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Childhood Amnesia in Children: A Prospective Study Across Eight Years

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This was a prospective study of earliest memories across 8 years for 37 children who were of age 4–9 years initially. In three interviews (initial and after 2 and 8 years) children provided their three earliest memories; those from earlier interviews that were not spontaneously provided later were cued. There was little consistency in the earliest memory or overlap across interviews in spontaneous memories. The youngest group also forgot over half their initial memories although few were forgotten by older children. For consistency of content, 25%–32% of information by former 6- to 9-year-olds was the same after 8 years, but < 10% provided by the youngest children was the same and 22% was contradictory. Emotion and contextual coherence predicted memory retention.

Childhood amnesia (also called infantile amnesia) is the absence or scarcity of memories from very early life. The very earliest memories that *adults* recall typically date from 3 to 4 years of age (Dudycha & Dudycha, 1941; Rubin, 2000; but see Wang & Peterson, 2014, 2016 for evidence that systematic misdating may distort estimates of age at earliest memory such that people's earliest memories may actually be earlier). Adults continue to recall few memories that predate around age 7 (Bauer, 2014, 2015; Rubin, 2000). The importance of these very early memories is highlighted in theories of childhood amnesia (Pillemer & White, 1989), autobiographical memory development (e.g., Bauer, 2014; Nelson & Fivush, 2004), and in discussions of the development of a continuous sense of self (e.g., Bluck & Alea, 2008; Habermas & Köber, 2014).

Recently, a small body of research has begun exploring childhood amnesia in *children*, too (for reviews, see Bauer, 2014, 2015). Much has been learned through cross-sectional research about patterns of childhood amnesia in children of different ages. However, little research has explored earliest memories in the same children across several years. The present study addressed this gap by prospectively studying childhood amnesia in children over an 8-year span. Our goals were fourfold: (a) Was there consistency in which memory was identified as the earliest? (b) How well did children recall the small group of memories that they had identified as their earliest three in interviews that took place at ages 4–9 when they were reinterviewed 8 years later? (c) For memories generated in prior interviews, how consistent was their content after so many years? (d) Could we predict which memories would be retained versus forgotten?

Long-Term Recall of Early Memories

It is clear that children can recall at least some events that happened when they were preschool aged for long periods of time, such as hurricanes after 6 years (Fivush, Sales, Goldberg, Bahrick, & Parker, 2004) and injuries requiring medical treatment after both 5 years (Peterson & Whalen, 2001) and 10 years (Peterson, 2015; see Peterson, 2012 for a review of the child-injury literature). These events, however, were highly emotional and stressful, properties that foster long-term retention (Peterson, 2002). Thus, they are likely to be among the most memorable events that children ever experience. In terms of more mundane events, most (or all) of the memories from those very early years are forgotten or inaccessible. Prospective studies in which older children were reinterviewed about parent-suggested target events experienced when children were preschoolers showed considerable forgetting with increasing child

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age (Cleveland & Reese, 2008). Age 7 seems to be a boundary for childhood amnesia, with children older than 7 years forgetting substantially more about preschool events than those younger than age 7 (Bauer & Larkina, 2014; Van Abbema & Bauer, 2005).

One typical method of studying childhood amnesia asks individuals to identify their earliest memory. This was done successfully with both adolescents (Jack, MacDonald, Reese, & Hayne, 2009; Peterson, Grant, & Boland, 2005; Reese, Jack, & White, 2010; Tustin & Hayne, 2010) and younger children (Peterson, Wang, & Hou, 2009; Peterson et al., 2005). Such a procedure elicits self-selected memories that have salience for the child and include a wide range of content and emotions.

In an early study by our laboratory (Peterson et al., 2005), children and adolescents were asked for their three earliest memories, and in a 2-year follow-up (Peterson, Warren, & Short, 2011), those who had been between 4 and 13 years old in the initial interview were again asked for their three earliest memories as well as cued about any formerly mentioned early memories that were not spontaneously recalled. (They were also given foils about plausible but false events, which children uniformly rejected.) Both the children themselves and, in most cases, parents provided estimates for children's age at the time of their memories, and parental estimates of children's age were used if available. Using parental estimates of age to identify children's very earliest memory among the set of memories they recalled, only 7% of 4- to 5-year-olds and 13% of 6- to 7-year-olds provided the same earliest memory in both interviews, whereas 39% of the 12- to 13-year-olds did so. When all three of the early memories provided by children in both interviews were considered, fully 85% of children who had been 4- to 5-year-olds, and 78% of 6- to 7-year-olds at the time of the initial interview spontaneously provided three totally different early memories 2 years later. In contrast, only approximately 43% of the 8- to 13-year-olds had no overlap in their three earliest spontaneous memories.

In terms of the proportion of all originally provided early memories that children were able to recall 2 years later, whether remembered spontaneously or cued, former 4- to 5-year-olds only remembered 48% of them. In contrast, former 8- to 9-year-olds recalled 88% of them and 12- to 13-year-olds recalled all but one memory. Thus, there is considerable developmental change for younger children in terms of the memories that are identified as their earliest as well as their ability to recall those memories at all. In contrast, older children showed more stability in memory (see Bauer, Tasdemir-Ozdes, & Larkina, 2014; Josselson, 2000 for evidence of high consistency in identified earliest memories in adults).

One goal of the present research was to follow some of the same children for a much longer period of time, that is, 8 years. A strength is that some of the children were clearly below the typically described boundary of childhood amnesia (age 7) at the time of their first interviews (age 4–5 years initially), and when reinterviewed 2 years later, they were still near this boundary. In contrast, other children were age 8–9 years initially and thus above this boundary from the beginning. An intermediate group was 6–7 years initially. Thus, 8-year maintenance of earliest memories in these three groups could be compared. In addition, almost all children provided new early memories during their 2-year follow-up interview, and the fate of these memories could be tracked 6 years later.

Consistency of Content

Children can be surprisingly consistent over time in some types of memory reports. For example, 3- to 5-year-olds provided similar information about a stressful injury requiring emergency room treatment when reinterviewed after 2 years (Peterson, 2011), 5 years (Peterson & Whalen, 2001), and 10 years (Peterson, 2015). Van Abbema and Bauer (2005) found that 7- to 9-year-olds recalled similar amounts of information about events that had been discussed with their mothers at age 3 for those events that they still remembered. However, little is known about the consistency of earliest memories across many years. Bauer et al. (2014) found that *adults* provided the same amount of content information for the same memories across 4 years, although only just over half of the information (52%–55%) was the same across interviews. In the only extant prospective study on similarity of content for earliest memories of *children*, we also found that children provided the same amount of content across a 2-year delay (Peterson et al., 2011) as did adults described in Bauer et al. As well, former 8- to 13-year-olds had the same degree of overlap in specific content (52%–56%), whereas former 4- to 7-year-olds were less consistent, with 35%–37% overlap.

Predictors of Memory Maintenance

Why some very early memories are maintained and others are not is an important question, and several potential explanations have been proposed.

These include the presence of emotion (Howes, Siegel, & Brown, 1993; Mullen, 1994; Saunders & Norcross, 1988), event uniqueness (Howe, 1997; Nelson & Fivush, 2004), and presence of reminders like photographs or family discussion (Nelson & Fivush, 2004). Recently, some researchers have emphasized the quality of memory narratives, suggesting that higher quality memory reports are likely to reflect how well the event was initially encoded. In particular, narrative coherence, defined as how well a memory narrative is structured and elaborated, has been deemed a conceptually critical property (Fivush, Haden, & Adam, 1995; Morris, Baker-Ward, & Bauer, 2010).

One measure of narrative coherence is the number of traditional narrative components in the memory report (i.e., who, what, when, where, how, and why), termed narrative breadth (Bauer, Burch, Scholin, & Güler, 2007; Bauer & Larkina, 2014). Also, Reese et al. (2011) recently published a coding scheme that evaluates three independent dimensions of coherence (NaCCs—Narrative Coherence Coding Scheme: theme, chronology, and context). Morris et al. (2010) were able to apply the NaCCs to 5- to 9-year-olds' recall of parent-nominated events discussed with an experimenter a year earlier, and they found that thematic coherence (defined as the extent to which there was a clear focus) predicted memory survivability, but chronological coherence (defined as the extent to which the events in the memory could be put on a timeline by the listener) did not. Although the NaCCs also codes for contextual coherence (defined as the extent to which the narrative includes information that orients in both time and place), Morris et al. (2010) were unable to assess this.

Most research exploring dimensions purported to increase memory survivability is hampered by being cross-sectional in design. But a cross-sectional study can only describe the properties of those memories that are actually maintained; it cannot compare the properties of memories that are retained with those of memories that are lost. Such a longitudinal comparison was done in our laboratory (Peterson, Morris, Baker-Ward, & Flynn, 2014). Children were asked for their earliest memories 2 years apart, and properties of those memories that survived were compared with those of memories that did not. We found that event uniqueness, type of event, presence of reminders, or report length did not differentiate memories that were maintained versus lost. However, the presence of emotion as well as all three indices of NaCCs coherence (theme, chronology, and context) increased retention 2 years later.

The Current Study

This was an extension of our 2-year follow-up studies (Peterson et al., 2011, 2014): It assessed children's self-identified earliest memories prospectively over 8 years. Children who had been ages 4–9 years at the time of initial interviews and reinterviewed after 2 years were reinterviewed again after 8 years. At all three time points, children were asked for their three earliest memories; at follow-up interviews, they were also given brief cues to memories provided earlier but omitted in the follow-up (along with foils about false memories—see Peterson et al., 2011). Specifically, children provided new memories at their first interview 8 years earlier. These memories are Memory Set A. In Interview 2, 6 years earlier, they could recall the same memories and/or provide additional new memories. Almost all children provided at least one new memory, and these new memories constitute Memory Set B. In Interview 3, children could recall memories that were previously recalled in one or both prior interviews, or were new. Thus, we tracked children's recall of memories across both 8 years (Memory Set A) and 6 years (Memory Set B). In addition, we compared what children said about the recalled events in different interviews. Finally, potential predictors of long-term memory maintenance were assessed. In keeping with earlier findings (Peterson et al., 2011, 2014), we hypothesized that the youngest children would be unlikely to identify the same memory as their earliest, would have forgotten more memories over time, and would be more inconsistent in memory content in comparison with older children. We also anticipated that the presence of emotion and all indicators of coherence would predict long-term memory maintenance.

Method

Participants

There were 37 participants, divided into three age groups. For clarity, throughout this article the ages given are those at the time of the initial interview, even though children are 8 years older when the final interview was conducted. There were thirteen 4- to 5-year-olds (7 girls [53.8%]; M_{age} = 60.5 months old, *SD* = 6.7 months), twelve 6- to 7-year-olds (3 girls [25%]; M_{age} = 82.5 months, *SD* = 8.3 months), and twelve 8- to 9-year-olds (5 girls [41.7%]; M_{age} = 107.3 months, *SD* = 5.8 months). This sample consisted of all of the 4- to 9-year-old (at initial interview) participants from Peterson et al. (2011, 2014) who were still able to be contacted and agreed to participate. Participants were mostly Canadians of European descent; they had been recruited from the emergency room of the only children's hospital in their community as part of another study (Peterson, 2011, 2012). Because health care is free in Canada, they were a cross-section of the community in terms of socioeconomic status. Data were collected between May 2000 and March 2012.

Procedure

Children were visited in their homes three times: initially, after 2 years (M_{delay} = 29.0 months, *SD* = 5.3 months), and after 8 years (M_{delay} = 99.2 months, *SD* = 13.7 months). When initially visited, after signed consent by parents and assent by children, children were given the prompt "I want you think way back and tell me the first thing you ever remember, something that happened when you were really little." They were prompted for more information by asking "What else do you remember about that?" and then probed for more detail. Children were then asked for their next two earliest memories in the same way (see Peterson et al., 2005 for more detail on procedure). The same procedures were followed at the beginning of the 2- and 8-year follow-up visits. After children were asked for their earliest three memories in the 2-year visit, they were given short prompts about any of their prior memories that they had not provided spontaneously to see if the children still recalled them, as well as given three foils about false events. More information was prompted about any recalled memories. In the final 8-year follow-up, children could potentially have provided as many as six memories in their prior two visits (three per visit), if they had no overlap during the prior interviews in the three memories they spontaneously provided. They were given brief cues about all of the memories that had been provided in either prior interview and which they had not spontaneously described at the beginning of the visit, along with six foils about false events. At all interviews, children were also asked to date their memories, and parents were asked to date them at the time of first recall. Comparisons of child versus parent memory dating after 2 and 8 years were the focus of separate reports (Wang & Peterson, 2014, 2016) and will not be considered here. All aspects of the project were approved by the Interdisciplinary Committee on Ethics in Human Research, ICEHR Approval # 40002168-SC, Project Title: Children's Earliest Memories.

Data Coding

Long-Term Recall

Memories in later interviews were deemed the same as those in earlier interviews if they were about the same topic and included the same or similar content. Three aspects were coded: (a) whether or not the child and/or parent identified the same memory as their very earliest in compared interviews, both spontaneously and after cueing; (b) the proportion of overlap between the spontaneous memories provided in the final interview and the spontaneous memories in both Interview 1 (Set A) and Interview 2 (Set A and/or B); and (c) the proportion of overlap between all memories provided in the last interview, whether spontaneous or cued, and all memories provided in Interviews 1 or 2.

Consistency of Content

Content was scored the same way as in Peterson et al. (2011). Memories in later interviews that were the same as those in the first interview were scored for information about persons, event actions, locations, objects, and descriptions. Then each item of content in later interviews was compared with that in earlier interviews and classified as the same, new, or contradictory information.

Predictors of Memory Maintenance

The four predictors assessed in Peterson et al. (2014), namely emotion and the three types of coherence coded by NaCCs (context, chronology, and theme) were coded here the same way as there. In addition, memory breadth, length in terms of word count, and whether or not a Set A memory had been recalled at the 2-year follow-up were also investigated to see if they predicted memory maintenance after 8 years.

1. Emotion: Memories were categorized as to whether they contained at least one explicit reference to an emotion or affective state (e.g., mad, happy, excited, cried).
2. Thematic coherence (from NaCCs—see Reese et al., 2011): This indicated the degree to which there was a clearly developed focus to the narrative, from minimally developed (coded as 0) to substantially developed events that included elaborations, interpretations, or causal links (coded as 3).
3. Chronological coherence (from NaCCs): This assessed whether the event of the narrative

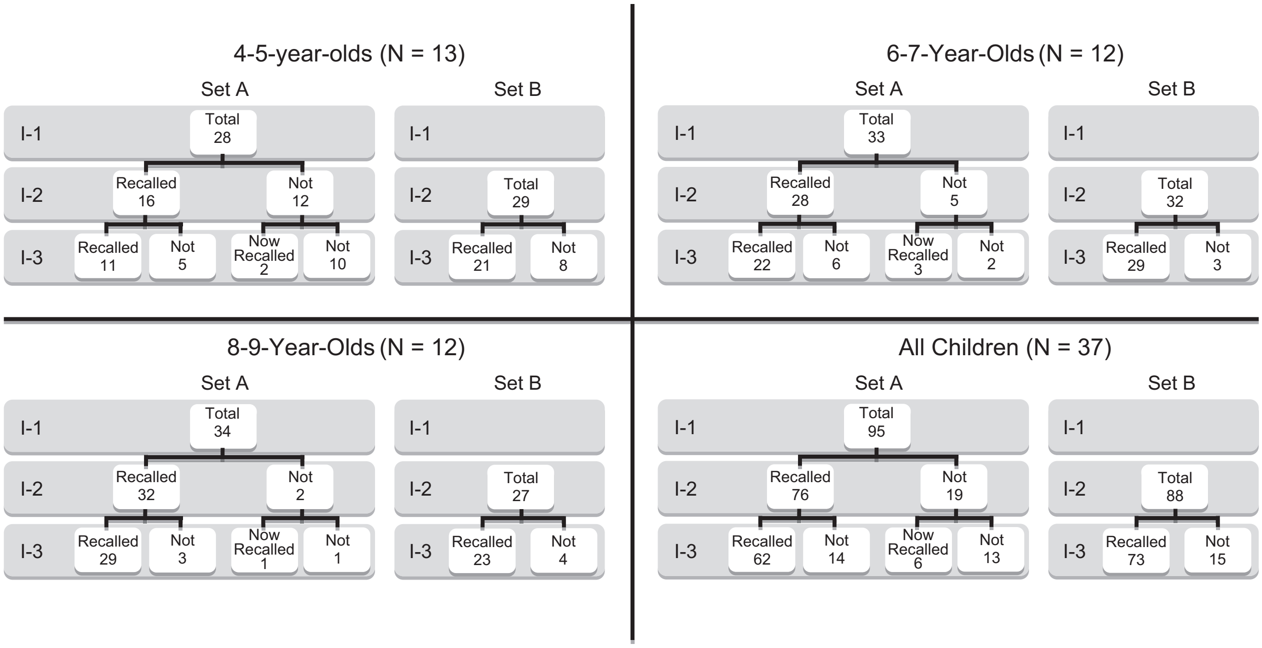

Figure 1. Pattern of remembering and forgetting across all three interviews, for all children combined.
Note. I indicates which interview (1, 2, or 3); not = "not recalled"; "now recalled" = recalled at Interview 3 although not recalled at Interview 2. Set A memories were produced at the initial interview, and Set B memories were new ones produced at the 2-year follow-up. All ages are children's age at Interview 1.

could be placed on a timeline by a listener, ranging from 0 (no temporal ordering) to 3 (75% or more of the actions were sequenced).

4. Context coherence (from NaCCs): Memories were coded for the degree of inclusion (coded from 0 to 3) of information that orients the memory in both time and place, with 0 assigned to those that contained none of this information and 3 assigned when specific information about both time and location were provided ("It happened in my Nana's backyard when I was three.")
5. Breadth: Memories were coded for the presence of the following types of information: who, what object, what action, when, where, why, how-description, and how-evaluation (see Bauer et al., 2007, 2014).
6. Length: The number of words in the memory at the time of its first recall.
7. For Set A memories only—whether a memory was recalled at Time 2.

Reliability

Approximately 24% of the transcripts (three from each age group) were randomly selected for calculating reliability. Interrater reliability (Cohen's kappa) was .93 for identifying a memory as describing the same event between two different interviews, .84 for memory content coding, .97 for presence of emotion, and .88 for breadth. For coding coherence, two coders independently rated each dimension of coherence and intraclass correlations were .85 for context coherence, .82 for chronological coherence, and .77 for thematic coherence.

Results

To best understand the data, we first describe the survival pattern of the memories. Figure 1 depicts the number of memories reported at the first interview and how many of those memories were recalled at the second and third interviews (Set A memories). It also depicts how many new memories were reported at the second interview, and how many of those were subsequently recalled at the third interview (Set B). Furthermore, it provides this information for each separate age group and for all the age groups combined. As can be seen from Figure 1, there were a total of 95 memories that were originally recalled at the first interview included in this data set (Set A) and 88 new memories first provided in the second interview (Set B). These constituted the total number of memories provided at the first two interviews by the 37 children who were interviewed at all three interviews.

Table 1
Mean (and SD*) Number of Memories Per Child Across Age Group and Interview*

	Age group		
Interview	4- to 5-year-olds *M* (*SD*)	6- to 7-year-olds *M* (*SD*)	8- to 9-year-olds *M* (*SD*)
Set A: Memories			
Reported at Interview 1	2.2 (0.8)	2.8 (0.5)	2.8 (0.4)
Recalled at Interview 2	1.2 (0.9)	2.3 (0.7)	2.7 (0.5)
Recalled at Interview 3	1.0 (0.8)	2.1 (0.8)	2.5 (0.7)
Set B: Memories			
Reported at Interview 2	2.2 (0.7)	2.7 (0.5)	2.3 (0.5)
Recalled at Interview 3	1.6 (0.8)	2.4 (0.7)	1.9 (0.7)

Note. This table reports mean number of memories recalled per child both when they are first reported (at Interview 1 for Set A and at Interview 2 for Set B) and when they are recalled at any later interview.

Figure 1 depicts the data at the memory level but not at the child level, which is better characterized by the average number of memories per participant. The means (and standard deviations) of the number of memories per child are provided in Table 1.

The analyses were organized in three sections. The first set of analyses explored the characteristics of the set of memories across age groups, including consistency of earliest memory, overlap of memories, and the differences in recall rates. The second set of analyses investigated memory content, specifically the information in the memories and the degree to which this information was consistent across the interviews for each age group. The last set of analyses tested which properties of these memories predicted their later recall. In some analyses, specifically those in which data were summed across memories for each individual child, different children provided different numbers of memories and thus scores were averaged across memories. In other analyses, individual memories rather than children were assessed.

Characteristics of the Memory Set

The Earliest Memory

Was there similarity in children's very earliest memory across interviews? We used two vectors to explore this: We identified which specific memory was identified by the children themselves in each interview as their earliest according to their own estimates of age at the time of the event and which specific memory was identified as the earliest according to parental estimates of age that were collected at the time the children originally provided the memory. We had parental judgments of age for 77% of the 4- to 5-year-olds, 92% of the 6- to 7-year-olds, and 92% of the 8- to 9-year-olds, and if there was no parental age estimate available, the children's estimates were necessarily used. Table 2 depicts the fate of the earliest memory children had produced in their initial interview when reinterviewed 8 years later: still recalled either spontaneously or through cueing and still dated as the earliest, still recalled either spontaneously or through cueing but now dated later than another memory, unable to be dated, or forgotten. There are two sets of data in Table 2. We show the data according to children's own dating of their memories because this procedure was used in all research with adults, and more particularly, in Bauer et al.'s (2014) investigation of dating consistency of first memories in adults over time. We also show the data according to parental dating of the memories because this procedure was used in all our previous reports, and more particularly in Peterson et al.'s (2011) assessment of dating consistency of first memories in children over time. Thus, comparison with both bodies of research is possible.

Regardless of who dated the memories, we found very little consistency in spontaneously provided earliest memories. Only two children in the

Table 2
Long-Term Fate of Children's Earliest Memory at Their Initial Interview When Reinterviewed 8 Years Later: Age Estimates Provided by Child (C) and Parent (P)

	Age group in years					
	4–5		6–7		8–9	
Status of earliest memory	C	P	C	P	C	P
Same memory spontaneously, and still earliest	0	0	2	2	3	3
Recalled when cued, and still earliest	4	5	0	2	3	5
Recalled spontaneously, but dated later than another	0	0	1	1	0	0
Recalled when cued, but dated later than another	3	2	2	1	3	2
Recalled when cued, but age unknown	0	0	4	3	1	0
Forgotten	6	6	3	3	2	2

6- to 7-year group and three in the 8- to 9-year group spontaneously recalled the same earliest memory in all their interviews. None of the former 4- to 5-year-olds did so. When cued, a number of the children not only recalled the same earliest memory, seven of them also still dated it as their earliest; in contrast, parents identified 12 of these cued memories as the children's earliest. In addition, some memories that had been children's earliest in their initial interview were also forgotten. For the youngest group, almost half of the children no longer recalled that earliest memory, even after cueing. As well, three in the middle group and two in the oldest group also forgot that memory.

The analyses above did not address the question of what were the ages of the earliest memories and how those ages changed over time and between age groups. Such an analysis, with these same participants, was the focus of a separate report (Wang & Peterson, 2016).

Overlap of All Memories

Although the majority of children were able to recall at least some of the same memories 8 years later as they had in their initial interview (Set A), some did not. For the youngest group, five children (38.5%) had no recall of any of the early memories they had produced in Interview 1; for the intermediate group, only one child (8.3%) had no recall of any Set A memories, whereas all of the oldest children recalled at least one memory from 8 years previously. In terms of children's recall of those new memories generated 6 years previously in Interview 2 (Set B), two former 4- to 5-year-olds (15.4%) had no recollection of any Set B memory, whereas all of the children in the two older age groups could recall at least one memory from 6 years previously.

When children in Interview 3 were asked for their three spontaneously provided earliest memories, there was little overlap between interviews. The percentage of Set A memories that children spontaneously provided were 0%, 18%, and 21% for the youngest, middle, and oldest age groups, respectively. Likewise, the percentage of Set B memories that children spontaneously provided was also low, although higher than the overlap for Set A memories: the overlap was 14%, 36%, and 29% for the youngest, middle, and oldest age groups, respectively. Thus, when children provided their spontaneously self-selected three earliest memories in their last interview, most of them were novel. But this does not mean that those earlier memories were actually forgotten. To assess whether or not prior memories were remembered, one needs to consider what children recalled both spontaneously and after cueing.

Recall Rates

The pattern of memory recall is shown in Figure 1. The 4- to 5-year-olds had initially recalled 28 early memories, but only 16 (57.1%) of these memories were still recalled 2 years later and 13 (46.4%) of them 8 years later (with two memories that were not recalled in Interview 2 remembered again in Interview 3). For the 6- to 7-year-olds, fully 28 (87.5%) of their initial 32 memories were recalled 2 years later, and 25 (78.1%) were still recalled 8 years later (with 3 memories that had not been recalled after 2 years remembered again after 8 years). Similar to the 6- to 7-year-olds, the 8- to 9-year-olds recalled 32 (94%) of their initial 34 memories 2 years later and still recalled 30 (88.2%) of them 8 years later. When all of the memories that were queried at Interview 3 (i.e., 95 memories from Set A and 88 memories from Set B) are considered, the youngest group recalled only 59.6% of them, whereas the intermediate and oldest groups recalled 83.1% and 86.9% of them, respectively.

To test if these values were statistically significant from each other, we conducted a logistic multilevel model. Because this analysis compared the number of memories recalled, and because some of these memories were recalled by the same person (and some were not), a multilevel model was needed to control for the person level dependency of these memories. The multilevel model also included whether or not the memory was from Set A or Set B in order to control for any difference from being 2 years older when first recalling the memory. We found that the former 4- to 5-year-olds were significantly less likely to recall a memory than the two older age groups, who did not differ from each other (see Table 3). Although suggestive as a general pattern, it is possible that this finding was not the same for both Set A memories and Set B memories. Looking at the Set A memories first, the former 4- to 5-year-olds recalled only 46.4% of them, whereas the former 6- to 7- and 8- to 9-year-olds recalled 75.8% and 88.2%, respectively. For Set B memories, the former 4- to 5-year-olds recalled 72.4% of these memories, whereas the former 6- to 7- and 8- to 9-year-olds recalled 90.6% and 85.2%, respectively. Thus, the difference between the youngest age group and the two older age groups seemed to be stronger in Set A memories than Set B memories. To test this possibility, we ran separate logistic multilevel models testing the effect of age

Table 3
Logistic Multilevel Models Examining Differences Between Age Groups on Recalling Memories Controlling for Whether Memory Is From Set A or B

Variable	Odds ratio	95% CI	*p*
All memories			
Age group			
Intercept	3.90	[1.67, 9.10]	.002*
4- to 5-year-olds versus 6- to 7-year-olds	3.86	[1.37, 10.84]	.010*
4- to 5-year-olds versus 8- to 9-year-olds	5.42	[1.81, 16.21]	.002*
6- to 7-year-olds versus 8- to 9-year-olds	1.40	[0.45, 4.37]	.558
Memory set	2.27	[1.04, 4.97]	.040*
Set A: Memories only			
Intercept	0.87	[0.41, 1.82]	.706
4- to 5-year-olds versus 6- to 7-year-olds	3.61	[1.21, 10.71]	.021*
4- to 5-year-olds versus 8- to 9-year-olds	8.65	[2.40, 31.14]	.001*
6- to 7-year-olds versus 8- to 9-year-olds	2.40	[0.65, 8.92]	.191
Set B: Memories only			
Intercept	3.19	[0.98, 10.42]	.056
4- to 5-year-olds versus 6- to 7-year-olds	4.21	[0.73, 24.22]	.108
4- to 5-year-olds versus 8- to 9-year-olds	2.39	[0.46, 12.39]	.299
6- to 7-year-olds versus 8- to 9-year-olds	0.57	[0.09, 3.61]	.550

Note. The default comparison age group was the 4- to 5-year-olds, whereas the comparison group for memory set is Set A. To generate the contrasts between the two older age groups, the models were run again with the comparison group changed.
*$p < .05$.

group for each memory set. The results of these analyses are shown in the bottom of Table 3. Overall, we found that the youngest age group recalled significantly fewer memories than the two oldest age groups for Set A memories, but the age groups did not differ for the Set B memories.

Memory Content

The next set of analyses investigated whether the information contained in the memories was different across age groups or over time. Memories were coded for how much overall information they contained. Furthermore, they were also coded for how much of the information was the same, new, or contradictory compared to what was said previously about that memory. Table 4 shows the amount of information provided across different interviews for Set A memories (top half) and Set B memories (lower half). The extent to which children provided the same overall amount of information across the different interviews was analyzed. To do so, we restricted our sample to the 62 memories in Set A that were recalled at all interviews. Because not all participants had memories that were recalled at each interview, the number of participants was reduced to 31. The first analysis examined whether the amount of information per memory changed over time and whether or not this varied by age group. To test for differences in Set A memories, a Group (3 ages) × Interview (3 interviews: initial, 2-year follow-up, and 8-year follow-up) analysis of variance (ANOVA) was calculated, with interview as a repeated measure. Interview was not significant, either alone or in interaction with group. However, the age groups differed, $F(2, 28) = 7.02$, $p = .003$, $\eta_p^2 = .334$. Using post hoc analyses, we found that the youngest age group provided significantly fewer pieces of information per memory than the oldest age group, whereas the middle-aged group did not significantly differ from either group. For Set B memories, a parallel Group (3) × Interview (2 interviews: 2- and 8-year follow-ups) ANOVA was calculated, with interview as a repeated measure. For these memories, there was no effect of age group, interview, or the interaction between them.

Table 4
Mean (and SD) Amount of Information Provided About the Same Memories, Averaged Per Memory: For Set A Memories, Amount of Information at Interview 1, Interview 2, and Interview 3, and for Set B Memories, Amount of Information at Interview 2 and Interview 3

Age	Number of children	Amount of information		
		Interview 1	Interview 2	Interview 3
Set A: Memories				
4–5	8[a]	5.93 (1.61)	4.93 (3.09)	6.12 (3.30)
6–7	11[b]	6.33 (4.55)	7.15 (3.19)	9.09 (4.86)
8–9	12	9.20 (3.61)	9.43 (2.05)	11.68 (4.86)
Set B: Memories				
4–5	11[c]	—	9.97 (2.94)	7.84 (5.77)
6–7	12	—	8.62 (3.10)	10.94 (4.95)
8–9	12	—	11.36 (3.88)	12.30 (6.02)

Note. Set A memories were produced at Time 1. Set B memories were new memories produced at Time 2. The amount of information at each time period for each child is divided by the number of memories recalled by that child.
[a]Five children had no recall of Set A memories. The data only include children who remembered at least one Set A memory at all three interviews. [b]One child had no recall of any Set A memories at Time 2 or Time 3. [c]Two children had no recall of any Set B memories at Time 3.

The next set of analyses examined the extent to which the information within each memory from one interview to the next was either the same, new, or contradictory. These data are presented in Table 5. For each comparison between interviews, Table 5 lists the mean number of pieces of information per memory that is either the same, new, or contradictory as well as the percentage prevalence of same, new, or contradictory information. Furthermore, this information is broken down by age group. To test if there were any differences in the consistency of information in Set A memories from Interview 1 to Interview 2 compared to Interview 1 versus Interview 3, a series of 3 (group) × 2 (comparison) analyses of variance (ANOVAs) were conducted, with comparison as the within factor, on the percentage overlap in same, new, and contradictory information. For the overlap of the same information, there was a significant effect of comparison, $F(1, 28) = 25.23$, $p < .0005$, $\eta_p^2 = .474$, and no effect of group, but there was a significant interaction, $F(2, 28) = 4.02$, $p = .029$, $\eta_p^2 = .223$. Using simple main effects analyses, we determined that while there was no significant difference between the age groups when comparing Interview 1 to Interview 2, there was a difference when comparing Interview 1 to Interview 3, $F(2, 28) = 4.70$, $p = .017$, $\eta_p^2 = .251$, with the youngest group having significantly less overlap of same information than the oldest group. For the percentage overlap of new information, there was a significant effect of comparison, $F(1, 28) = 11.45$, $p = .002$, $\eta_p^2 = .290$, where there was a higher percentage of new information provided between Interview 1 and Interview 3 than there was between Interview 2 and Interview 3. There was no effect for group and no interaction. Finally, for the contradictory information, there was a significant effect of comparison, $F(1, 28) = 4.19$, $p = .050$, $\eta_p^2 = .130$ and no significant effect for group, but there was a significant interaction between them, $F(2, 28) = 4.72$, $p = .017$, $\eta_p^2 = .252$. Using simple main effects analyses, we demonstrated that although there was no group effect when comparing Interview 1 to Interview 2, there was a significant group effect when comparing Interview 1 to Interview 3, $F(2, 28) = 4.04$, $p = .029$, $\eta_p^2 = .224$. In this case, 4- to 5-year-olds had a significantly higher percentage of contradictory information than did the 6- to 7-year-olds and nearly significantly more than did the 8- to 9-year-olds.

We conducted a set of parallel analyses to the ones conducted above to see if there were any differences in consistency when comparing Set A to Set B memories in the Interview 2 to Interview 3 comparisons. We ran 3 (group) × 2 (set) ANOVAs with set as a within factor and percentage overlap of same, new,

Table 5
Comparison of Information in Set A Memories at the Three Different Interviews (Contrasting Two at a Time) and in Set B Memories (Time 2 vs. Time 3): Mean Amount (and Percentage) of Information That Is the Same in Both Interviews, New, or Contradictory

	Age at initial interview					
	4–5 years		6–7 years		8–9 years	
Comparison	*M* (*SD*)	%	*M* (*SD*)	%	*M* (*SD*)	%
Set A: Comparison of Time 1 versus Time 2						
Same	1.87 (0.79)	48.6	2.37 (1.94)	33.8	4.55 (1.31)	49.0
New at Time 2	2.87 (2.70)	48.3	4.36 (2.42)	59.3	4.17 (2.06)	42.7
Contradictory	0.18 (0.37)	3.2	0.41 (0.61)	6.8	0.69 (0.53)	8.3
Set A: Comparison of Time 1 versus Time 3						
Same	0.69 (1.03)	9.6	2.31 (2.15)	25.3	3.41 (1.51)	31.9
New at Time 3	4.31 (2.89)	68.2	6.46 (3.61)	69.4	7.40 (4.96)	59.6
Contradictory	1.12 (0.83)	22.2	0.30 (0.64)	5.3	0.86 (0.69)	8.4
Set A: Comparison of Time 2 versus Time 3						
Same	0.93 (0.67)	14.5	3.45 (1.97)	40.1	3.94 (2.05)	34.3
New at Time 3	4.56 (3.13)	70.5	5.34 (3.15)	56.4	7.18 (3.40)	60.6
Contradictory	0.62 (0.69)	15.0	0.28 (0.52)	3.5	0.55 (0.52)	5.1
Set B: Comparison of Time 2 versus Time 3						
Same	2.27 (1.74)	29.9	3.32 (1.69)	30.9	4.88 (2.40)	38.1
New at Time 3	5.01 (4.07)	61.1	6.50 (3.43)	62.0	6.18 (4.60)	51.8
Contradictory	0.56 (0.79)	8.9	0.82 (0.53)	7.1	1.23 (0.96)	10.1

Note. The amount of information of each type for each child is divided by the number of memories recalled by that child.

and contradictory information as the dependent variables. For new information, there was a significant effect for set, $F(1, 27) = 7.42$, $p = .011$, $\eta_p^2 = .216$, where there was a higher percentage of same information for Set B memories than for Set A memories. There was also a significant effect for group, $F(2, 27) = 8.01$, $p = .002$, $\eta_p^2 = .372$, where the youngest children has less overlap of the same information compared to the oldest children. The interaction was not significant. For the percentage of new information, there was no effect for set, no effect for group, and no interaction, although the effect for group was near significance (i.e., $p = .056$). Finally, for the contradictory information, the results paralleled that of the new information, with no effects for set or group and no interaction but with a trend for the group effect (i.e., $p = .084$).

Table 6
Logistic Multilevel Models Examining Whether Recall at Interview 2 Predicts Recall at Interview 3 in Set A Memories

Variable	Odds ratio	95% CI	*p*
Age group			
Intercept	0.31	[0.10, 0.94]	.038*
4- to 5-year-olds versus 6- to 7-year-olds	2.18	[0.65, 7.33]	.208
4- to 5-year-olds versus 8- to 9-year-olds	4.36	[1.08, 17.62]	.039*
6- to 7-year-olds versus 8- to 9-year-olds	2.00	[0.51, 7.89]	.323
Being recalled at Time 2	6.79	[2.03, 22.62]	.002*

Note. The default comparison age group was the 4- to 5-year-olds. To generate the contrast between the two older age groups, the model was run again with the comparison group changed.
$^*p < .05$.

Predicting Which Memories Were Remembered

The next set of analyses examined the properties of a memory that predicted it being remembered. The first analysis examined whether being remembered once before increased the chance that the memory would be remembered again. Because Set A memories were originally recalled at Interview 1, and their recall was queried at Interview 2 and Interview 3, we tested whether being recalled at Interview 2 predicted whether an Interview 1 memory was recalled at Interview 3. Including only Set A memories, a logistic multilevel model was conducted with being remembered at Interview 3 as the outcome variable and being remembered at Interview 2 as a predictor. Age group was also added as a predictor in order to control for the effect of age. Overall, 82.7% of memories recalled at Interview 2 were recalled again at Interview 3, whereas only 33.3% of memories that were not recalled at Interview 2 were recalled at Interview 3. This difference was statistically significant, and results of this model are described in Table 6. Thus, recall of a particular memory at Interview 2 predicted its recall at Interview 3.

Next, we considered what properties of the memory (coded at the time of first recall) predicted that memory being remembered in the third interview. Memories were coded for word count, presence of emotion, coherence (context, chronology, and theme), and breadth; means and standard deviations for these memory properties are shown in Table 7. Each predictor was entered into a separate logistic multilevel model with being remembered at Interview 3 as the outcome variable, and age group and whether it was a Set A or Set B memory as control variables (see Table 8). Individually, higher word count, presence of emotion, and greater breadth at the first interview the memory was recalled were related to a higher likelihood of recall at Interview 3. Among the coherence variables, higher amounts of context were also related to higher rates of recall, but theme and chronology were not related.

It is possible that some of these memory properties that individually predicted higher, later recall would not be significant predictors once we take their relation with the other memory properties into account. To test for this, we conducted one more logistic multilevel model, again with recall at Interview 3 as the outcome variable, which included all four of the significant memory properties from the previous analyses (and also with age group and memory set as the control variables). The results of this analysis are in the bottom half of Table 8; emotion and context remained separate and significant predictors, but word count and breadth were no longer significant.

Discussion

The beginning of enduring personal memories for an individual are the beginning of one's sense of personal continuity over time and the construction of a temporally continuous sense of self (Bluck & Alea, 2008; Habermas & Köber, 2014). Yet little is known about whether children have a consistent starting point for their life story. Moreover, many memories from early childhood slip through the veil of childhood amnesia, but not all do so. This study prospectively explored the retention of early

Table 7
Properties of Both Set A and Set B Early Memories Recalled By Children in All Three Age Groups, and Each Interview: Means (and SDs)

	Properties of memories					
Age	Emotion	Theme	Chronology	Context	Breadth	Length
Set A: Memories						
Interview 1						
4–5	1.57 (0.50)	1.04 (0.4)	1.13 (1.10)	1.14 (1.01)	5.32 (1.02)	49.6 (25.4)
6–7	1.58 (0.50)	1.09 (0.30)	0.86 (0.94)	1.22 (0.79)	4.82 (1.24)	43.7 (38.8)
8–9	1.29 (0.46)	1.45 (0.56)	1.83 (1.02)	1.33 (1.02)	6.47 (1.16)	96.6 (67.3)
Interview 2						
4–5	1.25 (0.45)	0.92 (0.52)	0.73 (0.79)	1.08 (0.64)	5.50 (1.55)	55.1 (36.5)
6–7	1.22 (0.42)	1.12 (0.52)	0.75 (0.74)	1.04 (0.72)	5.93 (1.47)	79.0 (47.1)
8–9	1.09 (0.30)	1.00 (0.26)	0.58 (0.76)	0.52 (0.93)	6.38 (0.94)	80.5 (39.3)
Interview 3						
4–5	1.54 (0.52)	1.17 (0.39)	0.82 (1.08)	1.17 (0.58)	5.62 (1.80)	64.1 (55.5)
6–7	1.28 (0.46)	1.21 (0.51)	0.78 (0.67)	1.63 (0.97)	6.42 (1.77)	114.6 (71.1)
8–9	1.23 (0.43)	1.38 (0.78)	0.85 (0.72)	1.97 (1.05)	6.83 (1.39)	135.0 (81.8)
Set B: Memories						
Interview 2						
4–5	1.21 (0.41)	0.92 (0.56)	0.60 (0.91)	1.32 (0.90)	6.03 (1.30)	83.8 (61.5)
6–7	1.09 (0.30)	0.94 (0.51)	0.61 (0.72)	1.56 (0.88)	5.84 (1.08)	76.0 (60.5)
8–9	1.07 (0.27)	1.07 (0.55)	0.70 (0.72)	1.89 (1.01)	6.89 (0.93)	100.0 (57.5)
Interview 3						
4–5	1.33 (0.48)	0.90 (0.44)	0.75 (0.91)	1.52 (0.87)	5.48 (1.75)	81.0 (70.7)
6–7	1.38 (0.49)	1.18 (0.39)	0.36 (0.68)	1.54 (1.04)	6.72 (1.28)	138.0 (81.0)
8–9	1.22 (0.42)	1.43 (0.66)	0.95 (0.84)	1.70 (1.06)	6.74 (1.42)	137.5 (108.3)

memories over a span of many years, the degree to which the memories that remained still retained consistency in content, and whether we could predict which ones are more likely to persist.

The Earliest Memory

In adults, two studies show that there is considerable consistency in which memories are identified as the earliest across significant time spans (Bauer et al., 2014; Josselson, 2000), but in the current study, the consistency of the particular spontaneously provided memory that children dated as their earliest was quite low across 8 years, as predicted, regardless of whether children themselves or parents dated the memory. This contrasts sharply with the high consistency of earliest memories found in adults across time, although even adults are not entirely consistent, and fully 40% of high school students provided a different earliest memory when reinterviewed after 3 months (Kihlstrom & Harackiewicz, 1982). In the current study, when children were reminded about the memory that had been their earliest in the initial interview, seven of them still thought that it was the earliest although eight children did not, even though parental dating suggested otherwise. Change over time in how children date their early memories, including the participants of the present study, has been documented by Wang and Peterson (2014, 2016), and such redating may partially account for inconsistency in which particular enduring memory is thought to be one's earliest.

There were other contributors to this lack of consistency in identification of one's first memory besides redating the memory. Most importantly, younger children were more likely to simply forget the memory, and even cueing did not help. This also occurred for the older children but at a substantially reduced level. By definition, earliest memories are of events that occurred when the individual was very young; at this time of life, the neural, cognitive, and mnemonic processes that underlie the retention and forgetting of events are not fully formed (Bauer, 2015). Thus, memories of early events are more vulnerable to forgetting, as has been shown by a number of researchers (e.g., Bauer & Larkina, 2014; Cleveland & Reese, 2008).

Another contributor is that although some children could still recall the same earliest memory, cueing was required to remind them of it. Cues clearly facilitate later retrieval of early events (e.g., MacDonald, Uesiliana, & Hayne, 2000). Almost half of the

Table 8
Logistic Multilevel Model of Initial Memory Characteristics Predicting Recall at Interview 3

Memory characteristic	Odds ratio	95% CI	*p*
Individual analyses			
Word count	2.04	[1.05, 3.95]	.034*
Presence of emotion	3.22	[1.23, 8.48]	.018*
Coherence: Theme	1.12	[0.72, 1.75]	.602
Coherence: Chronology	1.41	[0.88. 2.25]	.149
Coherence: Context	1.83	[1.16, 2.90]	.009*
Breadth	1.81	[1.22, 2.67]	.003*
Full model			
Age group			
Intercept	1.07	[0.40, 2.84]	.900
4- to 5-year-olds versus 6- to 7-year-olds	4.73	[1.43, 15.58]	.011*
4- to 5-year-olds versus 8- to 9-year-olds	2.89	[0.84, 9.93]	.092
6- to 7-year-olds versus 8- to 9-year-olds	0.61	[0.15, 2.44]	.485
Memory set	0.92	[0.34, 2.44]	.862
Word count	1.29	[0.61, 2.72]	.502
Emotion	2.95	[1.07, 8.13]	.037*
Context	1.69	[1.02, 2.79]	.040*
Breadth	1.60	[0.86, 2.99]	.141

Note. For the individual analyses section, each of the memory characteristics were run in a separate model controlling for age group and whether memory was from Set A or Set B, but only the odds ratio for the memory characteristic is reported. The full model section lists all coefficients (converted to odds ratios) for a model that includes the same control variables plus the four memory characteristics that were significant predictors in the individual analyses. For the full model, the comparison group is the 4- to 5-year-olds for age group and Set A for memory set. To generate the contrast between the two older age groups, the model was run again with the comparison group changed.
*$p < .05$.

former 4- to 5-year-olds required cues in order to remember their earliest enduring memory, and even a quarter of the older children did too. These cued memories were still the earliest of all those described in their final interview, and thus, there was still some consistency in the identity of the first memory (especially using adult estimates of age) if it was still remembered at all. Because the children were adolescents at the time of the final interview, an inability to follow task instructions is unlikely to account for why they did not produce these memories spontaneously when asked for their very earliest one. Rather, the memories may have been more fragile or less salient, and therefore less accessible.

Overlap of Memories

There was relatively little overlap in the spontaneous memories that children provided across the three interviews, although age was an important variable. About a fifth of the memories that children spontaneously provided in their final interview overlapped with the memories that they had provided 8 years earlier, but this was only true for those who had initially been at least 6 years of age. Former 4- to 5-year-olds had no overlap at all in spontaneous memories. For all children, there was considerably more overlap when children were cued. That is, most of those memories that were not spontaneously recalled were not actually forgotten. However, age was again of key importance: Almost 40% of the children who had been 4 or 5 years of age at the time of their initial interview were unable to recall *any* of the Set A memories, in contrast to children in the two older age groups. Only one former 6-year-old had no memory for any Set A memory. Overall, over half of the Set A memories were inaccessible to children in the youngest age group after the passage of 8 years, whereas most memories produced by children who had been at least 6 years of age at the time of initial recall were still remembered.

Importantly, the Set B memories produced by former 4- to 5-year-olds in their second interview 2 years later, when they were 6- to 7-year-olds, were recalled at the same rate as those of children in the two older age groups. Thus, it is those memories produced by children who were preschool aged that were particularly vulnerable to forgetting. This highlights a major shift in memory retention between preschoolers and older children, and supports research that proposes an age shift in memory at this particular age. For example, Bauer and Larkina (2014) propose that children seem to exhibit a constant rate of forgetting before the age of 6 or 7 that is characterized by an exponential function rather than the power function that characterizes adult forgetting. This would result in a smaller pool of memories available for later retrieval—which is consistent with what we found.

Consistency of Content

First, the amount of information children provided about the same remembered events did not differ across time, for either Set A or Set B. This similarity of content amount across time parallels findings with both adult (Bauer et al., 2014) and child (Peterson et al., 2011) prior studies, in spite of the fact that the time gap between interviews was so large. Not surprisingly, children in the youngest group provided less information than did those in the oldest group—but only with Set A memories. In terms of the similarity of content across interviews, the amount of delay between interviews had a considerable impact. In both Peterson et al.'s (2011) child sample and Bauer et al.'s (2014) adult sample, approximately half of the information was the same across their delays of 2 and 4 years. The same was found for all age groups in the current study when the initial and 2-year follow-up interviews were compared. However, when the delay was much larger, the amount of overlap decreased, particularly for the youngest children. Less than 10% of the information in these children's final interview 8 years later was the same as in their initial interview. Even the older children only had 25%–32% overlapping information. When comparing the information in Interview 2 and Interview 3, 6 years later, again the youngest children had relatively little overlap in the information they provided—only about 15% of the information was the same.

The youngest children also had significantly more information that contradicted what they had said in Interview 1 than did older children when the delay was long, although very little contradiction when the delay was short. When the effect of similar lengthy delays was assessed for highly salient events such as hurricane experiences (6-year delay—Fivush et al., 2004) and personal injuries (10-year delay—Peterson, 2015), accuracy was still quite high after these long delays, although it had deteriorated by a relatively small amount. All of the children in Peterson (2015) were as young at the time of their first interview as the children here (age 3–5 years); nevertheless, 80%–90% of the information they provided was accurate. However, injury events are highly salient and are talked about a great deal at the time of occurrence, and indeed, children still recalled most of the relevant information 10 years later. However, one cannot assume a similar degree of accuracy when a child's very earliest enduring memories are recalled. Also, according to parent report, a lot of these early memories had not been the topic of family discussion and such rehearsal may help long-term accuracy (Nelson & Fivush, 2004).

Predictors of Long-Term Recall

The current study enabled us to compare the memories that were kept over a substantial length of time with those that were not. Two factors were seen as key: emotion and an aspect of coherence. In the adult literature, the presence of emotion has been frequently suggested as an important characteristic of those very early memories that are retained (Howes et al., 1993; Mullen, 1994; Saunders & Norcross, 1988; but see Kihlstrom & Harackiewicz, 1982). In contrast, cross-sectional research with children documented that most of their earliest memories are affectively neutral and refer to everyday events that do not include affective descriptors (Peterson et al., 2005, 2009). Longitudinal research may enable researchers to provide an explanation for this divergence. Peterson et al. (2014) found that the presence of emotion increased the likelihood of a memory being retained across 2 years by two and a half times. In the current study, emotion was again a strong predictor of which memories were kept versus forgotten across a much longer span of 6 or 8 years. As examples, a 4-year-old girl remembered when her mother came home from the hospital with a new baby: "And the most thing I loved about it was when she [mother] came home with [my sister]." A 4-year-old boy, while describing a dining mishap, stated: "I got all mad because I got all dirty." When emotion is narratively included as part of the memory for events, these events are likely to be more salient and meaningful than are affectively neutral events, and such personal meaning seems to foster long-term recall. Thus, if the number of affectively neutral memories is progressively winnowed down, one may be left with a pool of early memories that are more likely to involve emotion—which is consistent with the adult literature.

Coherence, defined as how well a particular memory is structured, organized, and elaborated (e.g., Fivush, 2007; Morris et al., 2010; Reese et al., 2011), has also been proposed as an important characteristic of memory retention. In a 1-year longitudinal study, Morris et al. (2010) found that two aspects of coherence predicted retention of recently occurring events in 4-, 6-, and 8-year-olds, namely, thematic coherence (as coded by NaCCs—see Reese et al., 2011) and breadth (inclusion of information on who, what, when, where, etc.—see Bauer & Larkina, 2014). In that study, they were unable to assess contextual coherence. In our previous 2-year longitudinal study of 4- to 13-year-old children's retention of earliest memories, we found that all three aspects of coherence measured by NaCCs, namely thematic, chronological, and contextual coherence, predicted memory survivability, with thematic coherence most important and chronological coherence least (Peterson et al., 2014). (The authors did not measure breadth.) In the current study, contextual coherence continued to be an important predictor, although, surprisingly, thematic coherence was not. Contextual coherence measures the extent to which an event is embedded within a mesh of time and space; the more such embedding, the richer the memory representation.

The other factor that predicted memory survival in the 8-year follow-up interview was recall in the 2-year interview. This is not surprising because the greatest amount of forgetting for the youngest children in particular was during the first 2 years of the study. Memories that were not recalled after 2 years would be expected to continue to be forgotten.

Conclusions

Overall, the results documented considerable variability in the event that children identified as their first memory and thus in what can be considered to be their starting point for a continuous sense of self. Furthermore, there was considerable instability in what children claimed to be their early memories. This was particularly true for those memories initially provided by preschoolers, who showed substantial forgetting of memories even when cued. In addition, the information that children in the youngest group actually provided about those memories (i.e., the ones that they recalled) differed substantially after 8 years. Eight years later, a whopping 22% of the information they provided about the same events was contradictory to what they had said before, and < 10% was the same. This was not true for memories provided by children who were at least 6 years of age at the time of initial memory recall, including for children in the youngest group who provided those memories during their second interview when they were 2 years older. Thus, the age of 6–7 seems to mark a significant difference in not only whether a memory is recalled or not, but also in the consistency of that memory's recall.

The present study was limited in terms of the size of the sample being studied, both in terms of the number of children and the number of memories. Longitudinal research over such long periods of time is rare; nevertheless, it needs to be done. Findings of the current study suggest potential directions of this future research. With a larger sample size of individuals as well as of early memories, it would be informative to explore in more depth the role of emotion, with more finely grained analyses of emotional valence and saturation. In addition, much more needs to be done to understand the consistency of children's memories over time and whether we can predict what sort of information in particular is more likely to alter over time in children's recollections. Furthermore, a better understanding of the dimensions of coherence that are important for predicting memory maintenance is needed.

However, our results reinforce the conclusions articulated in Peterson et al. (2014), namely, "our recollections of earliest childhood are not merely random flashes of previous life that penetrate the veil of childhood amnesia for unknown reasons" (p. 447). Parallel to our findings in that report, we found meaningful predictors for memory retention, namely, emotion and coherence. Those memories that articulated a description of emotion and were embedded in temporal and spatial context were more likely to escape the ravages of time.

References

Bauer, P. J. (2014). The development of forgetting: Childhood amnesia. In P. J. Bauer & R. Fivush (Eds.), *The Wiley handbook of the development of children's memory* (Vol. II, pp. 519–544). Chichester, UK: Wiley.

Bauer, P. J. (2015). A complementary processes account of the development of childhood amnesia and a personal past. *Psychological Review*, *122*, 204–231. https://doi.org/10.1037/a0038939

Bauer, P. J., Burch, M. M., Scholin, S. E., & Güler, O. E. (2007). Using cue words to investigate the distribution of autobiographical memories in childhood. *Psychological Science*, *18*, 910–916. https://doi.org/10.1111/j.1467-9280.2007.01999.x

Bauer, P. J., & Larkina, M. (2014). Childhood amnesia in the making: Different distributions of autobiographical memories in children and adults. *Journal of Experimental Psychology: General*, *143*, 597–611. https://doi.org/10.1037/a0033307

Bauer, P. J., Tasdemir-Ozdes, A., & Larkina, M. (2014). Adults' reports of their earliest memories: Consistency in events, ages, and narrative characteristics over time. *Consciousness and Cognition*, *27*, 76–88. https://doi.org/10.1016/j.concog.2014.04.008

Bluck, S., & Alea, N. (2008). Remembering being me: The self-continuity function of autobiographical memory in younger and older adults. In F. Sani (Ed.), *Self-continuity: Individual and collective perspectives* (pp. 55–70). New York, NY: Erlbaum.

Cleveland, E. S., & Reese, E. (2008). Children remember early childhood: Long-term recall across the offset of childhood amnesia. *Applied Cognitive Psychology*, *22*, 127–142. https://doi.org/10.1002/acp.1359

Dudycha, G. J., & Dudycha, M. M. (1941). Childhood memories: A review of the literature. *Psychological Bulletin*, *36*, 668–682.

Fivush, R. (2007). Maternal reminiscing style and children's developing understanding of self and emotion. *Clinical Social Work Journal*, *35*(1), 37–46.

Fivush, R., Haden, C., & Adam, S. (1995). Structure and coherence of preschoolers' personal narratives over time: Implications for childhood amnesia. *Journal of*

Experimental Child Psychology, *60*, 32–56. https://doi.org/10.1006/jecp.1995.1030

Fivush, R., Sales, J. M., Goldberg, A., Bahrick, L., & Parker, J. (2004). Weathering the storm: Children's long-term recall of Hurricane Andrew. *Memory*, *12*, 104–118. https://doi.org/10.1080/09658210244000397

Habermas, T., & Köber, C. (2014). Autobiographical reasoning is constitutive for narrative identity: The role of the life story for personal continuity. In K. C. McLean & M. Syed (Eds.), *The Oxford handbook of identity development* (pp. 149–165). Oxford, UK: Oxford University Press.

Howe, M. L. (1997). Children's memory for traumatic experiences. *Learning and Individual Differences*, *9*, 153–174. https://doi.org/10.1016/S1041-6080(97)90004-2

Howes, M., Siegel, M., & Brown, F. (1993). Early childhood memories: Accuracy and affect. *Cognition*, *47*, 95–119.

Jack, F., MacDonald, S., Reese, E., & Hayne, H. (2009). Maternal reminiscing style during early childhood predicts the age of adolescents' earliest memories. *Child Development*, *80*, 496–505. https://doi.org/10.1111/j.1467-8624.2009.01274.x

Josselson, R. (2000). Stability and change in early memories over 22 years: Themes, variations, and cadenzas. *Bulletin of the Menninger Clinic*, *64*, 462–481.

Kihlstrom, J., & Harackiewicz, J. (1982). The earliest recollection: A new survey. *Journal of Personality*, *50*, 134–148.

MacDonald, S., Uesiliana, K., & Hayne, H. (2000). Cross-cultural and gender differences in childhood amnesia. *Memory*, *8*, 365–376. https://doi.org/10.1080/09658210050156822

Morris, G., Baker-Ward, L., & Bauer, P. J. (2010). What remains of that day: The survival of children's autobiographical memories across time. *Applied Cognitive Psychology*, *24*, 527–544. https://doi.org/10.1002/acp.1567

Mullen, M. K. (1994). Earliest recollections of childhood: A demographic analysis. *Cognition*, *52*, 55–79. https://doi.org/10.1016/0010-0277(94)90004-3

Nelson, K., & Fivush, R. (2004). The emergence of autobiographical memory: A social cultural developmental theory. *Psychological Review*, *111*, 486–511. https://doi.org/10.1037/0033-295X.111.2.486

Peterson, C. (2002). Children's long-term memory for autobiographical events. *Developmental Review*, *22*, 370–402. https://doi.org/10.137/0012-1649.35.6.1493

Peterson, C. (2011). Children's memory reports over time: Getting both better and worse. *Journal of Experimental Child Psychology*, *109*, 275–293. https://doi.org/10.1016/j.jecp.2011.01.009

Peterson, C. (2012). Children's autobiographical memories across the years: Forensic implications of childhood amnesia and eyewitness memory for stressful events. *Developmental Review*, *32*, 287–306. https://doi.org/10.1016/j.dr.2012.06.002

Peterson, C. (2015). A decade later: adolescents' memory for medical emergencies. *Applied Cognitive Psychology*, *29*, 826–834. https://doi.org/10.1002/acp.3192

Peterson, C., Grant, V. V., & Boland, L. D. (2005). Childhood amnesia in children and adolescents: Their earliest memories. *Memory*, *13*, 622–637. https://doi.org/10.1080/09658210444000278

Peterson, C., Morris, G., Baker-Ward, L., & Flynn, S. (2014). Predicting which childhood memories persist: Contributions of memory characteristics. *Developmental Psychology*, *50*, 439–448. https://doi.org/10.1037/a0033221

Peterson, C., Wang, Q., & Hou, Y. (2009). "When I was little": Childhood recollections in Chinese and European Canadian grade-school children. *Child Development*, *80*, 506–518. https://doi.org/0009-3920/2009/8002-0015

Peterson, C., Warren, K. L., & Short, M. M. (2011). Infantile amnesia across the years: A 2-year follow-up of children's earliest memories. *Child Development*, *82*, 1092–1105. https://doi.org/10.1111/j.1467-8624.2011.01597.x

Peterson, C., & Whalen, N. (2001). Five years later: Children's memory for medical emergencies. *Applied Cognitive Psychology*, *15*, 7–24. https://doi.org/10.1002/acp.832

Pillemer, D. B., & White, S. H. (1989). Childhood events recalled by children and adults. *Advances in Child Development and Behavior*, *21*, 297–340. https://doi.org/10.1016/S0065-2407(08)60291-8

Reese, E., Haden, C., Baker-Ward, L., Bauer, P. J., Fivush, R., & Ornstein, P. (2011). A multidimensional model of narrative coherence across the lifespan. *Journal of Cognition and Development*, *12*, 424–462. https://doi.org/10.1080/15248372.2011.587854

Reese, E., Jack, F., & White, N. (2010). Origins of adolescents' autobiographical memories. *Cognitive Development*, *25*, 352–367. https://doi.org/10.1016/j.cogdev.2010.08.006

Rubin, D. C. (2000). The distribution of early childhood memories. *Memory*, *8*, 265–269. https://doi.org/10.1080/096582100406810

Saunders, L. M., & Norcross, J. C. (1988). Earliest childhood memories: Relationship to ordinal position, family functioning, and psychiatric symptomatology. *Individual Psychology*, *44*, 95–105.

Tustin, K., & Hayne, H. (2010). Defining the boundary: Age-related changes in childhood amnesia. *Developmental Psychology*, *46*, 1049–1061. https://doi.org/10.1037/a0020105

Van Abbema, D. L., & Bauer, P. J. (2005). Autobiographical memory in middle childhood: Recollections of the recent and distant past. *Memory*, *13*, 829–845. https://doi.org/10.1080/09658210444000430

Wang, Q., & Peterson, C. (2014). Your earliest memory may be earlier than you think: Prospective studies of children's dating of earliest childhood memories. *Developmental Psychology*, *50*, 1680–1686. https://doi.org/10.1037/a0036001

Wang, Q., & Peterson, C. (2016). The fate of childhood memories: Children postdated their earliest memories as they grew older. *Frontiers in Psychology*, *6*, 1–7. https://doi.org/10.3389/fpsyg.2015.02038