Published in final edited form as:
Memory. 2014 November ; 22(8): 907–924. doi:10.1080/09658211.2013.854806.

The onset of childhood amnesia in childhood: A prospective investigation of the course and determinants of forgetting of early-life events

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Abstract

The present research was an examination of the onset of childhood amnesia and how it relates to maternal narrative style, an important determinant of autobiographical memory development. Children and their mothers discussed unique events when the children were 3 years of age. Different subgroups of children were tested for recall of the events at ages 5, 6, 7, 8, and 9 years. At the later session, they were interviewed by an experimenter about the events discussed 2 to 6 years previously with their mothers (early-life events). Children ages 5, 6, and 7 remembered 60% or more of the early-life events. In contrast, children ages 8 and 9 years remembered fewer than 40% of the early-life events. Overall maternal narrative style predicted children's contributions to mother-child conversations at age 3 years; it did not have cross-lagged relations to memory for early-life events at ages 5 to 9 years. Maternal deflections of the conversational turn to the child predicted the amount of information children later reported about the early-life events. The findings have implications for our understanding of the onset of childhood amnesia and the achievement of an adult-like distribution of memories in the school years. They highlight the importance of forgetting processes in explanations of the amnesia.

Keywords

autobiographical memory; childhood amnesia; long-term memory; maternal style; narrative

The relative paucity of memories from early in life experienced by adults—so-called, *childhood amnesia*—has been a phenomenon of substantial interest at least since its identification in the late 19th century (Henri & Henri, 1895; Miles, 1893) and naming in the early 20th century (Freud, 1905/1953). Among adults, the average age of earliest memory typically is age 3 to 4 years. There is a gradually increasing number of memories from the ages of 3½ to 7 years, at which time an adult-like distribution of autobiographical memories is assumed (see Wetzler & Sweeney, 1986 for empirical evidence; Pillemer & White, 1989, for discussion; and Bauer, Burch, Scholin, & Güler, 2007, and Bauer & Larkina, in press, for suggestions that the adult distribution of autobiographical memories may be a developmentally later achievement).

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Historically, adults were the only participants in research on childhood amnesia. That is, the phenomenon was defined in terms of the age of earliest memory among adults, and the distribution of early memories recalled by adults (see Bauer, 2007, 2008, 2014, for reviews). Data from children are a relatively recent addition to the empirical landscape of childhood amnesia. Studies in which children are asked to report their earliest memories provide evidence of amnesia for early-life events by the end of the first decade of life (Peterson, Grant, & Boland, 2005; Reese, Jack, & White, 2010; Tustin & Hayne, 2010). The findings stand in sharp contrast to the large literature documenting that even young children form and retain autobiographical memories (see, for e.g., Bauer, 2014; Reese, 2014, for reviews). They compel investigation of the processes involved in loss of access to memories of early-life events, heralding the *onset* of childhood amnesia (Bauer, 2012, 2014). We report the results of a prospective study in which we addressed this question and also examined one potential determinant of the preservation of early memories beyond the onset of childhood amnesia, namely, maternal narrative style.

Virtually since the dawning of developmental research relevant to childhood amnesia, the focus has been on the development of remembering. That is, attention has been on the emergence of and subsequent improvements in autobiographical memory. This focus was motivated by theories of childhood amnesia that attributed the phenomenon to the inability of young children to form memories of personally relevant events that would endure over time (see, e.g.,Nelson, 1993; Perner, 2001; Perner & Ruffman, 1995; Bauer, 2007, 2014, for discussion). Evaluation of such perspectives demanded research on autobiographical memory in the period eventually obscured by the amnesia. If evidence of autobiographical memories was found, such perspectives could not explain the childhood amnesia phenomenon. Beginning in the 1980s, a steady flow of studies reported autobiographical competence among children in the preschool years (e.g., Hamond & Fivush, 1991; Harley & Reese, 1999; Hudson & Fivush, 1991; Peterson & Rideout, 1998; Todd & Perlmutter, 1980). The work made clear that by the age of 2 years, children not only remember specific past events over long periods of time (e.g., Bauer, Wenner, Dropik, & Wewerka, 2000), they also use their budding language skills to talk about personally-relevant past events (Fivush, Gray, & Fromhoff, 1987). It also documented substantial development in autobiographical memory over the next few years such that by age 6 to 7 years, children provide relatively complete reports of events that they remember and they retain the memories over long periods of time (see Bauer, 2007, 2014, for reviews). The literature demonstrates that within the period eventually obscured by childhood amnesia, children form and retain autobiographical memories. As such, it makes clear that childhood amnesia among adults cannot be explained by absence of autobiographical memory competence during the years eventually obscured by the amnesia.

In contrast to the large literature documenting autobiographical competence among preschool-age children, the literature on childhood amnesia in childhood is small. It is largely consistent, however, and indicates that amnesia for early-childhood events is apparent by the end of the first decade of life. Evidence comes from two different paradigms. In one paradigm, children are explicitly asked to recall their earliest memory. These studies reveal that as children approach the second decade of life, the average age of

earliest memory approximates that observed among adults (e.g., Peterson et al., 2005; Reese et al., 2010; Tustin & Hayne, 2010). In contrast, by the same measure, while children are within the period that eventually is obscured by childhood amnesia, the average age of earliest memory is significantly younger than the average age for adults (i.e., 18 months among 5-year-olds vs. 3½ years among adults; Tustin & Hayne, 2010). In the second paradigm, the age of earliest memory is estimated based on responses to cue words (e.g., Rubin, 1982). Participants are asked to retrieve memories of past events associated with each of a number of cue words (e.g., *dog*, *chair*, *sun*), and also identify their age at the time of the event. When examined in this manner, the average age of earliest memory of children 7 to 11 years old is 3 years 8 months, a value highly consistent with the average age of earliest memory among adults (Bauer & Larkina, in press). Results from these two paradigms strongly suggests that, like adults, children suffer from childhood amnesia.

Juxtaposition of these two literatures—one on developments in autobiographical memory and the other on childhood amnesia in childhood—compels consideration of the processes involved in loss of access to memories of early-life events (Bauer, 2007, 2012). Essentially, what is needed is an account that explains why memories formed and retained relatively early in childhood later are lost to recall. Effective consideration of the processes implicated in this explanation requires that early memories be documented and then tracked through the period eventually obscured by the amnesia, and across the boundary of the amnesia into later childhood. Importantly, none of the studies of childhood amnesia summarized above affords the necessary perspective. By definition, they measure what was *retained* from early childhood; they cannot inform what children have forgotten. Consideration of the processes involved in the onset of childhood amnesia requires prospective studies of the fates of memories of early-life events both within and across the boundary of the period eventually obscured by childhood amnesia.

There are a small number of prospective studies of the process of loss of (or loss of access to) memories for early-life events. Cleveland and Reese (2008) obtained conversations between mothers and their children about past events at each of ages 19, 25, 32, 40, and 65 months. The fact that the children talked about the events provided evidence that they had formed memories of them. When the same children were 66 months of age, they were asked about events from each of the prior data collection points. Thus at 66 months, children were tested for memories of events 1, 26, 34, 41, and 47 months in the past. The amount that the 5½-year-olds remembered decreased steadily as the retention interval increased. They recalled roughly 80% of events from only 1 month in the past but fewer than 40% of events from 47 months in the past. Fivush and Schwarzmueller (1998) reported a similar trend, though higher rates of retention, from 8-year-olds interviewed about events from ages 3½ and 4 (77% of events remembered) versus 5 and 6 (92% of events remembered) years of age. Both studies suggest that as time goes by, forgetting becomes more pronounced. However, for purposes of the present research, the data are limited because in both studies, events with the longest delays between the initial and later tests also were events with the earliest age of encoding (i.e., 19 months in Cleveland & Reese). Also, only Fivush and Schwarzmueller (1998) documented the fates of memories over the boundary of childhood amnesia (i.e., beyond age 7 years).

In Van Abbema and Bauer (2005), we held the age at encoding constant and varied the retention interval, thereby allowing for examination of the fates of early memories over time. Specifically, we recorded conversations of dyads of 3-year-old children and their mothers as they discussed a number of events from the recent past. Children's contributions to the conversations made clear that they had formed memories of the events. Thus we had documentation of memories from the age period corresponding to that from which adults report their earliest memories. We then tested different subgroups of the children again roughly 4, 5, or 6 years later, at the ages of 7, 8, or 9 years of age—ages at which, based on adult data, we would expect to see evidence of childhood amnesia. The data were suggestive of the onset of the amnesia. Whereas the children 7 years of age remembered 64% of the events from age 3 years, the 8- and 9-year-olds remembered only 36% and 34% of the past events, respectively.

In the present research, we extended the literature on the onset of childhood amnesia in two ways: with a study of the emergence of childhood amnesia from 5 to 9 years, and by testing a potentially important determinant of the fates of early memories beyond the onset of childhood amnesia, namely, maternal narrative style (see Morris, Baker-Ward, & Bauer, 2009; and Peterson, Morris, Baker-Ward, & Flynn, 2013, for examinations of other potential determinants, such as characteristics of children's memory reports). The first extension was to the database provided by Van Abbema and Bauer (2005). In the earlier study, children 7, 8, and 9 years of age were questioned about events from age 3 years. Subsequent to the 2005 publication, additional children who were drawn from the same population and experienced the same protocol at age 3 years were tested again roughly 2 or 3 years later, at the ages of 5 and 6 years. Because the populations represented and both the age-3 and the later protocols were identical to those in Van Abbema and Bauer, the samples can be directly compared. Inclusion of five age groups of children, tested between 2 and 6 years after recall of specific past events, provides a more complete picture of the pattern of remembering and forgetting of specific events from early childhood. Importantly, it also effectively straddles the boundary of childhood amnesia, marked in the adult literature as age 7 years (e.g., Wetzler & Sweeney, 1986). For all five age groups, we examined the proportion of events from age 3 years recalled at ages 5 to 9 years. We also examined the narrative accounts that the children produced about the events, to inform the content of memories from early in life.

The second extension provided by the present research was determination of relations between maternal narrative style and the fates of early memories beyond the onset of childhood amnesia. The assessment of maternal narrative style was based on the conversations children had with their mothers at age 3 years. Within the preschool years, maternal narrative style is a consistent predictor of children's contributions to conversations about past events (e.g., Farrant & Reese, 2000; Fivush & Fromhoff, 1988; Nelson & Fivush, 2000, 2004; see Fivush, 2014, for a review). Parents who provide rich descriptive information about previous experiences and invite their children to “join in” on the construction of stories about the past are said to use an *elaborative* style. Parents who provide fewer details about past experiences and instead pose specific questions to their children are said to use a *low-elaborative* or *repetitive* style. Both concurrently and over time, preschoolers of mothers using a more elaborative style are more involved in

conversations about past events than preschoolers of mothers using a less elaborative style (e.g., Bauer & Burch, 2004; Fivush & Fromhoff, 1988; Peterson & McCabe, 1994). For example, Reese, Haden, and Fivush (1993) examined mother-child conversations at four time points, between 3 and 6 years of age. Concurrent correlations between maternal elaborations and children's participation in memory conversations were observed at all time points. Cross-lagged relations also were apparent. For instance, mothers who used more elaborations when their children were age 3 years had children who at 5 and 6 years made more memory contributions.

Findings of relations between maternal narrative style and preschoolers' participation in autobiographical reminiscing have been replicated several times over (e.g., Bauer & Burch, 2004; Boland, Haden, & Ornstein, 2003; Fivush & Fromhoff, 1988). However, how maternal style variables relate to remembering and forgetting of specific past events from the period eventually obscured by childhood amnesia has been explored only minimally. Jack, MacDonald, Reese, and Hayne (2009) tested whether maternal style in conversations with children at 24 to 40 months related to the age of earliest memory among the same children when they were adolescents (12 to 13 years). Mothers who had used a more elaborative style with their preschoolers had adolescents with younger earliest memories relative to adolescents whose mothers had used a less elaborative style (see Larkina, Merrill, Fivush, & Bauer, 2009, for similar findings). Second, Reese et al. (2010) found relations between maternal narrative variables from the preschool years (when children were 19–65 months: see Cleveland & Reese, 2008) and adolescents' (age 12 years) early memories. Maternal evaluations were the only unique predictor of a derived variable reflecting the amount of information adolescents reported about (a) their earliest memories, and (b) two early-life events discussed when the children were 19 to 65 months of age.[1] These studies represent important steps in understanding the relations between maternal narrative style and children's later recall of events from early in life. Yet because they featured only one age (early adolescence), the studies have a constrained developmental perspective. Moreover, because the studies were with young adolescents, they shed no light on the pattern of relations during the period of emergence of childhood amnesia. The studies also cannot inform the factors that predict the fates of specific memories known to have been formed early in life.

To begin to address these voids in the literature, in the present research, we used measures of maternal narrative style obtained at 3 years as predictors of the percentage and content of memories from age 3 children would remember at ages 5 to 9 years. Because children were tested at ages ranging from 5 to 9 years, the present research enabled examination of the possibility of differential relations with maternal style variables at different ages and different delays from the early-life events. The age period also is of interest because, as discussed above, it is during this time that childhood amnesia emerges and an adult-like

[1]Reese et al. (2010) also featured examination of relations between maternal narrative style variables obtained from the preschool years and the age of earliest memory reported in adolescence. However, the age of earliest memory was analyzed as part of a factor-analytic derived variable that also reflected (a) a rating of the level of insight the adolescent had gained from two life-changing events, and (b) the adolescent's knowledge of her or his own family history. The heterogeneous nature of the composite variable makes it difficult to interpret the resulting relation. For that reason, the relation is not discussed further.

distribution of autobiographical memories begins to take shape (Bauer & Larkina, in press; Bauer, 2012, for discussion).

In summary, the present research is a prospective examination of the fates of memories of early-life events as children exit the preschool period and cross the traditional boundary of childhood amnesia. We predicted that children younger at the time of the follow-up test would remember more early-life events than children older at the time of the test, thus documenting long-term retention of early-life events eventually lost to forgetting. The study also makes a substantial contribution by examining relations between maternal narrative style variables from the preschool years and the preservation—or loss—of specific event memories with the passage of time. The broader literature relating maternal narrative style with preschoolers' emerging autobiographical narrative skills supports the prediction that children of mothers who use a more elaborative style will have richer autobiographical memories in general (e.g., Nelson & Fivush, 2004) and an earlier offset of childhood amnesia (Jack et al., 2009). However, the one prior test of whether maternal style was related to preservation of memories of specific early-life events did not find relations with overall maternal style. Instead, the amount that children remembered was uniquely predicted by maternal evaluations of children's contributions (Reese et al., 2010). Based on this finding, we predicted that evaluations in the form of maternal invitations of children's perspective on the events would be positively correlated with children's memories for specific early-life events. In the present research, this maternal stance was captured in the variable of *deflections* (see Data Reduction).

Method

Participants

Eighty-three children (44 girls) and their parents participated. All of the families were drawn from a participant pool at the Institute of Child Development, University of Minnesota. The families were primarily Caucasian and of middle to high socioeconomic status (based on parental report of occupation and education). Children initially were enrolled at 13 to 20 months of age in a longitudinal study of infant memory development (Bauer et al., 2000). The visit at age 3 years that provided the first autobiographical reports actually was the fifth visit to the lab. However, because the first four visits are not relevant for present purposes, the fifth visit is hereafter referred to as Session 1.

At Session 1, children were 3 to $3^{½}$ years of age (mean = 3.29; range 3.01–3.54 years). The age period corresponds to that from which adults report their earliest memories (e.g., Tustin & Hayne, 2010; West & Bauer, 1999). Children were recruited for Session 2 at one of five ages: 5-year-olds (mean age 4.76, range 4.64–4.89, n = 16, 8 girls), 6-year-olds (mean age 5.80, range 5.65–5.97, n = 16, 10 girls), 7-year-olds (mean age 6.84, range 6.16–7.12, n = 16, 9 girls), 8-year-olds (mean age 8.02, range 7.78–8.19, n = 19, 7 girls), and 9-year-olds (mean age 8.93, range 8.69–9.18, n = 16, 10 girls). The age range corresponds to that from which adults report a smaller number of memories that would be expected by forgetting alone (Pillemer & White, 1989) through the age by which an adult-like distribution of autobiographical memories is expected (Wetzler & Sweeney, 1986).

Both the mean age at Session 2 and the mean delay between sessions differed reliably across groups: Fs(4, 78) = 1999.17 and 1345.13, ps < .001, respectively. Of the 51 7-, 8-, and 9-year-olds in the present sample, 45 (88%) also were included in Van Abbema and Bauer (2005). The data for the six additional children became available after the publication of Van Abbema and Bauer (2005). All sessions were video-recorded for later analysis. At the end of each session, children were given an age-appropriate toy and parents were provided with a pair of movie tickets as a token of appreciation for their participation. At both sessions, prior to data collection, parents provided written informed consent for themselves and their children to participate in the research. All procedures were approved and regularly reviewed by the University of Minnesota IRB.

Materials and Procedure

Session 1—As described in Van Abbema and Bauer (2005), upon arrival at the laboratory, children engaged in warm-up activities, and then completed the final component of the longitudinal protocol for the study of infant memory. Children then participated in the parent-child conversation that is central to the present research. Eighty-one children engaged in the conversation with their mothers. Two children took part in conversations with their mothers and fathers simultaneously. The data from these two cases were excluded from all analyses of parental conversational style (hereafter: maternal style). Parents were asked to talk with their children about six relatively unique events from the past "…as you normally would at the dinner table or in the car." The events were generally affectively neutral to positive, featuring activities such as family outings (e.g., camping, trips to the zoo or park, visits with relatives) and positive life transitions (birth of a sibling, own birthday party, first day of preschool). Subsequent to the conversations at Session 1, parents provided approximate dates for the events discussed.

Preparation for Session 2—As explained in Van Abbema and Bauer (2005), at Session 2, children were to be interviewed about four of the six events discussed at Session 1. A subset of the events was targeted in order to keep the protocol a reasonable length and consistent across participants. We first reviewed each child's Session 1 transcript (see below) and identified events the child had not recalled. As is typical in the literature (e.g., Fivush & Schwarzmueller, 1998; Reese et al., 1993), the minimum criterion for an event to be considered "recalled" was provision of two unique details about it. For 26% of the sample, fewer than four events met the criterion. In these cases, one (20% of the sample), two (4% of the sample), or three (2% of the sample) of the events that were not recalled at Session 1 were included in the Session 2 protocol, in order to make the session protocols consistent across children. These events were not included in the analyses (i.e., the analyses were based on the subset of events recalled at Session 1). Additionally, for two children, none of the events met the criterion. These two participants were not included in the analyses.

For each event available for inclusion in the Session 2 protocol, we created a brief synopsis to be used as a specific prompt in the interview (see below). When there were more than four events that met the criterion for recall, excess events were eliminated based on event frequency information provided by the parents during Session 2 (i.e., events that had been repeated in the interim were preferentially excluded).

Session 2—Five female experimenters conducted the interviews at Session 2. Prior to testing, the researchers trained to adhere to a detailed protocol. Throughout data collection, the researchers conducted regular tape reviews with one another during which they provided and received feedback on adherence to the study protocol, thus ensuring fidelity.

Upon arrival at the laboratory, parents and children participated in a number of activities. The researcher then engaged the child in conversation about the four distant and two more recent events (nominated by parents earlier in the session), in random order. She began by saying, “Now I'm going to ask you about some things you did at different times in the past and I want you to try to tell me everything you can remember.” She then preceded in the following order for each event in turn: (1) introduction of the event (“What can you tell me about the time…”); (2) generic prompts (e.g., “What else can you tell me?”) provided (along with neutral affirmation such as “okay”) until the child offered nothing in response; and (3) specific prompt (e.g., “It looks like you went skating. What else can you tell me about the time you went skating?”), which came directly from the synopsis. If the child had already provided all of the details in the synopsis, this step was omitted. Because they are not central to the purposes of the present research, analyses of the conversations about recent events are not included in this report but are available from the authors.

The parent observed the researcher and child conversation from an adjacent room. The parent was asked to make note of any cases in which the child described an event different from that targeted by the researcher (e.g., the child's 4th rather than 3rd birthday party).

Data Reduction

Conversations were transcribed verbatim from the video-recordings and then reviewed for accuracy of transcription. For mothers, the Session 1 transcripts were used to determine narrative style. For children, the Session 1 and Session 2 transcripts were used to determine whether each queried event was recalled by the child and both the length (in propositions) and content of the narratives the children produced.

Mothers: Narrative style at Session 1—Maternal utterances were coded using a scheme modified from Reese et al. (1993). The most significant modification was use of the deflection category introduced in Burch, Austin, and Bauer (2004, discussed below). Each utterance was divided into propositional units; the number of propositions was a measure of the overall length of the speakers' contribution. Each proposition was assigned to one of the following mutually exclusive and exhaustive categories (see Burch et al., 2004, for details): (1) *Elaborations* introduced a new topic, provided new information, or made a new request for information from the child; (2) *Affirmations* confirmed the child's response (e.g., “yeah,” “good job”), or repeated the child's contribution, thereby implicitly confirming its correctness; (3) *Repetitions* restated information the mother had previously provided or repeated a request for information; and (4) *Deflections* turned the conversational turn back to the child but provided no specific information (e.g., “What happened?”, “Tell me more,” and tag questions such as, after stating “It was cold,” posing the question “Wasn't it?”).

We used the relative frequency of elaborations, affirmations, and repetitions to calculate the maternal *elaboration ratio* (ratio of elaborations plus affirmations relative to the number of

elaborations, affirmations, and repetitions). These conversational elements are reliably and consistently associated with children's autobiographical reports (e.g., Fivush, Haden, & Reese, 2006; Haden, Ornstein, Rudek, & Cameron, 2009; see Fivush, 2014, for a review). The proportion of maternal behaviors that are positively associated with children's contributions (elaborations, affirmations) relative to the proportion that are negatively associated (repetitions) serves as the measure of overall maternal narrative style. Because the elaboration ratio is considered a measure of overall maternal narrative style, we feature the ratio variable in analyses, rather than the individual narrative categories that constitute it. We included deflections because they are specific invitations of the child's perspective on an event and thus, based on Reese et al. (2010), are expected to correlate positively with children's memories for specific early-life events.

Four additional categories were assigned, but were not included in analyses because they were relatively infrequent (accounting for less than 5% of total maternal contributions). All on-task maternal contributions were included in the calculation of the *total propositions* which provides a measure of maternal talkativeness. Each transcript was coded by two independent raters. Reliability of coding estimated on a randomly selected 25% of the sample was 83%. A third experienced coder reviewed all transcripts and resolved disagreements. The arbitrator's judgments were used in all analyses.

Children: Assessment of event recall—The first criterion for determining whether children recalled the events at each session was whether they provided at least two unique details about them (e.g., Fivush & Schwarzmueller, 1998; Reese et al., 1993). For Session 1 and Session 2, events for which fewer than two unique pieces of information were provided were considered not recalled. For Session 2 only, given both the children's advanced age (they were as old as 9 years) and the distance in time between sessions (as many as 6 years), we supplemented this criterion with additional requirements. Specifically, we excluded narratives that parents indicated were about non-target events, such as a more recent skating event, for example. Exclusions based on this criterion were rare (<6% of narratives). We also coded for whether the narratives featured evidence that the child recalled a specific instance of an event, as opposed to a general category of events. Events for which the narratives featured little to no evidence of recollection of a specific past event were considered to be unrecalled. Two experienced raters each coded approximately 50% of the sample. For purposes of estimating the reliability of coding, they both coded 25% of the sample. Reliability between the coders was 94%. All coding disagreements were resolved by discussion.

Children: Assessment of content provided—The data from both sessions were coded using the scheme from Bauer et al. (2007) and Larkina & Bauer (2012); the data from Van Abbema and Bauer (2005) were re-coded using the scheme. Children's contributions to the conversations first were divided into propositional units. Each unique proposition (i.e., repetitions were excluded) was assigned one or more of the narrative categories who, what-object, what-action, where, when, why, how-description, and *how-explanation* (see Bauer et al., 2007; Larkina & Bauer, 2012, for description of the categories). Because propositions typically contained a verb and associated information, it was common for a single

proposition to receive multiple codes. All of the category codes combined provided a measure of the *total content* in the narratives. To assess the completeness of the reports (the number of components of a traditional narrative included), we calculated a *breadth* score for each narrative, reflecting the number of different narrative categories included (max breadth = 8 per event). Finally, propositions that were on-task but provided no content (e.g., "I don't know," "Yes") were included in a measure of *total propositions*, which reflects the child's overall talkativeness and involvement in the conversation. Two experienced coders independently coded all transcripts. Reliability of coding estimated on a randomly selected 20% of the sample was 79%. A third experienced coder reviewed all transcripts and resolved all disagreements. The arbitrator's judgments were used in all analyses.

Results

We addressed two major questions: (a) the percentage and content of memories from age 3 years recalled by children ages 5 to 9 years, and (b) whether recall of events from age 3 years was related to maternal style variables from age 3 years either concurrently or over time. Before addressing these major questions, we conducted a number of preliminary analyses to determine whether any characteristics at Session 1 differed systematically as a function of the group to which children would be assigned at Session 2.

Preliminary Analyses

Preliminary analyses of whether characteristics at Session 1 differed systematically as a function of the group to which children would be assigned at Session 2 revealed only one significant effect. Specifically, analysis of variance (ANOVA) yielded a difference in mean age at Session 1 as a function of the group in which children would participate at Session 2, $F(4, 78) = 5.40$, $p < .001$ (mean ages 3.38, 3.34, 3.22, 3.28 and 3.23 for 5-, 6-, 7-, 8- and 9-year-old groups, respectively). Follow-up analyses (Tukey, $p < .05$) revealed that the mean age at Session 1 of children assigned to be in the 5-year-old group at Session 2 differed from children assigned to be in the 7- and 9-year-old groups. Additionally, the mean age at Session 1 of children assigned to be in the 6-year-old group at Session 2 differed from children assigned to be in the 7-year-old group. In light of this difference, children's age at Session 1 was controlled in all subsequent analyses.

There were no other significant differences at Session 1 among the groups to which the children would be assigned at Session 2. The variables tested were: (a) the number of events discussed at Session 1 (dyads were asked to discuss six events, the range in number of events discussed was 2 to 7, $M = 5.94$, $SD = 0.89$); (b) the proportion of events that met the criterion to be considered recalled at Session 1 (and thus the number of events featured in the analyses: $M = 0.83$, $SD = 0.22$, range 0–1); (c) the mean length of time between the events and the conversations about them at Session 1 ($M = 5.26$ months, $SD = 4.00$, median = 4.17, range = 0.03–16.60 months; 83% of the events had occurred within 9 months of the session and fewer than 4% of events occurred more than 12 months prior to the session); (d) each maternal style category, as well as the total number of propositions provided by mothers, and elaboration ratio; and (e) children's total content, narrative breadth, total number of propositions, and each individual narrative category. None of these ANOVAs (or

ANCOVAs) was significant, indicating no differences at Session 1. Thus with the single exception of differences in mean age at the time of Session 1, the groups assigned to experience Session 2 at different ages were exceptionally well matched. The sole difference was controlled in all subsequent analyses.

Events from Age 3 Years Recalled at 5 to 9 Years

Percentage of events recalled—Figure 1 reflects the percentage of events from age 3 years recalled by the children at Session 2. A one-way ANCOVA, controlling for children's age at Session 1, with five levels of age revealed a significant main effect, $F(4, 75) = 5.66$, $p < .01$, $\eta^2 = .22$. The percentage of early-life events recalled by the children at Session 2 was relatively stable for children ages 5, 6, and 7 years, after which time the percentage fell. Posthoc analyses using Tukey tests of significant difference ($p < .05$) revealed that the percentage of events recalled by 5-, 6- and 7-year-olds was significantly greater than the percentage recalled by 8-year-olds. The percentage of events recalled by 5- and 6-year-olds also was greater than the percentage recalled by 9-year-olds. The number of children who recalled none of the events from age 3 years also suggested a change in the accessibility of early memories after age 7 years. Whereas a maximum of 6% of children ages 5, 6, and 7 years recalled none of the events from age 3 years (one 5-year-old recalled none of the early-life events), 37% of 8-year-olds ($N = 7$) and 25% of 9-year-olds ($N = 4$) recalled none of the early-life events. The difference in the distribution was statistically significant (Fisher's exact test, $p = .003$).

The reasons for failed recall of the early-life events were different for the youngest children in the sample and for the four older age groups. Among the 5-year-olds, the overwhelming reason for failed recall was that the children did not report at least 2 unique pieces of information, even after cueing by the experimenter. In contrast, for children ages 6 to 9 years, the reasons for the lack of recall of the early-life events were roughly evenly distributed between failure to report the minimum amount of information and report of either the wrong event or failure to provide information that indicated retrieval of a specific event. Importantly, whether an event was recalled at Session 2 was not related to children's narrative behavior at Session 1. One-way (within-subjects) ANCOVAs (with age at Session 1 controlled) revealed no differences at Session 1 between the events that children would recall versus not recall at Session 2, on any narrative measures (i.e., each narrative category, total content, breadth, total propositions).

Narrative descriptions of early-life events—Children younger at Session 2 recalled a larger percentage of early-life events than children older at Session 2, yet their narratives were in general less complete than the narratives of the older children. This conclusion is based on the results of separate one-way ANCOVAs (with age at Session 1 controlled) of the length (measured in propositions) and breadth of children's narratives about the early-life events, as well as each of the individual narrative content categories (alpha adjusted to $p < .005$, to account for multiple comparisons; significant main effects were examined with posthoc Tukey tests, $p < .05$). Because only recalled events could be evaluated for content, the analyses are based on the 69 children who recalled at least one event from the preschool years (i.e., as detailed above, 12 children recalled none of the events).

Descriptive statistics for the variables are provided in Table 1. The total number of propositions produced at Session 2 did not differ by age. Thus there were not differences in children's talkativeness or involvement in the conversations. Nevertheless, the total amount of narrative content differed by age: $F(4, 63) = 5.22$, $p < .001$, $\eta^2 = .25$. Children age 5 years at Session 2 produced less total content than children ages 8 and 9; the total content produced by children 6 and 7 years of age was intermediate and did not differ from any age group. There also were age differences in the completeness of children's reports of the early-life events, as reflected in a significant effect for narrative breadth, $F(4, 63) = 7.52$, $p < .001$, $\eta^2 = .32$. Children 5 and 6 years of age at Session 2 produced less complete narratives relative to children 8 and 9 years of age. The narrative breadth of 7-year-old children's narratives was intermediate and did not differ from any age group.

Analyses of the individual narrative categories also revealed significant differences in the specific details that children reported about the early-life events. Exceptions for which there were no age group differences were the categories of who and what-object. For when, how-evaluation, and why (for 7- to 9-year-olds only; there was insufficient variance among 5- and 6-year-olds to include them in the analysis of why), there were significant age-related effects: Fs(4, 63) = 2.70, 2.75, and 3.03, $p < .05$, $\eta^2 = .15$. However, the effects fell above the adjusted alpha level and post-hoc analyses revealed no significant differences: For the other narrative categories, significant age-related effects emerged: Fs(4, 63) = 6.15, 5.62, and 4.14, ps < .005, $\eta^2 = .28$, .26, and .21, for what-action, where, and how-description, respectively. Relative to 8-and 9-year-olds, 5- and 6-year-olds provided less information about the actions that took place in the events. Five-, 6-, and 7-year-olds also provided less information about where events took place, relative to 9-year-olds. Five-year-olds produced less how-descriptive information than 8-and 9-year-olds. There were no other significant differences among the age groups. These analyses reveal that whereas older children remembered fewer of the events from age 3 years, relative to younger children, for the events they recalled, they typically provided more information.

Maternal Style as a Determinant of the Fates of Early Memories beyond the Onset of Childhood Amnesia

Within the preschool years, maternal style is consistently related to children's narrative descriptions of their memories. We tested whether the result also obtained in the present sample. We also extended the literature by testing whether maternal style variables from the time of initial experience of the events predicted recall of the specific events within and beyond the period eventually obscured by childhood amnesia. Statistics describing maternal narrative behavior at Session 1 are provided in Table 2.

Concurrent relations at Session 1—Statistics describing children's contributions to the conversations are provided in Table 3, Panel a. As reflected in Table 3, Panel b, there was a consistent pattern of relation between maternal style variables and the 3-year-old children's contributions to the conversations (even after Bonferroni correction for multiple comparisons). Mothers with a more elaborative style (measured by elaboration ratio) had children who contributed more content and produced more complete narratives overall (measured by breadth and several individual narrative categories). Similarly, deflections

(turning the conversational turn over to the child) were positively related to the proportion of events the children recalled, both total propositions and total content, narrative breadth, and several individual narrative categories. Overall, consistent with the literature on children in the preschool years, we observed concurrent correlations between maternal narrative behavior and children's descriptions of past events.

Cross-lagged relations from Session 1 to Session 2—In a pattern quite different from that observed within the preschool years, overall maternal style at age 3 years was not related to 5- to 9-year-old children's memories of early-life events. In contrast, long-term memories of early-life events were related to the individual category of deflections. Specifically, the measure of overall maternal style (elaboration ratio) at Session 1 was not correlated with either the percentage or the number of early-life events recalled. Nor was it correlated with the total number of propositions produced, the amount of content children provided, or with the breadth of children's narratives about the events they did recall. Moreover, none of the correlations between maternal elaboration ratio and children's individual narrative categories was significant. Analyses of the individual maternal narrative behaviors that comprise the elaboration ratio (elaborations, affirmations, repetitions) revealed only one significant relation, between elaborations at Session 1 and children's provision of how-description information at Session 2 ($r = .25$, $p < .05$). Controlling for children's ages at Sessions 1 and 2 did not alter the patterns.

Although overall maternal style and the individual narrative categories that comprise it were virtually uncorrelated with children's later recall of early-life events, there were cross-lagged correlations between the number of deflections mothers used at Session 1 and children's recall at Session 2. After controlling for children's ages at Sessions 1 and 2, the number of maternal deflections was related to the total propositions children provided ($r = .25$, $p < .05$), the total amount of content children provided ($r = .27$, $p < .05$), and to the individual narrative categories of what-action, what-object, when, and how-description (rs = .24, .26, .25 and .25, ps < .05, respectively). Thus whereas there were abundant concurrent correlations between overall maternal style and children's narratives at Session 1, cross-lagged correlations between overall maternal narrative style at Session 1 and children's independent recall of early-life events at Session 2 were not significant. Only maternal deflections of the conversational turn were consistently related over time.

Discussion

The present research furthers our understanding of a major paradox in the autobiographical memory literature, namely, childhood amnesia among adults in the face of rapidly developing autobiographical memory competence during the years eventually obscured by the amnesia. It involved a prospective examination of the fates of memories of early-life events as children exit the preschool period and cross the traditional boundary of the amnesia of childhood. The findings suggest resolution of the paradox in terms of forgetting processes. Specifically, children 5, 6, and 7 years of age remembered a substantial percentage of events from the age of 3 years. In contrast, children 8 to 9 years of age had lost access to many of their memories of events from the same early age. In addition, in their narrative descriptions of the early-life events, children in the younger age groups provided

less total content (5-year-olds only) and less complete narratives (5- and 6-year-olds) relative to children in the older age groups (8- and 9-year-olds). On most measures, children 7 years of age did not differ from either the younger or the older children. These findings are consistent with Wetzler and Sweeney's (1986) designation of age 7 years as the “inflection point” in childhood amnesia, that is, the point in development at which the adult distribution of autobiographical memories (including a “childhood amnesia component”; Pillemer & White, 1989) begins to take shape. To our knowledge, the present research is the first empirical demonstration of this “event” in the developmental literature: All prior studies that inform this point are from adults' recollections of childhood.

It is noteworthy that the patterns of remembering and forgetting of early-life events and of narrative completeness were in opposite directions. That is, younger children remembered more of their early-life events than older children, yet their narratives about the events generally were less complete than those of the older children. Among the 5- and 6-year-olds, narratives about early-life events were relatively sparse, typically featuring fewer than half of the categories that make for a “good” narrative account. One of the most salient omissions was information about why events happened as they did. Information that located the events in particular place and time also was relatively rare, as was evaluative information. In contrast, 8- and 9-year-olds remembered fewer early-life events, yet their narratives averaged more than 5 of the 8 categories that make for a good narrative account. They routinely featured the “basics” of who did what to whom, and also information that located the events in time and place. Importantly, they also took perspective on the events by providing evaluative information about them.

The findings regarding age-related differences in the content of narratives about early-life events are important for two reasons. First, they inform the nature of memories formed early in life. As observed in the present research, young children's event narratives often lack features that are characteristic of autobiographical memory, such as evaluations that indicate a subjective perspective on the event, and temporal and spatial markers that differentiate one event from another and suggest that the narrator is mentally traveling back in time (and space) to the original experience. The relative absence of such features has been interpreted to suggest that early in life, the memories children form are not autobiographical (e.g., Fivush, 2012; Nelson & Fivush, 2004) or even episodic (e.g., Wheeler, 2000). This provides a ready explanation for childhood amnesia—there is no autobiographical record of early-life events because none was formed. The fact that in the present research, older children's narratives about early-life events located the events in time and place and featured a subjective perspective (evaluations), strongly suggests that the children's memories of those long-ago events were both episodic and personal.

Second, the fact that the younger children had less complete narratives, relative to the older children, likely has consequences for the continued accessibility of early memories beyond the first decade of life. Narrative retelling affords opportunity for explicit rehearsal and organization of memories. To the extent that children produce more complete and content-filled narratives, they capitalize on this opportunity, thus further strengthening the memory representation. We may anticipate that the net result would be that memories that survive into the 9th or 10th year of life—when narrative skills are more developed—would continue

to be accessible over time. In contrast, although early-life events were still readily accessible to children at age 5 years, the narratives that the 5-year-olds produced were relatively impoverished. As a result, the young children likely experienced diminished benefits from the rehearsal opportunity. The anticipated result is a memory trace that grows less and less accessible over time. One might even go so far as to predict that incomplete narrative description of an event would contribute to retrieval-induced forgetting (i.e., retrieving some elements of a memory trace may result in forgetting of non-retrieved elements: e.g., Anderson, Bjork, & Bjork, 1994), and its narrative equivalent, socially shared retrieval-induced forgetting (Stone, Barnier, Sutton, & Hirst, 2010). In other words, we suggest that older children's better developed narrative skills afford them the opportunity for strengthening of memory traces of long-ago life events they retrieve, thus facilitating continued accessibility. In contrast, rather than facilitating later access, younger children's incomplete narrative rehearsal may have a neutral or perhaps even detrimental effect that may contribute to lower accessibility of a memory trace going forward, beyond the first decade of life.

The hypothesized long-term consequences of less versus more complete narratives about early-life events may help explain age-related differences in consistency of earliest memories in younger and older children. Peterson, Warren, and Short (2011) interviewed children 4 to 13 years of age about their earliest memories. Two years later, they asked the same children to once again report their earliest memories. Strikingly, among children 4 to 7 years of age at the first interview, there was little overlap in the memories nominated at the two time points: fewer than 20% of the children repeated any memories at the second relative to the first interview. In contrast, 50–60% of the children 8 to 13 years of age repeated at least some memories at the second interview. Moreover, when the memories were the same, more of the specific content of the report was repeated by the older children relative to the younger children. These data suggest age-related increases in the stability of the corpus of early memories, an outcome consistent with the suggestion that memories that survive into the 9^{th} or 10^{th} year of life are likely to continue to be accessible, perhaps even into adulthood.

The suggestion that memories that survive into the 9^{th} or 10^{th} year of life are likely to remain accessible over the long term begs the question of why some memories enjoy continued accessibility throughout the first decade of life whereas others do not. In the present research we explored maternal narrative style as a determinant of long-lasting memory for early-life events (see Morris et al., 2009; Peterson et al., 2013, for tests of other possible determinants). The present research converged with a large related literature demonstrating a robust pattern of concurrent relations between overall maternal narrative style and preschool-age children's contributions to conversations about past events (e.g., Bauer & Burch, 2004; Fivush & Fromhoff, 1988; Peterson & McCabe, 1994; Reese et al., 1993). In contrast, cross-lagged relations between overall maternal style (elaboration ratio) collected when children were 3 years of age and children's later recall of early-life events were not significant. Moreover, there was only one significant relation between children's later recall and any of the individual narrative categories that contribute to overall maternal style (elaborations, affirmations, repetitions).

Although overall maternal narrative style was not related to recall across the boundary of childhood amnesia, we found that the category of maternal deflections of the conversational turn to the child was correlated with the amount of content the children provided about the early-life events as well as with some of the individual narrative categories (see also Burch et al., 2004, for a similar pattern of concurrent relations in the context of preschoolers' recall of mildly negative events). Both of these findings are consistent with Reese et al. (2010), which provided the only other test to date of relations between maternal narrative style variables and children's later recall of early-life events. Reese and colleagues found that only the individual maternal narrative variable of evaluations from the preschool years was a unique predictor of the amount of information children provided about their earliest memories and two other early-life events; overall maternal narrative style was not predictive. Together, the results of the present research and of Reese et al. (2010) carry two important implications. The first implication is that different aspects of maternal narrative behavior facilitate the early development of autobiographical memory versus the preservation of early memories beyond the onset of childhood amnesia. The second—related—implication is that the specific maternal narrative behaviors of evaluation and deflection contribute to the longevity of individual early event memories, thus helping to explain why some events are remembered across the boundary of childhood amnesia and others are forgotten.

The results of the present research may seem to contrast with Jack et al. (2009), in which adolescents whose mothers used a more elaborative style when their children were preschoolers were found to have younger earliest memories relative to adolescents whose mothers used a less elaborative style. We argue that the contrast is more apparent than real and can be attributed to differences in the predicted outcomes in Jack et al. (2009) and in the present research and to differences in the nature of the recall tasks in which children engaged. With regard to the predicted outcome, in Jack et al., the question concerned the *offset* of childhood amnesia in terms of the age of earliest memory. In contrast, the focus in the present research was the *onset* of childhood amnesia, namely, the course of forgetting of early-life events. How might this variation in the predicted outcome contribute to the differences in the pattern of associations observed? As discussed in detail elsewhere (e.g., Bauer, 2007; Fivush, 2012, 2014; Nelson & Fivush, 2004), an elaborative reminiscing style, in which parents co-construct accounts of past events with their children, schools children in the arts of creating and sharing autobiographical narratives. In particular, elaborative reminiscing imparts to children the important lesson that the purpose of talking about the past is to share your thoughts, feelings, reactions, and experiences with others. These early interactions seemingly facilitate the development of autobiographical memory in early childhood. Jack et al. provided empirical evidence for the corollary assumption that richer autobiographical memory in early childhood should relate to the later availability of a larger corpus of early memories and thus, younger earliest memories (see also Weigle & Bauer, 2000).

In contrast to the situation in which one casts the net and retrieves an early memory, the demand to retrieve a particular past event calls for a strong memory representation of that specific episode. The present findings suggest that a strong memory representation of an

early-life event is facilitated by maternal “bids” to include the child in conversation about the event. Deflecting a turn to the child encourages the young partner to both participate in the give-and-take of the conversation and to populate the memory representation with her or his own content. Tag questions (e.g., “Isn't it?”), in particular, may facilitate the child's reflection on or reaction to what the mother has contributed. This maternal behavior did not relate to the number of early-life events that survived the transition from the preschool to the school years. Yet it had far-reaching consequences for the amount of information children reported about the memories that did survive.

The nature of the recall task in Jack et al. (2009) also differed from that in the present research. In Jack et al., the adolescents were instructed to report “your first memory” or “the first thing that you remembered doing or happening to you” (p. 499). Children were free to identify any event from their entire corpus of memories. In contrast, in the present research, the to-be-remembered event targets were substantially more constrained, such that children were probed for memory for four particular events that happened at specific places and specific times. The target events may not have been those for which children had especially strong memory representations. Unlike in Jack et al., the events were not self-nominated—they all originally were selected by the children's mothers and may or may not have been especially self-relevant or even salient to the children themselves. Moreover, the events were generally affectively neutral to positive and thus may not have had the emotional qualities associated with long-term retention. Perhaps especially under these cirsumstances, the specific maternal narrative behavior of deflection of the conversational turn may have contributed to the ongoing accessibility of memories of early-life events.

The findings of the present research have important implications for our understanding of the developmental achievement of childhood amnesia. Given that childhood amnesia is defined in terms of a deficit—a relative paucity of memories of events—it may seem incongruous to refer to its emergence as an “achievement.” Yet in the context of the development of autobiographical memory, it is precisely that. For well over a century, studies with adults have revealed amnesia for early-life events (e.g., Miles, 1893). To the extent that children do not exhibit the amnesia, they lack a salient feature of adult autobiographical memory; as the amnesia emerges, autobiographical memory becomes more adult-like. The present research indicates that by the age of 8 to 9 years, the pattern of recall apparent in adults is emerging in children. In this regard the findings are broadly consistent with the small handful of studies of children's earliest memories (e.g., Peterson et al., 2005; Reese et al., 2010) and of the fates of memories of early-life events as children approach (Cleveland & Reese, 2008) and cross (Fivush & Schwarzmueller, 1998) the boundary of childhood amnesia. They suggest that childhood amnesia is not just for adults—it is apparent in school-age children as well.

What explains the developmental achievement of childhood amnesia? Traditional explanations of the phenomenon were in terms of late development of autobiographical mnemonic competence. That is, the suggestion was that adults did not remember much from early childhood because young children did not form and retain autobiographical memories (see Bauer, 2007, 2008, 2014, for reviews). Yet the results of the present research make clear that young children do remember, even over relatively long periods of time. The 3-

year-old children in the present research evidenced memory for the events their mothers asked them about. The children who were asked to recall the events again after 2, 3, and even 4 years had passed still remembered the majority of the events. In contrast, the children who endured delays of 5 and 6 years before being asked to recall the events remembered fewer than 40% of them. This pattern of findings makes clear that changes in remembering alone cannot explain childhood amnesia—explanation of the phenomenon must consider forgetting processes as well (Bauer, 2012). It is forgetting that explains why children who had equally good memories at the age of 3 years had differential memory for early-life events after 2, 3, and 4 years versus 5 and 6 years had passed since the events.

Explicit focus on forgetting processes as part of the explanation of patterns of remembering has made its way into experimental work. Both among infants (e.g., Bauer, Güler, Starr, & Pathman, 2011; Bauer, Wiebe, Carver, Lukowski, Haight, Waters, et al., 2006) and children (Bauer, Larkina, & Doydum, 2012) the amount of forgetting experienced in the hours and days after an event accounts for substantial variance in recall over subsequent delays of weeks to months. When measures of both encoding success and measures of forgetting shortly after experience of an event are entered into predictive equations, post-encoding forgetting explains significant unique variance in recall over the long term, and in some cases even renders encoding-related variance nonsignificant (e.g., Pathman & Bauer, 2013).

More obviously relevant to autobiographical memory and childhood amnesia are findings from studies that chart the distribution of autobiographical memories across the lifespan using responses to cue words (e.g., Rubin, 1982). Among adults, the resulting distributions of memories are well fit by the power function which indicates an initial steep rate of forgetting that slows over time (e.g., Wetzler & Sweeney, 1986; Rubin, Wetzler, & Nebes, 1986). A consequence of slowing in the rate of forgetting is that after an initial period of vulnerability, memory traces remain relatively stable over time. This helps explain why in adulthood, there are comparable distributions of early memories among 20-year-olds and 70-year-olds (Rubin & Schulkind, 1997), even though for older individuals, many more years have passed since childhood. In contrast to adults, for children as old as 11 years of age, distributions of memories in response to cue words are better fit by the exponential function (Bauer et al., 2007; Bauer & Larkina, in press). The exponential function implies that rather than slowing over time, the rate of forgetting remains constant. The result is that, rather than stabilizing, the corpus of memories continues to shrink over time.

Observation of exponential forgetting helps to explain a number of findings about memory for early-life events in childhood. As noted above, it accounts for why children who had equally good memories at the age of 3 years had differential memory for early-life events 2, 3, and 4 years versus 5 and 6 years after the events. It also explains why the corpora of early memories are more and less stable in older and younger children, respectively (Peterson et al., 2011). For older children forgetting has slowed whereas for younger children it has not. It also explains the within-subjects upward “shift” in the age of earliest memory in childhood observed in Peterson et al. (2011). Relative to the first interview, two years later at the second interview, the estimated age of three earliest memories increased by 7 months, from 32 months at Time 1 to 39.6 months at Time 2. Upward movement in age of earliest memory is a likely outcome in a corpus of memories that has yet to stabilize (see Peterson et

al., 2011, for a consistent argument). In sum, consideration of forgetting processes brings order to an array of observations associated with the onset of childhood amnesia in childhood.

In conclusion, the present research adds to the small literature on the childhood onset of childhood amnesia. It also informs the determinants of recall of specific early-life events. It provides evidence that the particular maternal behavior of deflecting the conversational turn to the young child is predictive of the amount of content that children preserve and subsequently express about the particular experiences that survive the onset of childhood amnesia. The work also provides compelling evidence that accounts of childhood amnesia that focus only on changes in remembering cannot explain the phenomenon. The complementary processes involved in forgetting also are part of the explanation.

Acknowledgments

Support for this research was provided by NICHD HD28425 and HD42483 to Patricia J. Bauer, and by the College of Arts and Sciences, Emory University. The authors also thank Melissa Burch, Mari Strand Cary, Julie Stone Lynch, Emily Stark, Dana Van Abbema, and Jennie Waters, and other members of the Cognition and Transition (University of Minnesota) and Memory at Emory laboratory groups. They extend special thanks to the children and families who generously gave of their time to participate in this longitudinal research study.

References

Anderson MC, Bjork RA, Bjork EL. Remembering can cause forgetting: Retrieval dynamics in long-term memory. Journal of Experimental Psychology: Learning, Memory, and Cognition. 1994; 20:1063–1087.

Bauer, PJ. Remembering the times of our lives: Memory in infancy and beyond. Lawrence Erlbaum Associates; Mahwah, NJ: 2007.

Bauer, PJ. Infantile amnesia. In: Haith, MM.; Benson, JB., editors. Encyclopedia of infant and early childhood development. Academic Press; San Diego, CA: 2008. p. 51-61.

Bauer, PJ. The life I once remembered: The waxing and waning of early memories. In: Berntsen, D.; Rubin, DC., editors. Understanding autobiographical memory: Theories and approaches. Cambridge University Press; Cambridge, UK: 2012. p. 205-225.

Bauer, PJ. The development of forgetting: Childhood amnesia. In: Bauer, PJ.; Fivush, R., editors. The Wiley-Blackwell Handbook on the Development of Children's Memory. Wiley-Blackwell; West Sussex, UK: 2014. p. 519-544.

Bauer, PJ.; Burch, MM. Developments in early memory: Multiple mediators of foundational processes. In: Lucariello, JM.; Hudson, JA.; Fivush, R.; Bauer, PJ., editors. The development of the mediated mind. Lawrence Erlbaum; Mahwah, NJ: 2004. p. 101-125.

Bauer PJ, Burch MM, Scholin SE, Guler O. Using cue words to investigate the distribution of autobiographical memories in childhood. Psychological Science. 2007

Bauer PJ, Güler OE, Starr RM, Pathman T. Equal learning does not result in equal remembering: The importance of post-encoding processes. Infancy. 2011; 16:557–586.

Bauer PJ, Larkina M. Childhood amnesia in the making: Different distributions of autobiographical memories in children and adults. Journal of Experimental Psychology: General. in press.

Bauer PJ, Larkina M, Doydum AO. Explaining variance in long-term recall in 3-and 4-year-old children: The importance of post-encoding processes. Journal of Experimental Child Psychology. 2012; 113:195–210. [PubMed: 22749667]

Bauer PJ, Wenner JA, Dropik PL, Wewerka SS. Parameters of remembering and forgetting in the transition from infancy to early childhood. Monographs of the Society for Research in Child Development. 2000; 65(4) Serial No. 263.

Bauer PJ, Wiebe SA, Carver LJ, Lukowski AF, Haight JC, Waters JM, Nelson CA. Electrophysiological indices of encoding and behavioral indices of recall: Examining relations and developmental change late in the first year of life. Developmental Neuropsychology. 2006; 29:293–320. [PubMed: 16515408]

Boland AM, Haden CA, Ornstein PA. Boosting children's memory by training mothers in the use of an elaborative conversational style as an event unfolds. Journal of Cognition and Development. 2003; 4:39–65.

Burch MM, Austin J, Bauer PJ. Understanding the emotional past: Relations between parent and child contributions in emotionally negative and nonnegative events. Journal of Experimental Child Psychology. 2004; 89:276–297. [PubMed: 15560875]

Cleveland ES, Reese E. Children remember early childhood: Long-term recall across the offset of childhood amnesia. Applied Cognitive Psychology. 2008; 22:127–142.

Farrant K, Reese E. Maternal style and children's participation in reminiscing: Stepping stones in children's autobiographical memory development. Journal of Cognition and Development. 2000; 1:193–225.

Fivush, R. Subjective perspective and personal timeline in the development of autobiographical memory. In: Berntsen, D.; Rubin, DC., editors. Understanding autobiographical memory: Theories and approaches. Cambridge University Press; New York, NY: 2012. p. 226-245.

Fivush, R. Maternal reminiscing style: The sociocultural construction of autobiographical memory across childhood and adolescence. In: Bauer, PJ.; Fivush, R., editors. The Wiley-Blackwell Handbook on the Development of Children's Memory. Wiley-Blackwell; West Sussex, UK: 2014. p. 568-585.

Fivush R, Gray JT, Fromhoff FA. Two-year-olds talk about the past. Cognitive Development. 1987; 2:393–409.

Fivush R, Fromhoff F. Style and structure in mother – child conversations about the past. Discourse Processes. 1988; 11:337–355.

Fivush R, Haden CA, Reese E. Elaborating on elaborations: Role of maternal reminiscing style in cognitive and socioemotional development. Child Development. 2006; 77(6):1568–1588. [PubMed: 17107447]

Fivush R, Schwarzmueller A. Children remember childhood: Implications for childhood amnesia. Applied Cognitive Psychology. 1998; 12:455–473.

Freud, S. Childhood and concealing memories. In: Brill, AA., editor. The basic writings of Sigmund Freud. The Modern Library; New York: 1905/1953.

Haden CA, Ornstein PA, Rudek DJ, Cameron D. Reminiscing in the early years: Pattern of maternal elaborativness and children's remembering. International Journal of Behavioral Development. 2009; 33(2):118–130.

Hamond NR, Fivush R. Memories of Mickey Mouse: Young children recount their trip to Disneyworld. Cognitive Development. 1991; 6:433–448.

Harley K, Reese E. Origins of autobiographical memory. Developmental Psychology. 1999; 35:1338–1348. [PubMed: 10493658]

Henri V, Henri C. On our earliest recollections of childhood. Psychological Review. 1895; 2:215–216.

Hudson JA, Fivush R. As time goes by: Sixth graders remember a kindergarten experience. Applied Cognitive Psychology. 1991; 5:347–360.

Jack F, MacDonald S, Reese E, Hayne H. Maternal reminiscing style during early childhood predicts the age of adolescents' earliest memories. Child Development. 2009; 80:496–505. [PubMed: 19467006]

Larkina M, Bauer PJ. “Family stories” and their implications for preschoolers' memories of personal events. Journal of Cognition and Development. 2012; 13:473–504.

Larkina, M.; Merrill, N.; Fivush, R.; Bauer, PJ. Linking children's earliest memories and maternal reminiscing style. Poster presented to the Cognitive Development Society; San Antonio, Texas. Oct. 2009

Miles C. A study of individual psychology. American Journal of Psychology. 1893; 6:534–558.

Morris G, Baker-Ward L, Bauer PJ. What remains of that day: The survival of children's autobiographical memories across time. Applied Cognitive Psychology. 2009; 24:527–544.

Nelson, K. Events, narratives, memory: What develops?. In: Nelson, CA., editor. Minnesota symposium on child psychology: Volume 26. Memory and affect in development. Erlbaum; Hillsdale, NJ: 1993. p. 1-24.

Nelson, K.; Fivush, R. Socialization of memory. In: Tulving, E.; Clark, FIM., editors. The Oxford handbook of memory. Oxford University Press; New York: 2000. p. 283-295.

Nelson K, Fivush R. The emergence of autobiographical memory: A social cultural developmental theory. Psychological Review. 2004; 111:486–511. [PubMed: 15065919]

Pathman T, Bauer PJ. Beyond initial encoding: Measures of the post-encoding status of memory traces predict long-term recall in infancy. Journal of Experimental Child Psychology. 2013; 114:321–338. DOI:10.1016/j.jecp.2012.10.004. [PubMed: 23174532]

Perner, J. Episodic memory: Essential distinctions and developmental implications. In: Moore, C.; Lemmon, K., editors. The self in time: Developmental perspectives. Erlbaum; Mahwah, NJ: 2001. p. 181-202.

Perner J, Ruffman T. Episodic memory and autonoetic consciousness: Developmental evidence and a theory of childhood amnesia. Journal of Experimental Child Psychology. 1995; 59:516–548. [PubMed: 7622991]

Peterson C, Grant VV, Boland LD. Childhood amnesia in children and adolescents: Their earliest memories. Memory. 2005; 13:622–637. [PubMed: 16076676]

Peterson C, McCabe A. A social interactionist account of developing decontextualized narrative skill. Developmental Psychology. 1994; 30:937–948.

Peterson C, Morris G, Baker-Ward L, Flynn S. Predicting which childhood memories persist: Contributions of memory characteristics. Developmental Psychology. 2013 doi: 10.1037/a0033221.

Peterson C, Rideout R. Memory for medical emergencies experienced by 1- and 2-year-olds. Developmental Psychology. 1998; 34:1059–1072. [PubMed: 9779751]

Peterson C, Warren KL, Short MM. Infantile amnesia across the years: A 2-year follow-up of children's earliest memories. Child Development. 2011; 82(4):1092–1105. [PubMed: 21557741]

Pillemer, DB.; White, SH. Childhood events recalled by children and adults. In: Reese, HW., editor. Advances in child development and behavior. Vol. Volume 21. Academic Press; Orlando, FL: 1989. p. 297-340.

Reese, E. Taking the long way: Longitudinal approaches to autobiographical memory development. In: Bauer, PJ.; Fivush, R., editors. The Wiley-Blackwell Handbook on the Development of Children's Memory. Wiley-Blackwell; West Sussex, UK: 2014. p. 972-995.

Reese E, Haden CA, Fivush R. Mother-child conversations about the past: Relationships of style and memory over time. Cognitive Development. 1993; 8:403–430.

Reese E, Jack F, White N. Origins of adolescents' autobiographical memories. Cognitive Development. 2010; 25:352–367.

Rubin DC. On the retention function for autobiographical memory. Journal of Verbal Learning and Verbal Behavior. 1982; 21:21–38.

Rubin DC, Schulkind MD. The distribution of important and word-cued autobiographical memories in 20-, 35-, and 70-year-old adults. Psychology and Aging. 1997; 12:524–535. [PubMed: 9308099]

Rubin, DC.; Wetzler, SE.; Nebes, RD. Autobiographical memory across the adult lifespan. In: Rubin, DC., editor. Autobiographical memory. Cambridge University Press; Cambridge: 1986. p. 202-221.

Stone CB, Barnier AJ, Sutton J, Hirst W. Building consensus about the past: Schema consistency and convergence in socially shared retrieval-induced forgetting. Memory. 2010; 18(2):170–184. [PubMed: 19693723]

Todd, CM.; Perlmutter, M. Reality recalled by preschool children. In: Perlmutter, M., editor. New directions for child development: Children's memory. Jossey-Bass Inc; San Francisco, CA: 1980. p. 69-85.

Tustin K, Hayne H. Defining the boundary: Age-related changes in childhood amnesia. Developmental Psychology. 2010; 46:1049–1061. [PubMed: 20822222]

Van Abbema DL, Bauer PJ. Autobiographical memory in middle childhood: Recollections of the recent and distant past. Memory. 2005; 13:829–845. [PubMed: 16298891]

Weigle TW, Bauer PJ. Deaf and hearing adults' recollections of childhood and beyond. Memory. 2000; 8:293–309. [PubMed: 11045238]

West TA, Bauer PJ. Assumptions of infantile amnesia: Are there differences between early and later memories? Memory. 1999; 7:257–278. [PubMed: 10659077]

Wetzler, SE.; Sweeney, JA. Childhood amnesia: An empirical demonstration. In: Rubin, DC., editor. Autobiographical memory. Cambridge University Press; New York: 1986. p. 191-201.

Wheeler, MA. Episodic memory and autonoetic awareness. In: Tulving, E.; Craik, FIM., editors. The Oxford handbook of memory. Oxford University Press; New York: 2000. p. 597-608.

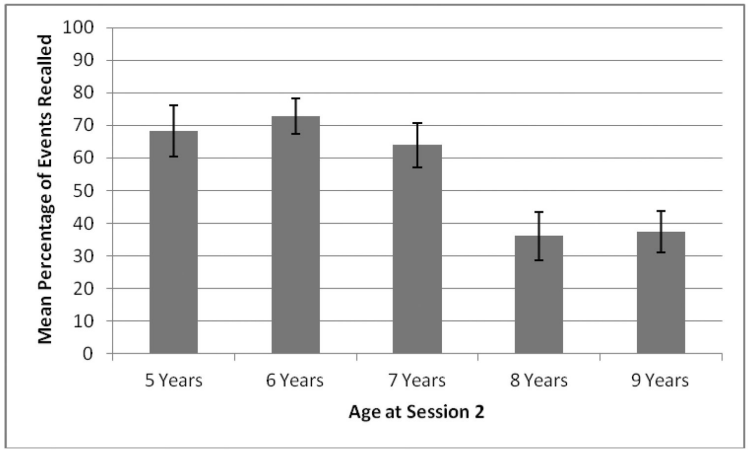

Figure 1.

The mean percentage of events from age 3 years (Session 1) recalled by the children at ages 5 to 9 years (Session 2). Error bars indicate standard error of the mean.

Table 1

Means (and Standard Deviations) for Narrative Categories for Early-life Events at Session 2

	Age at Session 2				
	5-year-olds	6-year-olds	7-year-olds	8-year-olds	9-year-olds
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Sample size	**15**	**15**	**15**	**12**	**12**
Total propositions	9.47 (3.17)	13.09 (7.09)	14.51 (10.18)	16.55 (9.15)	15.58 (8.49)
Total content	6.21 (3.35)	8.21 (6.04)	10.59 (7.14)	15.54 (9.44)	15.49 (10.12)
Breadth	3.13 (0.85)	3.53 (1.30)	4.29 (1.47)	5.15 (1.60)	5.24 (1.33)
Who	1.05 (0.99)	1.06 (1.47)	1.27 (1.63)	0.93 (0.73)	1.08 (0.82)
What-object	1.81 (0.99)	2.39 (2.30)	2.50 (2.10)	3.67 (2.72)	2.50 (2.28)
What-action	1.22 (1.25)	1.66 (1.85)	2.51 (1.63)	4.40 (2.29)	4.47 (3.27)
Where	0.82 (0.63)	1.02 (0.78)	0.92 (0.83)	1.40 (0.91)	2.29 (1.85)
When	0.22 (0.40)	0.12 (0.28)	0.34 (0.53)	0.60 (0.68)	0.72 (0.87)
Why	0.04 (0.12)	0	0.34 (0.37)	0.60 (0.73)	0.68 (1.40)
How-description	0.84 (1.06)	1.48 (0.96)	2.01 (2.04)	3.01 (1.78)	3.06 (2.59)
How-evaluation	0.18 (0.27)	0.47 (0.65)	0.74 (0.78)	0.89 (0.92)	0.78 (1.14)

Table 2

Means (and Standard Deviations) for Maternal Reminiscing Categories at Session 1

Categories	Mean	SD	Range
Elaborations	13.07	5.54	3.67–26.50
Affirmations	6.93	4.04	0.33–19.67
Repetitions	5.16	3.07	0.33–13.67
Elaboration ratio	0.79	0.09	0.55–0.95
Deflections	1.78	1.45	0–7.00
Total Propositions	29.91	13.51	4.67–76.00

Note: Descriptive statistics are based on $N = 81$ dyads (data from the two conversations that involved both mothers and fathers are excluded). Assessment of maternal style variables was based on all of the events discussed at Session 1, even those the children did not recall at the time (i.e., events about which they did not contribute at least two unique pieces of information). The choice was motivated theoretically in that maternal style differences are considered to be most important when children are not contributing to the conversation (e.g., Fivush et al., 2006; Nelson & Fivush, 2004).

Table 3

Means (and Standard Deviations) for Children's Narrative Categories at Session 1 based on Recalled Events (Panel a) and Correlations with Maternal Narrative Variables at Session 1 (Panel b)

Category	Panel a: Children's Recall and Narratives at Session 1			Panel b: Correlations with Maternal Narrative Variables at Session 1	
	Mean	SD	Range	Elaboration Ratio	Deflections
Proportion of events recalled	0.83	0.22	(0–1)	.36**	.26*
Total propositions	15.96	7.38	4.50–44.33	.07	.54**
Total content	8.08	4.20	2.00–23.17	.35**	.35**
Breadth	3.59	1.09	1–6.00	.36**	.30**
Who	1.23	0.89	0–3.67	−.12	.02
What-object	2.04	1.32	0–8.67	.37**	.30*
What-action	1.52	1.06	0–4.50	.34**	.41**
Where	1.10	0.68	0–3.00	.31**	.35**
When	0.16	0.33	0–1.83	.15	.18
Why	0.13	0.22	0–1.50	.28*	.07
How-description	1.47	1.17	0–6.50	.30**	.25*
How-evaluation	0.35	0.33	0–1.80	.23*	.17

Note:

Correlations based on 79 dyads (excluding 2 mother-father-child triads, and 2 dyads in which the child failed to recall any of the events); all correlations .35 and higher remained significant after Bonferroni correction for multiple comparisons.

* $p < .05$;

** $p < .01$.