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City University of New York PH.D. 1984

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Recollection and reconstruction in children's autobiographic memory

by

Judith A. Hudson

A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

1984

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August 29, 1984 — Katherine Nelson
date — Chairman of Examining Committee

August 30, 1984 — Herbert D. Saltzstein
date — Executive Officer

Katherine Nelson

Joe Glick

Sylvia Scribner
Supervisory Committee

The City University of New York

Abstract

RECOLLECTION AND RECONSTRUCTION
IN CHILDREN'S AUTOBIOGRAPHIC MEMORY

by

Judith A. Hudson

Advisor: Katherine Nelson

This study tested a schematic processing model of autobiographic memory in which autobiograhic memories are conceived of as the products of constructive memory processes, guided by general knowledge structures such as event schemas or scripts.

Sixty nursery-school children (mean age 4,7) and 58 kindergarten children (mean age 5,8) participated in either a single creative movement workshop (the episodic condition) or a series of 4 workshops (the script condition) and recalled workshops one month later. It was predicted that children in the script condition would acquire a script for the event which would organize their long-term recall of particular workshops. Rehearsal and cueing were also manipulated in order to test for effects of these factors on autobiographic memory.

Although immediate recall was unaffected by condition, there were marked differences in children's recall in the script and episodic conditions after 4 weeks. Children in the script condition recalled more than children in the episodic condition; children in each condition recalled different types of activities; and children in the

script condition confused activities occurring in different workshops. Older children remembered more than younger children and generalized more in both conditions, but effects of constructive processing were evident at both ages.

While rehearsal and specific cues increased recall in both conditions, these interventions did not improve accuracy in recall. Thus rehearsal and cueing did not affect the schematization process whereby similar episodes of familiar events become confused in memory. The finding that rehearsal did not differentially affect children's recall at different ages suggests that older children's improved recall was not due to the use of rehearsal strategies; but the finding that younger children relied more heavily on recall cues than older children suggests that older children were more efficient at directing their own memory search.

The findings from this study of children's autobiographic memory which controlled for amount of experience with an event, amount of rehearsal, and effects of cueing, are consistent with the hypothesis that after experiencing a series of recurring episodes, preschool children formed a script for a novel event which guided their long-term recall of particular episodes.

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Introduction

> Recollecting differs from remembering....because recollecting is, as it were, a kind of inference; for when a man is recollecting he infers that he has seen or heard or experienced something of the sort before, and the process is a kind of search.
>
> Aristotle (322 B. C.)

A new approach to memory research is apparent in recent naturalistic studies which emphasize the importance of studying everyday memory (Gruneberg, Morris & Sykes, 1978, Neisser, 1982(a)). This shift in orientation is especially useful for the study of memory development in children where traditional experimental paradigms have underevaluated young children's abilities (Brown, 1975, Perlmutter, 1980). Historically, memory development research has investigated children's memory for words, pictures, or prose designed to test particular aspects of memory performance (e.g., recall vs. recognition, short- or long-term memory, encoding and retrieval strategies: See Liben (1982) for a review). Recent naturalistic studies have found that preschool children who have great difficulty remembering experimental stimuli are quite good at remembering in familiar contexts that take advantage of their real-world knowledge. For example, preschool children can remember sequences of daily activities (Somerville, Wellman & Cultice as reported in Wellman & Sommerville, 1980) and locations of objects hidden in their homes (DeLoache & Brown, 1979) and can recall real-world events with accuracy after a time delay of one year (Fivush, Hudson & Nelson, 1984).

The present research examines the development of one type of everyday memory, that is, autobiographic memory. Autobiographic memory has been defined by Schactel (1947) as "the ability for voluntary recall of one's past life." By this definition, all past experienced events can be candidates for autobiographic memories. However, it is clear that of all the events we experience in the course of our lives, only a fraction are retained in memory. Theories have alternatively emphasized psychodynamic or cognitive processes as responsible for both forgetting and remembering real-world experience (See White & Pillemer, 1979 for a review).

In the present study, developmental differences in children's autobiographic memory are examined in the context of a schematic processing model. Within this model, autobiographic memories are conceived of as the products of constructive memory processes, drawing not only from memories of particular past experiences, but also from general knowledge structures. One very important source of constructive processing in autobiographic memory may be general event knowledge, organized schematically in the form of general event representations.

There are a number of lines of evidence to support the proposal that general event representations can influence the organization and retrieval of autobiograhic memories. First, research had shown that general event representations and autobiographic memories involve similar representational properties. Second, a schematic processing model can account for many of the distortions found in adults' autobiographic recall. Third, research on children's memory for real world events has shown that familiarity with events affects children's

memory for specific episodes. These points are discussed in the following sections. Finally, the developmental implications of a schematic processing approach to autobiographic memory are discussed and a study designed to test aspects of the model is presented.

A schematic processing model of autobiographic memory

General event representations. Research has shown that children and adults have well organized knowledge about familiar events organized as generalized event representations or scripts (Mandler, 1983, Nelson & Gruendel, 1981, Schank & Abelson, 1977). Event schemas are cognitive structures that describe sequences of necessary and optional actions for particular events. They are activated automatically whenever familiar events are encountered and provide sets of expectations to guide behavior in real world situations. Actors, actions, locations, and props are represented in terms of slots that can be filled by various slot fillers. Depending on the event, different slot fillers are more or less likely to occur and probability values for the occurence of particular slot fillers are also included in event schemas. Because event schemas are wholistic structures, what occupies one slot will constrain the range of possibilities for filling other slots.

For example, at a birthday party, the participants, games, presents, and type of cake may all vary from party to party. However, certain types of games such as pin the tail on the donkey or musical chairs are more likely to be played than baseball or tag. Expectations for what games will be played and what presents will be given will be different if the party is for a child or an adult. While games may

vary, there is always a birthday cake. Even three-year-olds' knowledge of birthday parties includes such information.

Generalized event representations not only guide behavior in routine events, but also provide a cognitive framework for understanding and remembering stories. For example, adults and children are better at remembering the most salient actions from event-based stories and their recall is disrupted when events are presented out of sequence (Bower, Black & Turner, 1980, Hudson & Nelson, 1983, McCartney & Nelson, 1981). Because event schemas are activated automatically when a familiar event is referred to and specify start and stop rules in memory search, they provide an implicit mechanism by which "natural" or "incidental" memory occurs. Thus preschool children who fail to use deliberate encoding and retrieval strategies are able to use event schemas to guide comprehension and recall of event-based stories (Hudson & Fivush, 1983).

Reliance on schematic structures in recall can also result in distortions in memory. Actions that are expected to occur but that are not explicitly stated are falsely recalled and more typical slot fillers can replace those actually presented (Hudson & Nelson, 1983). In addition, details of different stories about the same event can become confused with one another (Martin, Harrod & Siehl, 1980, Slackman & Nelson, 1984). In this way, reliance on general event representations in memory leads not only to more complete recall, but also to distortions in recall in the direction of the canonical event representation (Mandler, 1979).

General event knowledge and autobiographic memory. Historically, autobiographic memory and general world knowledge or semantic memory have been considered as separate memory systems (Tulving, 1972). Autobiographic memory has been thought of as a type of episodic memory phenomenon. The distinguishing feature of this type of memory is that it is stored and retrieved in terms of temporal and spatial information. General conceptual knowledge of which generalized event representations are one type was thought to be stored and accessed separately.

An alternative formulation is that general knowledge about events and memory for details of particular experiences are two forms of event representation, general and specific, that are intimately linked in the memory system. Autobiographic memories can be thought of as specific event representations organized in memory not by spatial and temporal tags, but in terms of their relationships to general event representations. In this formulation, specific episodes of real world events act as particular instantiations of general event schemas. That is, because general event representations already specify information about possible instantiations for various slots in event schemas, details from a single episode that match what is included in a general event schema contain no new information and are not stored separately as an individual autobiographic memory.

In trying to remember a specific occurence of a familiar event, the general event representation may be automatically activated to guide autobiographic recall in much the same way that recall of event-based stories is schematically organized. Schematic processing in autobiographic memory may produce similar kinds of distortions in recall

as recall of "what happened" may be confused with "what should have happened" based on general knowledge about the event.

However, this relationship may be altered by a novel or atypical experience. A single experience can be thought of as an event representation in which all slot fillers have a 100% chance of occurring because there are no other potential fillers represented. (Of course it is always possible that general knowledge about people and places that is not bound to a particular event can influence event schemas. See Schank (1983) for a discussion of effects of thematic knowledge on the organization of event knowledge.) In this case, all details from the experience are retained in memory.

Atypical episodes may also be linked in memory to general event representation, but because they include unusual or unexpected slot fillers, they can be tagged in memory in terms of their distinctive features. For example, in recalling a specific dinner at a restauant, we might remember one in which something unusual happened -- the waiter was rude, the food was very bad or very good, it was especially expensive or inexpensive, etc.

If what is initially experienced as a novel event or an unusual variation is subsequently repeated, details of a specific occurrance which are initially tagged in memory as a specific episode can be incorporated into the general event representation as alternative slot fillers. In this way, autobiographic memories can become schematized over time and with repeated encounters (Linton, 1975, 1978, 1982, Taylor & Winkler, 1980).

There are, of course, many characteristics of autobiographic memory that are different from remembering presented stories. For example, autobiographic recall is often cued by specific people, objects or locations, and frequently occurs in social contexts where other participants from the recalled experience are present to provide verbal cues (e.g. "Do you remember the time that we...?"). Real world experiences may also be rehearsed either by an individual because of their personal significance or for an audience because of their social significance (e.g. "What did you do in school today?", "Remember what happened the last time you visited Grandma?", "Class, what did we talk about yesterday?").

In addition, particular experiences may be remembered as instantiations of other general knowledge structures such as self schemas, schemas for social interactions, or part of an individual's life history. Generalized event representations are only one of many types of knowledge oganization that can affect the content of autobiographic memory and a full account of autobiograhic memory organization must consider these influences as well.

However, research on adults' autobiographic memory generally supports the proposal that general event knowledge can exert a powerful influence on recall of individual episodes. In particular, adults display differential recall for novel and familiar events, and recall of familiar events is subject to distortion from effects of general event knowledge. The following section reviews the evidence for this statement.

Constructive processes in adults' autobiograhic memory

Studies of adults' recollections of childhood have appeared since the turn of the century (Colegrove, 1899, Henri & Henri, 1898, Hall, 1899). A traditional instrument used to assess autobiographic memory is a questionnaire in which subjects are asked to describe and date their earliest memories. Variations on this approach include a direct interview method (Dudycha & Dudycha, 1933(a), Hanwalt & Gebhart, 1964) and an early memory check list in which subjects are asked to mark names of objects and situations that prompt an early memory and provide an age for the memory (Child, 1940, Crook & Harden, 1931). Related research includes investigations of the effects of different types of prompts (e.g., object, action and affect words) on autobiographic recall (Fitzgerald, 1980, 1981, Robinson, 1976), studies of recall of particular time periods or historical events such as mother's memories of their child's birth and early development (Haggard, Brekstad & Skard, 1960, McGraw & Molloy, 1941, Robbins, 1963), adolescents' memories of kindergarten (Gold & Neisser, 1978), and recall of presidential assassinations and assassination attempts (Brown & Kulik, 1977, Colegrove, 1899, Pillemer, in press, Winograd & Killinger, 1983), as well as case studies of individuals' autobiographic memory (Barclay, Abrams & Wellman, 1982, Hall, 1899, Linton, 1975, 1978, 1982, Neisser, 1981, Smith, 1952).

A consistent finding from recollection studies is that novel episodes are remembered more frequently than recurring episodes. Sixty-four percent of the first memories reported by 100 college students in Potwin's (1901) study were of single episodes while 36% were

of repeated episodes. (The first day of school was omitted from this analysis because it was felt that it could be too easily confused with subsequent episodes.) Hanawalt & Gebhart (1964) also found a greater number of memories for single episodes than recurring ones in 65 subjects' memories from the years one to five. From a sample of 9 subjects, Smith (1952) reported that 57% of the 101 memories of up to 4.5 to 5 years of age were of novel episodes while only 15% were for repeated episodes (Smith, 1952). Although Dudycha & Dudycha (1933(a), 1933(b)) did not analyze their data along these lines, Waldfogel (1948) found that, of the 25 memories they describe in detail from their studies of adults' first memories, 66% are stated to be or appear to be novel episodes.

The only exception to these findings is found by Gold & Neisser (1978) in a study of fifth, eighth, and eleventh graders' recall of kindergarten experiences. At all ages, more memories were of general information than of specific episodes. This discrepancy can be explained by the fact thay they were only asked about one event which was itself a repeated event. Further, the general memories tended to be of general information such as, "during recess, we used to go outside..." This type of recall is usually excluded from most recollection studies in which subjects are asked to recall particular episodes that occurred at a particular time. Although the general memories reported by Gold & Neisser are not comparable to memories of particular episodes of recurring events reported in other studies, these findings support the hypothesis that general event knowledge organizes autobiographic memory for episodes of familiar events.

In summary, recollection data indicates that memories of specific episodes of recurring events are less accessible than memory for novel events and are consistent with the formulation that details of recurring experiences are represented in memory in the form of general event representations which store information about specific episodes as instantiations of the general event schema, and not as distinct individual episodes.

When it is possible to compare autobiographic recall to objective records, distortions in autobiograhical memory become apparent. These distortions also suggest that autobiographic memories of familiar events have become incorporated into a general event schema, making it difficult for subjects to distinguish what happened one time from what happened many times.

For example, when memories are checked against records, it is sometimes the case that information a subject recalled in a single episode actually occurred over two or more repeated episodes. In John Dean's recall of his meeting with President Nixon on Sept. 15, 1972, he reports, "The President asked me to sit down" (Neisser, 1981, p. 9), and under further questioning Dean recalls, "He said, 'Sit down'" (p. 11). In fact, the President did not ask Dean to sit down. Dean is probably fusing information from many meetings in the Oval Office and is generating this detail from knowledge about what usually happens at the beginning of such meetings. Smith (1952) found similar types of fusions in recall and, in some cases, subjects did not even realize the episode had been repeated but thought they were recalling a single experience.

Neisser has coined the term "repisodic recall" to describe these memories of particular episodes which are actually based on details that are repeated over a number of similar episodes. He describes Dean's repisodic recall: "What seems to be specific in his memory actually depends on repeated experiences, rehearsed presentations, or overall impressions. He believes that he is recalling one conversation at a time...but he is mistaken" (Neisser, 1981, p. 20). In light of these findings, it seems probable that many of the episodes recalled by subjects in recollection studies are actually repisodic and not episodic in content.

Neisser also reports a related phenomenon, the confusion of two or more repeated episodes in recall. In recalling a meeting from March 13, 1973, John Dean reports a discussion of "hush money" to be paid to the Watergate burglars. Although this conversation did take place and Dean's testimony is relatively true to the facts, it did not occur on March 13. Rather it transpired on March 21, but in Dean's recall of the March 21 meeting, he fails to mention this momentous conversation. In this example, memory for two separate instances is retained, but the details from both are confused with one another. Similarly, Barclay et al. (1982) found that subjects tended to confuse actual descriptions of "what happened" recorded by themselves a year ago with event descriptions that were consistent with "what should have happened."

Linton's data (Linton, 1975, 1978, 1982) provides additional examples of fusion and confusion in autobiographic memory. Linton recorded descriptions of daily episodes over a six year time span. At periodic intervals, she tested her ability to recall and date episode

descriptions selected at random. Repeated experiences with an event resulted in increased confusion between episodes. For example, the description "I xerox the final draft of the statistics book and mail it to Brooks/Cole" when first written referred to a singular experience. After three "final drafts" were mailed, she could not distinguish one episode from another. Linton decribes this process as a "transition from episodic to semantic memory."

These data raise the issue of cueing in autobiographic recall. In the above example, the cue "final draft" is an effective recall cue only when there was a single final draft to be remembered. It loses its effectiveness when that particular feature of the experience is repeated. However, "the last final draft", by virtue of being more specific, might endure longer as an effective retrieval cue, providing there is not a fourth draft.

The issue of cueing or prompting is discussed in only two additional studies, but in both cases was also found to be an important determinant of recall. McGraw & Molloy (1941) found that accuracy in mother's recall of their children's early physical and behavioral development improved when mothers were given more specific questions (e.g., "Do you remember about the time your baby could sit alone leaning forward on his hands?" accompanied by a line diagram instead of "When did he begin to sit up alone?") Gold & Neisser (1978) also found that subjects who could not recall anything when asked, "Do you remember any field trips from kindergarten ?" were able to recall a number of details when asked, "Do you remember taking a field trip to an apple orchard?"

Another factor assumed to influence autobiographic memory, but which has rarely been studied systematically, is the effect of rehearsal on recall. In general, recollection studies provide no data on how frequently early memories have been rehearsed. It is possible that novel episodes tend to be recalled or rehearsed more often than routine episodes and rehearsal rather than novelty causes them to be recalled better over long periods of time. It is possible that very vivid memories of important historical events such as the assassination of the President known as "flashbulb" memories (Brown, & Kulik, 1977, Colegrove, 1899, Pillemer, in press, Winograd & Killinger, 1983) may be well-remembered because they are well-rehearsed, not necessarily because of the events' historical significance or emotional impact (Neisser, 1982(b)). Alternatively, one might predict than routine episodes should be recalled better because repeated experiences provide a type of rehearsal for specific episodes.

Neisser (1981) found that John Dean's recall was most accurate for the parts of conversations which he had probably rehearsed beforehand, such as well-prepared reports which he delivered. Further, Linton (1978) found that episodes that had previously been tested were more likely to be remembered and this effect was most apparent for time delays of 2 or more years. After 4 1/2 years, only 36% of the episodes tested for the first time were remembered while 85% of the episodes that had been tested more than 3 times were remembered.

In summary, two types of memory failures are found in recall of recurring events: failure to recall a particular episode in detail although a plausible particular episode can be generated based on knowlege of what happens in general, and failure to distinguish between recall of two or more similar episodes. These memory failures can be explained by the proposal that general event representations are guiding autobiographic recall. Schematic or constructive processing produces intrusions in recall in which information consistent with general event knowledge is falsely remembered and details from separate experiences are confused with one another. Over time and repeated experience, "reproductive" memory is superceded by "reconstructive" memory (Slackman & Nelson, 1983). However, intrusions are minimized with specific questioning and rehearsal. These findings suggest that cueing and rehearsal may mediate constructive processes in autobiographic memory for recurring events. The next section discusses evidence for schematic processing in children's autobiographical memory.

Constructive processes in children's autobiographic memory

Diary studies show that children as young as two have autobiographic memories and children remember experiences over longer periods of time as they grow older (Hurlock & Schwartz, 1932, Nelson & Ross, 1980). Preschool children are able to narrate organized accounts of past episodes either spontaneously (Umiker-Sebeok, 1977), or in response to elicitations (Todd & Perlmutter, 1980). They use the past tense appropriately and provide necessary orienting information such as who, what, and how (Menig-Peterson & McCabe, 1978). Indeed,

conversations about past episodes are frequent in early mother-child interactions (Eisenberg, 1982, Engel, Kyratzis & Lucariello, 1984, Ratner, 1980).

How do children's autobiographic memories compare to adults' recollections? Young children recall both novel and recurring episodes (Hurlock & Schwartz, 1932, Nelson & Ross, 1980, Todd & Perlmutter, 1980) and parents' questions about the past refer to particular episodes as well as general knowledge about recurring events (Ratner, 1980). While Todd & Perlmutter found an equal number of memories for novel and routine episodes in 3-4 year old children's elicited recollections, Nelson & Ross found a slightly higher proportion of memories for single episodes than for routine ones in 2-year-olds'spontaneous recall.

Although parents verified most of the memories from these studies, factors influencing accuracy have not been investigated. However, accuracy in recall of a specific episode was studied by Sheingold & Tenney (1982) who compared responses of 4-, 8-, and 12-year-olds' to questions about the circumstances surrounding the birth of a sibling. While age at the time of recall varied, all subjects were four years old when their sibling was born. Instead of asking for free recall, both children and their mothers were asked specific questions (e.g. "Who took care of you right after your mother left to go to the hospital?"). Results showed that amount and accuracy of recall did not vary substantially by age.

In contrast, Worsley (1982) found that accuracy in recalling a recurring event (preschool activities) decreased as a function of time delay and subsequent school experience. Preschool, kindergarten, first, second, and third grade children who had all attended the same preschool were shown pictures of preschool activities and were asked to judge whether the activities had or had not occurred. With age, there was a linear increase in failure to recognize activities which had occurred during preschool but which later dropped out of the school day routine. Another common error was false recognition of activities that had been added to the school day after preschool, as well as activities that are inferred to take place in preschool but which were not part of the preschool experience (e.g. naptime).

In comparing these two studies, it can be seen that, unlike recall of a relatively novel and extremely salient episode, recall of a routine event was affected by subsequent experiences of the same event. Children had difficulty recalling activities unique to the particular event and intrusions in recall were found in the direction of activities common across all grades. These findings are consistent with results from adult recollection studies indicating more accurate and accessible recall for novel events and intrusion of general knowledge into recall of episodes of recurring events.

Further evidence for effects of familiarity on children's memory for specific episodes comes from a study comparing children's general knowledge of routine everyday events with their memories of specific episodes of the same events -- snack at summer day camp and dinner at home (Hudson, 1983). Preschool children had greater difficulty

answering the question, "What happened yesterday...?" than the question, "What happens...?" They mentioned less information in response to the episodic question and were unable to recall many details about the episodes in question.

A follow-up study compared 3-, 5-, and 7-year-olds' responses to general and episodic inquiries about events which varied systematically in terms of familiarity. After only one experience, children's responses to "What happened one time...?" included many episodic details, but with increased experience, their memories included more general and less episodic information. Older children consistently recalled more than younger children for both novel and familiar events. However, 3-year-olds had particular difficulty recalling episodes of very familiar events and tended to give general event scripts instead. For example, in recalling a day at summer camp one three-year-old reported: "In summer you go to camp. Play. And play. Play in the sandbox."

The episodes that children recalled appeared to stand out because they were very recent or they involved personally salient people and places. A few reports included violations in the standard event sequence such as a thunderstorm at the beach or a trip to the zoo when a favorite species was missing. These findings suggest that, like adults, children's autobiographic memory is organized around general event representations with the addition of specific "tags" pointing to distinctive slot fillers (particular people, places and props) and deviations from the routine.

These two studies also suggest that cueing plays a role in children's autobiographic recall. While children had great difficulty recalling "what happened yesterday" in the first study, they were able to give longer and more detailed accounts of "what happened one time" in the second study even when the event was very familiar. It is possible that the "one time" cue was more effective because it allowed children to select episodes that were tagged in memory in terms of unusual or distinctive slot fillers.

Effects of novelty and cueing in children's autobiographic recall were further highlighted in a study of children's memory for an unfamiliar event (Fivush, Hudson & Nelson, 1984). This study traced kindergarten children's recall of an unusual class trip (to an archeology exhibit) from immediate recall of the episode on the same day to recall of the trip one year later. After six weeks, children's memory for the event was as accurate and detailed as their immediate recall. After one year, children's recall was equally accurate, but children required more specific cues to recall the same information that was so easily accessed before. Whereas only 7% of the children were able to recall the trip given the original question, "Can you tell me what happened when you went to the Jewish Museum?", an additional 53% responded when they were asked, "Do you remember you learned about archeology?" Although these children had been to museums before, this was the only archeology exhibit they had been to. This cue provided distinctive enough information for children to distinguish this one specific episode from all other occurences of the event.

Thus, children's autobiographic memory system appears to operate in much the same way as the adult system. That is, increased familiarity with an event leads to greater difficulty in recalling a particular episode, resulting in generalizations and confusions between similar episodes in recall. Retrieval of autobiographic memories also depends on the match between the distinctive features of episodes and recall cues. Recall is therefore enhanced when an episode is not repeated or if the cue given for recall refers to a distinctive feature of the episode. If children's autobiographic recall follows the same pattern as adults', rehearsal of episodic information should improve retrievability and accuracy in recall. This hypothesis needs to be investigated.

This line of research also points to developmental differences in children's autobiographic memory. For example, younger children (3 years) tend to remember less than older children (5-7 years) and their recall is less detailed (Hudson, 1983). Does this indicate that younger children represent less information from real world experiences in memory, or are they less efficient at retrieving autobiographic information?

An alternative interpretation is that younger children's autobiographic memory is more schema-bound than older children's. Evidence for this interpretation comes from research on chldren's use of schemas in story comprehension and recall. A consistent finding from this research is that younger children tend to rely more heavily on schematic structures in memory than do older children and adults. Younger childen's recall is therefore more disrupted when material

deviates from their expectations (Fivush & Hudson, 1983, Hudson & Nelson, 1983, Mandler, 1978, Mandler & DeForest, 1979).

Because younger children's recall is more schema-bound, they may be more influenced by general event representations in recalling particular experiences than older children. To the degree that distortions in autobiographic memory are a result of using general event schemas to guide retrieval, more distortions would be predicted to occur in younger children's recall of recurring events.

However, it is unclear how an increased dependence on schematic structures would affect recall of novel events. One possibility is that young children would have greater difficulty recalling a single episode because they would have no schema available to guide recall. An alternative prediction is that recall would be better for a single experience because it would not be schematized into general event knowledge.

Purpose and predictions

A general problem with much of the data on autobiographic memory in adults and children is that explanations for what is remembered and what is forgotten are largely retrospective. Predictions about what should be remembered over time and subsequent experience have not been tested in situations where age, experience, and rehearsal have been controlled.

To test for effects of familiarity on children's autobiographic memory, nursery-school and kindergarten children in the present study experienced the same events in two conditions: In the episodic conditions, children participated in a single creative movement workshop that was a novel experience and was never repeated. Four weeks later, children were asked to recall the workshop. In the script condition, children participated in a series of 4 creative movement workshops once a week for one month. Four weeks after the first workshop (week 5), children were asked to recall the first workshop, and 4 weeks after the last workshop (week 8), they were asked to recall the last workshop. The workshops children experienced in the episodic condition were identical to the first and last workshops children experienced in the script condition.

Thus children in both conditions were tested for long-term recall of the same events consisting of the same activities. However, children in the script condition should have acquired a schema for the event which was expected to affect their recall of particular workshops. In addition, amount of rehearsal and cueing were manipulated to test for mediating effects on schematization. The following predictions about effects of schematic processing on children's autobiographic memory were made.

First, if children were using event schemas to guide recall of specific episodes, children's recall in the script condition should be longer and more cohesive than children's recall in the episodic condition after a time delay of 4 weeks. Because an event schema represents all actions of an event in terms of potential slot fillers,

when an event schema guides recall, all of the component actions are automatically invoked and are filled by specific slot fillers, resulting in longer and more structured recall. An experience that is not related in memory to this kind of wholistic organizing structure, as is the episodic condition, is therefore more difficult to retrieve and recall is not as organized.

It was also predicted that children's recall in the script condition might reflect a more general level of organization. Experiencing recurring similar episodes could result in more generalization in recall as children reported both what generallly happens in the workshops as well as what specifically happened in the particular workshop queried. This effect has been found in both children's and adult's recall of recurring events (Hudson, 1983, Linton, 1975, 1978, 1982).

Next, recall was expected to be more accurate in the episodic condition than in the script condition. Because different activities can fill the same action slot in an event schema, in reconstructing memory for specific episodes, activities that filled the same action slots in different episodes can become confused with one another. That is, "what happened" is difficult to distinguish from "what could have happened".

If younger children rely more on general event representations than older children, these effects should be greater for nursery-school children than for kindergarten children: They would have greater difficulty recalling the workshops without a general event

representation to guide recall in the episodic condition; nursery-school children in the script condition would generalize more than in the episodic condition, and their recall would include more intrusions due to greater confusion between specific instantiations of the general event schema.

Predictions about the effects of cueing and rehearsal on children's recall in the two conditions were more tentative. Although research suggests that temporal cues such as "yesterday" are generally ineffective while cues referring to distinctive features of an episode enhance recall, there has been no systematic investigation of cueing on novel and familiar events for children at different ages. If details of a particular episode of a recurring event are retrievable, then specific activity cues and photographs of the episode could prompt more recall. However, if details from similar episodes have been incorporated into a general event schema as potential slot fillers, even very specific cues may not improve children's recall in the script condition.

Rehearsal effects could also interact with effects of familiarity. Immediate rehearsal may help children preserve memory for details. Although this would not affect recall in the episodic condition where confusions in recall should be relatively low, rehearsal could enhance accuracy of recall in the script condition by mediating the efffects of schematization whereby details of individual occurrences become confused in memory.

Effects of cueing and rehearsal may also vary by age. It has generally been shown that in directed memory tasks, younger children fail to utililize deliberate rehearsal and retrieval strategies (e.g., Hagen, Jongewald & Kail, 1975, Hagen & Stanovich, 1977). A traditional paradigm for exmamining strategy deficits is to provide children at different ages with explicit training or cues and to measure improvement in recall. If younger children's poorer recall performance is due to failure to use such strategies, their recall should be more improved than older children's recall (see Kobasigawa, 1977 for a review). By analogy, if nursery-school children in this study show greater improvement in recall than kindergarten children as a result of rehearsal or more specific cueing, it would suggest that without these interventions, they are less able than older children to spontaneously use these types of strategies in recall.

Method

Design

Twenty children in each age group participated in a series of weekly creative movement workshops for 4 weeks (the script condition). One week after the last workshop (week 5), children were asked to recall the first workshop and three weeks later (week 8), children were asked to recall the last workshop. (A schedule of workshops and recall sessions in shown in Table 1.) Twenty children in each age group also participated in a single workshop, workshop A, identical to the first workshop in the script condition, and 20 children in each age group participated in a single workshop, workshop D, identical to the last

workshop in the script condition (the episodic conditions). Children in the episodic conditions were asked to recall the workshops 4 weeks later.

Table 1

Schedule of workshops and recall sessions

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 8
	Workshops				Recall sessions	
Condition:	A	B	C	D	A	D
Script:						
Rehearsal	X*	X	X	X*	X	X
No Rehearsal	X	X	X	X	X	X
Episodic (A):						
Rehearsal	X*				X	
No Rehearsal	X				X	
Episodic (D):						
Rehearsal				X*		X
No Rehearsal				X		X

* Immediate recall session on the same day as the workshop

Because the workshops required participation from children as a class, nursery and kindergarten classes were randomly assigned to either the script condition or one of the two episodic conditions. (Due to absences, only 19 kindergarten children participated in each episodic condition.) Within each class, equal numbers of children were randomly assigned to either the rehearsal or the no rehearsal group. Children in the rehearsal group for the script condition were asked to recall the

first and last workshops on the same day as the workshops took place. Children in the episodic condition rehearsal groups also recalled the workshops on the same day. Children assigned to the no rehearsal groups did not recall the workshops until 4 weeks later.

Subjects

Subjects were 60 nursery-school children (mean age 4,7; age range 3,6-5,1) and 58 kindergarten children (mean age 5,8; age range 5,2-6,2) from public and private preschool programs in New York City drawing from mixed ethnic and socioeconomic populations. Children's academic ability ranged from low average to gifted. Approximately equal numbers of girls and boys participated in the study.

Procedure

Workshops. An instructor who was unknown to the children came to their classrooms and conducted the workshops. Workshops consisted of enjoyable activities that involved physical participation and that were not regularly included in the school curriculum. It was important to select activities that were appropriate for children from 3 1/2 to 6 years old so that even the youngest children were able to participate fully and the older children were not bored. Consequently, the workshops consisted of familiar types of activities such as singing, dancing, and movement games. However, many of the specific songs, dances, and games were novel and they were performed in novel ways (e.g., faster, slower, louder, softer, with different movements, with a drum, etc.). The particular sequence of activities was also novel.

Each workshop started by having the class sit in a circle on the floor and the instructor introduced (or reintroduced) herself by saying her name and tapping a rhythm on her drum. Then the drum was passed around the circle for each child to "say their name on the drum" by tapping a rhythm as they announced their name. Next, there was a warm-up activity -- a familiar song, "Clap Your Hands", which was extended to include movements with various parts of the body ("shake your hands", "stamp your feet", "run in place"). This fairly rousing song was followed by returning to a sitting position in the circle and singing a new song, either "Rum Sum Sum" or "Roll and Roll and Pull" which were accompanied by specific hand movements. After a couple of choruses, the song was sung faster, slower, louder, softer, etc. Then children stood up and a whole body activity was introduced which varied across each workshop. To wind down, children lay down on the floor and slowly raised their arms to the ceiling and "floated" them down. This action was repeated with legs and then arms and legs together. Finally, children sat in a circle again, and passed around the drum to "say good-bye on the drum" by tapping out a rhythm. (A complete description of each workshop's activities is given in Appendix A.) An experimenter was present at each workshop to record that all activities in each of the workshops occurred according to schedule. She also took photographs of workshops A and D for some of the classes. Each workshop was completed in 25-30 minutes.

To facilitate schematization of the workshop event by children in the script condition, the sequence of core acts, that is, the most salient action categories, was fixed across workshops. These included:

the 2 anchor acts, saying hello and good-bye on the drum songs; songs (with accompanying movements); and movements (whole body movements and dances). Thus a script for the event would consist of the following acts: "You play on the drum, you sing songs, you do movements and you play the drum again." While these acts occurred in a fixed sequence, specific songs and movements varied across workshops. Act slots were therefore filled by different specific activities in each workshop. (See Appendix A.)

Specific activities also varied in terms of how frequently they were experienced. Ten activities included in each workshop occurred as follows: the 2 anchor activities always occurred at the beginning and end of each workshop (saying hello and good-bye on the drum); 2 recurring activities also occured in each workshop ("Clap your hands" song and the resting activity); 1 variable activity varied in alternate workshops ("Rum sum sum" or "Roll and roll and pull" songs); and there were at least 4 activities unique to each workshop (whole body movements).

Thus children in the episodic condition experienced an enjoyable and relatively novel event in the context of morning school activities. While this event had not been experienced before, it was not uncommon for new and special activities to occur sometimes. In contrast, the workshops became a familiar event to children in the script condition. They knew the instructor by name and called out to her when she arrived each week. As they participated in more workshops, children anticipated some of the activities. For example, children became more inventive in tapping out rhythms on the drum. Children who were too shy to play the

drum in the first workshop eagerly took their turn in later workshops. Children also performed movements accompanying songs more readily and called out variations themselves (e.g."Let's do it without words"). By the last workshop, the activity of raising and lowering arms and legs was slower and more controlled.

Rehearsal interviews. Children in the rehearsal groups were interviewed on the same day as the workshop, from 5 minutes to 2 hours after the workshop was completed. Children were first asked "What happened in the workshop today?". This question was followed by general probes (e.g., "Anything else?"). Next, children were asked to recall the workshop in sequence (e.g., "What was the first thing that happened?", "Then what happened?").

Because older children generally recall more than younger children, to ensure that all children received the same amount of rehearsal, children were also reminded of activities they failed to recall spontaneously. Reminders took the form of questions about specific activities. For example, children were asked "Did you sing some songs?" and if they failed to recall any, they were asked, "Did you sing 'Clap your hands?'" Rehearsal interview questions are provided in Appendix B.

Each child was interviewed individually by one of two female experimenters who each interviewed equal numbers of children.

Recall interviews. Children in the script condition were asked "What happened in the first (or last) workshop?" and children in the episodic condition were asked "What happened in the workshop?". These questions were followed by general and then sequential probes.

If children did not spontaneously recall all of the activities for each workshop, they were given verbal prompts such as "What was the first thing that happened?" "Did you sing some songs?" and "Did you do a Raggedy Ann dance?" However, prompts that mentioned specific activities were only given at the end of the interview if children had not recalled those activities spontaneously. Specific activities depicted in the photographs shown to children in the photograph identification phase were not referred to in verbal probes so that children's responses to the photograph identification task would not be confounded with verbal prompts provided by the experimenter in the interview phase. Delayed interview questions are provided in Appendix C.

Next, children were shown photographs of 6 of the activities that took place in the workshop. Children were told, "I have some pictures of your class (or some children) in the workshop (or the first or last workshop). Let's look at them together and maybe you can tell me what happened in each of the pictures? Here's the first one. What happened in this picture?" The last question was repeated for each photograph. If children merely described the photograph (e.g. "They're sitting in a circle"), they were asked additional probe questions to test whether they actually recalled the activity depicted (e.g. "What were they singing?" "What happened after that?")

The photographs depicted the following activities: saying hello on the drum, the warm-up song ("Clap your hands"), a song with movement ("Rum sum sum" or "Roll and roll and pull"), 2 activities unique to the particular workshop, and the relaxation exercise. These activities included an anchor act, two repeated acts, one variable act and two

unique acts and were selected because they were maximally distinct activities. For example, some of the movements in the Raggedy Ann dance from workshop A looked similar to some movements in the Looby Loo dance from workshop D. Consequently, these activities were not depicted. The order of presentation of photographs matched the order in which the activities took place in the workshops. A complete list of photograph descriptions in included in Appendix D.

Because photographs were not available for all classes, approximately half of the children were shown photographs of their own class performing the activities and the other half were shown photographs of children of the same age in a different class performing the activities.

Each child was interviewed by one of two female experimenters who had conducted the rehearsal interviews. Children in the rehearsal groups were interviewed by different interviewers in the rehearsal and recall sessions.

Coding

Rehearsal and recall interviews were tape recorded and transcribed verbatim for coding. Recall for 10 activities in each workshop were coded as follows: children were credited with spontaneous recall of these activities if they specifically mentioned them without prompting. For example, a child would have to mention the specific song, "Rum Sum Sum" to be credited with recall of the song with movement in workshop A. Children were credited with recall with verbal prompting if they

mentioned specific actions or gave additional details when queried. For example, if a child was asked "Did you do a dance? How did the dance go?" and said either that they did a "Raggedy Ann dance" or described the dance, "You go flop, flop, flop, and then stand up," they were credited with recalling that activity with a verbal prompt. In the recall interview, children were credited with recall with photograph cues if they mentioned specific activities or gave additional details when they were shown photographs.

Any activity mentioned by a child that did not occur in the workshop was coded as an intrusion. For example, if a child falsely recalled activities from workshops B, C, or D in recalling workshop A (e.g. "We did animal movements", "We did a witch's dance" or "We sang 'Roll and roll and pull'"), these were coded as intrusions. If a child mentioned an activity that had not occurred in any of the workshops (e.g. "We sang 'A-B-C'" or "We did the hokey pokey"), these were also coded as intrusions. In addition, children sometimes referred to the workshop activities at a more general level, for example, "we played the drum," "we did exercises," and "we sang songs." These statements were not included in the coding for recall of specific activities but they were coded as general statements.

Examples of coded protocols are provided in Appendix E. Two coders scored a sample of 20% of the recall protocols representing a cross section of protocols from all ages, groups, and conditions and achieved 91% agreement for workshop A and 86% agreement for workshop D for coding of specific activities. Intercoder agreement for intrusions and general statements was 98% across both workshops. One coder coded the remaining

protocols.

Results

Amount recalled

Rehearsal recall. Although the primary focus of this study was on children's delayed recall after 4 weeks, children's immediate recall in the rehearsal interview provided a baseline measure to compare to delayed recall. The number of activities children in the rehearsal groups recalled in immediate recall on the same day as the workshops was analyzed in a 2 (age; nursery-school and kindergarten) x 2 (condition; script and episodic) x 2 (workshop; A and D) analysis of variance.[1]

Although older children recalled more activities than younger children ($F(1,73)=8.71$, $p < .01$; means of 6.99 activities recalled by kindergarteners and 5.58 activities recalled by nursery-school children), there was no significant difference in the number of activities recalled by children in the script and epsodic conditions (means of 6.49 activities for children in the script condition and 6.08 activities for children in the episodic condition). Moreover, there were no differences in children's recall of A and D in either condition. Thus in immediate recall, children who had experienced 4 workshops recalled as much from the last workshop (workshop D) as they had

1. Condition is actually both a within- and between-subjects factor because children in the script condition were interviewed about both workshops A and D but children in the episodic condition were interviewed about either workshop A or workshop D. To clarify analyses, condition is treated as a between-subjects factor for all analyses, and the Greenhouse-Geiser corrected level of significance is used to test all effects.

recalled from the first workshop (workshop A) and as much as children who had only experienced one workshop (either workshop A or D). After 4 weeks, however, this was no longer the case.

Delayed recall. The number of activities children recalled at 4 weeks was analyzed in a 2 (age) x 2 (condition) x 2 (rehearsal; rehearsal and no rehearsal) x 2 (workshop) analysis of variance. As shown in Table 2, kindergarten children continued to recall more activities than nursery-school children ($F(1,144)=28.54$, $p < .001$) but children in the script condition recalled more than children in the episodic condition ($F(1,144)=7.56$, $p < .01$). In addition, children recalled more activities with rehearsal than without, $F(1,144)=16.63$, $p < .001$. There were no significant interactions for any of these factors.

Table 2

Mean numbers of activities recalled by age, condition, and rehearsal group

	Condition			
	Script		Episodic	
Age:	No Rehearsal	Rehearsal	No Rehearsal	Rehearsal
Nursery-school	3.70	5.50	2.80	4.10
Kindergarten	5.25	6.46	4.64	5.62

These findings indicate that age, experience, and rehearsal all improved children's recall at 4 weeks. These effects were primarily additive, not interactive. That is, all of these factors increased children's recall, but did not differentially affect nursery school and kindergarten children.

Rehearsal effects

Children in the rehearsal group consistently recalled more than children with no rehearsal. But how did rehearsal improve recall? One possibility is that the rehearsal interview provided a type of repetition of the workshop, increasing children's recall of all activities 4 weeks later regardless of what children actually reported in the rehearsal interview. If this were the case, there might be relatively little overlap between children's rehearsal and delayed recall because merely hearing the activities mentioned by the experimenter, and not actually recalling the activities themselves would improve their recall at 4 weeks.

Alternatively, the cognitive effort involved in recall may have helped children to remember more activities 4 weeks later. If this were the case, activities that were recalled spontaneously in rehearsal should be remembered better in delayed recall than activities that were prompted because spontaneous recall requires more cognitive effort on the part of the child. It follows that children's spontaneous recall in the delayed recall session would then include many of the activities they spontaneously recalled in rehearsal.

Another possibility is that improvement in recall was due to the experimenter's prompting in the rehearsal interview. That is, the experimenter prompted children's recall of activities they did not remember spontaneously and these activities were incorporated into children's spontaneous recall at 4 weeks. This would result in a high amount of overlap between children's prompted recall in the rehearsal interview and their spontaneous recall in the delayed recall interview.

To examine the relationship between rehearsal and delayed recall, children's delayed recall was compared to their rehearsal recall. Four measures of overlap were computed for each child: a) spontanecus-spontaneous overlap -- the percentage of activities in children's spontaneous delayed recall that were also recalled spontaneously in rehearsal; b) spontaneous-prompted -- the percentage of activities in children's spontaneous delayed recall that were either recalled spontaneously or that were prompted in rehearsal; c) prompted-prompted -- the percentage of activities in children's prompted delayed recall that were also recalled either spontaneously or with prompts in rehearsal; and d) total-prompted -- the percentage of activities in children's total delayed recall (including verbal and photograph cues) that were recalled either spontaneously or with prompts in rehearsal.

Overlap proportions (converted by arcsine transformation) were entered in a 2 (age) x 2 (condition) x 2 (rehearsal) x 2 (workshop) x 4 (type of overlap) repeated measures analysis. The only significant effect was a main effect of type of overlap ($F(1,144)=44.09$, $p < .001$). Activities that were recalled spontaneously in rehearsal only accounted

for 33% of spontaneous delayed recall while activities that were prompted in rehearsal accounted for 62%. This finding indicates that activities that were recalled with prompts in rehearsal were then incorporated into children's spontaneous recall 4 weeks later.

In addition, children's prompted delayed recall included 80% of the activities they recalled both spontaneously and with prompts in rehearsal. This finding indicates that children's recall after 4 weeks, although less complete, was very much related to what they initially remembered from the workshops. However, with photograph cues, the amount of overlap in rehearsal and delayed recall decreased to 77%. Although this is a small decrease, it was consistent across age groups, workshops and conditions and suggests that photographs reminded children of some activities they had not been able to recall in the rehearsal interview.

Thus children's long term memory was very much influenced by what they had recalled in rehearsal with the help of verbal cues, but photographs may have cued memory for some activities that were not recalled in rehearsal.

Content

Types of activities. It is clear that children recalled more activities if they experienced the workshops as a recurring event instead of a single episode. This finding suggests that children formed an event representation of the workshops which guided their recall of particular workshops. A script for the workshops would include the

following acts: "Say hello on the drum, sing songs, do movements, say good-bye on the drum". In recalling a particular workshop, a child could use this framework and fill in with the particular songs and movements that occurred in that workshop. Recall would then be more extensive and more exhaustive because children should recall at least one activity for each of the core acts.

However, recall of some specific activities could become confused by children in the script condition. In particular, their recall of activities that occured only once (unique activities) might be lower than recall of other types of activities because children could confuse these activities across workshops. For example, in recalling the act, "do movements", children could insert movement activities from another workshop, thereby reducing their score for accurate recall of unique activities. (See below for an analysis of intrusions in recall).

It was therefore predicted that recurring and variable activities should be recalled better than unique activities by children in the script condition. However, despite the fact that recurring activities were experienced in each workshop (4 times) while variable activities were experienced in every other workshop (only twice), these should be recalled equally well by children in the script condition if an event schema was guiding recall. If the content of children's recall was influenced only by frequency of occurrence, recurring activities would be recalled better than variable activities.

In contrast, because children in the epidodic condition experienced each activity only once in a single episode, their recall of each activity would be unrelated to a schematic event representation. This would result in lower overall recall (as reported above), and there would be no difference between types of activities in children's recall other than anchor effects (greater recall of the first and last activities) which would be predicted for children' recall in the script condition as well.

Separate measures of recall for each type of activity were computed for each child by dividing the number of activities recalled from each category by the number of times each type of activity occurred in each workshop (2 anchor activities, 2 recurring activities, 1 variable activity, 5 unique activities). Recall scores therefore ranged from 0 to 1. These were entered into a 2 (age) x 2 (condition) x 2 (rehearsal) x 2 (workshop) x 4 (activity type) repeated measures analysis of variance. The mean recall scores for each type of activity are shown in Table 3.

Table 3

Mean recall scores for each type of activity for each condition

	Type of activity			
Condition:	Anchor	Recurring	Variable	Unique
Script	.87	.56	.56	.36
Episodic	.75	.32	.29	.37

Main effects of age ($F(1,144)=29.02$, $p < .001$), condition ($F(1,144)=23.58$, $p < .001$), and rehearsal ($F(1,144)=20.68$, $p < .001$) were consistent with the analysis of quantity of recall reported above. There was also a main effect of type of activity, $F(3,144)=72.83$, $p < .001$, indicating that, as expected, anchor activities were recalled better than all other activity types. Also as predicted, children in the script condition recalled more recurring and variable acts than unique acts while there were no significant differences for recall of these acts in the episodic condition ($F(3,144)=6.89$, $p < .001$).

A type by rehearsal by workshop interaction, $F(3,144)=4.90$, $p < .01$, showed that with rehearsal, children tended to recall more from each act category except the variable act in workshop A where recall was approximately equal across rehearsal and no rehearsal groups (means of .53 and .49, respectively). Perhaps the song, "Rum sum sum" was a particularly enjoyable one for young children and was remembered well without rehearsal.

Thus children's increased recall in the script condition was primarily due to their recalling more recurring and variable acts. This finding is consistent with the interpretation that children's recall in the script condition was more exhaustive of each activity category. The finding that children's recall of unique acts in the script condition was not different from children's recall in the episodic condition suggests that they confused unique activities from other workshops, as predicted by the schematic processing hypothesis.

Except for the finding that children in the script condition recalled variable activities as well as recurring activities, frequency effects could also explain this pattern of recall. But in support of a constructivist interpretation, analysis of the children's immediate recall produced a different pattern of results. Effects of age ($F(1,73)=5.51$, $p < .05$) and type of activity ($F(3,219)=16.36$, $p < .001$) were similar to delayed recall in that older children recalled more than younger children and anchor activities were recalled best, but there were no effects of condition on children's recall of activity types. However, as shown in Table 4, there was an interaction of workshop and type of activity, $F(2,219)=9.54$, $p < .001$, indicating that children recalled activities from workshop A and workshop D differently in immediate recall regardless of whether the activities had been experienced in previous workshops (as in the script condition).

Table 4

Mean recall scores for each type of activity for each workshop, rehearsal recall

	Type of activity			
	Anchor	Recurring	Variable	Unique
Workshop A	.79	.53	.46	.64
Workshop D	.92	.65	.80	.47

Taken together, these findings indicate that in immediate recall, differences in the content of children's recall were due to differences in the particular activities experienced in each workshop. After 4

weeks, when constructive processes in recall came into play, the types of activities children recalled were no longer influenced by the particular workshop experiences, but were affected by whether the workshops were remembered as single episodes or as episodes of a familiar event.

Intrusions. It was expected that children in the script condition might falsely recall activities from other workshops when recalling workshops A and D. However, it was also predicted that rehearsal could highlight the activities that were unique to workshops A and D and could therefore depress the number of intrusions in delayed recall.

An age x condition x rehearsal x workshop analysis of variance of the number of intrusions in recall showed that intrusions were more frequent for children in the script condition (mean = 1.51 intrusions) than for children in the episodic condition (mean = .33 intrusions), $F(1,144)=54.40$, $p < .01$. There were no other significant effects in this analysis. This finding indicates that children in the script condition confused specific activities filling the same core act slots even when they were reminded of the specific activities in rehearsal.

The fact that rehearsal did not minimize intrusions supports the interpretation that constructive processes in recall are greater in long-term recall. To examine this effect more closely, a 2 (age) x 2 (condition) x 2 (workshop) x 2 (session; rehearsal and delayed) repeated measures analysis of variance was performed on the number of intrusions made by children in the rehearsal groups. As shown in Table 5, not only were intrusions more frequent for children in the script

condition ($F(1,73)=21.38$, $p < .001$), but intrusions were relatively infrequent in rehearsal as compared with delayed recall ($F(1,73)=34.26$, $p < .001$), and this effect was significant only for children in the script condition ($F(1,73)=13.16$, $p < .001$).

Table 5

Mean frequencies of intrusions in rehearsal and delayed recall for each condition

	Recall	
Condition:	Rehearsal	Delayed
Script	.24	1.34
Episodic	.10	.36

These findings are consistent with the notion that over time, details of particular episodes of schematically organized events can become confused in memory. Although children's recall of particular workshops was relatively accurate immediately after each of the workshops in the script condition, over time, particular songs and movements became confused with slot fillers from other workshops in children's spontaneous and cued recall. In addition, although rehearsal increased the level of accurate information recalled, it did not decrease the level of intrusions in recall.

Generalizations. Although general statements were not included in the analysis for recall of specific activities, this type of reporting could indicate an awareness that specific activities could be subsumed

under a more general act category. It was expected that children in the script condition would be more aware of this relationship than children in the episodic condition. Frequencies of general statements reported by each child were entered into a 2 (age) x 2 (condition) x 2 (rehearsal) x 2 (workshop) analysis of variance. Although kindergarten children reported more general statements than nursery-school children (means of .32 and .58 for nursery school and kindergarten children, respectively, $F(1,144)=10.02$, $p < .01$), there were no significant effects for condition or rehearsal.

The finding that kindergarten children produced more general statements, but nevertheless, recalled more specific activities than nursery school children may indicate that kindergarten children's recall was better organized. That is, their memory for the workshops seemed to be organized in terms of general acts which they were able to use as retrieval guides for recalling specific activities.

Interestingly, frequency of general statements was unrelated to condition. This suggests that older children may represent real world experiences in terms of general act categories even after a single experience. Although the specific workshop activities were novel, the general acts of playing the drum, singing, and doing movements were already familiar to the children. Kindergarten children took advantage of this knowledge to a greater extent than nursery school children.

Effects of cueing

Amount recalled. One of the issues of interest was how cueing affected recall at different ages. Although kindergarten children consistently recalled more than nursery-school chldren, it is possible that this difference is largely due to their ability to recall more spontaneously. That is, older children may rely less on external prompting in recall than younger children.

The proportion of children's total recall that consisted of activities that were remembered spontaneously, with verbal prompts, and with visual cues were analyzed in a 2 (age) x 2 (condition) x 2 (rehearsal) x 2 (workshop) x 3 (type of recall; spontaneous, verbally promped, and visually prompted) repeated measures analysis of variance. (Proportion scores were converted by arcsine transformation for analysis.)

As shown in Table 6, verbal prompts accounted for the highest proportion of recall, $F(2,284)=12.41$, $p < .001$. However, nursery-school children relied on verbal prompts more than kindergarten children ($F(2,284)=4.00$, $p < .05$): They recalled twice as much with verbal prompts as they recalled spontaneously.

Table 6

Proportions of total recall by age and type of cue

Age:	Type of cue: Spontaneous	Verbal	Visual
Nursery-school	.24	.48	.28
Kindergarten	.34	.39	.27

Further, as shown in Table 7, many nursery-school children could not remember the workshops at all unless they were given a verbal cue and this effect was most apparrent for nursery-school children in the no rehearsal groups.

Table 7

Frequencies and percentages* of children with no spontaneous recall by age, condition, and rehearsal group

Condition:	Age:	Group: No Rehearsal	Rehearsal
Script	Nursery-school	10 (50)	3 (15)
	Kindergarten	5 (25)	1 (4)
Episodic	Nursery-school	12 (60)	7 (35)
	Kindergarten	3 (16)	5 (26)

*Percentages shown in parentheses

In contrast, kindergarten children recalled approximately equal proportions of spontaneous and verbally prompted recall and were better able to remember at least one workshop activity without prompting. Visually prompted recall was approximately equal for both age groups and accounted for 27-28% of children's total recall.

Together, these findings indicate that nursery school children not only remembered less than kindergarten children, but they also needed more cues for recall.

Intrusions. It is possible that children reported intrusions because they were under pressure to respond to specific questions. For example, if they could not remember the specific song that was sung, they might guess the name of any song rather than say "I don't know." To test for this possibility, the number of intrusions children reported in response to various cues was calculated. Frequencies and percentages of intrusions by level of recall for each condition are shown in Table 8.

Table 8

Frequencies and percentages* of intrusions reported by cue type and condition

	Type of cue			
Condition:	Spontaneous	Verbal	Visual	Total
Script	45 (37)	51 (42)	26 (21)	122
Episodic	3 (11)	15 (56)	9 (33)	27

*Percentages shown in parentheses

A chi square analyisis on intrusion frequencies showed that the proportion of intrusions in recall varied across cues and conditions, $\chi^2(2)=7.68$, $p < .05$. Although the majority of intrusions were made in response to verbal prompts, children in the script condition included a higher proportion of intrusions in spontaneous recall than children in the episodic condition.

These findings suggest that children may have been guessing in some of their responses to specific questions. However, this was more likely to be the case for children in the episodic condition than for children in the script condition. Whereas intrusions were reported by children in the episodic condition primarily when they were asked specific questions, children in the script condition confused activities from different workshops in spontaneous recall as well as when they answered specific questions or were shown photographs to identify. Both groups were more likely to say "I don't know" when asked to identify photographs than when asked a direct question.

The type of intrusions children made at different levels of recall provided further evidence that children in the script condition formed an event representation of the workshop experience that was distinct from their previous experience with similar activities. Frequencies and percentages of intrusions from other workshop activities and from activities not included in any of the workshops are shown in Table 9.

Table 9

Frequencies and percentages* of intrusions made by children in the script condition by type of intrusion and cue type

Type of intrusion:	Type of cue: Spontaneous	Verbal	Visual
Workshop	43 (96)	35 (69)	18 (69)
Other	2 (4)	16 (31)	8 (31)
Total	45	51	26

*Percentages shown in parentheses

A chi square test confirmed that children produced different types of intrusions in spontaneous recall than in prompted recall, $\chi^2(2)=12.13$, $p < .001$. Although children's recall in the script condition occasionally included intrusions of songs and activities that had not been experienced in any of the workshops, 96% of the intrusions in spontaneous recall were activities from other workshops. And while children in the script condition reported activities not included in any of the workshops under more specific questioning, these were much less frequent than intrusions from other workshops. Even when they may have been guessing in response to a direct question, children in the script condition were more likely to report a song or movement from one of the 4 workshops than just any song or movement activity.

In comparing Tables 8 and 9, it can be seen that the level of non-workshop intrusions reported by children in the script condition was approximately equal to the level of intrusions reported by children in

the episodic condition. This indicates that there was some similiarity between the workshop activities and children's prior experience with songs and movement games. Children in both conditions tended to assimilate the workshops to their prior experience. However, the higher level of workshop intrusions reported by children in the script condition and the finding that workshop confusions occurred in both spontaneous and prompted recall indicate that children in the script condition also formed a new event schema for the workshops that was distinct from their past experience.

Discussion

This study examined effects of familiarity, rehearsal, and cueing on preschool children's memory for real world events. The factor of greatest interest was familiarity, that is, how long-term recall of a particular episode is affected by general event knowledge. In this study, children in the script condition were provided with four episodes of a creative arts workshop while children in the episodic condition experienced only a single workshop. In recalling particular workshops four weeks later, children in the script condition were recalling an episode of a familiar event while children in the episodic condition were remembering a one-time experience. This difference affected the amount of information children could remember as well as the content and accuracy of their recall, indicating effects of schematization on children's recall in the script condition.

Constructive processing in children' autobiographic memory

It was expected that children in the script condition would develop an event schema or script for the event over the series of workshop experiences and their general event schemas would guide recall of individual workshops in delayed recall at 4 weeks as constructive processing become more apparent over long time delays (Bartlett, 1932). Reliance on event schemas generally produces more complete recall because all major acts in the event are automatically invoked when the schema is activited and each act slot is then filled by a particular activity in recall. This "top down" processing produces more extensive recall than when items must be remembered separately (Mandler, 1979). As predicted, although there was no difference in the number of activities recalled by children in the script and episodic conditions in immediate recall, after 4 weeks, children in the script condition recalled more from both workshops than children in the episodic conditions. Thus, the first and last workshop in a series were recalled equally well and better than the same workshops experienced as a one-time event.

The content of children's recall after 4 weeks was also different in the two conditions. In immediate recall, the content of children's recall varied only by the particular worksops. But in delayed recall, children's recall in the episodic conditions was evenly distributed across unique, variable, and recurring activities, while children in the script condition recalled more variable and recurring activities than unique acts. (Anchor acts were recalled best in both conditions, indicating that even within schemas, the first and last components have

special status, Mandler, 1978.) Further, children's recall in the script condition was superior to children's recall in the episodic condition for all categories except unique activities. Thus, children's recall in the script condition was not only longer, but more structured than children's recall in the episodic condition.

Lower recall for unique acts in the script condition was caused by children's confusing unique activities from different workshops as indicated by the higher number of intrusions made by children in the script condition than by children in the episodic condition and the finding that most of these intrusions were from activities occurring in other workshops. Based on their general knowledge about what happens in these workshops, children in the script condition were able to infer that they must have performed whole body movements in each workshop, but could not reliably recall which movements belonged to the first workshop and which belonged to the last workshop. Although these types of intrusions were not evident in immediate recall, after 4 weeks, children had difficulty in separating "what happened" from "what could have happened" in both spontaneous and prompted recall.

Effects of schematization in recall of particular episodes was equally apparent in both age groups. Although nursery-school children recalled less than kindergarten children, their recall was no less accurate. Thus, the prediction that younger children were more schema-bound than older children was not borne out; in recall after 4 weeks, younger children recalled less than older in both conditions; they did not generalize more, but rather produced fewer general statements, and they did not report more intrusions than older children

in recall in the script condition.

It is possible that, as predicted, nursery-school children recalled less than kindergarten children in the episodic condition because they had greater difficulty recalling an individual episode without a general event representation to guide retrieval, and younger children also had greater difficulty forming a general event representation on the basis of 4 experiences with an event which deflated their recall in the script condition. This interpretation is consistent with data from Slackman & Nelson (1984) showing that 4-year-olds had greater difficulty than 6-year-olds in forming a schema of an unfamiliar event through sucessive story presentations. While there may be developmental difference in schema development which could have influenced children's use of a general event representation in recalling particular episodes of an event that was experienced four times, an independent assessment of children's general event knowledge at different ages would be necessary to support this interpretation.

Although effects of schematization in recall were evident, children in the script condition did not produce more general statements than children in the episodic condition. This suggests that constructive processes in recall were implicit and automatic, and not a subject of conscious reflection. That is, general event knowledge guided recall of specific episodes but the schema itself was not recalled. Rather, schematic organization was inferred from the pattern of constructive recall. In this study, differences in the quantity, content, and accuracy of children's recall in the two conditions provided evidence that children in the script condition were using a general event schema

to guide their recall of specific workshops.

These findings are especially interesting in light of current theories of the development of autobiographic memory that have been proposed to account for the phenomenon of infantile amnesia, that is, why adults have almost no recall of the years 0-3 and very little recall of the years 3-8 as compared to their recall of later ages. One explanation for this phenomenon is that cognitive developaments during childhood reorganize children's memory system so that adults are unable to recall childhood experiences because the schemas adults use to organize memory are qualitatively different from those of young children (Neisser, 1967, Piaget, 1962, Schactel, 1947, White & Pillemer, 1979). One reorganization phase corresponds with the culmination of a major phase in language acquisition around the ages 2-3 years. Another reorganization occurs around the age of 5 years and corresponds to cognitive developments such as the onset of concrete operations as well as the beginning of formal schooling. The reorganization explanation would predict developmental differences in the content and organization of children's autobiographic memory from the ages 3-5.

An alternative explanation based on the schematic processing model of autobiographic memory presented here is that that young children may be unable to represent or retrieve individual autobiographic memories if they have no general schemas to guide recall. Until the age of about 3 years, while children are acquiring general knowledge structures, specific experiences are absorbed into schemas and are not retained as individual autobiographic memories. Therefore, it is only after this age that children can remember specific episodes as separate from a

general event schema (Nelson & Ross, 1980). After this point, however, children's autobiographic memory may function much the same as the adult system, but because many events that are novel to a young child are subsequently repeated and because autobiographic recall is highly dependent on cueing, many childhood memories may have fused into general event representations or are inaccessible without specific cues (Hudson, 1983, 1985, Hudson & Nelson, 1984).

The results from this study provide support for the constructive explanation in that children at both ages children remembered episodes of a familiar event better than novel episodes. The major developmental difference found was in the quantity of children's recall but the content of children's recall was similar across age. However, in support of the reorganization hypothesis, it is also possible that older children's increased production of general statements indicates a more developed awareness of how specific activities relate to broader action that may have helped organize their recall of specific episodes. This interpretation suggests that with age and cognitive development, children's autobiographic memory may become integrated with a number of developing knowledge systems, providing additional ways to organize memory for real-world experience. This interpretation is only speculative at the moment because it is also possible that younger children may be as aware of these relationships as older children but that older children tend to talk at a more general level.

Effects of rehearsal and cueing on children's autobiographic memory

In addition to amount recalled, another developmental difference was that nursery-school children appeared to rely more heavily on verbal prompts in recall than did kindergarteners. Sixty percent of nursery-school children could remember nothing from the single workshop without prompting if they had not rehearsed their recall before. Even in the script condition, 50% of nursery-school children were unable to recall a single activity without prior rehearsal. Further, only 24% of the activities nursery-school children remembered were recalled spontaneously as compared to 34% for kindergarten children. Not only was younger children's recall less complete than older children's, but it was also less accessible.

This finding raises the issue of how memory aids such as rehearsal and cueing affected children's recall at different ages. Because younger children display poorer memory skills in general than older children, if these interventions were more effective for younger children than for older children, it would provide evidence of a production deficiency. That is, older children may spontaneously rehearse experiences to themselves or may spontaneously direct their own memory search in a systematic way while younger children do not (Kobasigawa, 1977).

In addition, adult recollection studies suggest that rehearsal and cueing can mediate effects of schematization in autobiographic memory. Rehearsing individual episodes may help preserve memory for details of individual experiences that would otherwise be incorporated into the

general event representation as alternative slot fillers. At the time of recall, more specific cueing might assist retrieval of particular distinctive details that could distinguish a particular episode from all others.

With respect to the production deficiency hypothesis, rehearsal resulted in more extensive delayed recall for both age groups. This finding does not support the interpretation that age differences in the quantity of children's recall is due to older children employing deliberate rehearsal strategies. Analysis of the content of children's rehearsal and delayed recall indicated that the rehearsal interview reminded children of activities thay did not spontaneously remember and these were incorporated into their spontaneous recall four weeks later. In this study, rehearsal with another person did not so much preserve what children were most likely to remember (which was not much), but called attention to what they were likely to forget after a delay of less than 2 hours. Although the workshops were enjoyable and meaningful events for the children, they were not highly significant nor personally salient experience. Rehearsal seemed to intervene into the natural process whereby the experience was soon forgotten as opposed to preserving memory for an event that would be remembered anyway in somewhat less detail.

Prompting, both verbal and visual, also improved children's recall at both ages groups, but as discussed above, younger children seemed to rely more heavily on cues than older children. This finding supports the interpretation that older children may be better able to direct their own memory search than younger children. There was also some

suggestion that visual cues may have helped children remember activities that were inaccessible through verbal cues. Twenty-nine percent of children's total recall was prompted by veiwing photographs after they had been given verbal cues for each activity. Because verbal and visual cues were not used independently a direct comparison of the two cannot be made. And because photographs are necessarily more specific than verbal cues, it is unclear whether it was the imagery of the photographs or their specificity that made them more effective than verbal cues. However, the finding that the degree of overlap in children's rehearsal and delayed recall dropped slightly when visual cues were introduced, suggests that photographs prompted recall of activities that had not been recalled in the rehearsal interview even when each activity was specifically mentioned.

With respect to the schematization hypothesis above, rehearsal did not improve accuracy in recall in the script condition. Children in the script condition tended to rememember more about the workshops with rehearsal, but the schematization process whereby separate episodes become confused with one another was not affected by immediate rehearsal. Together with the findings that intrusions were minimal in rehearsal, but were found in both spontaneous and prompted recall, these results provide further evidence that over long-term time delays, reproductive memory is superceded by reconstructive memory.

Methodological considerations

Evidence for constructive processing in autobiographic recall is consistent with findings on children's naturalistic memory performance in general and highlights an important difference between performance in directed recall tasks and involuntary or "natural" memory. While performance in laboratory experiments is generally dependent on the development of specific encoding and retrieval stategies, memory in real-world contexts is more influenced by the development of appropriate knowledge structures (see Brown, 1975, Purlmutter, 1980).

In the present study, when children participated in the workshops, they were not consciously participating in a memory task. What they were remembering was a social event, directly experienced in the context of their school day. Until they were asked to recall the workshops, they were unaware that the experience was in any way connected to a memory task. Increased experience not only provided the repetition necessary for forming a schema of the event, but also influenced how children were able to participate in the events. The knowledge children acquired over recurring workshops provided a framework of expectations children used to anticipate activities and to participate more fully in the event, and in turn, was available as an implicit retrieval guide in recalling the workshops. Thus, children's level of participation in the workshops which may be an important factor in how they remembered the event was also influenced by the development of general event knowledge.

However, because the recall interview was not a naturalistic context, some results may be a reflection of how children performed in the context of a memory task. In particular, the finding that intrusions increased with specific questioning suggests that children may have been guessing at times in order to meet the experimenter's requests for information. This finding is consistent with Dent & Stephenson's (1979) study showing that more specific questioning led to increased recall of accurate as well as inaccurate information in second-grade children's recall of a filmed episode while children's spontaneous recall, although less complete, was most accurate. In the present study, children's spontaneous recall was also more accurate than prompted recall although children in the script condition confused individual workshops.

In addition, the finding that older children were able to recall more activities with fewer prompts is similar to age differences found in children's recall in directed memory tasks. This finding may indicate that the recall interview used in this study was more similar to an experimental situation than a real-world recall context. It is also possible that age differences in use of retrieval strategies are not confined to experimental situations, but are characteristic of developmental differences in children's memory skills in general.

Because there is no data available on autobiographic recall in naturalistic contexts for children over 3 years old, it is not clear how the interview context differs from real-world autobiographic recall. Clearly, this type of experience is not a likely condidate for the kinds of experiences that form an individual's personal autobiography or life

history. However, it is possible that many of real-world contexts for recall of specific episodes are not very different. For example, more specific questioning may be used by parents and teachers to prompt children's recall. Children themselves may use specific cues to elicit recall in conversation (e.g. "Don't you remember...?"). Certainly in giving testimony, both children and adults are asked both general and specific questions to probe their recall of details of an episode. More research is needed to clarify differences and similarities in real-world and experimental assessments of autobiographic memory.

Finally, it should be pointed out that there are other dimensions of autobiographic memory that are not captured by their relationship to general event schemas. Autobiographic memories are more than just representations of specific episodes in memory, but also constitute individuals' personal autobiographies or life histories and are mediated by personality factors and systems of self-knowledge (Barclay et al., 1982, Neisser, 1981, Purcell, 1952). The proposed model of autobiographic memory in which recall of particular episodes is viewed as a constructive process, drawing not only from memory of individual episodes, but also from general knowledge structures is not inconsistent with these influences on autobiographic memory. At the same time, however, the results from this study which systematically examined effects of familiarity on children's recall of specific episodes, while also controlling for amount of rehearsal, time delay and cueing effects, indicate that increased experience with events influences both how much and what children recall about particular episodes. These findings suggest that general event schemas may be particularly powerful forms of

cognitive representation that are used to organize and retrieve autobiographic memories.

Summary and Conclusions

This study examined children's memory for real-world events in the context of a schematic processing model. Within this model, autobiographic memories are conceived of as the products of constructive memory processes, drawing not only from memories of particular past experiences, but also from general knowledge structures such as event schemas or scripts.

Sixty nursery-school children and 58 kindergarten children participated in either a single creative movement workshop (the episodic condition) or a series of 4 workshops (the script condition) and were asked to recall workshops a month later. It was predicted that children's recall in the script condition would be guided by a general event schema, resulting in more complete, but less accurate recall than children's recall in the episodic condition. If younger children's recall is more schema-bound, as suggested by research on schematic processing in children's memory, these effects would be greater for nursery-school than kindergarten children. Rehearsal and cueing were also manipulated in order to test how these factors influence constructive processes in children's autobiographic memory.

Although children's immediate recall on the same day as the workshop was equivalent in amount and content in both conditions, after 4 weeks, there were marked differences in children's recall in the

script and episodic conditions. Children in the script condition recalled more than children in the episodic condition; children in each condition recalled different types of activities from the workshops; and children in the script condition confused particular activities from individual workshops.

Contrary to predictions, older children remembered more than younger children and generalized more than younger children in both conditions. Thus there was no evidence that younger children's recall at four weeks was more schema-bound than older children's recall. It is also possible that an appreciation of how specific activities relate to more abstract action categories may have helped older children organize their recall of specific episodes, even for an unfamiliar, novel event.

Rehearsal and more specific cues improved children's recall in both conditions but did not improve accuracy in recall. Thus rehearsal did not affect the schematization process whereby similar episodes of familiar events become confused in memory. More specific cues produced more intrusions in recall as well as more extensive accurate recall reflecting, to some degree, children's efforts to respond to direct questions. The finding that rehearsal did not differentially affect children's recall at different ages suggested that older children's improved recall was not due to the use of rehearsal strategies but the finding that younger children relied more heavily on prompts than older children suggests that older children were more efficient at directing their own memory search.

These findings are consistent with the hypothesis that after experiencing a series of recurring episodes, preschool children formed a script for a novel event. While their immediate recall was the same as children's recall who had only experienced a single episode, over time, "reproductive" recall was replaced by "reconstructive" recall as children relied on general event schemas to guide recall of particular episodes. Thus, the schematization process whereby recall of specific episodes becomes organized by general knowledge structures which has been observed in adults' memory for real-world events was created in the present study with preschool children.

The implications of these findings are that autobiographic memory is influenced by constructive processing and that general event knowledge is used by young children to organize recall of specific episodes of real world events.

Appendix A

Descriptions of workshop activities

Workshop A

Greeting	Saying hello on the drum
Warm-up song	"Clap your hands"
Song with movement	"Rum sum sum"
Whole body movements	Making different shapes with the body: Small and round like a ball, flat on your back, tall and high, twisted shapes, repeat with variations.
	Raggedy Ann dance
	Relaxation exercise: Lying down on the floor, slowly lift arms and legs to the ceiling and "float" them down.
Ending	Saying good-bye on the drum

Workshop B

Greeting	Saying hello on the drum
Warm-up song	"Clap your hands"
Song with movements	"Roll and roll and pull"
Whole body movements	Witch's dance: Pretend to make a witch's stew: "Catch" flies, bats, etc. to put into the pot, stir the pot, do a witch's dance, repeat with variations.
	Relaxation exercise: (See Workshop A)
Ending	Saying good-bye on the drum

Workshop C

Greeting	Saying hello on the drum
Warm-up song	"Clap your hands"
Song with movements	"Rum sum sum"
Whole body movements	Animal movements: Jump like a frog, swim like a fish, walk like a bear, waddle like a duck, gallop like a horse, squirm like a worm, fly like a bird, creep like a snail, roll like a kitten.
	Relaxation exercise: (See Workshop A)
Ending	Saying good-bye on the drum

Workshop D

Greeting	Saying hello on the drum
Warm-up song	"Clap your hands"
Song with movements	"Roll and roll and pull"
Whole body movements	Shake and freeze with different body parts
	Different body positions: Knee to chin and elbow to ankle, sitting on the floor with arms and legs raised, jumping while holding on to ankles, touching feet to head with stomach on the floor
	Looby Loo dance
	Relaxation exercise: (See Workshop A)
Ending	Saying good-bye on the drum

Appendix B

Rehearsal interview questions

Workshop A

1. Do you remember the workshop you just had with Margaret? Can you tell me what happened in the workshop? Anything else?

2. What did you do at the very beginning? (What was the first thing that happened?) Then what did you do? Then what happened?

3. Did you sing some songs? What songs did you sing? Did you sing "Clap your hands?" Can you tell me about that? (How did that go?) Did you sing any other songs? Did you sing "Rum sum sum?" Can you tell me about that? (How did that go?)

4. Did you make some shapes? Did you get flat on you backs on the floor? Can you tell me about that? What other shapes did you make? Did you make twisted shapes? Can you tell me about that? Any other shapes? Did you do a Raggedy Ann dance? Can you tell me about that? Then what happened? (How did that go?) Did you lie on the floor and put your arms in the air? Then what did you do?

5. What did you do at the very end? (What was the last thing that happened?) Anything else?

Workshop D

1. Do you remember the workshop you just had with Margaret? Can you tell me what happened in the workshop? Anything else?

2. What did you do at the very beginning? (What was the first thing that happened?) Then what did you do? Then what happened?

3. Did you sing some songs? What songs did you sing? Did you sing "Clap your hands?" Can you tell me about that? (How did that go?) Did you sing any other songs? Did you sing "Roll and roll and pull?" Can you tell me about that? (How did that go?)

4. Did you do some shaking? Can you tell me about that? (How did that go?) Then what happened? Did you freeze? Did you touch your knee with your chin? Can you tell me about that? (How did that go?) What else did you do? Did you do Looby Loo? Can you tell me about that? (How did that go?) Then what happened? did you lie on the floor and put your arms in the air? Then what did you do?

5. What did you do at the very end? (What was the last thing that happened?) Anything else?

Appendix C

Recall interview questions

Workshop A

1. Can you remember the (first) workshop you had with Margaret? Can you tell me what happened in the (first) workshop? Anything else?

2. What did you do in the very beginning of the (first) workshop? Then what happened? (Then what did you do?)

3. Did you sing some songs? What songs did you sing? Can you tell me about that? Did you sing any other songs? Can you tell me about that?

4. Did you lie on your backs and put your arms in the air? Can you tell me about that? Then what happened?

5. What happened at the very end? (What was the last thing that happened?) Anything else?

6. Did you make some different shapes? Can you tell me about that? What shapes did you make? Did you lie flat on your back? Can you tell me about that? (How did you do that?) What else? Did you make twisted shapes? Can you tell me about that? (How did you do that?) What else? Did you do a Raggedy Ann dance? Can you tell me about that? (How did that go?) Anything else?

Workshop D

1. Can you remember the (last) workshop you had with Margaret? Can you tell me what happened in the (last) workshop? Anything else?

2. What did you do in the very beginning of the (last) workshop? Then what happened? (Then what did you do?)

3. Did you sing some songs? What songs did you sing? Can you tell me about that? (How did that go?) Did you sing any other songs? Can you tell me about that? (How did that go?)

4. Did you lie on your back and put your arms in the air? Can you tell me about that? Then what happened?

5. What happened at the very end? (What was the last thing that happened?) Anything else?

6. Did you do some shaking? Can you tell me about that? (How did that go?) Then what did you do? Did you shake and freeze? Can you tell me about that? Did you touch your knee with your chin? Can you tell me about that? (How did you do that?) What else did you do? Did you do Looby Loo? Can you tell me about that? (How did that go?) Anything else?

Appendix D

Photograph descriptions

Workshop A

1. Saying hello on the drum: Children are seated in a circle on the floor and one child is playing a large drum.

2. "Clap your hands" song: Children are seated in a circle, clapping their hands.

3. "Rum sum sum" song. Children are seated in a circle with hands in fists, one on top of another (the hand movement accompanying the words, "rum, sum, sum").

4. Making a round ball shape: Children are curled up in round shapes on the floor.

5. Making a tall and high shape: Children are standing on tip toes with arms extended straight above their heads.

6. Raising arms and legs: Children are lying on their backs on the floor with either their arms or legs extended toward the ceiling.

Workshop D

1. Saying hello on the drum: Children are seated in a circle on the floor and one child is playing a large drum.

2. "Clap your hands" song: Children are seated in a circle, clapping their hands.

3. "Roll and roll and pull" song: Children are seated in a circle either with arms extended to their sides (the movement accompanying the word, "pull") or hammering with their fists on the floor (the movement accompanying the words, "hammer here, hammer there").

4. Balancing without arms and legs: Children are seated on the floor with both their arms and legs lifted up in the air.

5. Touching feet to head: Children are lying on their stomachs on the floor, holding on to their ankles with heads raised, attempting to their head with their feet.

6. Raising arms and legs: Children are lying on their backs on the floor with either their arms or legs extended up toward the ceiling.

Appendix E

Sample recall protocols

Key to coding scheme:

Type of recall:

Act - Activity

Int - Intrusion

Gen - General statement

Type of activity:

(A) - Anchor

(R) - Recurring

(V) - Variable

(U) - Unique

Type of cue:

/Spon - Spontaneous

/Prompt- Verbally prompted

/Photo - Visually prompted by photograph

Example 1: Subject 68, Kindergarten, Script condition, Rehearsal group (Workshop D)

E: Do you remember the last workshop you had? Can you tell me what you did in the last workshop

)/Spon — C: Well we, we didn't only say bye bye but we said bye bye and sometimes we said to somebody. And we did most of the things that we did in the other workshops and then a lot more so that we would really be learning a lot in all the workshops. And we, like we

Gen — did in the first workshop, we touched parts of our body, but some of the parts of the body we never had

Act(U)/Spon — done before. And some of them were hard like touching our foot to our ear. We were laying on our stomach. Something like that, but I'm not saying exactly like that. And I had to bend my head back very far and put my foot up very far and I had to hurt my neck because I bended it back so far. And I couldn't help having a little bit of my stomach off of the ground.

E: Very good. What other things did you do in the last workshop

E: Well, what other things do you remember?

Gen — C: Well we sang a few songs. Like some of them we didn't know and some of them we already did.

E: What songs were those?

C: Well I remember there were more old than new. And some of the new songs I kept on making mistakes on because I had never sung them before.

E: Do you remember anything else? What was the first thing that happened?

C: That was the songs I think.

E: What did you do at the very end of the workshop?

C: Said good bye on the drum.

E: Do you remember anything else? Did you do Looby Loo? Can you tell me about that?

Act(U)/Prmpt — C: Well we, we were going around singing that song and we stopped and did something and moved a little bit.

And then we kept on going. And we did different movements while we were going around.

E: Did you do some shaking? Did you shake and freeze? Can you tell me about that?

Int/Prmpt — C: She did something on the drum. And then we did some shaking. And then when she stopped, we had to freeze where we were.

E: Good. Can do you remember anything else from the last workshop ^.K.Here are some pictures of some children doing the last workshop. Let me show you the pictures and see if you can tell me what happened in each of them. Here's the first picture. (Saying hello on the drum) Can you tell me what happened in this picture?

C: They're saying something on the drum.

E: What are they saying?

Act(A)/Photo — C: Hello or good bye.

E: O.K. What happened in this picture? ("Clap your hands" song)

C: They were singing one of the songs.

E: What song were they singing?

C: I don't know.

E: What happened in this picture? ("Roll and Roll and Pull" song)

Act(V)/Photo — C: They're singing the one, roll and roll and pull, that one.

Touching head with feet while lying on stomach)

C: They're touching something to something else.

E: O.K. What happened in this picture? (Lying on backs and raising arms)

C: They're laying down and putting their hands up.

E: What happened after that?

Act(R)/Photo — C: Then we put our feet up. Then we put both our hands and our feet up.

Example 2 Subject 93, Kindergarten, Episodic condition, No rehearsal group, (Workshop A)

Code	Dialogue
	E: Do you remember the first workshop you had? Can you tell me what happened in the first workshop?
Gen	C: Well she, um, beat the drum and she, um, did some things. Like she told us to lie flat and we did it. And she wanted us to do it fast and we did it faster.
	E: What else did you do?
Act(A)/Spon	C: Nothing much. But, uh well, we sounded out the names with the drum, Da-vid.
	E: What else? What did you do after that? Did you sing some songs? Do you remember any of the songs you sang? Do you remember the very last thing that you did? Did you make some different shapes? Did you lie down flat?
	C: Yeah.
	E: What else did you do?
Act(U)/Prmpt Int/Prmpt	C: We made circles. And we winded up ourselves.
	E: Did you make any other shapes? Did you do a Raggedy Ann dance? No? Well, I've got some pictures of your class in the first workshop. Maybe if I showed them to you, you could tell me what happened in the pictures? Here's the first one. (Saying hello on the drum) What happened in this picture?
	C: We're beating our names.
	E: Good. ~re's the next picture. ("Clap your hands" song) What happened in this picture?
	C: We're clapping our hands.
	E: What song are you singing?
Act(R)/Photo	C: Clap, clap your hands.
	E: O.K. What happened in this picture? ("Rum Sum Sum" song)
Act(V)/Photo	C: We're doing, like I don't remember. Oh, that was gooly, gooly, rum sum sum.

	E: O.K. What are you doing in this picture? (Round ball shape)
	C: We're, um, lying down. That's when we made ourselves into little circles.
	E: And this picture? (Tall and high shape)
Act(U)/Photo	C: Stand up as straight as, very tall.
	E: And what happened in this picture? (Raising arms)
	C: Oh that was, that was trying to lie, that was lying down on our backs and nothing else.
	E: Then what happened?
Act(R)/Photo	C: And we were trying to reach the ceiling.

<u>Example 3: Subject 2, Nursery school, Script condition, Rehearsal group, (Workshop A)</u>

	E: Do you remember the first workshop you had with Margaret? Can you tell me what happened in the first workshop
pon Act(V)/Spon Act(R)/Spon Int/Spon	C: We did Roll and Roll and Pull. We did Rum Sum Sum. And we did Clap, Clap, Clap Your Hands. And we did the spoon thing.
	E: What's the spoon thing?
Act(A)/Spon)/Spon	C: We stirred the soup. And we said hello on the drum. We said good bye on the drum. I forgot the rest.
	E: What was the first thing that happened?
	C: We said hello on the drum.
	Clap Your Hands.
	E: And then after that?
	C: I think we did Rum Sum Sum.
	E: And after that, what happened?

C: I forgot.

E: Allright. Do you remember that you made different shapes? You don't remember that?

Int/Prmpt — C: I think we made different kinds of animal moves.

E: What kind of animal moves?

C: A lamb, a snake.

E: Did you lie flat on your backs? Tell me about that.

Act(U)/Prmpt
Act(U)/Prmpt — C: We laid flat on our backs and we curled up in a ball and stood up high.

E: What else?

C: And, and I think we said good bye on the drum.

E: Good. Did you make some twisted shapes?

C: Yeah.

E: Tell me about those.

Int/Prmpt — C: I twisted and jumped up and down holding our ankles.

E: What else?

C: I don't know.

E: Did you do a Raggedy Ann dance? Can you tell me about that?

Int/Prmpt — C: We shaked.

E: You shaked? What else? What did you shake?

C: I forgot what we shaked.

E: O.K. I have some pictures of some children in the first workshop here. Maybe if you looked at them you could tell me what happened in the pictures. O.K.? Here's the first picture (Saying hello on the drum). What happened in this picture?

C: I think they're saying hello on the drum.

E: Good. What happened in this picture? ("Clap your hands" song)

C: They're doing clap clap your hands.

	E: O.K. Here's another picture. ("Rum sum sum" song) What happened in this picture?
	C: Rum Sum Sum.
	E: O.K. What happened in this picture? (Round ball shape)
	C: They're curling up in a ball.
	E: And here? (Tall and high shape)
	C: They're getting up high.
	E: And what happened in this picture? (Raising legs)
	C: They're putting their legs up in the air.
	E: Then what happened?
Act(R)/Photo	C: They put their hands up in the air.

<u>Example 4: Subject 17, Nursery school, Script condition, No rehearsal group, (Workshop A)</u>

	E: Do you remember the first workshop you had? Do you remember what you did in the first workshop? Anything at all?
Int/Spon	C: I remember we did the witch's brew, I think.
	E: Good. What else? What was the first thing you did?
Gen	C: We did on the drum.
	E: What did you do on the drum?
Act(A)/Prmpt	C: Hello.
	E: Good. And what did you do after that? Well, what was the very last thing that you did?
Act(A)/Prmpt	C: We said goodbye on the drum.
	E: Well, do you remember you sang some songs? Do you remember you did different shapes? Did you lie flat on your backs? Do you remember any other shapes?
Act(R)/Prmpt	C: We, we uh, when we were on our backs, we reached up with our hands.

E: Good. Did you make some twisted shapes, too? Did you do a Raggedy Ann dance? O.K. Here are some pictures I took of your class in the first workshop. Maybe if you look at them you can tell me what happened in the pictures. Here's the first picture. (Saying hello on the drum) Can you tell me what happened in this picture?

C: Good bye or hello.

E: Good. What happened in this picture? ("Clap your hands" song)

C: Oh yeah, They're clapping.

E: What song are they singing?

Act(R)/Photo C: Clap clap clap your hands.

E: What happened in this picture? ("Rum Sum Sum" song)

Act(V)/Photo C: Hammer here, hammer there.

E: O.K. What happened in this picture? (Round ball shape)

C: I don't know that.

E: How about this picture. (Tall and high shape)

C: They're stretching their hands up where they're standing.

E: Here's the last picture? What happened here? (Raising legs)

C: They're putting their feet up in the air.

E: What happened after that?

C: They we put our heads up.

E: And then?

C: We put them down.

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