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Laura K. Morris 4/12/11

The Influence of Autobiographical Memory Development on Strategic Remembering Performance

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Abstract

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Autobiographical memory and strategic remembering are two memory skills that develop during childhood. These skills vary in their functions, trajectories, and determinants. The current study investigated the developmental changes in both autobiographical memory and strategic remembering among 37 4-year-old children over a 4-year period. Children's memory skills were assessed 4 times 1 year apart. The research showed that children significantly increase in their autobiographical memory performance. For strategic remembering, though there is some increase in strategy use, the children still struggle with deliberate remembering skills at such a young age. We also demonstrated that autobiographical memory and strategic remembering were related to each other such that the performance on autobiographical memory tasks at earlier ages is predictive of strategic remembering results at later phases. This suggests that the capacity to organize and recall information early on drives the extent to which strategies are available to children during encoding and retrieval on deliberate memory tasks as they age. These findings provide interesting insight into the developmental course of these 2 individual areas of research, as well as evidence of their relationship and organization of memories.

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The Influence of Autobiographical Memory Development on Strategic Remembering Performance

Childhood is a time of new learning experiences, some of which are spontaneous and others which are well-planned. Autobiographical memory and strategic remembering are constantly evolving throughout early childhood. Both of these memory forms in particular undergo rapid development during the same time frame of ages 4 to 7. However, although there is a large literature that covers each of these memory forms independently, there is no research on the relationship between the two. The present research examined the connection between autobiographical memory and strategic remembering. We proposed that autobiographical memory performance acts as a force to drive strategic remembering skills. It may be that individual differences in deliberate remembering are strengthened by children's abilities to recall and categorize information when providing personal narratives. In other words, the idea is that better developed and organized autobiographical memories may help explain why some children are better at deliberately organizing memories and utilizing memory strategies. This information can help us explore whether children with a stronger ability to accurately encode memories also have a higher capacity to instruct themselves to use certain strategies. This longitudinal study analyzed a group of 4-year-old children once a year across 4 years. Looking at the relationship between children's performance on autobiographical memory and strategic remembering assessments provided us with insight into a relationship between the two domains.

Autobiographical Memory

Nelson and Fivush (2004) define autobiographical memory as a type of memory referring to "an explicit memory of an event that occurred in a specific time and place in one's personal past." These memories represent events that the person herself experienced, as opposed to ones

she simply heard about or was told to focus on (Harley & Reese, 1999). Autobiographical memory can be categorized as a subtype of episodic memory, as opposed to semantic memory. While semantic memory refers to our general knowledge of categories or facts, episodic memory refers to memories that encode where and when an event occurred, as well as an awareness of one's own presence and specific details of the event (Nelson, 1993; Tulving, 1983). It therefore incorporates aspects of time, place, and people included in the specific event.

Autobiographical memory is also a declarative and explicit memory form (Bauer, 2007). This means that one possesses a conscious awareness of its existence. That is, when one recalls a specific event, she can often remember the details of when and where it happened, and understands its significance and her role in the event. Alternatively, non-declarative memory refers to our unconscious knowledge base, such as skills or procedures. Bauer (2007) also indicates that declarative memory is more subject to error or forgetfulness. It could be that the significance of the memory, such as whether it had an emotional aspect to it versus if it is a common occurrence, influences the impact it makes upon us and therefore our ability to recall it at a later point in time.

Bauer (2007) explains that autobiographical memories also tend to have personal significance, such that they are unique to the individual, rather than simply a daily or frequent event that many people experience. "Autobiographical or personal memories are the memories of events and experiences that make up one's life story or personal past" (p. 4). They are important to study because they define who we are, based on how past events have shaped us today, and how we act, in that we use our past experiences to influence our actions in the future. To reiterate, autobiographical memory shapes our unique sense of self. It is associated with an awareness of experiencing an event, and may be recalled later in narrative form accompanied by

details of where or when, for instance, an event occurred, along with a subjective reflection of these experiences.

Developmental Course. Autobiographical memories emerge during the preschool years, but continue to develop well into the school years and beyond. These memories can be thought of as the "outcome of a social, cultural, cognitive *system*" (Nelson & Fivush, 2004, p. 487), in that there are a number of different factors that play a role in the development of autobiographical memories. The social-cultural model of autobiographical memories indicates a number of developing influences that contribute to the creation of autobiographical memories (see Nelson & Fivush, 2004 for model). For instance, the core self and basic memories begin to form at age 1, advance to more complex language and episodic memory by age 3, and grow into narrative structure and content and self-representation by ages 4-5. This model outlines how complex the development of autobiographical memory is, and all the different factors that influence its development. However, it depicts that although children experience a lot of memory development very early on, autobiographical memory itself does not begin to emerge until ages 4-5. Furthermore, it emphasizes the constant changes within this memory form that build upon one another and contribute to a child's autobiographical memory emergence. However, it is important to note that there is no indication in this particular model of the role or time of development of strategic remembering.

Consistent with the suggestion that autobiographical memory is apparent by 4-years of age, 4-year-old children are capable of giving independent reports of their experiences and can actually recall events for a relatively long period of time after they first occurred (Harley & Reese, 1999; Van Abbema & Bauer, 2005). Howe and Courage (1997) suggested that this improvement in memory may develop simultaneously with a stronger capacity for organizing

events, such that as children grow older, they are more likely to remember a greater number of events in better detail. The extent of autobiographical memories can be measured with the use of narratives as obtained through experimenter-child interviews (Fivush, Haden, & Adam, 1995). Nelson (1993) suggested that as children get older and acquire a stronger memory capacity, their narratives should become more descriptive and children should be capable of providing more comprehensive narratives. Providing children with cues can also further aid in their memory retrieval (Pillemer, Picariello, & Pruett, 1994).

Previous literature has examined why people remember certain autobiographical memories very clearly, yet have no recollection of others. Factors such as cognitive capacity or one's sense of self most likely all play a role in the encoding and retrieval of memories (Morris, Baker-Ward, & Bauer, 2009). The effects of these factors vary depending on age, quality of social interaction, the developing sense of self, language development, and the narrative structure and context of the event. Other factors operate at the level of the individual experience. It has also been widely suggested that memories with emotional significance are more likely to be long-lasting.

Fivush and Reese (1992) focused on the role of social interactions during both encoding and retrieval periods. The way in which a child discusses the event and her interpersonal interactions may impact the extent of the memory. Furthermore, Pillemer et al. (1994) discussed the concept of breaking up the narrative period into free-recall, cued-recall, and direct questions about the event. This way, children have multiple opportunities to express the extent of their knowledge about the event, and researchers can observe the circumstances under which children's memory may be activated the most. Again however, there has been no research examining the role of strategic remembering in relation to autobiographical memory.

Childhood Amnesia. The childhood amnesia period refers to a time in adult's lives when they recall few of the events they experienced. There are two main time frames associated with childhood amnesia: under 3 years of age, a time from which adults recall few if any memories, and the time between 3 to 7 years old, from which they recall a smaller number of memories than expected based on forgetting alone (Pillemer & White, 1989). Though some researchers suggest that perhaps this is because memories were simply not formed during this period (see Bauer, 2007, for discussion), other researchers suggest that children as young as 2 or 3 actually are in fact capable of producing autobiographical memories (Fivush & Schwarzmueller, 1998; Nelson, 1993; Peterson, 2002). The 4-7 age range therefore provides a fascinating group of children to study. In the present research, we tested children throughout this age period, thus providing us with an interesting framework to track any changes or lapse in memory skills that may have occurred. This allows for another interesting aspect to observe when studying the development of autobiographical memory across early childhood.

Strategic Remembering

There is a large literature on social factors that contribute to the development of autobiographical memory, but there are numerous key cognitive aspects that relate to memory as well. For instance, speed of processing, or how quickly we interpret events, and working memory, referring to our memory of most recently experienced events, have been associated with the strength of autobiographical memory recall (Nelson & Fivush, 2004). This current research focused on strategic remembering, which can be defined as "mental or behavioral activities that achieve cognitive purposes and are effort-consuming, potentially conscious, and controllable" (Gaultney, Bjorklund, & Schneider, 1992, p.250). The key aspect in strategic remembering is that it is a deliberate effort made to remember something; the person is aware of

her motive to remember. Numerous strategies come into play during encoding and retrieval period of strategic remembering, and this memory form develops most rapidly over the elementary school years (Coyle & Bjorklund, 1996; 1997). A commonly used task to assess the strength of children's strategic remembering as well as the influence of different strategies children use is the sort/recall task, which requires or facilitates the use of deliberate memory strategies. In this task, children are typically given cards and a time limit to memorize the cards, and are specifically told to try to remember the cards and that they will be tested on them later on.

Coyle and Bjorklund (1997) suggested that "the consistent use of a specific combination of strategies across trials would result in improvements in memory performance and that this effect would increase with age, as children begin to use consistently a mixture of strategies that yields optimal performance" (p. 373). Strategies in this context refer to conscious efforts or techniques a person may use when she is instructed to remember something specific. The understanding of which strategies are appropriate to use, and even how strategies may be used simultaneously to enhance one's ability to recall information, notably develops as children mature and gain a better understanding of the task at hand, as well as the capabilities of their own memories.

Developmental Course. Some children utilize more memory strategies than other children of similar ages. According to Bjorklund (2000), factors such as encoding, metamemory, and clustering may all influence the extent of a child's strategic skills. During the encoding of an event, younger children typically use fewer strategies than older children (Ackerman, 1984; Coyle & Bjorklund, 1996). Because research suggests that the 4- to 7-year-old age range is a time of rapid and significant development of memory strategies among children, studying

children in this age group will allow us to examine the growth in strategies that children may experience, and allow for us to track the development of children's memory strategies as well. Children's performance on sort/recall tasks has suggested that certain strategies may appear more effortlessly at an earlier age for children, while other more sophisticated strategies may not surface until later. Additionally, children's strategic memory skills may begin to develop over time as children are taught specific strategies in an educational setting, further contributing to the advancement of more high-level strategies.

Four-year-old children typically show very basic, if any, memory strategies when performing the sort/recall task. The strategies they use include simply repeating the information that is presented, or engaging in simple interactions with the physical stimuli. By age 7, there are more developed and complex memory techniques that are beginning to be used (Coyle & Bjorklund, 1997), such as chunking similar pieces of information together, or elaborating upon the information provided. Younger children may be able to remember a word, but older children are more likely to link that word, or multiple words, to other memories or related experiences (Bjorklund, 2000). Strategies like this enhance the chance of recall at a later point in time for that word, as well as other words associated with it.

Observing the children during the study and recall periods provides insight into deliberate remembering strategies typical of children of that age (Coyle & Bjorklund, 1996; 1997). When presented with cards to memorize, 7-year-old children are much more likely to implement elaboration by telling themselves stories about the cards, testing themselves by turning away from the cards and trying to recall them, or sorting them into categories based on similarities. These types of strategies greatly enhance the chance of recall (Coyle & Bjorklund, 1997). Four-year-old children are also more likely to try to study the cards as unrelated to one another,

whereas older children may try to group certain cards into categories or tie them to things of personal significance, which aids them during the recall period. Examples of strategic memory strategies used more frequently and efficiently among the 7-year-old age group include rehearsal, where the child repeats the name of the picture to themselves, sorting, where the child groups similar cards together based on similarities, and physical examining, where the child may move around or interact with the cards (Coyle & Bjorklund, 1996). These strategies may all come into play during the encoding period of information. However, an additional strategy, clustering, may be apparent during the recall period as an indication of the extent to which information remained within original categories in a child's memory during storage and retrieval.

Clustering. Clustering refers to the proportion of category repetitions presented in comparison to the actual possible number of category repetitions, and therefore is tested during the recall period when children are asked to recall as many cards as they can remember. By analyzing the order in which a child produces information during recall for the sort/recall task, the amount of grouping and categorization that the child uses can be studied. This memory strategy is particularly useful in testing children's organizational skills, and therefore challenges their memory beyond whether or not the children simply recall the cards (Frender & Doubilet, 1974; Roenker, Thompson, & Brown, 1971). It is possible that it could also help in providing insight into the organization of autobiographical memories, to the extent that remembering one item can serve as a reminder or trigger of another. Perhaps children who display stronger category organization skills may translate that organizational ability over into other aspects of their memory and events they experience.

Relation to metamemory. Research has also suggested that as children age, they begin to have a better understanding of what memory is and how to manipulate their own memories to

their advantage (Bjorklund, 2000). This concept, referred to as metamemory, can influence children's understandings of memory tasks and what they may be capable of given the memory skills and knowledge they have available to them.

Metamemory "refers to a knowledge of the workings of one's memory" (Bjorklund, 2000). The older children get, the better their understanding of what they are capable of remembering, what they have remembered in the past, and how their memory works best. As a result, metamemory could relate to strategy use. As children's memories develop, they come to have a better understanding of how concepts relate, as well as techniques they can use to help themselves remember, perhaps based on what has worked for them in the past. Therefore, one could hypothesize that a more highly developed metamemory could accompany more sophisticated memory strategies. Metamemory is often assessed by asking children a number of hypothetical questions about memory use, such as comparing their memory capabilities to those of older or younger children, or children of the same age. This allowed us to assess the awareness children have about how their memory works, and how it may compare to others' memories. The age of the child and the type of questions she is asked seem to be the most influential factor in determining the extent of metamemory development (Bjorklund, 2000; Cantor, Andreassen, & Waters, 1985).

It is important to note however that although children's memory strategies and capacity may increase rapidly over time, their awareness of their own memory capabilities may develop at a slower rate (Cavanaugh & Perlmutter, 1982; DeMarie, Miller, Ferron, & Cunningham, 2004). Children's increased performance on sort/recall tasks may not necessarily mean that they have a full understanding yet of how their memories work. However, DeMarie et al. (2004) explained that "young children who knew that sorting helped them to remember were the ones who

continued to use the sorting strategy one week later with a different experimenter and distinctly different stimuli" (p. 463). This shows that children are in fact capable of understanding what strategies work for them, and may then apply those strategies to other scenarios that require memory use based on what has proven successful for them in the past. Furthermore, children may be able to rely upon their metamemory to choose and coordinate which strategies will work best for the task at hand depending on their understanding of the goal and what is being asked of them (DeMarie et al., 2004).

Autobiographical Memory and Strategic Remembering

There is a very large literature base on the domains of autobiographical memory and strategic memory individually, but there is no research linking the two memory domains. The present research proposes that the skills that drive autobiographical memory development aid in the formation and retrieval of strategic remembering skills, and that children with a higher capacity for autobiographical memory will also perform better on strategic remembering tasks. Increased strategy use as a child ages could indicate better control and organization of one's memories, as well as better retrieval and an advanced ability to use cues (Bauer, 2007; Nelson & Fivush, 2004), and thus could potentially account for a relationship between the two memory forms. Morris et al. (2009) suggested that events that have higher organization and coherence are more likely to survive across time. As a result, we further hypothesize that the strength in organizational skills during the recall of autobiographical memories may aid in the use of strategies and extent of recall during strategic remembering tasks.

The purpose of the present research was to test whether there is a relationship between strategic remembering and autobiographical memory, and whether autobiographical memory skills and organization can aid in the use of deliberate strategies and recall. Understanding this

relationship between strategic remembering and autobiographical memory can provide better insight into how memories are encoded, factors that play a role in this, and the organization of information during encoding and retrieval periods. It can allow us to track changes in autobiographical and strategic memory across assessment points and examine the relation between these memory systems across time. By simulating the sort/recall task and narrative interviews used in previous research as measures for strategic remembering and autobiographical memory, performance on these tasks can be analyzed and the relationship between the two domains can be tested.

This research observed a group of children once a year as they aged from 4 to 7, providing 4 total assessment points. The age range is associated with significant memory changes and advancements in both autobiographical memory and strategic remembering (Bauer, 2007; Nelson & Fivush, 2004). Performing the same autobiographical and strategic memory tasks at each age allowed us to evaluate progressions and make comparisons, both in terms of the individual children's memory changes as well as within the cohort as a whole. The children's autobiographical memories were evaluated based on whether or not they remembered the events they were asked about, as well as the breadth, or completeness, of their narratives. More complete events are more likely to survive across time and relates to the quantity of autobiographical memory. The autobiographical memory skills may serve as a foundation for the development of strategic remembering, and individual differences in autobiographical memory may contribute to individual differences in strategic remembering performance. Additionally, a higher grasp of the metamemory component could provide insight in terms of whether a child's concept of her memory influences her performance on actual memory tasks. Ultimately, the main purpose of this research was to focus on one potential contributor to another memory skill –

autobiographical memory presence and completeness in relation to the development of strategic remembering.

Method

Participants

The participants were 37 children (15 female, 22 male) who participated in a longitudinal study. They represent a subset of a larger study sample of 4-, 6-, and 8-year-old children focused on having children complete different tasks to observe memory development and various memory domains. The children in this group participated in four phases of the study. Phase 1 occurred when they were 4 years old (*M* = 4.18 years, *SD* = .06, *range* = 4.09 – 4.40 years). The subjects then returned three more times with approximately a year in between each visit, so that by Phase 4, the subjects were 7-years old (*M* = 7.11 years, *SD* = .08, *range* = 6.98 – 7.37 years). Phase 1 began with 48 4-year olds, but only the data of the children who participated in all four phases (N = 37) were analyzed. All children were reported as Caucasian with non-Hispanic backgrounds.

Subjects were recruited from the participant pool at the Institute of Child Development at the University of Minnesota. Children were placed in the database shortly after birth if their parents expressed interest in participating in studies. Participants were given gift cards to a local merchant as an appreciation for participating during each phase of the study.

Materials

During the Phase 1 visit, children were presented with 15 cards to remember for the sort/recall task. Phases 2, 3, and 4 took place at ages 5, 6, and 7, respectively, and children were presented with 18 cards to remember at these 3 phases. Each card featured a black and white picture. The objects pictured could be sorted into 3 groups of either 5 or 6 cards, for the 15 or 18

card sets, respectively. Examples of categories included sports, vegetables, parts of a house, electronics, and animals (Appendix A).

Procedure

All data were collected at the Institute of Child Development at the University of Minnesota. The data for this research were coded at The Bauer Lab at Emory University. All procedures were approved by the Institutional Review Boards of both universities, and all parents provided written consent for their children to participate in the study. Children took part in two 2 $^{1}/_{2}$ hour testing sessions approximately 1 week apart at each of the 4 phases (i.e., ages 4, 5, 6, 7 years). Children participated in a number of different tasks (e.g., sort/recall task, autobiographical memory narrative task) at each phase. Four female experimenters administered all testing, and children saw a different experimenter at each phase. To ensure reliability among the experimenters, each of them underwent the same training and attended weekly meetings to discuss and coordinate methods and procedures. All sessions were videotaped. This research only presents the procedures of the tasks that are being analyzed: the sort/recall task as a test of strategic remembering, and the narrative interviews as a test of autobiographical memory.

Sort/Recall Task. Children experienced the sort/recall task at the beginning of Session 1 at each phase. Different sets of cards were used at each phase and the sets were counterbalanced among participants. The children were placed in a room with a table and seated next to their parent and across from the researcher. The only other things on the table during the time of the sort/recall task were a timer and a microphone.

The children were told that they were going to be shown a certain number of cards, and then would be given 2 minutes during which they could do whatever they wanted with the cards

to try to remember them. After 2 minutes, the cards would be taken away and the child would be asked to recall as many items on the cards as possible.

The researcher then laid out each card individually, and asked the child to repeat the name of the picture on the card after them. The cards were laid out in a 6x3 sequence (or 5x3 for 15 cards). The cards were not placed in their categories, and no cards of the same category were placed next to one another. The researcher then repeated that the child had 2 minutes to study the cards, and reiterated that they could do whatever they liked with the cards to help them remember. The researcher then started the timer.

The children's parents were told ahead of time not to participate at all, and both the parent and researcher worked on their own paperwork during the 2 minutes. After 2 minutes had elapsed, the researcher collected all the cards, and then played a quick game with the child to act as a buffer, typically tic-tac-toe, for about 30 seconds.

The researcher then asked the child how many cards they thought they would remember. The researcher then asked the child to name the cards, and wrote down, in order, the words the child said. The child was then asked a number of metamemory questions (Appendix B). In addition, the child was questioned about any strategies they used to help themselves remember the cards.

Autobiographical Memory Task. Children participated in an experimenter-child interview at each phase. The interviews were distributed across two sessions at each phase in order to prevent fatigue for the children. The children's autobiographical memories were tested by questioning them about events they had recently experienced. Four months before their first testing (Phase 1), the children's parents were given a calendar and asked to keep track of unique events that the child participated in (about 1 per week). Parents were asked to make note of

memorable experiences that the child did not experience on a regular basis. Examples included birthday parties, school field trips, trips to the doctor, and family vacations. The parents were asked to record events on a calendar before each additional visit for the following 3 phases.

On the day of the testing, the child was asked about at least 3 events selected from the calendar (Year 1 – 9 events, Year 2 – 6 new events, Years 3 and 4 – 3 new events). Therefore, during Phase 1, the children were asked about events that had taken place within the past 4 months (Appendix C). The events the child was questioned about were randomly selected.

A year later, during Phase 2, the child was asked about 3 of the 9 events from Phase 1, in addition to 6 more events that were selected out of new events that the parent recorded. During Phase 3, the child was asked about 3 events from Phase 1, 3 events from Phase 2, and 3 newly recorded events. During Phase 4, the child was asked about 3 events from Phase 1, 3 events from Phase 2, 3 events from Phase 3, and 3 newly recorded events (Appendix C). For the present project, only recall of recent events was analyzed so that all events were new and had not been previously discussed. Because there were a different number of new events across phases, the average performance on each category and for breadth scores was calculated and used for analyses.

The interviews were conducted by using a specific procedure (Appendix D). The experimenter began by simply asking the child "What do you remember about event X?" or "What can you tell me about X?" to initiate free recall. After the child responded, the experimenter then asked "What else do you remember about X?" until it became apparent that the child could not recall any more information. Next, the experimenter used cues that were planned out ahead of time that the parent believed would help refresh the child's memory. For instance, if the experimenter was questioning the child about his birthday party, a cue may

include “You got lots of presents” or “There were balloons there.” The experimenter then continued to use nonspecific prompts to encourage the child to keep talking such as “Tell me more” or “What else do you remember?” The child was then given another chance to recall the event.

After the free-recall and cued-recall periods, the child was questioned about the *who*, *what*, *where*, *when*, *why*, and *how* of the events at each of the sessions, which were classified as “Wh-questions.” All Wh-questions were asked even if the child had already reported the information during the free-recall or cued-recall period. These questions were asked to quantify the extent to which the child encoded the event and to provide the greatest support for memory retrieval.

For this study, only free-recall and total recall (free recall + cued-recall + Wh-prompting) sections of the interview were analyzed. These provided us with the clearest examples of the impact of prompting, as well as insight into which information children were most likely to provide on their own.

Coding

Sort/Recall Task. The coding for the sort/recall task was done separately for the study period and recall period. The study period coding involved watching the videotaped sessions. The recall period coding was based on the summary sheets of the interviews, which were created by the experimenter during the time of the interview.

***Study Period*.** During the 2 minutes that the children had to try to memorize the cards, they could perform a number of different memory strategies. All of the sessions were recorded, so when rewatching the videos, we coded the types of strategies used in a number of ways. First, the 2 minutes were broken into four 30-second intervals. This way when analyzing the strategies

used, researchers could keep track of how many memory strategies were used and at what point during the 2 minutes they were implemented.

There were 8 different possible memory strategies used: *Sorting*, which included the child physically sorting at least 3 cards by visibly placing them next to each other – the number sorted was tallied as well; *Category naming*, which involved the child saying out loud the name of at least one of the categories represented; *Rehearsing*, which included saying either out loud or visibly mouthing the name of at least one of the cards presented; *Physical examining*, which included touching, pointing to, or moving around the cards without necessarily sorting them into categories; *Visual examining*, which involved looking at the cards; *Sequential touching*, which included touching at least 3 cards of the same category in a row; *Testing*, which was when the children tested themselves on the cards by either covering their eyes or looking away and then attempting to repeat what the pictures were, or flipping the cards over and then trying to remember which card was which picture; and *Elaboration*, which was when the children told a story or incorporate the word into a sentence to help themselves remember, such as "I played *baseball* in the *park* yesterday." Finally, children could also be marked *off-task* if they were looking away from the cards or were visibly distracted from the task for more than 5-seconds.

Reliability was calculated for the sort/recall tasks by having a second independent researcher code the memory strategies used for 25% of the children. The inter-rater reliability was 88.83% (*range* = 71% – 100%).

Recall Period. The clustering scores for children were also calculated. Clustering refers to the extent to which cards remembered were grouped into categories. Because the researcher recorded the order of the cards that the child remembered, the clustering score was calculated by observing whether the cards remembered were mentioned in category clusters. The Adjusted

Ratio of Clustering (*ARC)* was used to calculate the scores (see Roenker, Thompson, & Brown, 1971). The *ARC* indicates the proportion of category repetitions presented by the child in comparison to the actual possible number of category repetitions. The clustering scores range from -1 to 1, with 1 representing a perfect cluster and -1 indicating that none of the cards was grouped with other cards from their original categories. By using the order that the child repeated the cards as indicated on the summary sheets, we marked A, B, or C depending on what category each word was in. Even if the child did not remember all or most of the cards, as long as all of the cards they remembered are perfectly clustered by categories, they will still receive a 1 as a clustering score.

Metamemory. After recalling the cards, the children were asked a series of metamemory questions. Each question was worth one point, and the child could either score 0 or 1 point per question. Their accuracy was determined depending on if the child correctly answered by responding "More than me," "Less than me," or "About the same." The maximum number of possible points a child could score on the metamemory questions was 9 (Appendix B).

Autobiographical Memory Task. The children's responses to both the free-recall and Wh-prompted autobiographical memory questions were coded based on content and breadth. The events coded were divided into "free-recall (before cue)," "cued-recall (after cue)," and "Wh-questions" categories.

Participants' responses were allotted points for the free-recall period based on breadth and coherence. The content was coded based on the child's response to memory probes. Participants were awarded points for the cued-recall period if their answers indicated that they were aware of the event that the researcher questioned them about.

The narrative transcripts generated from the experimenter-child interviews were coded based on what point in the interview the child provided a piece of information about the event in question. Each event was coded separately and the responses were marked by "free-recall" "cued-recall" or "Wh-questions" based on when during the interview the child provided information. The child received credit for a category (*who*, *what-object*, *what-action*, *where*, *when*, *why*, *how-description*, *how-evaluation*) in the phase of the interview in which the information was first suggested to identify spontaneity (Bauer, Burch, Scholin, & Güler, 2007; Van Abbema & Bauer, 2005). See Bauer et al. (2007) descriptions of each category. Narrative breadth (1-8 score total) was determined by the presence or absence of these 8 categories.

The Wh-questions were coded on a scale of 8. Children earned 1 point for each Wh-question to which they responded. These elements consisted of *who* (people, gender, or class of people present during the event), *what-object* (specific objects present), *what-action* (activities performed by a character in the narrative), *where* (location or place), *when* (time of event, including order within the event), *why* (mentions of justification or causation), *how-description* (adverbs, adjectives, or phrases that describe physical or observable characteristics), and *how-evaluation* (personal evaluation of the event, including intensifiers) (Bauer et al., 2007). If the participant answered any of these questions more than once, only the first identification of the element was coded. The breadth was determined by the inclusion or exclusion of each of these 8 elements.

Reliability was calculated for the Wh-coding by having a second independent researcher code the narrative transcripts for 25% of the children. The inter-rater reliability was 88.37% (*range* = 87% – 90%).

Results

Strategic Remembering

Description of strategies. See Table 1 for descriptive statistics of strategies used during the encoding and retrieval periods. See Table 2 for descriptive statistics and ranges of the number of cards sorted, the total strategies used during study and retrieval periods, the number of cards recalled, and metamemory scores. See Figure 1 for the number of children who used each strategy across phases. Across all 4 phases, rehearsing and physical examining were consistently the most commonly used strategies.

Comparisons across phases. To compare strategy use across the 4 phases, a one-way between-subject analysis of variance (ANOVA) was conducted for each of the strategies with a Bonferroni Post Hoc test.

Study Period. The results indicated that there was a significant increase in sorting behavior, $F(3, 36) = 6.30$, $p = .001$. Post hoc tests showed that sorting in Phase 4 was used significantly more than in Phase 1 ($p = .003$). There was also a significant difference in the number of cards sorted, $F(3, 36) = 12.07$, $p < 0.001$, with more cards sorted in Phase 4 than Phases 1 and 2 ($p = .001$). In addition, the changes in rehearsing behavior were significant across the phases, $F(3, 36) = 3.01$, $p < .05$, with Phase 2 significantly higher than Phase 4 ($p = .03$).

There were no significant differences between phases for category naming $F(3, 36) = 1.77$, physical examining $F(3, 36) = 1.61$, total strategies used during the study period $F(3, 36) = 2.274$, clustering $F(3, 36) = 1.26$, and total strategies used during both the study and recall period $F(3, 36) = 2.66$. Sequential touching, testing, and elaboration were not analyzed because of the very minimal use of these strategies across the phases.

Recall Period. The number of cards recalled, $F(3, 35) = 27.51$, $p < .001$, was significantly greater in Phase 4 than in Phases 1, 2, and 3 ($p < .01$). There were also significantly more cards recalled in Phase 3 than Phase 1 ($p < .01$).

Metamemory Performance. The total metamemory score, $F(3, 35) = 10.42$, $p < .001$, was significantly higher in Phases 2, 3, and 4 than in Phase 1 ($p < .05$).

Concurrent correlations. We calculated correlations between each individual strategy and the number of cards recalled, as seen in Table 3. There was a significant correlation between physical examining and the number of cards recalled (Phase 1), metamemory scores and the number of cards recalled (Phase 1), sorting and the number of cards recalled (Phase 3), the number of cards sorted and the number of cards recalled (Phase 3), and clustering and the number of cards recalled (Phase 4).

Cross-lagged correlations. There were significant correlations between children's use of strategies across phases. Specially, there were correlations over time in the use of sorting (Phases 3 and 4), rehearsing (Phases 1 and 3; Phases 2 and 3; Phases 2 and 4; Phases 3 and 4), category naming (Phases 1 and 3; Phases 3 and 4), total number of strategies used during the study period (Phases 2 and 3), the number of cards sorted (Phases 3 and 4), and metamemory scores (Phases 3 and 4).

Autobiographical Memory

Analyses were run separately for free recall, and total recall (free recall + cued-recall + Wh-prompting) categories and breadth scores to observe differences in the separate recall periods. See Table 4 for means and standard deviations for each category.

Comparisons across phases. To observe differences across phases for both free recall and total recall, we ran a one-way within-subjects ANOVA with a Bonferroni Post Hoc test.

Free recall. The results indicated that there were significant differences across phases for free recall breadth scores between Phases 1 and 4, Phases 2 and 4, and Phases 3 and 4 for Wh-scores for free recall, F (3, 35) = 8.74 ($p < .05$). See Figure 2 for means for each Wh-category during free recall.

Total recall. For total recall, there were significant differences across phases for total breadth scores, F (3, 35) = 22.34 ($p < .05$), at Phases 1 and 2, Phases 1 and 3, Phases 1 and 4, Phases 2 and 4, and Phases 3 and 4. See Figure 3 for means for each Wh-category during total recall.

See Figure 4 for free recall and total recall breadth scores across phases. See Figure 5 for average total recall breadth score across each phase for each child.

Consistency across wh-categories. We calculated Pearson correlations for each of the categories at both free recall and total recall to determine relationships and consistency between autobiographical variables at different phases.

Free recall. There were significant correlations between the following Wh-categories at free recall in the following phases: Who (Phases 2 and 3), What: Object (Phases 1 and 2; Phases 1 and 4; Phases 2 and 4), What: Action (Phases 1 and 2; Phases 2 and 4), When (Phases 1 and 2), Why (Phases 1 and 2), and Evaluation (Phases 1 and 3), (ps < .05). Correlations were significant for breadth-scores for free recall between Phases 1 and 2 ($p < .05$) and Phases 2 and 3 ($p < .01$). There were no significant correlations between free recall phases for Where or Description.

Total recall. Phases with significant correlations across Wh-categories for both free recall and Wh-questions included: What: Object (Phases 1 and 2), What: Action (Phases 2 and 3), When (Phases 1 and 2; Phases 2 and 3), Why (Phases 2 and 3), and Description (Phases 2 and 4),

(ps < .05). There was a significant correlation for total breadth-scores between Phases 2 and 3 (p < .05). There were no significant correlations for Who, Where, or Evaluation.

Strategic Remembering and Autobiographical Memory

Correlations between breadth scores and strategic remembering. We calculated Pearson correlations for breadth scores for free and total recall (autobiographical memory measure) with the number of cards recalled and total strategies used (strategic remembering measures), and with metamemory scores. See Table 5 for correlations between number of cards recalled and free recall and total recall breadth scores. See Table 6 for correlations between total number of strategies used and free recall and total recall breadth scores See Table 7 for correlations between metamemory scores and free recall and total recall breadth scores. There were no significant correlations between any individual strategies and breadth scores.

Concurrent correlations. There was a correlation between total breadth score and the total number of strategies used at Phase 1, indicating that children who performed better on total recall for autobiographical memory narratives were also the children who used the largest number of strategies during the sort/recall task.

Cross-lagged correlations. The significant correlations between breadth scores at Phase 1 and the number of cards recalled at Phases 2, 3, and 4 indicates early performance on autobiographical memory tasks is predictive of later performance on strategic remembering tasks. Breadth scores for free recall at Phase 2 were also correlated with the number of cards recalled at Phase 4. The total number of strategies at Phase 2 was significantly correlated with the free-recall breadth score at Phase 4. Additionally, metamemory scores at Phases 2 and 3 were correlated with breadth score at Phases 3 and 4, respectively.

Discussion

The significant results provide an incredibly interesting and useful look at the relationship between strategic remembering and autobiographical memory. This new research contributes to existing literature on the two individual domains by illustrating that strategic remembering is impacted by autobiographical memory performance. This information can provide useful insight into the importance of organization, comprehension, and prompting during encoding and retrieval periods.

Strategic Remembering

Our findings were very consistent with the literature that there is not a lot of consistency in strategy use overall between the ages of 4 and 7. Though performance improved with age, the sort/recall task is overall a difficult one for children (Coyle & Bjorklund, 1996). Analyses indicated that certain strategies were more common amongst the children at different ages.

Younger children demonstrated very basic memory strategy use with a high use of rehearsing and physical examining. Consistent with Coyle and Bjorklund's findings (1996), this could indicate that these strategies tend to develop earlier in younger children. They require less thought and planning, as they involve more simplistic interaction with the cards or repeating the card names. Additionally, previous research suggests that strategic remembering may increasingly develop in later phases, as children enroll in school and engage in increased socialization practices, where they are explicitly taught memory organization and recall skills (Larkina, Güler, Kleinknecht, & Bauer, 2008). More sophisticated strategies, were used very little or not at all across the first two phases. Again, these strategies are typically associated with an older cohort with a stronger grasp on which memory strategies increase the chances for remembering more cards (Haden, Orstein, O'Brien, Elischberger, Tyler, & Burchinal, 2010).

As children aged, there was an increase in more sophisticated strategies such as sorting and category naming, as is consistent with the literature (Bjorklund, 2000). As children's metamemory skills improve, this could indicate that they had a better understanding of how their memories work and what strategies could help them to remember more cards. Physical examining remained relatively constant in its use from Phases 1 and 2. According to previous literature, strategies such as sequential touching, testing, and elaboration appear when children are older than this study sample (Gaultney et al., 1992). The significant difference in sorting and number of cards sorted from Phase 1 to Phase 4 indicates that there are a lot of developmental differences that take place between the ages of 4 and 7. Rehearsing actually had a significant decrease from age 5 to age 7, which could imply that though this strategy comes very effortlessly for young children, it may be replaced by more complex strategies as they grow older.

Although there is still some clear room for improvement and use of more sophisticated strategies, the progression of children's memory development begins to become much more apparent at later phases (Bjorklund, 2000). These findings overall demonstrate the beginning of a clear trajectory path. As children age across phases, they begin to show an increase in strategy use and recall performance. However, there is a still a lot of potential development and growth available to the children before they reach their maximum capability of recall.

Clustering was used by 12 children in Phase 1, 15 in Phases 2 and 3, and 20 in Phase 4. Consistently, the results seem to indicate lower memory strategy use and understanding at Phase 1, similarities at Phases 2 and 3, and clearer advancements at Phase 4. Because age 7 marks the beginning stages of strategic remembering development (Bjorklund, 2000), it makes sense that by the end of the 4 phases, children are beginning to show much more apparent memory strategy use.

The consistency in strategy use demonstrates that children who used a strategy at earlier phases were very likely to use it at future phases. By ages 6-7, children were beginning to have a better grasp of their memory and how it works (Bjorklund, 2000; Coyle & Bjorklund, 1996). Overall, the strategic remembering findings remained very consistent with previous literature. The emergence of basic strategies at earlier ages, and evidence of more sophisticated strategies at later ages is consistent with Coyle and Bjorklund's findings (1996). As Larkina et al. (2008) suggested, increased strategy use as children age can develop as a function of education and socialization processes, as well as the structure of encoding and recall periods. However, there is not a lot of strategy use with such a young age range, and recall of cards is often difficult for children. Though the sort/recall task is hard to grasp at such a young age however, there is a clear progression that begins to occur as the children age, and more complex strategy use and higher recall does begin to become evident.

Autobiographical Memory

In the present study, we tested children's autobiographical memory performance across 4 years in the context of experimenter-child interviews. Our analytic approach was consistent with previous findings, and separately analyzing free recall and total recall performance, which produced different results and correlations, indicated the benefit of prompting when asking children to provide narratives.

There were significant correlations for breadth scores at free recall for the first 2 phases, which could imply similar narrative styles at earlier ages, but more varied and complex ones at later phases as children develop better memory and encoding skills. The results also provided interesting insight into which categories children are more or less likely to produce on their own without prompting. Most notably, *when* and *why* were provided less than the other categories by

the children, indicating that these categories may not have as much significance to the child during the encoding period of the event. This finding is consistent with Fivush and Nelson's work (2006), which suggested that comprehending *why* may come as a result of understanding other wh-categories first. Phase 1 had significant differences from other phases with every narrative category, except evaluation which had no significant differences between phases. This indicates that after age 4, children experience notable development in their narratives, and it demonstrates a clear progression in a higher level of detail that children can both remember and provide. Additionally, each of the first 3 phases was significantly different from Phase 4 breadth scores. This remains consistent with Nelson and Fivush's (2004) analysis that autobiographical memory begins to develop at ages 4-5, after which it undergoes a number of changes. Overall, there were multiple significant differences between phases, indicating that children's memory capacities are indeed very different even with only a year in between testing. This again implies that children's memories and narrative capabilities are definitely advancing during this critical age range.

Correlations for total breadth scores only occurred between Phases 2 and 3, indicating that children ages 5 and 6 performed similarly overall in their narratives and provided information. However, there was much higher overall performance for total recall than free recall, indicating the importance of prompting. Bauer (2007) suggested that as children receive cues and prompting, they are more likely to provide more complete narratives. Perhaps this indicates that children benefit from direct questions, or knowledge of what exactly is expected of them. Overall though, the fact that children still have a lot of development to undergo before they are producing more comprehensive narratives remains consistent with Bauer et al. (2007) that this skill usually develops in older children 7-years and older. The increase in breadth scores,

both across phases and with wh-prompting as opposed to only free recall, indicates that children not only perform better at older ages, but also with more directed questions. Perhaps these questions help children to organize their memories, as they only have to recall one piece of information at a time as opposed to all they can recall at once, or perhaps the prompts help to focus their attention better. Similar to free recall though, Phase 1 varied the most notably from each of the other phases. Evaluation had significant differences between phases, unlike free recall, indicating that perhaps evaluation is a narrative category where differences in memory ability vary more with prompting. Because all wh-categories experienced differences across the phases, this again signifies the importance of prompting as well as potentially different paces of development for different categories. The similar pattern of changes was observed when children's total narratives, produced after wh-prompting, were analyzed for changes in breadth score and certain categories.

Strategic Remembering and Autobiographical Memory

Our results indicated a number of significant correlations between strategic remembering and autobiographical memory measures, which indicated that autobiographical memory may be a driving force for strategic remembering. This is consistent with Bauer's (2007) argument that increased strategy use as a child ages indicates better control of one's memories, and thus could potentially account for a relationship between the two memory forms. Additionally, Morris et al. (2009) suggested that events with a higher consistency and organization are more likely to survive long-term.

Concurrent relationship. Although children demonstrated different levels of performance in recalling their personal event and in memorizing category-related cards, we found that the autobiographical memory performance at Phase 1 was correlated with total

strategies used at Phase 1, indicating that children who performed the best on recalling information in their narratives also used the largest number of strategies in the sort/recall task. This could imply that they have a better understanding of how to boost their memory and what strategies will help them remember information. Overall though, there were very few concurrent relationships between the two domains.

Cross-lagged relationship. The main pattern of relations we found suggests that it is autobiographical memory that influences children's strategic remembering. The cross-lagged correlations provide more insight into the relationship between the two memory skills. Autobiographical memory performance at age 4 appears to be predictive of the number of cards recalled on the sort/recall task at ages 5 through 7. This could indicate that younger children who are better at recalling specific details of an event may also be better at organizing information during encoding and recalling it at retrieval later on. This skill may therefore be transferred over to deliberate memory tasks, where a child who begins the study with more coherent organization skills is also able to perform better on memory tasks. Children who do well with prompting are more successful in remembering. This suggests that autobiographical memory, particularly at earlier ages, helps to drive recall performance on deliberate memory tasks. Higher performance in delivering autobiographical memory narratives may indicate an overall stronger memory capacity and higher organization. This organization may then drive a child's deliberate memory performance, as they take advantage of strategies available to them in helping to organize the information in front of them to support their recall later on (Morris et al., 2009).

Interestingly, the total strategies used at Phase 2 was also correlated with breadth scores at Phase 4, demonstrating that children who continued to use more strategies ultimately performed better on autobiographical memory tasks, perhaps because they had more memory

strategies available to them. This information suggests that though there may be a reciprocal relationship between autobiographical memory and strategy use initially, over time strategy use appears to be predictive of how well children will perform on narratives tasks later on.

Total breadth scores for free recall in Phase 2 correlated with the number of cards recalled in Phase 4. This could indicate that those children who are asked to simply recall as much information as they could, before they received any prompting, are likely to do well later on sort/recall tasks, when they are also asked to recall as many cards as possible without prompting. This again suggests that autobiographical memory is helping to drive performance on strategic remembering recall tasks. Metamemory scores at ages 5 and 6 are also correlated with autobiographical memory performance at ages 6 and 7, respectively. As children begin to perform better on metamemory tasks and are starting to have a stronger understanding of what memory is and how it functions best, it makes sense that they start to perform better on retrieval tasks. Perhaps a stronger comprehension of their own memory allows them to better organize pieces of information and articulate them at a later point in time.

Conclusion

The main focus of this research was to explore the novel area of the relationship between autobiographical memory and strategic remembering. Our findings are very consistent with previous literature on each of the two individual areas of study. We hypothesized that children's performance on autobiographical memory tasks would drive organization required for strategic remembering tasks, which was supported by our results. Perhaps children who perform well on autobiographical memory tasks have a stronger ability to group and recall information, which then translates nicely into deliberate memory tasks where children must apply organization skills to aid their memories. A clear similarity can be seen between wh-prompting and deliberate

memory tasks, where children are asked for a specific piece of information, as opposed to anything at all they can remember. This fascinating domain of research, which combines two rapidly developing memory forms that show great advancements during a similar age range (4-7), could be extremely useful when studying the importance of prompting and organization in terms of how children's memories work. It can provide insight into ways in which memories are encoded, and factors that are most beneficial in encouraging retrieval.

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Appendix A

Sample set of 18 picture cards shown to children during the sort/recall task

Appendix B

1. This time you remembered **X** pictures. If we did this again do you think you would remember more, less or about the same?

2. If we did this again and I showed you more than 15 (18) pictures to remember, would it be easier, harder, or about the same to remember?

3. I have a friend who is **older** than you do you think s/he would remember more, less, or about the same as you? I also have a friend who is **younger** than you do you think s/he would remember more, less, or about the same as you?

4. If we did this again but this time I showed you pictures of the same kind of thing (so, if I showed you 15 (18) pictures of animals), do you think that it would be easier, harder, or about the same to remember?

Questions asked of each child after card recall as a metamemory assessment.

Appendix C

Narrative Events Presented at Each Phase

Phase 1	Phase 2	Phase 3	Phase 4
1	1		
2	2		
3	3		
4		4	
5		5	
6		6	
7			7
8			8
9			9
	10	10	
	11	11	
	12	12	
	13		13
	14		14
	15		15
		16	16
		17	17
		18	18
			19
			20
			21

Phase 1 (4-yrs.) – 9 new events

Phase 2 (5-yrs.) – 3 events from Phase 1, 6 new events

Phase 3 (6-yrs.) – 3 events from Phase 1, 3 events from Phase 2, 3 new events

Phase 4 (7-yrs.) – 3 events from Phase 1, 3 events from Phase 2, 3 events from Phase 3, 3 new events

Appendix D

Free Recall Example

EXA: Okay the next one is about um, let's see, when you went to City Park with Grandma?

CHI: I um, go on a big train, or a small one. I definitely went on the train.

EXA: Okay.

CHI: And I think I went on the ferris wheel.

EXA: You're right, actually you did. I have it right here. Good job, what else do you remember about City Park?

CHI: Well, there was lots of rides.

EXA: Lots of rides.

CHI: Lots of kids rides.

EXA: Yes.

CHI: Not, not um, scary ones.

EXA: Okay, anything else that you can tell me about City Park with grandma?

CHI: No.

Wh-Questions Example

EXA: Okay, now tell me <u>who</u> was there.

CHI: My grandma.

EXA: Yes.

CHI: And me.

EXA: Yes.

CHI: I think it was my sister, too.

EXA: Okay.

CHI: I think um, my mom.

EXA: Yes.

CHI: And I think, and, yes, that, that's it.

EXA: So let's see, how did you go on those rides, how did you decide on which rides to go?

CHI: Um, I wanted to do all of them.

Table 1

Descriptive Statistics of Strategy Use across Phases

	Phase 1		Phase 2		Phase 3		Phase 4	
	n	*M (SD)*	*n*	*M (SD)*	*n*	*M (SD)*	*n*	*M (SD)*
Sorting	2	.08 (.36)	5	.24 (.64)	8	.54 (1.20)	15	.84 (1.09)
Category Naming	1	.05 (.33)	1	.03 (.16)	4	.19 (.70)	5	.24 (.76)
Rehearsing	24	1.76 (1.61)	20	1.73 (1.76)	22	1.43 (1.50)	15	.95 (1.35)
Physical Examining	26	2.27 (1.73)	30	2.59 (1.52)	29	2.35 (1.64)	26	1.81 (1.54)
Sequential Touching	0	0	1	.03 (.16)	1	.03 (.16)	1	.03 (.16)
Testing	0	0	0	0	0	0	2	.14 (.59)
Elaboration	0	0	0	0	1	.03 (.16)	1	.03 (.16)
Clustering	12	.32 (.48)	15	.41 (.50)	15	.42 (.50)	20	.54 (.51)

Table 2

Descriptive Statistics for Strategy Use, Recall, and Metamemory across Phases

	Phase 1		Phase 2		Phase 3		Phase 4	
	Range	*M (SD)*	*Range*	*M (SD)*	*Range*	*M (SD)*	*Range*	*M (SD)*
Number Sorted	0-8	.41 (1.72)	0-7	.68 (1.84)	0-18	3.22 (6.71)	0-18	6.92 (8.79)
Total Strategies: Study Period	1-3	1.81 (.62)	1-4	1.84 (.8)	1-4	2.11 (.77)	1-4	2.14 (.98)
Total Strategies	1-3	2.14 (.82)	1-4	2.24 (.98)	1-4	2.51 (.99)	1-5	2.68 (1.11)
Number Recalled	0-9	4.35 (2.55)	0-10	5.14 (2.16)	0-13	6.61 (2.86)	5-13	8.62 (2.24)
Total Metamemory	0-6	2.73 (1.52)	1-6	3.75 (1.16)	0-8	4.08 (1.63)	2-8	4.57 (1.35)

Table 3

Significant Correlations between Strategies and Recall

	Number Recall 1	Number Recall 2	Number Recall 3	Number Recall 4
Sorting 3			.52***	
Sorting 4			.33*	
Number Sorted 3			.56***	
Number Sorted 4			.37*	
Physical Examining 1	.39*			.42**
Metamemory 1	.35**			
Metamemory 4			.46**	
Clustering 4				.33**

* $p < .05$
** $p < .01$
*** $p < .001$

This table illustrates the significant correlations between the number of cards recalled at each phase and individual strategies, as well as metamemory and clustering scores.

Table 4

Descriptive Statistics for Wh-categories at Free Recall and Total Recall

		Phase 1 *M (SD)*	Phase 2 *M (SD)*	Phase 3 *M (SD)*	Phase 4 *M (SD)*
Free Recall	Who	.62 (.23)	.40 (.30)	.45 (.31)	.59 (.36)
	What: Object	.45 (.27)	.75 (.22)	.71 (.31)	.85 (.24)
	What: Action	.65 (.23)	.81 (.21)	.82 (.27)	.89 (.23)
	When	.19 (.20)	.28 (.25)	.28 (.31)	.42 (.31)
	Where	.39 (.22)	.39 (.25)	.44 (.30)	.59 (.31)
	Why	.12 (.17)	.18 (.20)	.13 (.21)	.28 (.25)
	Description	.47 (.27)	.48 (.30)	.53 (.41)	.67 (.33)
	Evaluation	.29 (.24)	.19 (.21)	.27 (.31)	.30 (.28)
	Breadth Score	3.18 (1.43)	3.43 (1.35)	3.59 (1.56)	4.58 (1.58)
Total Recall	Who	.79 (.18)	.94 (.11)	.93 (14)	.99 (.06)
	What: Object	.62 (.28)	.94 (.13)	.84 (.28)	.95 (.13)
	What: Action	.77 (.21)	.96 (.11)	.92 (.24)	.98 (.10)
	When	.45 (.26)	.53 (.32)	.64 (.36)	.80 (.28)
	Where	.70 (.23)	.83 (.20)	.82 (.28)	.97 (.10)
	Why	.52 (.31)	.74 (.30)	.81 (.28)	.88 (.23)
	Description	.71 (.23)	.79 (.28)	.82 (.25)	.86 (.23)
	Evaluation	.68 (.28)	.88 (.22)	.91 (.21)	.92 (.21)
	Breadth Score	5.23 (1.68)	6.54 (1.07)	6.58 (1.2)	7.35 (.87)

Table 5

Correlations between the Number of Cards Recalled and Breadth Scores

		Number of Cards Recalled (Strategic Remembering)			
		Phase 1	Phase 2	Phase 3	Phase 4
Autobiographical Memory Breadth Scores					
Free Recall	Phase 1	.31	.26	.24	.46**
	Phase 2	.14	.22	.14	.54**
	Phase 3	.18	.01	.04	.21
	Phase 4	.11	.19	.22	.24
Total Recall	Phase 1	.30	.40*	.37*	.34*
	Phase 2	.31	.20	.06	.32
	Phase 3	.11	.06	.08	.20
	Phase 4	.05	.27	.25	.12

* $p < .05$
** $p < .01$

Table 6

Correlations between the Total Number of Strategies Used and Breadth Scores

		Total Strategies Used (Strategic Remembering)			
		Phase 1	Phase 2	Phase 3	Phase 4
Autobiographical Memory Breadth Scores					
Free Recall	Phase 1	.09	.14	.29	.02
	Phase 2	.13	.19	.02	.04
	Phase 3	.04	.26	.09	.20
	Phase 4	.05	.33*	.11	.07
Total Recall	Phase 1	.36*	.19	.21	.07
	Phase 2	.05	.16	.15	.07
	Phase 3	.12	.29	.27	.06
	Phase 4	.05	.30	.05	.07

* $p < .05$

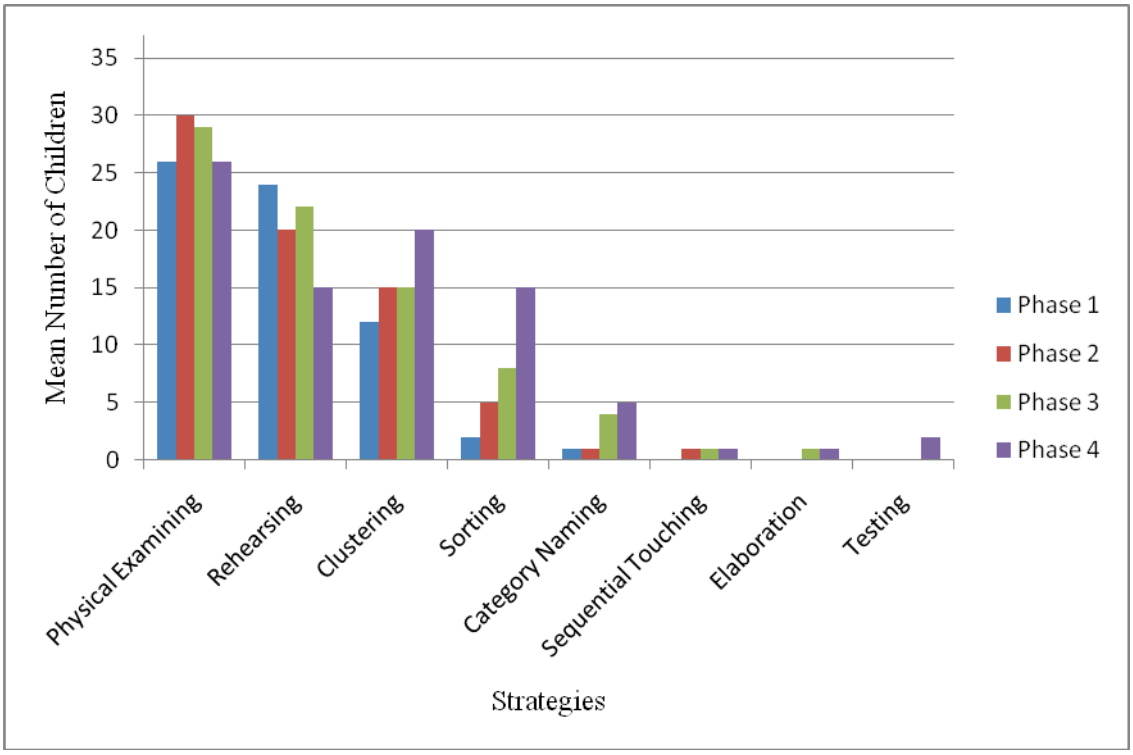
Table 7

Correlations between Metamemory Score and Breadth Scores

		Metamemory Score			
		Phase 1	Phase 2	Phase 3	Phase 4
Autobiographical Memory Breadth Scores					
Free Recall	Phase 1	.04	.04	.11	.22
	Phase 2	.08	.17	.12	.03
	Phase 3	.06	.34*	.04	.22
	Phase 4	.24	.11	.25	.07
Total Recall	Phase 1	.01	.09	.15	.13
	Phase 2	.05	.07	.08	.02
	Phase 3	.01	.22	.08	.15
	Phase 4	.20	.07	.33*	.04

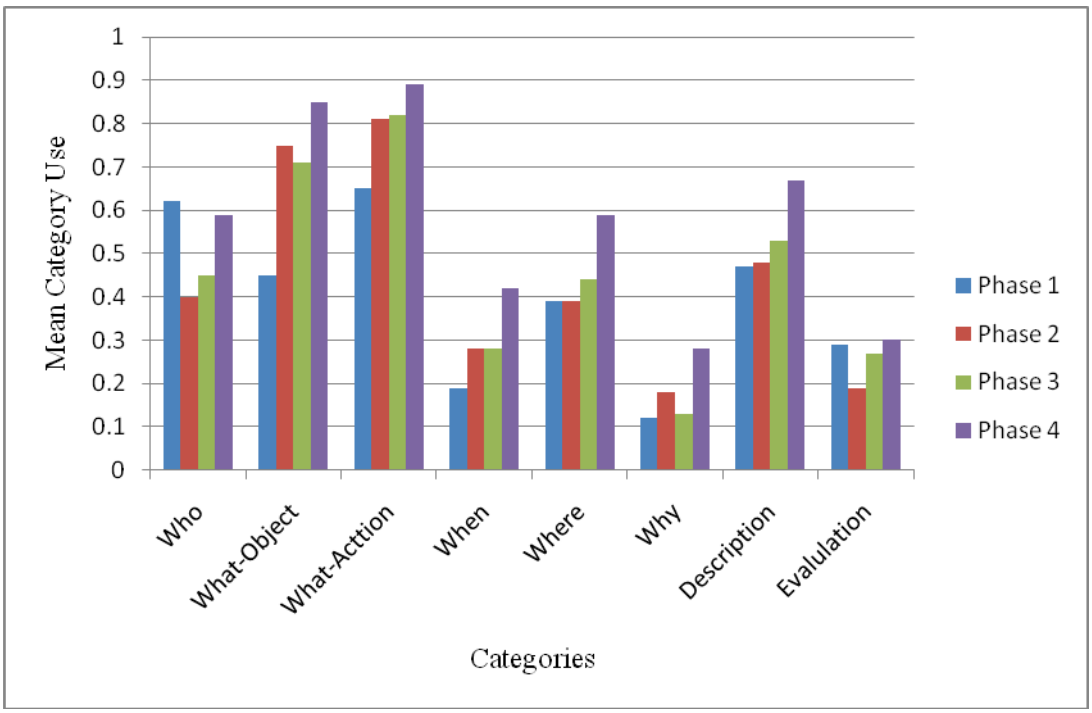
* $p < .05$

Figure 1



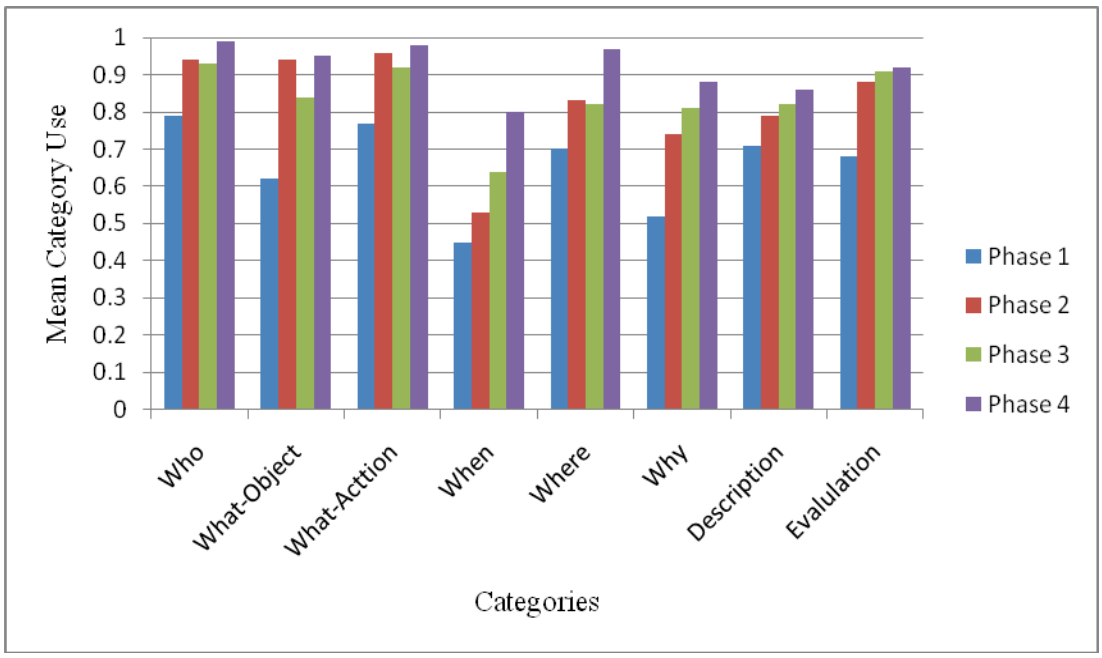
This graph demonstrates the average number of children who used each strategy across phases for the sort/recall task. The left represents strategies most common for 4-year-olds to use, while the right illustrates more sophisticated strategies that just begin to emerge as children reach age 7.

Figure 2



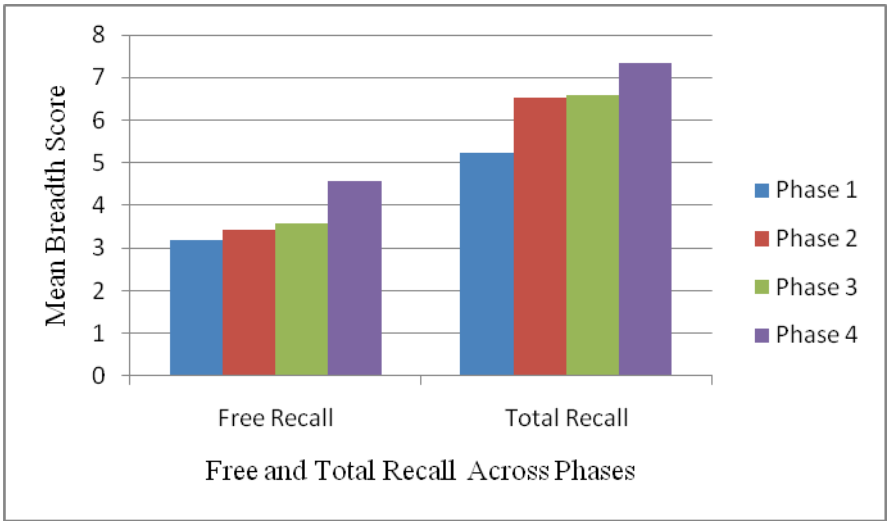
This graph demonstrates the average category fulfillment across Phases 1-4 for free recall.

Figure 3



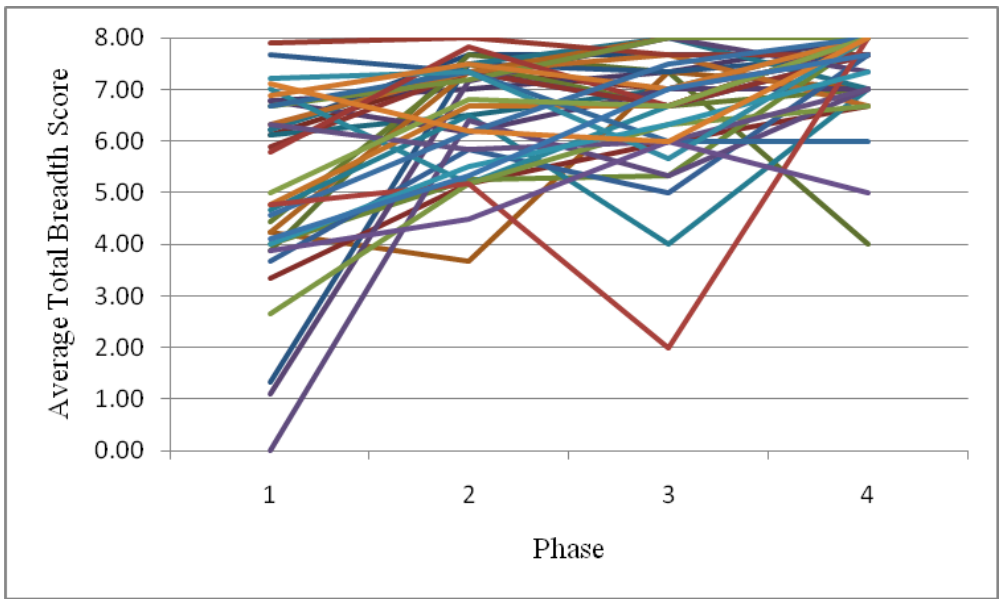
This graph demonstrates the average category fulfillment across Phases 1-4 for total recall (free recall + cued-recall + wh-prompting).

Figure 4



This graph demonstrates the average breadth scores across Phases 1-4 for free recall and total recall.

Figure 5



This line graph demonstrates each individual child's (n = 37) average total recall breath score across each phase.