence for an alteration in narrative style (Bluck et al., 2016). We interpret our findings as evidence that age-related accumulation of knowledge and shift in narrative style, while potentially disruptive for episodic remembering, could be viewed as constructive for other types of story-telling, including describing lifetime periods.

In our scoring of the narratives, we considered whether personal semantics were experience-near or experience-far in content quality. This enabled us to evaluate at a fine-grained level whether the type of personal knowledge incorporated into lifetime period or episodic narratives subtly shifts in older adults towards being more abstract (i.e., experience-far). Interestingly, although older adults generated more personal semantic details in both forms of narratives, the ratio of experience-near to experience-far did not significantly differ between the groups. If replicated, these findings would indicate that the relative use of more spatiotemporally connected and abstract autobiographical knowledge to elaborate on multiple forms of narratives may be unaltered in normal cognitive aging. Thus, reduced episodic specificity may be isolated to unique event content among cognitively normal older adults, sparing the use of more episodic-like semantics. The generation of such content, therefore, may help older adults approximate the episodic quality of unique events.

What are the functional implications of an age-related sparing of lifetime period narrative construction? According to some theories, a core function of autobiographical memory is to leave traces of one’s identity across time, enabling an individual to mentally travel back and

create a continuous or extended sense of self between past and present (Conway, 2005; Prebble et al., 2013). This is believed to be essential for wellbeing and maintaining a coherent and comprehensive life story (Prebble et al., 2013; Strikwerda-Brown et al., 2019). Self-continuity has been split into two types (Addis & Tippett, 2008). The first type, known as phenomenological self-continuity, is built on episodic memory and therefore emerges from the construction of a vivid past. However, the second type, known as narrative self-continuity, is constructed by linking personal semantic and episodic contents, and therefore depends on the ability to retrieve networks of related memories (Prebble et al., 2013). From this view, prior studies have revealed that phenomenological self-continuity is weakened with normal aging. This may in turn amplify the role of narrative self-continuity in older age and thus the importance of the ability to engage in lifetime period narration. The results of the present study suggest that with normal cognitive aging, the ability to rely on narrative self-continuity may be enhanced, which in turn may be able to compensate for reductions in phenomenological continuity (for related findings in mild cognitive impairment and dementia, see Tippett, Prebble, & Addis, 2018).

Also relevant to functional implications, prior research has revealed that engaging and enhancing elaborative episodic retrieval has adaptive effects on imagination, decision making, and other forms of constructive retrieval, such as creativity (Madore, Gaesser, & Schacter, 2014; Madore & Schacter, 2014; Madore, Addis, & Schacter, 2015; McFarland, Primosch, Maxson, & Stewart, 2017). Consistent with this work, age-related reduction in episodic specificity has been associated with sub-optimal performance in a variety of episodic memory-supported functions, including future thinking and problem solving (Addis et al., 2008; Vandermorris, Sheldon, Winocur, & Moscovitch, 2013). An interesting future direction would be to determine whether engaging or enhancing lifetime period elaboration can compensate for the adaptive functions of memory that normally (or optimally) would be facilitated by episodic construction.

Although the present study takes an important step in understanding age-related differences in autobiographical narration, it also raises questions that will require additional research. For instance, to better understand whether our lifetime period results are specific to autobiographical narration, or alternatively, reflect broader age-related differences in narrative style, it will be important to include a language-based task that does not require memory retrieval, such as a picture description task (Gaesser et al., 2011; Madore et al., 2014). Also, future studies should examine whether the phenomenological characteristics of life chapters influence the age-related differences in lifetime period narration. For instance, it would be interesting to know if the emotional valence of lifetime periods has an impact on detail generation, given that there could be age-related shifts in the affective evaluation of memories (Comblain, D'Argembeau & Van der Linden, 2005).

In sum, in the present study we reached beyond episodic remembering and asked whether there are age-related differences in the generation of autobiographical narratives that capture broader periods of time in one's life. Our findings indicate that older adults construct narratives of lifetime periods with richer semantic detail than young adults, although both age groups rely predominately on personal semantics when crafting these narratives. Whereas episodic remembering among older adults tends to lack episodic specificity, which

can have negative functional consequences, the ability to engage in lifetime period narrative construction appears to change minimally with age. We suggest that future studies investigate the positive functional implications of this style of autobiographical narration, which may include benefits to self-concept, decision making, and social communication.

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Figure 1.

Boxplot of mean number of episodic (EP), personal semantic (PS), general semantic (GS), and other (OTH) details generated per remote and recent life chapters. The box captures the upper and lower quartiles, and the median is represented by a line within the box for each type of detail. The brackets capture the full range of the data.

Figure 2.

Boxplot of the proportion of facts that were experience-near (EN) generated by each group while describing remote and recent life chapters. The box captures the upper and lower quartiles, and the median is represented by a line within the box for each group. The brackets capture the full range of the data.

Figure 3. Boxplot of mean number of episodic (EP), personal semantic (PS), general semantic (GS), and other (OTH) details generated per remote and recent episodic memories. The box captures the upper and lower quartiles, and the median is represented by a line within the box for each type of detail. The brackets capture the full range of the data.

Figure 4. Boxplot of proportion of facts that were experience-near (EN) generated by each group while describing remote and recent episodic memories. The box captures the upper and lower quartiles, and the median is represented by a line within the box for each group. The brackets capture the full range of the data.

Table 1:
Examples of detail categories scored

Detail subtypes	Examples
Episodic	“and the people in the room started laughing” (unique event about a classroom) “and he came up and asked her if he could lap swim” (unique event about swimming)
Personal semantic	
<i>Experience-near</i>	“on the weekends, we would go to the countryside” “I went to summer school”
<i>Experience-far</i>	“I was never close to [my father]” “the name of that school was _____”
General semantic	“It is an AHL (hockey) team” “summer spans about four months there”
Other	“I’m going to start now if tha’s ok” “And that’s just the way of the world”