ABSTRACT

JOHNSON, JENNIFER MELISSA. The Role of Maternal Reminiscing Style and Language Ability at 36 Months of Age on Second Graders’ Reports of First Memories. (Under the direction of Lynne Baker-Ward, Ph.D.)

This investigation examined the relation between mothers’ use of an elaborative style in discussing shared experiences with their preschoolers and these children’s reports of early childhood memories five years later. In addition, the influence of both language ability during early childhood and maternal education on later reports of early childhood experiences was examined. When the children were 36 months of age, 54 mother-child dyads reminisced about past events and the children were administered the Expressive Communication Scale of the Preschool Language Scale-4. The reminiscing conversations were coded for the mother’s use of elaborations, repetitions, and elaborative questions, and a ratio score was calculated by dividing the total number of elaborations by the number of repetitions. Five years later, the children reported as many memories from early childhood as possible during a memory fluency task, and both the children and their mothers dated each report. Correlational analyses supported the hypothesis that mothers who used a greater number of elaborative questions during the early childhood reminiscing conversations had children who later retrieved more early autobiographical memories as compared to children with mothers who used fewer elaborative questions. Contrary to expectations, there was no support for a relationship between the number of elaborative questions and the age of children’s earliest memories, nor a relationship between the ratio of elaborations to repetitions and children’s earliest memory or the number of memories retrieved.
Additionally, multiple regression analyses, controlling for children’s language, did not support the hypothesized significant unique contribution of maternal reminiscing style to children’s autobiographical memory reports. There was no evidence for the hypothesized relations between children’s early expressive language ability and the age of their earliest memory or expressive language ability and the number of events recalled. In addition, there was no support for the hypothesis that children’s expressive language ability would moderate the relationship between maternal reminiscing style and measures of children’s autobiographical memory. Finally, in contrast to a hypothesized relation between maternal education and aspects of autobiographical memory reports, maternal education was not related to either the age of children’s earliest memory or the number of memories recalled. These results are considered in light of the limited power to fully test the hypothesized model and seen as preliminary support for the importance of mothers’ use of elaborative questions during early childhood discussions for children’s developing autobiographical memory skills.
The Role of Maternal Reminiscing Style and Language Ability at 36 Months of Age on Second Graders' Reports of First Memories

by
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DEDICATION

To my husband, Josh, thank you for your constant love, support, and encouragement. I also dedicate this to my parents, Trey Johnson and Kimberly Schultz, for always encouraging me to work hard and pursue my dreams.
**BIOGRAPHY**

Jennifer M. Johnson was born in San Antonio, Texas and raised in the suburbs of Atlanta, Georgia. She has a large family comprised of two siblings, two step-siblings, and five half-siblings. After graduating from Greater Atlanta Christian School in May 2005, Jennifer attended Auburn University in Auburn, Alabama, where she played on the soccer team and graduated summa cum laude with a B.A. in psychology in May 2009. The following year she served as the laboratory manager for Dr. Christopher Newland on a grant examining the neurobehavioral toxicity of methylmercury. In Fall 2010, she entered the doctoral program in Lifespan Developmental Psychology at North Carolina State University under the direction of Dr. Lynne Baker-Ward. Jennifer’s master’s research focused on how characteristics of early mother-child conversations influenced children’s developing autobiographical memory skills.
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INTRODUCTION

Childhood amnesia is the limited ability of adults to report memories of events that transpired before age three or four, although there is individual and cultural variation in this age (Peterson, Grant, & Boland, 2005; Peterson, Wang, & Hou, 2009; Wang, 2003). This age estimation is most frequently inferred by prompting adults for their earliest memory, and the age at the time of that event is used as a proxy for the offset of childhood amnesia and the corresponding onset of autobiographical memory (Jack & Hayne, 2007). Recent work with children’s earliest memories has also demonstrated age-related changes in childhood amnesia, such that children report earlier first memories than the traditional three-and-a-half year boundary characteristic of Western adults (e.g., Peterson et al., 2005, 2009; Tustin & Hayne, 2010). Thus, it appears that childhood amnesia emerges gradually with age, and the limitations characteristic of adults are not apparent until adolescence (Peterson et al., 2005). Accordingly, investigations of early memories in children utilizing a developmental perspective are necessary to expand our understanding of childhood amnesia and the emergence of autobiographical memory, its evolution over time, and its underlying mechanisms (e.g., Peterson et al., 2009).

Current theoretical models propose that the development of autobiographical memory occurs through complex interactions between biological, cognitive, social and linguistic factors (Nelson & Fivush, 2004). Two of these factors may prove especially pertinent to predicting the age at which we begin to preserve our past as well as how many memories survive from the period of life eventually encompassed by childhood amnesia (Howe,
Courage, & Edison, 2003). They are social interaction, specifically parent-child memory sharing (Jack, MacDonald, Reese, & Hayne, 2009; Nelson & Fivush, 2004), and the acquisition of language and narrative skills (Peterson & Rideout, 1998). Whereas these variables are currently of high theoretical importance, there is a paucity of empirical evidence examining their contribution to the development of autobiographical memory. For this reason, the present longitudinal investigation examined the contribution of children’s early language ability and their reminiscing environment on their later accessibility to early autobiographical memories.

**Language and Memory**

Language ability is essential to the development of autobiographical memory. It creates an organizational structure for memory, promotes knowledge of what the past is and the notion of a continuous self in time, and allows a child to attach events to specific time points in the past and accept memories as subjective representations of the past (Fivush & Nelson, 2004). An investigation by Peterson and Rideout (1998) illustrates the importance of language development for autobiographical memory. The authors examined 12- to 34-month-old children’s long-term verbal memory for a trip to the emergency room after a traumatic injury. They found that children’s ability to narrate the details of the event at the time it occurred was subsequently related to their long-term verbal memory for that event. The children who were unable to narrate the experience at the time it occurred, but who acquired significant narrative skills in the interim, were unable to demonstrate verbal recall for the target event. Similarly, Simcock and Hayne (2002) found that children were unable
to translate their preverbal memories into language despite acquisition of the relevant vocabulary to report the event of interest. These studies and others (e.g., Richardson & Hayne, 2007) provide converging evidence that children’s verbal recall after a delay more closely reflects their language ability at the time of encoding the event, rather than their language ability during retrieval.

The results of other investigations, however, present challenges to this conclusion (e.g., Cheatham & Bauer, 2005; Morris & Baker-Ward, 2007). For example, Morris and Baker-Ward (2007) had 2-year-old children engage in a novel bubble machine task that used a particular color of bubble solution and found that children, who lacked color words during participation in the initial task but subsequently acquired color words, were able to use the newly acquired words when recalling the original bubble task. This result indicated that some early memories that occur in preverbal children may later be translated into words. However, children were interviewed with significant contextual support during recall and asked to report memories that were not clearly autobiographical in nature. In a follow-up to Simcock and Hayne (2002), Jack, Simcock, and Hayne (2012) assessed children’s verbal recall for a unique event experienced during early childhood (27-51 months of age) after six years. Approximately 20% of the children verbally recalled the event, and this was interpreted as strong evidence that early experiences can be verbally recalled after significant delays. Given the contradictory evidence presented, whether children have verbal access to events that were encoded without language remains unclear.
It is also uncertain and widely unexplored how language ability during early childhood promotes later accessibility to autobiographical memories. Given that language provides both a communicative and representational tool for later memory, it appears likely that a child’s early expressive language ability will influence the beginning of autobiographical memory and the survival of early childhood memories (Farrant & Reese, 2000; Wang, 2006). Further, children’s developing ability to represent and express events linguistically is facilitated by and contributes to verbally reminiscing about events with others (Nelson, 1993), another crucial factor emphasized in theoretical accounts of the offset of childhood amnesia. Thus, the present study contributed to the literature by examining how early language ability influenced children’s later accessibly to memories for early childhood.

**Maternal Reminiscing**

Mother-child reminiscing about the past has been hypothesized to contribute to the offset of childhood amnesia, although this possible influence has not been empirically established (e.g., Fivush, Haden, & Reese, 2006; Jack et al., 2009; Reese, Jack, & White, 2010). Evidence suggests that children learn the forms and functions of talking about the past and how to construct their own personal narratives through participation in shared reminiscing, and the critical variable underlying the development of these skills is the mother’s use of elaborations (Fivush et al., 2006; Nelson & Fivush, 2004). High elaborative mothers ask a lot of questions, provide additional details to conversations, prompt their child to provide additional information, evaluate responses and attempt to co-construct a narrative of the event with their child (Fivush et al., 2006; Kulkofsky, Wang, & Koh, 2009). Low
elaborative mothers generally talk less and ask a series of repetitive questions in the form of a memory test without providing additional contextual information in the conversations (Kulkofsky et al., 2009). Whereas reminiscing style was initially captured as a dichotomous variable (i.e., high, low) (e.g., Reese, Haden, & Fivush, 1993), it has recently been reflected as occurring along a continuum of elaborativeness (e.g., Nelson & Fivush, 2004).

One important variable that influences a mother’s reminiscing style and the ability of a child to contribute to these conversations is the child’s language ability. For example, mothers are more elaborative with young preschoolers who have better language skills (Farrant & Reese, 2000; Newcombe & Reese, 2004; Wang, 2006; Welch-Ross, 1997), and children’s language ability allows for an engagement in discussions about the past (Fivush & Nelson, 2004). Thus, it is important to consider these variables (i.e., maternal reminiscing, children’s language) both alone and in conjunction with each other when examining their influence on children’s autobiographical memory. Currently, it is unknown how maternal reminiscing and children’s language interact to predict aspects of early autobiographical memory. Thus, an additional contribution of the present study was to examine the interaction of children’s language and maternal reminiscing style on children’s autobiographical memory development.

Research, however, has demonstrated the positive influence of elaborative reminiscing on children’s autobiographical memory and narrative development (Boland, Haden, & Ornstein, 2003; Cleveland & Reese, 2005; Cleveland, Reese, & Grolnick, 2007; Fivush et al., 2006; McGuigan & Salmon, 2004, 2006; Peterson, Sales, Rees, & Fivush,
2007; Reese & Newcombe, 2007; Wareham & Salmon, 2006). Specifically, high elaborative mothers have children who develop more sophisticated autobiographical memory, and report more coherent narratives of past experiences than children of low elaborative mothers, even after controlling for the effects of children’s language skills (Fivush et al., 2006; Nelson & Fivush, 2004; Reese & Fivush, 1993). Children who have experienced more elaborative reminiscing conversations also provide more information and more accurate details about the event being discussed both concurrently (Reese & Fivush, 1993) and longitudinally (Reese et al., 1993; McCabe & Peterson, 1991), regardless of whether they recall the event with their mothers (Wang, 2006) or a researcher (Hudson, 1993). Whereas coding schemes developed for examining conversational styles during reminiscing often incorporate myriad codes such as evaluations and associative talk, elaborations and repetitions have been demonstrated to be of most importance for children’s developing autobiographical memory skills (Reese et al., 1993).

Hence, a more elaborative reminiscing style has been linked with more child memory contributions and enhanced narrative coherence when children and adults reminisce about past experiences. However, these studies do not clearly establish the utility of an elaborative reminiscing style on children’s independent narratives about other events that may constitute early autobiographical memory, such as those that were not the frequent topic of laboratory discussions or those that are reported without the aid of parental and/or interviewer cues. Thus, the present study contributed to the existing literature by examining how exposure to a general maternal reminiscing style during early childhood influences children’s later recall
for events of early childhood, rather than focusing on recall for events that were specifically reminisced about with their parents. There are many reasons why a highly elaborative reminiscing environment during early childhood would facilitate the maintenance and accessibility of children’s earliest memories. These elaborative conversations about the past provide the child with a narrative structure for organizing and reporting events, and also help preserve experiences in memories through rehearsal and reinstatement (Howe et al., 2003; Peterson et al., 2009). Children as young as two and a half are able to talk about specific events in these reminiscing conversations, but adults heavily scaffold such conversations (e.g., Hudson, 1990). However, by age 3 or 4, children assume a larger role in these conversations about past events and are able to use narrative form in these conversations, suggesting the importance of examining these conversations during a time when children first become active contributors in the present study (Howe et al., 2003).

**Gender**

Gender may be important to consider when assessing childhood amnesia and maternal reminiscing. With regards to maternal reminiscing style, mothers tend to be more elaborative with daughters rather than sons (Reese & Fivush, 1993). The majority of work on childhood amnesia with adults has found that females have earlier memories than males (e.g., Davis, 1999). However, much less is known about gender differences in children’s earliest memories or the presence of similar differences in measures of memory fluency. The few studies examining children’s event reports for medical procedures (e.g., Ornstein et al., 2006) or their earliest memories (Peterson, 2011; Peterson et al., 2005) rarely find any gender
differences in memory. Therefore, gender differences in children’s autobiographical memory are not anticipated in the present study, but will be examined initially.

SES

SES may also be important to consider in studies of autobiographical memory and maternal reminiscing. Research suggests that there is variability in the use of reminiscing styles, including high elaborative styles, among mothers with low education (Farrant & Reese, 2000), although the role of SES on maternal reminiscing has not been directly investigated. It appears that low-education and low-income mothers tend, in general, to adopt a less elaborative reminiscing style than mothers with high-education and high-income, but the reasons for this remain unclear (Levya, Reese, Grolnick, & Price, 2008; Reese & Newcombe, 2007). Further, among adults, age of earliest memory has been negatively correlated with verbal IQ (i.e., vocabulary), language ability, and social class (Bruhn, 1998; Davidow & Bruhn, 1990; Nelson, 1993). Thus, an indicator of SES, maternal education, will be included in the present study. Maternal education was assessed, rather than an alternative measure such as income-to-needs ratio, due to findings in the literature that suggest that this feature of SES would be more influential to the variables of interest in the present study (i.e., children’s language, maternal reminiscing).

Illustrative of the importance of maternal education, Hoff (2003) found that differences in vocabulary growth between 2-year-old children from high- (i.e., college-educated) versus mid-SES (i.e., high-school educated) families were mediated entirely by differences in maternal speech. Mothers from high-SES backgrounds tended to speak to their
children in longer utterances, use richer vocabularies, and produce more complex sentences as compared to mid-SES mothers. Additionally, Qi, Kaiser, Milan, and Hancock (2006) demonstrated that maternal education strongly predicted preschooler’s vocabularies, such that mothers with higher education tended to have children with greater vocabularies than mothers with lower education. Monthly household income was not uniquely related to vocabulary. Further, work has demonstrated that SES, as indicated by both maternal education and an income-to-needs ratio, is related to the rate of growth of expressive communication skills such that growth occurs at a faster rate for children in high-SES families compared to children in low-SES families (Pungello, Iruka, Dotterer, Mills-Koonce, & Reznick, 2009). Therefore, the influence of maternal education on children’s autobiographical memory will be explored, and it is hypothesized that its influence will be mediated by differences in maternal reminiscing style and/or children’s language ability.

**Issues with Extant Research**

Jack et al. (2009) provided the first prospective test of the hypothesis that individual differences in maternal reminiscing style influence children’s autobiographical memory, specifically age of earliest memory. Here, children and mothers participated in multiple reminiscing sessions when the children were between the ages of two and four. Approximately 10 years later, the children were cued to report early memories identified by their parents and asked to recall their earliest self-nominated memories. Mothers who used a larger ratio of elaborations to repetitions, and those who used a larger ratio of open-ended elaborative questions to repetitions, had children who reported earlier first memories. It is
important to note that 35% of children confirmed recollection of a parent-nominated event, and these events occurred earlier than child-nominated events. The authors did not find any relation between the number of elaborations or repetitions alone and participant’s age of earliest memory, suggesting that the ratios of elaborations to repetitions and open-ended elaborations to repetitions may be the key contributors to children’s developing autobiographical memory (Jack et al., 2009). They also discovered no evidence that the role of maternal reminiscing style in children’s early memory development was mediated by children’s language ability at 24 or 36 months, as assessed by the average of the vocabulary scores on the MacArthur Communicative Development Inventory for Words and Sentences at the two ages. However, the lack of a significant relationship here can likely be attributed to the small sample in the study as there was a trend for children with enhanced vocabulary scores in early childhood to report earlier first memories in adolescence. Further, the sample size \( N = 17 \) limited the potential analysis of the importance of maternal reminiscing style at each of the four individual age-points and precluded any examination of the interaction between children’s language and maternal reminiscing style.

Additional promising work was conducted by Haden, Ornstein, Rudek, and Cameron (2009) who examined individual differences in maternal reminiscing styles and children’s language skills and their contributions to children’s concurrent and longitudinal memory contributions within the reminiscing conversations from 18 to 30 months of age. Mothers who were categorized as “high-eliciting” at the initial time point, i.e., those who asked their children a large number of open-ended elaborative questions and used as many or more
elaborative questions as elaborative statements in their conversations, had children who provided more memory elaborations within the reminiscing conversations at 30 months. This effect was significant even after controlling for the concurrent association between children’s language skills and their memory responding at 30 months. These results suggest that mothers who provide their children more opportunities to participate in memory conversations by trying to elicit direct responses to elaborative questions help facilitate children’s developing recall abilities in memory conversations about previously experienced events.

Reese et al. (2010) also offered substantial support for the importance of the early reminiscing environment for children’s later autobiographical memory skills. They had children and mothers participate in reminiscing conversations when the children were 19-, 25-, 32-, and 40-months old and obtained additional assessments of children’s language, attachment security, theory of mind, self-awareness, and independent memory. When the children were adolescents \( (M = 12.46 \text{ years old}, SD = .25) \), they participated in a language assessment and a memory interview to assess what they could recall about the events discussed in the previous maternal reminiscing conversations. Specifically, they assessed the earliest memory and the number of memories recalled, as well as the average number of unique clauses reported about each memory (i.e., volume of recall). Additionally, children were interviewed to assess their level of insight into life events (Emerging Life Story Interview; Reese, Chen, Jack, & Hayne, 2010) and their knowledge of their own family history (\textit{Do You Know} questionnaire; Duke, Lazarus, & Fivush, 2008). Three memory
variables were calculated using factor analysis. The first factor comprised age of earliest memory, level of insight into life events, and knowledge of family history (factor termed “age and insight”). The second factor was “volume” of early memories (the average number of parent-verified clauses recalled), and the third factor was termed “density” and comprised of the number of specific memories recalled, the density of memories (the distance in months between the two earliest memories), and knowledge of family history. Correlation analyses relevant to the present study demonstrated that children’s early language abilities contributed to all memory variables. Additionally, mothers’ elaborative questions were related to the age and insight factor and density factor, and mothers’ repetitions and evaluations were related to the volume factor. Hierarchical multiple regression analyses, controlling for children’s language, demonstrated that the mothers’ elaborative questions during early childhood were the strongest predictor of the age and insight memory factor during adolescence. Mothers’ elaborative questions did not contribute uniquely to predicting the density factor. The authors were unable to replicate Jack et al.’s (2009) finding that mothers’ greater ratio of elaborations to repetitions was related to earlier memories.

Whereas these studies offer a promising foundation for connecting parental reminiscing with children’s autobiographical memory, there were several limitations that point to the need for future research. For example, all three aforementioned studies were comprised of primarily middle-class families of European descent and generalizability is limited. In addition, Haden et al. (2009) examined maternal reminiscing styles and children’s memory abilities within the limited context of the reminiscing conversations themselves, and
generalizations to children’s independent autobiographical recall longitudinally is not appropriate. Moreover, a number of limitations characterize the work of Jack et al. (2009). Notably, this investigation had an extremely small sample size ($N = 17$). The authors also only analyzed the age of first memory, providing no indication of the relationship between maternal reminiscing style and the number of early memories. Further, true autobiographical reports may have been distorted as children were allowed to recall events nominated by their parents and cued by the researchers. Additionally, no attempt was made to examine the source of a child’s memory, and it is unknown whether the events recalled were true autobiographical memories or the result of parental story-telling or the presence of reminders such as pictures. Finally, a first memory report was included from a child who reported a memory from when he was only a few days old, a time in which the hippocampus is notably immature and incapable of forming such autobiographical memories (e.g., Newcombe, Lloyd, & Ratliff, 2007). Excluding this participant weakened the results.

Reese et al. (2010) did not provide information as to the unique prediction of maternal reminiscing environment on the age of earliest memory recalled or the number of specific memories reported due to the use of factor analysis to create autobiographical memory factors comprised of multiple variables. However, the greater limitation of the study is that the adolescents participated in a memory interview that was entirely based on their recall of the specific events discussed extensively with their mothers during early childhood reminiscing tasks in the laboratory. Thus, no new events were introduced or available for recall, and only those events discussed previously were eligible for retrieval.
Accordingly, the number of events recalled during adolescence was limited to the number of previously discussed events and this number varied extensively (0-12) across participants. As the authors acknowledged, the number of previously discussed events may have also differentially affected the age of earliest memory and density of memories. Additionally, the interviewers were able to provide cues by means of specific event details to aid participants’ recall of events. These characteristics of the study prevent firm conclusions when trying to extrapolate to fully independent autobiographical recall. Accordingly, much remains to be learned about how social interaction within the context of joint reminiscing and children’s language may affect both the emergence of autobiographical memory (i.e., age of earliest memory) and also children’s general accessibility to early autobiographical memories (i.e., memory fluency or number of memories). Thus, the present study focused on children’s independent recall for events that were not the topics of laboratory-based reminiscing conversations during early childhood and further did not provide cues that may have distorted true autobiographical recall.

The Present Study

The present study investigated maternal reminiscing style and language ability as mechanisms underlying the development of early autobiographical memory, by building on the existing literature while addressing some of its limitations. Specifically, the present study directly investigated whether maternal reminiscing style during early childhood (36 months) was related to the age of earliest memory and/or general accessibility of early memories of children in the second grade as assessed through a memory fluency task, and further
examined the role of early language ability (36 months) on these relations. Two maternal reminiscing variables (the ratio of elaborations to repetitions and elaborative questions) were of primary interest given the recent literature demonstrating their influence on children’s memory (Jack et al., 2009; Reese et al., 2010). A memory fluency task was utilized because recent evidence supports the emergence of autobiographical memory as gradual, not an all-or-none phenomenon (Nelson & Fivush, 2004; Peterson et al., 2009). To account for this, recent investigations demonstrated the utility of incorporating the total number of memories recalled in a fluency task, providing a measure of general accessibility to early memories, along with the age of earliest memory (Peterson et al., 2009; Wang, Conway, & Hou, 2004). Examination of both of these variables enables researchers to not only establish the age at which childhood amnesia begins to wane, but also to examine how multiple early memories form the basis of autobiographical memory (Tustin & Hayne, 2010).

In addition, the characteristics of the sample used in this investigation enabled the examination of the potential generalizability of the existing work on mother-child reminiscing. Both African American and European American mother-child dyads were included in the study, and different levels of socioeconomic status, as indexed by maternal education, were represented within both racial groups.

There were three primary aims: (1) To determine the degree to which maternal reminiscing style as indicated by the ratio of elaborations to repetitions and the total number of elaborative questions at 36 months of age explained individual variations in (a) the age of earliest memory and (b) number of early memories reported in a memory fluency task by
children during the second grade; (2) To determine how children’s expressive language ability at 36 months (a) influenced the age of earliest memory and number of memories reported in the fluency task and (b) how it moderated the relationship between maternal reminiscing style and children’s earliest memories; and (3) To explore SES differences (as indicated by maternal education) in the aforementioned relationships. In addition, although no hypotheses regarding race differences were formulated, differences in performance between African-American and European-American dyads were explored in order to examine the generalizability of the existing literature.

The age of 36 months was selected for a number of reasons. As mentioned, children around this age begin to assume a more integral role in contributing to reminiscing conversations, suggesting that varying levels of participation in shared reminiscing at this age may underlie individual differences in early autobiographical memory. Further, differences in children’s language ability at this age influence the mother’s reminiscing style and the degree of children’s narrative competence which may in turn affect their autobiographical memory skills (e.g., Farrant & Reese, 2000). Moreover, the age of 36 months represents a period typically thought to encompass childhood amnesia. Enhanced language abilities during this period may facilitate the encoding and later accessibility of early childhood memories for verbal recall, and Wang (2006) has suggested that the effects of a highly elaborative reminiscing style on children’s autobiographical memory may be most important during the early preschool years.
Children have access to earlier memories than adults, and younger, but not older, children are especially vulnerable to losing access to their earliest memories (Peterson et al., 2005, 2009). Thus, an examination of autobiographical memory during childhood may provide insight into what factors contribute uniquely to the survivability of early memories over time. Hence, early childhood memories are not yet consolidated and the adult form of childhood amnesia has yet to emerge in second grade. Thus, a number of memories from the period encompassing childhood amnesia remain accessible during this time period, which can facilitate the investigation of the factors involved in promoting the survivability of early memories.

We hypothesized that: (1) Children with more elaborative mothers (i.e., those whose reminiscing conversations were characterized by a greater ratio of elaborations to repetitions and a greater number of elaborative questions) at 36 months of age would report an earlier age of first memory and retrieve a greater number of memories in the fluency task during second grade compared to children with less elaborative mothers; (2) Children with greater expressive language ability at 36 months would report an earlier age of first memory and retrieve a greater number of memories during the fluency task than children with lower expressive language ability; (3) Children’s expressive language ability at 36 months would moderate the relationship between mother’s reminiscing ratio and children’s reports of earliest memories (i.e., children with greater expressive language ability at 36 months would have a stronger relationship between an elaborative maternal reminiscing style and reports of earlier first memories and a greater number of memories reported in the fluency task than
children with lower expressive language abilities); and (4) Children with mothers with higher education would report an earlier age of first memory and retrieve a greater number of memories than children with mothers with lower education, although this effect was expected to be mediated by differences in maternal reminiscing styles and children’s expressive language. We made no directional hypotheses about children’s race being related to maternal reminiscing style or their autobiographical memory reports due to the limited research in this area. See Appendix A for a visual depiction of the conceptual model underlying these hypotheses.

METHOD

Participants

A total of 54 mother-child dyads constituted the final sample for this investigation. Each dyad participated in a mother-child reminiscing task and completed additional assessments when the child was 36 months of age. As second graders, the children took part in a cognitive assessment that included a memory interview.

The participants were recruited from the Durham Child Health and Development Study (DCHDS), a longitudinal study that has followed children from 3 months of age through the present time. For a more detailed description of the longitudinal investigation, see work by Moore et al. (2009), Pungello et al. (2009), and Propper, Willoughby, Halpern, Carbone, and Cox (2007). The original sample was recruited to be representative of the racial and socioeconomic status of native English speakers in the surrounding community and included only firstborn children. The sample in the present study thus included both
European American and African Americans who represented a range of socioeconomic backgrounds. Exclusion criteria for original participation in the DCHDS included: birth complications, premature birth greater than one month, multiple births, parental plans to leave the community within three years, and maternal age under 18 at the time of child’s birth.

The DCHDS involves two waves of data collection, with Wave 1 initially consisting of 75 children and Wave 2, 84 children. Only the 84 families in Wave 2 were available for the second grade follow-up, and 59 were recruited for the second grade cognitive assessment. The majority of the additional 25 families that constituted Wave 2 and participated in the 36-month data collection were successfully contacted, but declined to participate in the follow-up study in second grade. Of the 59 mother-child dyads who participated in the second grade assessment, four were not represented in the analyses due to missing maternal reminiscing and/or language data from the 36-month time point and one was excluded due to an interviewer mistake in following the protocol. The final sample of 54 dyads included 27 in which the children were male (10 European American, 17 African American) and 27 female (6 European American, 21 African American). Mothers were compensated $50 and children received a small toy for their participation at each time point in the DCHDS.

Procedure

Parental consent and child assent were gathered before all sessions. All procedures were approved by the North Carolina State University Institutional Review Board.
**Overview of 36-month visit.** Maternal education, mother-child reminiscing and children’s expressive language ability were assessed during the 36-month visit to the DCHDS laboratory as part of a larger battery of tasks. All tasks took place in one laboratory visit that was approximately 2 hr in duration. All tasks were administered by trained research assistants in a standard order across all participants. The mother-child reminiscing task took about 20 min to administer. Children’s expressive language ability was assessed in approximately 15 min.

**Overview of second grade visit.** As second graders, the DCHDS participants completed a memory fluency task assessing their earliest memories as part of a larger battery of tasks. All tasks took place in one laboratory visit that required approximately 3 hr for completion. All tasks were administered by trained research assistants in a standard order across all participants. The memory fluency task took approximately 20 min to administer.

**Parent-child reminiscing task.** The reminiscing tasks were completed in a laboratory setting under the direction of trained research assistants (see Appendix B for interview guidelines). One day before the scheduled visit, mothers were telephoned, provided with a brief description of the reminiscing task, and told about the types of events the researchers were interested in having them discuss with their children. Specifically, eligible events had to be novel events, mother-child shared experiences, and events that had occurred in the previous month or so. This occurred prior to the scheduled visit, as past experience revealed that it was sometimes difficult for mothers to come up with multiple
events on the spot. Mothers were asked not to discuss the events selected with their child prior to the scheduled laboratory visit.

During the scheduled laboratory visit, mothers, who were out of earshot of the child, were asked to select three events based on the above criteria. Events to be excluded from discussion included routine events (e.g., those likely to have a scripted or generic representation), events that extended over one day, or already had a story line (e.g., going to a movie), were experienced by only the mother or child alone and not together, and events that occurred too far in the past. Mothers were also encouraged to think of events other than those immediately preceding the visit. Examples of appropriate events included visiting a museum, going through an automatic car wash, attending a fair or church picnic, etc. After multiple potential events had been nominated, the three events that best met the criteria were selected and recorded on an index card. Then, the index cards were given to the mothers, and they were instructed to discuss the past events with their child in the order listed on the card in whatever way felt most comfortable, with no time restrictions. The conversations occurred in a comfortable place with no prominent distracters such as toys or books and were considered over when the mother indicated the discussion was complete. Conversations were audio and video recorded and later transcribed verbatim and coded.

**Memory fluency task.** Trained research assistants interviewed children individually once in the laboratory (see Appendix C for interview guidelines). At the session, the researcher first explained the purpose of the task by specifying that the child should report as many memories as he/she could from before kindergarten in 4 min (Peterson et al., 2009).
Further, children were instructed that they only needed to report a sentence or two about each event. Once the child understood the task and began talking, the researcher started a stop watch. The researcher provided neutral prompts throughout the task to encourage participation as needed (e.g., “Good working, tell me about something else”). The task lasted exactly 4 min. Following the task, the interviewer helped the child date each memory. If the child was only able to identify his/her age in years at the time the event occurred, the researcher attempted to narrow this age to a range of months by utilizing a series of questions (e.g., “Who was your pre-school teacher when that happened?” “Did that occur near any special occasions such as your birthday, Christmas, Easter?” etc.). Other useful sources of information to aid in dating the memories were gathered from the parents before the interview (Appendix D). For example, parents provided information about the child’s siblings, pets, family moves, school history, and family transitions such as divorce to be used to help the child locate a memory in time. Following the questions posed to date the memory, the researcher inquired about the source of the memory. Specifically, the child was asked whether the report was something he/she remembered in his/her own head, if he/she only knew about it because someone had told him/her about it or he/she had seen a picture, etc., or if the report was based on both a memory and outside sources. The child was also asked to report his/her emotion when the event occurred, and whether the event occurred once or multiple times (specificity) (see Appendix E for child data collection sheet).

**Parental verification.** Following completion of the child portion of the fluency task, a second interviewer, who was not present during the fluency task, presented the parent with
the data sheet used during the fluency task with the child in order to independently verify the child’s reports. On the data sheet was a brief description of each of the child’s memories as well as the child’s indications of his/her age at the time of the event, and the source, emotion, and specificity of the memory. Based on the information provided on the data sheet, parents were asked to provide additional information about each reported memory, including: (1) the likelihood of the occurrence of each reported event from 1 (“I am positive it did not happen”) to 5 (“I am positive it happened”); (2) their confidence that the source of the child’s report was memory from 1 (“I am positive it is not a memory”) to 5 (“I am positive it is a memory”); (3) the presence of reminders of the event (e.g., pictures, discussions, videos) (Yes, No) and the frequency with which a child came into contact with the reminders if present from 1 (rare or very limited exposure) to 3 (frequent or regular exposure); (4) the child’s age and their confidence of the age report from 1 (just guessing) to 5 (positive); (5) the child’s emotion at the time of the event (free response), and (6) whether the event was single or repeated. (See Appendix F for parent data collection sheet and Appendix G for the rating scales.)

Measures

Maternal education. As a marker of SES, mothers’ highest level of education attainment equaled the number of years that they reported attending school at the 36-month age point. Note that analyses were also conducted with maternal education classified by degree obtained (i.e., less than high-school, high-school graduate, some college, college-
graduate, advanced degree) and results were similar. Thus, maternal education was analyzed as a continuous variable.

**Language assessment.** The Preschool Language Scale-Version 4 (PLS-4) contains two subscales measuring children’s expressive communication and auditory comprehension. The focus in the present study was on the Expressive Communication Scale (PLS-4-EC) (Zimmerman, Steiner, & Pond, 2002). The PLS-4-EC was used to assess the words that children could produce at the 36-month age point. The areas of attention, play, gesture, vocal development, social communication, vocabulary, concepts, language structure, integrative language skills, and phonological awareness were all targeted. This measure is valid for use with different racial groups, and the standardization sample was diverse and included 39.1% ethnic minority children. Further, all items were reviewed by statistical procedures and experts for ethnic, gender, and socioeconomic bias. The PLS-4 correlates with other measures of language development and has internal consistency (Cronbach’s alpha) reliability coefficients ranging from .66 to .96 and test-retest reliabilities ranging from .82 to .95 for the subscale scores. Cronbach’s alpha for the PLS-4-EC in the present study was .90. The raw scores rather than the age-based standard scores were used in all analyses because there was so little variability in the children’s age at the time of the language assessment. As mentioned previously, verbal IQ, assessed through the Vocabulary subtest of the Wechsler Intelligence Scale for Children-Revised is negatively related to age of earliest memory (Davidow & Bruhn, 1990). Given the construct overlap between measures of verbal IQ and the PLS-4, and the predictive power of language on later IQ (e.g., Silva, McGee, & Williams,
only the PLS-4 was included to minimize the risk of multicollinearity. Further, the PLS-4 is a broader measure of early language skill than vocabulary and thus should capture important differences presumably related to the degree to which children were able to participate in maternal reminiscing conversations.

**Parent-child reminiscing task.** Following the procedures used by Haden (1998) and Reese et al. (1993), this task, as discussed in the procedure section, was used to assess mother-child memory conversations at the 36-month visit.

**Memory fluency task.** Following the procedures used by Peterson et al. (2009), this task, as discussed in the procedure section, was used to assess children’s early autobiographical memory skills during the second grade visit.

**Coding**

**Parent-child reminiscing task.** The coding scheme was adapted from Haden (1998) and Reese et al. (1993). Each of the mother’s utterances was coded for the frequency of elaborations, elaborative questions, repetitions, confirmations and negations, associative talk and behavioral regulation. Only data for elaborations, elaborative questions, and repetitions are reported here, as they are of the most theoretical and empirical significance (Reese et al., 1993). Elaborations were statements and/or questions (open-ended or yes-no) that introduced a new object or event to the discussion or provided new information about an object or event previously introduced to the conversation or tried to elicit new information from the child. Elaborative questions were the same as elaborations, excluding elaborative statements. Repetitions were statements and/or questions (open-ended or yes-no) that simply repeated the
same information (verbatim or gist) or asked for the same information from the child. The number of elaborations, elaborative questions, and repetitions in each event discussion were averaged across the three events discussed between a dyad in order to create an average number of each of these variables. A reminiscing ratio was calculated by dividing the number of elaborations by the number of repetitions for each mother (e.g., Jack et al., 2009). The other primary variable of interest was elaborative questions, given that previous work has shown that this variable is most influential in children’s memory (Reese et al., 2010). Pairs of coders independently coded 20% of the transcripts and the average agreement was 91% across all participants and all codes and ranged from 86% to 97% for individual participants.

**Memory fluency task.** Memories reported in the fluency task were recorded for likelihood (parent-rated), source (child-rated), emotion (child-rated), specificity (child-rated), and age at the time of the event (parent- and child-rated). The total number of memories each child reported during the fluency task was recorded and the age of earliest memory was calculated, with the focus on specific events only.

**Likelihood.** Memories that the parents rated as unlikely to have occurred (i.e., a 1 or 2 on the likelihood scale) were excluded from all analyses. Therefore, analyses only include memories that according to the parents were likely to have occurred (i.e., a 3, 4, or 5 on the scale). The mid-point on this scale (i.e., a score of 3) corresponded to a parent having no direct knowledge of an event. The events rated as such were not excluded to allow for inclusion of events that parents deemed reasonable to have occurred, but had no direct
knowledge of. We assumed that parents would not have been present for every event in children’s lives.

**Source of memory.** Events were classified as being either memories or known events. Memories included those events that the child reported remembering in his/her own head, as well as those that the child specified having memory for the event, but also reported knowing about it through sources other than direct experience. Known events were those that the child reported knowing about only because someone had told him/her about it or he/she had seen a picture, etc., and were excluded from all analyses.

**Emotion.** Based on the child’s report of the emotion attached to the memory, memories were coded as one of the following four mutually exclusive emotional categories: positive (e.g., happy, excited), negative (e.g., sad, angry), neutral (e.g., okay, normal), or other. The other category consisted of “do not remember” and “none” responses as well as physiological states that did not reflect emotion (e.g., tired, sick). The reported emotions were coded and classified based on their presence in one of the relevant categories in Linguistic Inquiry and Word Count (LIWC) analysis 2007 (Pennebaker, Chung, Ireland, Gonzales, & Booth, 2007). Specifically, each word was compared to its assignment in LIWC to one of the following categories: positive affect, negative affect, or biological processes (i.e., physiological states). In a few rare instances, research assistants were unable to rely on LIWC categorizations, and assignments were based on discussion and agreement. For example, “I felt normal” was not contained within these LIWC categories and assigned to the
neutral category. Two trained research assistants independently coded 20% of the data set for reliability estimates. Cohen’s Kappa was .97. One coder coded the remaining data.

**Specificity.** Consistent with previous work (e.g., Jack et al., 2009; Reese et al., 2010; Wang, 2004) a memory was classified as a single event if the child indicated that it had occurred only one time or as a repeated event if the child indicated that the event had occurred multiple times and did not report specific details from a single instance. Based on the specificity of the memories, the total number of single events was calculated. Repeated events were excluded from analyses.

Within the memory fluency task, children were encouraged to present only a brief overview, in essence a title, of each memory they reported. Following the fluency task, when additional information was gathered about each memory, children frequently reported more detailed information about the event when assessing whether it was a single or repeated event and when the event occurred. For example, a child may have reported “going to the beach with my parents” during the memory fluency task. However, when asked whether this event occurred once or multiple times, the child may have reported specific details about a particular beach trip and thus rated it as a single event (e.g., “I was talking about the one time we went to the beach after a storm and I saw lots of jellyfish on the sand.”). However, in all cases, the parents were only presented with the titles of the children’s memories (e.g., “going to the beach with my parents”) and brief notes, rather than the more detailed accounts of the recalled events provided after the fluency task. This was due to the fact that a second interviewer completed the parent rating scales while the first interviewer continued the
session with the child, and the second interviewer relied solely on the first interviewer’s notes, rather than an audio recording. Thus, parents, while making independent assessments of whether an event occurred once or multiple times, were not privy to the additional details that children provided when making similar assessments. Thus, the parents’ reports were not used for determining specificity. Continuing on the example above, a parent may have reflected on the fact that their family took a yearly beach trip, and unable to hear the additional details from the child, rated it is a repeated event.

Age at each memory. Following procedures developed by Peterson et al. (2009), the child’s age in months at the time that the event described in each memory transpired was calculated by taking the midpoint of the range of months specified when the exact month could not be readily identified. For example, if a reported event was identified as occurring when the child was between 24 and 30 months, the midpoint (27 months) was selected as the age for that memory. Similarly, if a reported experience was labeled as occurring when the child was two years of age, with no other information provided to narrow the age range, the midpoint of the entire year (30 months) was recorded. Because parents’ memory dating is considered more accurate than children’s (e.g., Tustin & Hayne, 2010; Wang et al., 2010), parents’ age estimates were collected for use in the analyses. The age given by the parent was analyzed when the parent and child agreed on the specificity of the memory (single vs. repeated). However, given the disagreement on the specificity of many memories, presumably because in many cases the parents did not have access to the full range of information provided by children, age estimates based on the child’s reports were used when
the child and parent disagreed on the specificity of the memory or when the parent data were missing. Memories that were reported to have occurred before the age of 18 months were considered implausible and excluded from all analyses (Bauer, 2004, 2008). Also, memories for events that were labeled as having occurred after the child was age 6 were excluded in an effort to capture only those memories encompassed within the range of the traditional childhood amnesia period from age 2 to 5 years (e.g., Peterson et al., 2009). The age of each child’s earliest memory is considered in analyses and termed “age of earliest memory” (Peterson et al., 2009).

RESULTS

Overview of Section

This section begins with a descriptive analysis of the memories that met criteria for inclusion. The impact of attrition was then examined by comparing the children and mothers retained in the sample to those lost to follow-up. Preliminary analyses were conducted to examine the distributions of study variables and potential age effects on memory. Correlation analyses follow to examine the relationships among study variables. Power analyses are reported prior to multiple regression analyses, and multiple regression analyses were conducted to examine the predictive value of children’s expressive language ability, maternal reminiscing style, and their interaction on both the age of earliest single memory and the number of single memories reported in the memory fluency task. The contribution of maternal reminiscing style was captured by the ratio of elaborations to repetitions as well as the total elaborative questions.
Inclusion of Valid Memories

The 54 participants reported a total of 243 memories in the fluency task ($M = 4.50/$child, range 0-12). Of these, 200 were identified as having a source of memory and the remaining 43 were excluded due to a source indicated solely as knowledge only. An additional 41 memories were excluded because they were reported to have occurred prior to 18 months ($n = 11$) or after 72 months ($n = 30$). Fourteen of these age estimates ($8$ single, $6$ repeated) were based on the children’s reports due to missing parental age data. Eleven memories were excluded because they were rated by the parents as unlikely to have occurred (i.e., likelihood rating of 1 or 2). Following the application of these criteria for inclusion, a total of 148 valid memories were available for analysis. Of these, $93$ were rated by the child as memories for single events and $55$ as reports of repeated events. In order to be consistent with the literature, analyses focused only on the $93$ memories of single events ($M = 1.72/$child, range = 0-6). It is interesting to note that $15$ children reported zero valid single memories in the memory fluency task. Analyses comparing these children to the children who reported one or more valid memories revealed no significant differences between the groups on language, age in months, maternal education, or the maternal reminiscing variables. However, there was a trend for children who reported one or more memories to have mothers who used a greater ratio of elaborations to repetitions ($M = 6.20$, $SD = 4.82$) than children who reported zero memories ($M = 3.68$, $SD = 2.58$), $t(52) = 1.89$, $p = .064$. 
Descriptive Analyses

Across all 148 valid memories, parents and children agreed on the specificity of the memory 109 times and disagreed 39 times. Across all memories, parents on average rated memories as occurring 1.39 months later than children (SD = 13.14). For only those memories classified as single events by the child (n = 93), parents’ age estimates averaged 1.19 months later than children’s (SD = 13.30), and for memories that children labeled as repeated events (n = 55), parents’ estimates were 1.71 months later (SD = 12.99). Across all memories, the children’s and parents’ estimates were significantly related, \( r = .56, p < .001 \). Note that analyses using only the parent estimates as well as using only the child estimates produced similar results.

Table 1 summarizes the parents’ ratings of how sure they were that each event occurred, that the source of the child’s report was memory, and the frequency with which the child was exposed to reminders of the event. Data are presented only for the single memories that met final criteria for inclusion in analyses (n = 93), which accounts for the fact that no memories were rated as having a likelihood of 1 or 2. These events were coded for emotion based on the child’s responses into one of four mutually exclusive categories: positive (n = 46), negative (n = 36), neutral (n = 4), or other (n = 7).

Impact of Attrition

Potential differences between the mothers and children in wave 2 of the longitudinal data collection at 36 months who participated in the memory fluency task in second grade (n = 54) and those who did not (n = 30) were examined with t-tests. Mothers whose children
participated in the memory fluency task had significantly higher levels of education ($M = 14.68$, $SD = 2.25$) than did mothers whose children did not participate ($M = 13.23$, $SD = 2.07$), $t (82) = -2.92$, $p = .005$. However, the mothers were comparable across all the 36-month maternal reminiscing variables (all $p$-values $> .216$). In addition, there were no differences in the PLS-EC scores of the children who did versus did not participate in the follow-up session, $t (82) = -1.35$, $p = .181$. A Goodness-of-Fit Chi-Square test revealed that attrition was associated with race, $\chi^2(1) = 7.12$, $p = .008$, such that European American dyads were more likely to be lost to follow-up than African American dyads.

**Preliminary Analyses**

Although efforts were made to interview children as close to their eighth birthday as possible during the second grade follow-up, the children ranged from 89.5 to 104.1 months old ($M = 95.98$, $SD = 3.79$) at the visit. Thus, preliminary analyses were conducted to examine the relationship between children’s months of age at the time of the memory fluency task and the age of earliest memory and number of memories reported. As anticipated, there was no relation between children’s age and their memory in the fluency task and age was not further considered.

The mean and standard deviations of study variables are presented in Table 2. Distributions of variables were examined for normality and outliers. All of the maternal reminiscing variables except for the number of elaborative questions were positively skewed, so log transformations of these variables were used in analyses. Note that the data presented
in Table 2 reflect the raw data. Examination of the z-score distributions of each maternal reminiscing variable revealed no outliers (i.e., values greater than 3.29).

**Correlational Analyses**

Table 3 displays the correlations between all study variables. To examine differences related to gender and/or race, $t$-tests were conducted. Gender was not significantly related to any of the study variables (all $p$-values $> .169$), and thus not included in any of the statistical models. European American children ($M = 45.06, SD = 5.16$) had higher PLS-EC scores than did African American children ($M = 41.11, SD = 5.79$), $t (52) = 2.37, p = .022$. Additionally, European American children had mothers who used a greater ratio of elaborations to repetitions ($M = 7.04, SD = 5.19$) than did African American children ($M = 4.85, SD = 3.99$), $t (52) = 2.01, p = .050$. This effect remained significant when controlling for the effect of maternal education. Children’s race was not significantly related to any of the other variables (all $p$-values $> .192$).

Maternal education was positively related to children’s language, number of elaborations and elaborative questions, and the maternal reminiscing ratio score (all $p$-values $< .002$), but not related to the child’s age of earliest memory ($p = .326$), or to the number of memories reported ($p = .194$). The maternal reminiscing variables were all significantly inter-correlated (all $p$-values $< .001$). The number of elaborations was marginally positively related to the number of single memories reported ($p = .053$) but not the age of earliest memory ($p = .981$). The number of elaborative questions was positively and significantly related to the number of single memories reported ($p = .041$) but not the age of earliest
memory ($p = .731$). The predicted relationships between the ratio of elaborations to repetitions and both the age of earliest memory ($p = .652$) and number of early memories ($p = .182$) were not present. Further, the anticipated relationships between children’s expressive language and the age of earliest memory ($p = .808$) and the number of early memories ($p = .188$) were not found. The age of earliest memory and the number of memories reported were significantly negatively related to each other ($p = .005$), such that children who reported more memories tended to have an earlier first memory compared to children who reported fewer memories.

**Power**

The primary analyses focused on predicting children’s autobiographical single memory reports from children’s language and maternal reminiscing styles. Thus, $G^*$Power and the linear multiple regression: fixed model, $R^2$ deviation from zero procedure, was used to estimate power for an omnibus $F$ test examining whether the identified predictors explained significant variation in memory outcomes. Analyses were first conducted to determine the appropriate sample size needed for a model to detect a moderate effect size ($f = .25$) with $\alpha = .05$ and 5 predictors (maternal education, race, maternal reminiscing style, child’s language ability, and the interaction between maternal reminiscing style and child’s language ability). Results indicated a needed sample size of 138. To detect a large effect size ($f = .40$), 63 participants would be needed. Given that the sample size was smaller than either estimation, the power analyses were performed again with the inclusion of only the three most important predictors for the research hypotheses (maternal reminiscing style,
child’s language ability, and their interaction). Results indicated a sample size of 119 needed to detect a moderate effect size and 54 to detect a large effect size. Therefore, further analyses should be considered in light of the fact that the sample size ($N = 54$) allowed only for the detection of a large effect size using three predictors.

**Predicting Children’s Autobiographical Single Memory Reports: Total Number of Memories and Age of Earliest Memory**

The primary analyses focused on the extent to which children’s language ability, maternal reminiscing style (ratio of elaborations to repetitions and the total number of elaborative questions), and their interaction contributed to explaining variance in the total number of single memories reported and the age of earliest memory recalled during the fluency task. Maternal education was not significantly related to either of the memory outcome variables, but its effect was examined given that the magnitude of the correlation exceeded .10 in both cases. Race was also examined to control for any racial effects on language or maternal reminiscing style. Since the two reminiscing variables were strongly inter-correlated, only one reminiscing variable could be entered into a single regression analysis to avoid multicollinearity.

Hierarchical multiple regression was used to examine the effects of child’s expressive language at 36 months (Step 1), the mother’s ratio of elaborations to repetitions at 36 months (Step 2), and their interaction (Step 3) on the number of single memories recalled during the fluency task. Predictor variables were centered in order to decrease potential multicollinearity. Each step of the overall model was non-significant, final step: $R^2 = .11$, .
$F(3, 50) = 1.98, \ p = .129$ and no predictor variables contributed significantly to variance in the number of single memories reported. However, the contribution of the interaction term neared significance, $\beta = .26, \ t = 1.82, \ p = .074$. Inclusion of maternal education and children’s race as Step 1 did not change the pattern of results.

A similar hierarchical regression was used to examine the effects of children’s language (Step 1), the mother’s ratio of elaborations to repetitions (Step 2), and their interaction (Step 3) on the age of the earliest single memory reported in the fluency task. Each step of the overall model was non-significant, final step: $R^2 = .01, \ F(3, 35) = .09, \ p = .966$, and no predictor variables contributed significantly to variance in the age of earliest single memory reported. Inclusion of maternal education and children’s race as Step 1 did not change the pattern of results.

Next, hierarchical multiple regression was used to examine the effects of child’s expressive language ability at 36 months (Step 1), the mother’s total elaborative questions at 36 months (Step 2), and their interaction (Step 3) on the number of single memories recalled during the fluency task. Each step of the overall model was non-significant, final step: $R^2 = .08, \ F(3, 50) = 1.42, \ p = .248$, and no predictor variables contributed significantly to variance in the number of single memories reported. Inclusion of maternal education and children’s race as Step 1 did not change the pattern of results.

A similar hierarchical regression was used to examine the effects of children’s language (Step 1), the mother’s elaborative questions (Step 2), and their interaction (Step 3) on the age of the earliest single memory reported in the fluency task. Each step of the overall
model was non-significant, final step: $R^2 = .03$, $F(3, 35) = .37$, $p = .762$, and no predictor variables contributed significantly to variance in the age of earliest single memory reported. Inclusion of maternal education and children’s race as Step 1 did not change the pattern of results.

Mediation Analyses

The hypothesized relationship between maternal education and children’s memory was not found. Thus, it was inappropriate to conduct mediation analyses to determine whether that relationship was mediated by (a) children’s expressive language or (b) maternal reminiscing ratio at 36 months.

Other Analyses

Additional analyses (not reported) examined the average age of all single memories reported as a memory outcome variable. Additionally, logistic regression was used to examine whether a model including children’s language, the maternal reminiscing variables (separately for the ratio of elaborations to repetitions and total elaborative questions) and their interaction were able to predict whether or not children reported one or more single memories and separately to predict whether or not children reported two or more single memories. All results were non-significant.

DISCUSSION

The primary purposes of the present study were to investigate the extent to which children’s expressive language ability and the reminiscing style of their mothers at 36 months of age contributed to the age of their earliest autobiographical memory and the number of
memories reported in second grade. A secondary aim was to investigate how SES influenced the aforementioned relationships. Although racial differences were difficult to examine due to the uneven distribution of race in the sample, the results of exploratory analyses are described. Results demonstrated that neither children’s expressive language nor maternal education was related to children’s autobiographical memory. However, maternal reminiscing style, specifically the number of elaborative questions used, was positively related to the number of memories children recalled. Each aim and corresponding hypothesis is discussed in turn.

**Maternal Reminiscing Style**

The first hypothesis was that children with more elaborative mothers at 36 months of age would report an earlier age of first memory and retrieve a greater number of memories in the fluency task during second grade compared to children with less elaborative mothers. Two maternal reminiscing variables were of interest: the number of elaborative questions and the ratio of elaborations to repetitions. Correlational analyses demonstrated that mothers who used a greater number of elaborative questions during reminiscing conversations had children who retrieved more autobiographical memories as compared to children whose mothers used fewer elaborative questions. However, there was support for neither a relationship between the number of elaborative questions and the age of earliest memory, nor for a relationship between the ratio of elaborations to repetitions and either the age of earliest memory or the number of memories retrieved.
The significant relationship between elaborative questions and the number of memories supports the importance of mothers’ elaborative questions during early childhood for developing autobiographical memory skills. The mothers’ use of these questions in the context of reminiscing actively encourages children to participate in the co-construction of a narrative about the past and to put these experiences into their own words, aiding long-term retention in memory (Fivush et al., 2006; Reese & Newcombe, 2007). This result is in line with Reese et al. (2010), who found a significant correlation between elaborative questions and the density of adolescents’ early memories (a factor comprised of the number of memories retrieved, the density, i.e., distance in months between the two earliest memories, and the child’s knowledge of family history). However, the present study was unable to replicate either Jack et al. (2009), who demonstrated a strong relationship between the ratio of elaborations to repetitions used by mothers during early childhood and adolescents’ age of earliest memory, or Reese et al. (2010), who found that elaborative questions were related to the age and insight factor of early memory. It is possible that the nature of the instructions in our task (discussed below) contributed to the failure to support the relationship between maternal reminiscing style and the age of children’s earliest memories.

Contrary to expectations, multiple regression analyses demonstrated that after controlling for children’s language, maternal reminiscing style (ratio of elaborations to repetitions or the number of elaborative questions) was not a significant unique predictor of the child’s age of earliest memory or the number of memories reported. This result stands in contrast to Reese et al. (2010), who analyzed factors created through factor analysis, and
found that mothers’ average elaborative questions across four time points was the strongest unique predictor of the age and insight of adolescents’ memory. However, the number of elaborative questions was not a significant unique predictor of the density factor they computed. Given that the density factor was comprised of three variables, it is difficult to draw clear conclusions as to the unique effect of elaborative questions on the number of memories recalled. Further, the non-significant results in their study should not be seen as definitive as the sample size ($N = 46$) was not ideal for factor analysis and the magnitude and non-significant correlations between the knowledge variable and the density variable and number of memories ($r = -.04$ and $.28$ respectively), as well as the lower factor loading for the knowledge variable, suggests that these three variables may not have comprised a true factor. However, they demonstrated that children’s memory information provided in the context of reminiscing conversations was the strongest unique predictor of the density of children’s autobiographical memory, providing preliminary evidence that child factors may be more important than maternal factors for some aspects of autobiographical memory. The present study did not examine children’s contributions to the reminiscing conversations because of the relatively limited input they made to them at 36 months. It will be important for additional research to consider the ways that children add to reminiscing conversations that are able to best facilitate the encoding and subsequent recall of early events in memory.

The present study had limited power to test the full hypothesized model, and results should be interpreted with caution. Thus, additional work is needed to draw stronger conclusions about the implications of maternal reminiscing variables on the onset of
children’s autobiographical memory. It is possible that in addition to the limited power, one discrepancy between the present study and existing literature influenced the results. Specifically, the focus in the present study was on only one early childhood time point (36 months). When Jack et al. (2009) examined the contributions of maternal reminiscing style at each of four individual early childhood points separately, many of the relationships between maternal reminiscing style and adolescents’ earliest memory diminished. Their findings suggested that the benefit of an elaborative reminiscing style may cumulate rather than increase across the preschool years or be more important at specific “crucial” points in development. Thus, it is possible that the null findings in the present study were due in part to the use of one early childhood time point rather than capturing the full developmental trajectory of maternal reminiscing. An enhanced design would involve following mothers longitudinally over the preschool years and training different groups of mothers to be more elaborative at various points in their child’s development. This approach might provide some insight into how maternal reminiscing style at certain ages influences autobiographical memory development.

**Children’s Expressive Language**

Previous work has shown that children’s ability to narrate the details of an event at the time it occurred, rather than at the time of recall, is related to their long-term verbal memory for that event (Peterson & Rideout, 1998). Additionally, although Jack et al. (2009) found a non-significant correlation between the age of adolescents’ earliest memory and their vocabulary score during early childhood, the magnitude of the correlation ($r = -.39$) in light
of the incredibly small sample size \((N = 17)\) led to the second hypothesis. Specifically, it was hypothesized that children with greater expressive language ability at 36 months would report an earlier age of first memory and retrieve a greater number of memories in second grade than children with lower language ability. Contrary to expectations, this hypothesis was not supported in correlational or multiple regression analyses, suggesting that children’s early expressive language ability did not influence their later autobiographical memory for early childhood events. However, Reese et al. (2010) found that children with greater language ability during early childhood recalled more specific childhood memories as adolescents. It is possible that differences between studies accounted for the discrepancies. Peterson and Rideout (1998) focused on memory for traumatic injury events and interviewed children at multiple time points throughout the study. Reese et al. (2010) examined adolescents’ memory for parent-nominated events discussed repeatedly with their mothers during early childhood. Thus, it is possible that children’s language ability is more important for the maintenance of memories that are frequent topics of discussion within the family, rather than independent autobiographical memories. Jack et al. (2012) found that the frequency that children had discussed an event with their parents predicted verbal recall for a unique event after a six-year delay, while language ability itself during early childhood did not predict verbal recall. This suggested that the act of discussing the event, rather than the language ability, aided retention in memory. In summary, it remains unclear how early language ability influences children’s developing autobiographical memory skills.
The third hypothesis was that children’s expressive language ability at 36 months would moderate the relationship between mother’s reminiscing style and children’s reports of earliest memories, such that children with greater expressive language ability would have a stronger relationship between an elaborative maternal reminiscing style and reports of earlier first memories and a greater number of memories than children with lower expressive language abilities. It was hypothesized that enhanced language ability would influence the extent to which children were able to participate in and contribute to reminiscing conversations, as well as influence the reminiscing style of the mother, both of which would facilitate encoding and later access to early events in memory. The interaction term between children’s language and maternal reminiscing style was not a significant unique predictor in any multiple regression analyses, failing to provide support for this hypothesis. It is potentially worthwhile to note that the interaction between children’s language and the ratio of elaborations to repetitions neared significance in the multiple regression analysis predicting the number of memories recalled; however, the overall model was non-significant. Future work involving a large sample size should investigate this possibility further to understand how children’s language and maternal reminiscing style interact with one another over time.

**SES**

Maternal education was used as a proxy for SES in the present study, and it was hypothesized that children with more highly educated mothers would report an earlier age of first memory and retrieve a greater number of memories than children with less educated
mothers. Further, this effect was expected to be mediated by differences in maternal reminiscing style and children’s expressive language. Results indicated that maternal education was related to the mother’s use of elaborations, elaborative questions, and the ratio of elaborations to repetitions. However, similar to the findings of Reese et al. (2010), maternal education was not related to either the children’s age of earliest memory or the number of memories reported. Mediational analyses were not conducted given that there was no support for a relationship between maternal education and children’s autobiographical memory. It is important to note that while the range of years of maternal education in the present study was large (10-20 years), on average mothers had completed more than two years of education beyond high school. Thus, the final sample as a whole was not under-educated and reflected a largely middle-class sample that was not as diverse as anticipated. Thus, it will be important for future work to include low-SES participants in order to facilitate our understanding of how SES influences maternal reminiscing and the development of children’s autobiographical memory.

Race

Much of the extant work on childhood amnesia and maternal reminiscing has focused on middle-class participants of European descent (e.g., Fivush et al., 2006) and presently little is known about maternal reminiscing in African Americans, although it is thought to serve different purposes in different racial and ethnic groups (Leyva et al., 2008). Thus, a strength of the present study was the inclusion of a large number of African American participants, representing an initial step towards broadening the research. Although the
longitudinal study began with a largely balanced distribution of race, the majority of mother-child dyads in the final sample were African American. Due to this imbalance, an in-depth examination of race was not possible. However, given that we currently know little about the nature of maternal reminiscing in different racial groups, it is important to describe the differences found in the present study. Maternal race was unrelated to years of education, yet African American mothers used a lower ratio of elaborations to repetitions than did European American mothers even when partialling out any effect of maternal education. African American children also had significantly lower expressive language scores than European American children, but did not differ in either of the autobiographical memory variables. In summary, characteristics of the sample prevented a full, direct exploration of race, and it remains an important endeavor to directly investigate the process by which racial background influences maternal reminiscing styles.

Comparison of Results with Existing Work

Given the composition of the present sample, with the majority of mother-child dyads African Americans, it is important to compare the results found with existing work. When examining the sample as a whole, the levels of maternal elaborations, repetitions, and elaborative questions seen here were generally comparable with Haden et al. (2008), who examined maternal reminiscing in a middle-class, largely European American sample, and Reese et al. (2010), who examined a largely European sample in New Zealand. The overall levels of elaborations and repetitions in Jack et al. (2009), who examined a middle-class, New Zealand sample, were much higher (23.99 and 7.52 respectively) than the present study
(12.63 and 3.17), but the ratio of elaborations to repetitions was similar (4.29 vs. 5.50). Because it is hard to draw definitive statements about levels across studies, it is unclear whether this discrepancy reflects meaningful differences between samples, and future work is needed to investigate the differences as they potentially relate to SES and racial background.

Additionally, the memory fluency task is a new measure and limited work has investigated its usage with children. In the present study, when examining the memories that met inclusion criteria, an average of only 1.72 single events was recalled per child and 15 children recalled zero events. It is unclear what accounted for the low frequency of memories, but there are several possibilities. It is possible that age-related improvements in metamemory (i.e., knowledge about, monitoring of, and control of memory functioning) (e.g., Schneider & Lockl, 2002), recollection (recalling qualitative details about an event) (e.g., Ghezzi & Angelini, 2008) and/or general episodic memory retrieval (e.g. Rhodes, Murphy, & Hancock, 2011) precluded the 8-year-old children from retrieving a large number of memories and that developmental changes occurring beyond this age period would facilitate retrieval. Peterson et al. (2009) found that 8-year-old Canadian children recalled fewer specific memories than 11- and 14-year-old children in a fluency task, but this age-related change was not seen in Chinese children. In addition to this culturally mediated age effect, the Canadian and Chinese 8-year-olds reported an average of 3.73 and 2.13 single events respectively, both greater than that seen in the present study. Reese et al. (2010) reported an average of 3.31 single events recalled per child. This pattern of previous results suggests that additional factors beyond the young age of the participants may also be
responsible for the results of the present study. It is possible that fatigue may have adversely affected the children’s recall and engagement in the memory fluency task within the longer, demanding protocol of the DCHDS, precluding an accurate portrayal of children’s autobiographical memory. Additionally, the criteria for the inclusion of memories in analyses were incredibly conservative. In addition to the commonly used criteria of only including single events occurring within a specific timeframe, the child also had to indicate that the source of the report was truly memory, and parents had to rate the event as likely to have occurred. Thus, multiple factors may have led to the low number of memories reported in the present study.

When examining the age of earliest memory reported, the average age of 6- to 9-year-old children’s earliest memory in Peterson et al. (2005) was 36.1 months, and Peterson et al. (2009) reported Canadian and Chinese children’s earliest memory to be 28.2 and 41.4 months, respectively. In studies of adolescents’ earliest memories, Jack et al. (2009) reported an average age of 28 months, and Reese et al. (2010), 31.53 months. The present study revealed an age of earliest memory of 39.67 months, a value later than nearly all of the existing literature with children, but consistent with the average age of 3 ½ seen in Western adults. It is likely that the nature of the fluency task resulted in this discrepancy, as Jack and Hayne (2007) found that the phrasing of instructions had a significant impact on the age of memories reported by adults. Our instructions emphasized eliciting as many memories as possible and did not explicitly ask the children to report their earliest memory. While the number of early autobiographical memories constitutes a more meaningful assessment of
autobiographical memory than does simply the age of one’s earliest memory, it may be worthwhile for future studies to include a separate component of the memory fluency task to tap into the children’s very earliest memory.

**Strengths and Limitations**

A strength of the present study was the longitudinal design, which allowed for a prospective investigation of maternal reminiscing style as an important influence on children’s developing autobiographical memory skills. Additionally, the existing work examining the influence of maternal reminiscing on children’s autobiographical memory has focused exclusively on the age of earliest memory (Jack et al., 2009) or children’s memory for events previously discussed with their mothers (Reese et al., 2010). Accordingly, the present study built on existing work by investigating how maternal reminiscing predicted children’s true, independent autobiographical memory reports in the absence of previous mother-child discussions in the laboratory. Further, the use of a memory fluency task to assess children’s general accessibility to early memories (e.g., Peterson et al., 2009; Wang et al., 2004), in addition to the age of earliest memory, was valuable given the recent evidence that the emergence of autobiographical memory is gradual, not an all-or-none phenomenon (Nelson & Fivush, 2004; Peterson et al., 2009).

In addition to the limitations mentioned throughout, the primary limitation of the present study was the limited power to test the full extent of the proposed model. The results found should only be considered against the backdrop of the limited power and future work with a larger sample is needed before drawing definitive conclusions about the influence of
maternal reminiscing style and children’s early language ability on later autobiographical memory. Another limitation was the small number of memories elicited during the fluency task that met criteria for inclusion in analyses.

**Conclusions and Future Directions**

In addition to the future directions already mentioned, a valuable future endeavor would be to compare the use of different protocols to elicit children’s early autobiographical memories over a number of ages. Specifically, comparison of the memory fluency task (Peterson et al., 2009) with a timeline procedure (Tustin & Hayne, 2010; Jack et al., 2009) and/or a cue-word procedure such as that developed and used with children by Bauer, Burch, Scholin, and Güler (2007) would provide insight into the type of protocol that will help young children search and retrieve early autobiographical memories. It is suggested that these protocols be implemented by themselves or in the context of a limited number of other assessments, to limit the potential impact of fatigue on young children.

In conclusion, the results of the present study, when considered in light of the limited power and conservative memory protocol used, suggest that some aspects of the early reminiscing environment, specifically the elaborative questions posed by mothers, may influence children’s developing autobiographical memory skills. Future work is needed to clarify the complexity by which autobiographical memory emerges and the best methods for tapping into this construct in early childhood.
REFERENCES


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Table 1
Descriptive information from the parent ratings for the single memories included in analyses

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
<th>Frequency Single (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>How Sure Happened*</td>
<td>3</td>
<td>11 (12.0)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>11 (12.0)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>70 (76.1)</td>
</tr>
<tr>
<td>Source is Memory*</td>
<td>1</td>
<td>4 (4.3)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>6 (6.5)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>11 (12.0)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>17 (18.5)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>54 (58.7)</td>
</tr>
<tr>
<td>Reminders Present**</td>
<td>No</td>
<td>48 (52.7)</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>43 (47.3)</td>
</tr>
<tr>
<td>Frequency of Reminders</td>
<td>Rare</td>
<td>19 (44.2)</td>
</tr>
<tr>
<td></td>
<td>Occasional</td>
<td>16 (37.2)</td>
</tr>
<tr>
<td></td>
<td>Frequent</td>
<td>8 (18.6)</td>
</tr>
</tbody>
</table>

Note: Numbers represent the frequency of the single memories that met criteria for inclusion in analyses that corresponded to the parents' ratings, with percentages in parentheses. How sure happened = how sure are you that this event occurred from 3 (no knowledge of event) to 5 (I'm positive it happened). 1s and 2s were excluded from analyses. Source is memory = how sure are you that the source of the child's report is a memory from 1 (I'm positive it is not a memory) to 5 (I'm positive it is a memory). Reminders present = are there reminders of the event present (e.g., pictures), yes or no. Frequency of reminders = if reminders are present, how frequency has your child come into contact with them from 1 (rarely) to 3 (frequently). Memories that were rated by the child to be known events were excluded, as were memories occurring prior to 18 months or after 72 months. *Data for one memory are missing. **Data for two memories are missing.
Table 2
*Ranges, means and standard deviations of the study variables*

<table>
<thead>
<tr>
<th>When measured</th>
<th>Variable</th>
<th>$N$</th>
<th>Range</th>
<th>$M$</th>
<th>$SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td>36 months</td>
<td>Maternal education (years)</td>
<td>54</td>
<td>10 - 20</td>
<td>14.68</td>
<td>2.25</td>
</tr>
<tr>
<td></td>
<td>Maternal elaborations</td>
<td>54</td>
<td>0 - 38</td>
<td>12.63</td>
<td>7.96</td>
</tr>
<tr>
<td></td>
<td>Maternal repetitions</td>
<td>54</td>
<td>0 - 13.50</td>
<td>3.17</td>
<td>2.60</td>
</tr>
<tr>
<td></td>
<td>Maternal elaborative questions</td>
<td>54</td>
<td>0 - 27.00</td>
<td>10.31</td>
<td>5.99</td>
</tr>
<tr>
<td></td>
<td>Maternal ratio score</td>
<td>54</td>
<td>0 - 21.50</td>
<td>5.5</td>
<td>4.44</td>
</tr>
<tr>
<td></td>
<td>PLS-EC</td>
<td>54</td>
<td>28 - 56</td>
<td>42.28</td>
<td>5.85</td>
</tr>
<tr>
<td>Grade 2</td>
<td>Total number of single memories</td>
<td>54</td>
<td>0 - 6.0</td>
<td>1.72</td>
<td>1.65</td>
</tr>
<tr>
<td></td>
<td>Age of earliest single memory (months)</td>
<td>39*</td>
<td>18.0 - 57.0</td>
<td>39.67</td>
<td>11.49</td>
</tr>
</tbody>
</table>

Note: Maternal education is the number of years that mothers reported attending school. Maternal elaborations is the sum of elaborative questions and statements. Maternal repetitions is the sum of repetitive questions and statements. Maternal elaborative questions is the sum of open-ended and yes-no elaborative questions. Maternal ratio score is the ratio of elaborations to repetitions. PLS-EC is the Expressive Communicative Scale of the Preschool Language Scale-4 (raw scores). The total number of single memories reflects only those memories that met criteria for inclusion. The age of earliest memory was calculated using the parent's reports when the child and parent agreed on the structure of the memory (single vs. repeated) and using the child's reports when the child and parent disagreed on the structure. *The sample size for the age of earliest memory is smaller due to 15 children reporting 0 valid single memories.
<table>
<thead>
<tr>
<th>When measured</th>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>36 months</td>
<td>1. Gender</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>2. Race</td>
<td>.16</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. PLS-EC</td>
<td>.16</td>
<td>-.31*</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Maternal education</td>
<td>.13</td>
<td>-.02</td>
<td>.46**</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Maternal elaborations</td>
<td>.09</td>
<td>-.18</td>
<td>.63**</td>
<td>.59**</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7. Elaborative questions</td>
<td>.19</td>
<td>-.16</td>
<td>.61**</td>
<td>.55**</td>
<td>.91**</td>
<td>.48**</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 2</td>
<td>8. Maternal ratio score</td>
<td>.15</td>
<td>-.27*</td>
<td>.43**</td>
<td>.42**</td>
<td>.48**</td>
<td>-.54**</td>
<td>.40**</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9. Total number of single memories</td>
<td>-.17</td>
<td>-.11</td>
<td>.18</td>
<td>.19</td>
<td>.26+</td>
<td>.07</td>
<td>.28*</td>
<td>.18</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10. Age of earliest single memory (months)</td>
<td>.07</td>
<td>.11</td>
<td>-.04</td>
<td>.16</td>
<td>-.01</td>
<td>.07</td>
<td>-.06</td>
<td>-.08</td>
<td>-.44**</td>
<td>---</td>
</tr>
</tbody>
</table>

Note: Gender coded as 0 = male and 1 = female. Race coded as 0 = Caucasian and 1 = African American. Log transformed variables were used where appropriate. +p ≤ .053. *p ≤ .05. **p < .01.
APPENDICES
Appendix A
Conceptual Model and Hypotheses

Figure 1. Visual depiction of the predicted relationships among variables in the present study.

Hypotheses:
1. Children with more elaborative mothers (i.e., those whose reminiscing conversations were characterized by a greater ratio of elaborations to repetitions and/or a greater number of elaborative questions) at 36 months of age would report an earlier age of first memory and retrieve a greater number of memories in the fluency task during second grade compared to children with less elaborative mothers.
2. Children with greater expressive language ability at 36 months would report an earlier age of first memory and retrieve a greater number of memories during the fluency task than children with lower expressive language ability.
3. Children’s expressive language ability at 36 months would moderate the relationship between mother’s reminiscing style and children’s reports of earliest memories (i.e., children with greater expressive language ability at 36 months would have a stronger relationship between an elaborative maternal reminiscing style and reports of earlier first memories and a greater number of memories reported in the fluency task than children with lower expressive language abilities).
4. Children with mothers with higher education would report an earlier age of first memory and retrieve more memories than children with mothers with lower education, although this effect may potentially be mediated by differences in children’s expressive language ability (5) and/or maternal reminiscing ratio (6).

Note: Relationships previously established in the literature are not represented by hypotheses and a corresponding number.
Appendix B
Interview Protocol: Mother-Child Reminiscing Task

1. Event Selection

a) Overview:

- During Event Selection, the research assistant will talk with the mother out of ear shot of the child.

- The goal of the Event Selection procedure is for the research assistant to help the mother to choose three past events that she will discuss with her child. Each of the events must meet ALL of the following criteria:

1. **Novel events.** The events that the mother and child will discuss will be one-time or infrequent events. Thus, the events will be non-routine, novel events in the children’s lives (e.g., flying on an airplane, going to the zoo, or visiting a special museum – when any of these events have only been experienced once by the child). Events to be excluded from discussion include routine events (i.e., those for which the child is likely to have a script or generic representation, such as grocery shopping, going to church, visiting relatives one sees regularly, etc.), events that extended over one day, or that already have a story line (e.g., going to movie or play).

2. **Mother-child shared experiences.** The events that each mother and child will be asked to discuss will be events that the mother and child experienced together. Other people may have also participated in the events (e.g., a sibling, the father) but BOTH the mother and child must been present for the entire event for it to qualify for discussion.

3. **Events that have occurred within the past month or so.** The events should be relatively recent occurrences. An event from “yesterday” qualifies, but it is important to encourage the mother to think of events other than those immediately preceding the visit.

b) Instructions to Mother -- Event Selection

- Allow the mother a few moments to think of the events, and repeat the instructions as necessary.

“As you know, we are interested in what young children remember. This particular task focuses on children’s memory for events that have been experienced in the past. We
would like for you to choose three past events that you will discuss with your child. In selecting events, we would like for you to identify events that were special or out-of-the ordinary activities for your child. So rather than focusing on routine or daily events, we would like you to think of events that were unique or novel for your child. In addition, we ask that you pick events that you and your child experienced together, and that have occurred within the past month or so.”

What events come to mind?”

- Some mothers find it helpful to consult a calendar when trying to come up with previous family events.
- Other mothers might ask for examples. If so, say:

“Examples include visiting a museum; attending a fair; participating in a family reunion or other special family event such as a wedding, baptism, christening; taking the car to get washed, making a trip on a train or plane; taking part in holiday celebrations [prompt for unique events appropriate to the season, including going to an Easter egg hunt, visiting Santa, watching fireworks]. In any case, the event should be unique, something your child has experienced only once, and something that you have done together.” Note: It’s OK if the child has experienced events in the category so long as the parent can identify a specific episode. For example, the child may have hunted for Easter eggs at age 2 at Grandmom’s house, but the parent identifies a recent Easter egg hunt at church that occurred three weeks ago.

c) Event Information Sheet

- As the mother nominates events, jot these down in the spaces provided on the Event Information Sheet. Write down all events suggested, and then go back and discuss each to find ones that best meet the criteria for our target events.

- Once the three events that best meet the criteria have been identified, list for these three events the following information on the Event Information Sheet:

1. “When did this event occur?” (Record an approximate month, day, year)

2. “How many times has your child talked about this event since it occurred?” (Record an approximate number)

3. “When did your child most recently talk about this event?” (Record an approximate month, day, year)
d) Listing Events in Order of Discussion

- At the end of the Event Selection Procedure, write down the three events to be discussed on an index card.

- The mother will be given this card just prior to the mother-child memory conversation to remind her of the events to be discussed (in the listed order).

2. Mother-Child Memory Conversation

- The researcher will help the mother and child select a comfortable place for their memory conversation (there should be no toys, books, or other distractions in the area).

- The research assistant will give the following instructions (note: Begin audio and video recording the reminiscing task at the start of these instructions.): 

  “We would like for you to talk with your child about these three past events in whatever way feels comfortable, for as long as you wish. We don’t expect children of this age to be providing a lot of verbal recall, but these observations will allow us to at a minimum to look at how interested they seem in this type of conversation.”

  - If the mother asks how long they should talk for, say: “As long as you want, just make sure you talk about each of the events.”

  - If the mother asks any questions about how they are doing, whether they talked enough, etc. respond with general assurances (e.g., repeating part of the instructions, “Whatever feels comfortable is fine.”)

  - The session ends when the mother indicates the conversation has been completed.
Appendix C
Interview Protocol: Memory Fluency Task

MEMORY FLUENCY TASK (Based on Peterson, Wang & Huo, 2009):

I want you to think back, way back, from before you went to kindergarten, like when you were 2 years old, 3 years old, or 4 years. I want to know as many memories as you can tell me from when you a little (girl/boy). I want to know things you remember happening, not things that you know because someone told you about them or because you saw pictures of them. As many different things as you can think of that you remember. It can be anything at all. So, how about you start telling me all the different things that you remember? You only need to say a sentence or so about each thing you remember. Let's start now. [Interviewer starts stopwatch as soon as child starts speaking. Stopwatch is set to count backwards for 4 minutes.]

[If a clearly repeated memory is reported during the four-minute fluency task, ask for "one time that happened." If a particular episode isn't forthcoming, that's fine, just move to the next memory after marking down the repeated event on the record form.]

Prompts [as needed]:

OK, good working./Good job./ What else do you remember? Tell me about something else/what else (do you remember)?
[If child provides extensive detail] Okay, one thing you remember is x, what is a different thing you can remember? Just talk a little bit about each thing you remember, just a sentence or so and/or Thank you, that sounds great, now let's talk about another thing you remember. Remember, we only need a brief synopsis of each memory.

Reminders as Needed:

Remember, I want to hear about things that happened when you were little, before you went to kindergarten.

MEMORY CHARACTERISTICS (after 4 minute limit): Repeat a, b, c and d for each memory.

a. You just told me about some things that happened to you before you went to kindergarten. I want to know some more about those things. First, you told me that (x) happened. Is that something you know because you remember it, or is that something that you know because someone told you about it? [Note: if the child reports the source as only "my mom told me"
(or another second-hand source like I saw it on a video), even after asking if they themselves can remember anything about it, there is no need to ask b, c, or d, just move on to the next memory. But, if in doubt, proceed with the questions and make a note.]

b. Did that happen just one time, or did that happen lots of time? [If the child reports that it was a repeated event, mark repeated and move on to c and d. Do not try to generate a single episode of a repeated event here.]

c. Now, I want to know how old you were, like, 2 years old, 3 years old, 4 years, or even 5 years old when (x) happened. [If memory was described as a repeated episode, make sure response provides an age range for the event. Probe as needed to get a range.]

Prompts to help determine age:

[Refer to data provided by parent] Was it summer or winter? Near a special occasion like Christmas, birthday, Easter, Halloween? Was the location a house from which the family has subsequently moved? Is there a younger sibling in the memory? If so, how much younger is the sibling than the child? Who was your pre-school teacher when x happened? (Etc.) [It should be possible to narrow down to a range of months that is less than a full year.]

d. Now, I want to know how (x) made you feel when it happened? [Long pause for child’s response.] Repeat prompt if needed: “How did you feel when that happened?” ONLY AS NECESSARY prompt with: “FOR EXAMPLE, were you happy, or sad or not happy or sad, or did you just feel something else?”

OK, that’s all we need to talk about. Thank you for telling me about your memories. I’m really glad you helped me out! I’m going to ask your mom [other adults] a few questions now. . . .
Appendix D
Cues Suggested by Parent for Dating Memories

We’ll be asking your child to report early childhood memories and to help us figure out his or her age when the event occurred. We appreciate your help in coming up with some cues that will help us date the events. The child’s responses will also help you verify his or her age at the time.

Child’s Birthdate: ________________________________________________________

Names and Birthdates of Child’s Siblings: __________________________________
____________________________________________________________________________
____________________________________________________________________________

Family’s Moves and Child’s Age at Move: __________________________________
____________________________________________________________________________
____________________________________________________________________________

Other Family Transitions (E. g., Divorce, Grandparent Moved In, Etc.)
____________________________________________________________________________
____________________________________________________________________________

Pets (Name, Species, Child’s Age When Pet Joined Family, Child’s Age at Loss of Pet:
____________________________________________________________________________
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Child’s Preschool History

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Anything else that would help us date your child’s memories? We appreciate your suggestions!

______________________________________________________________________________

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## Appendix E
Data Collection Form: Children Record Form

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*Sheet for research assistant to write down information about each memory provided.*
Appendix F
Data Collection Form: Parent Record Form

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Appendix G
Parent Rating Scales

“How sure are you that this event occurred?”
1 = I’m Positive It Did NOT Happen;
2 = I’m Pretty Sure It Did NOT Happen;
3 = No Direct Knowledge of Event;
4 = I’m Pretty Sure It Did Happen;
5 = I’m Positive It Happened.

“How sure are you that the source of the child’s report is a memory, rather than a picture or a conversation (etc.)?”
1 = I’m Positive It is NOT a Memory;
2 = I’m Pretty Sure It Is NOT A Memory;
3 = I’m Not Sure;
4 = I’m Pretty Sure It IS a memory;
5 = I’m Positive It IS A Memory.

“If reminders are present, how frequently has your child come into contact with them?”
1 = Rare or very limited exposure;
2 = Occasional and brief exposure;
3 = Frequent or regular exposure.

“How confident are you about the age you reported?”
1 = Just guessing;
2 = Doubtful;
3 = Neither sure nor unsure;
4 = Pretty sure;
5 = Positive.