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Effects of Script Structure on Children's Story Recall

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This study investigated preschool and first-grade children's use of scripts in story recall by manipulating the amount of goal information and the temporal structure of stories about familiar events. Children at both ages recalled more story units from the story about a more familiar event (birthday party), sequenced story units more accurately in the story about a more logically organized event (baking cookies), and tended to eliminate logically inconsistent information in order to preserve canonical event sequences. There were also age differences in amount of recall and selectivity in recall. Preschool children recalled fewer story units, were less accurate and consistent in sequencing the stories, and were more affected by the story manipulations than first graders. These results suggest that younger children's event knowledge is more schema bound but that with age, children become more flexible in their use of scripts in story recall.

A recurring theme in most theories of memory is that the organization of an individual's knowledge base plays an important role in determining what the individual will remember in any given memory task. It is therefore necessary to study the content and organization of children's knowledge as it develops in order to fully understand memory development in children. Mandler (1979) has recently proposed that much of young children's knowledge is organized as schemata for familiar objects, people, places, and events. Schemata are defined as spatially and temporally organized sets of expectations about what things will look like or the order in which events will occur. If young children's knowledge is organized around schematic structures, this organization has implications for what and how they remember.

Research on constructive processes in comprehension and memory has shown that adults' expectations frame their understanding of schematically organized materials (e.g., Bartlett, 1932; Thorndyke, 1977). These expectations typically produce certain kinds of distortions in memory; recall may include intrusions based on inferring appropriate information not explicitly stated. Details may be forgotten whereas central information capturing the gist of the material is more likely to be remembered. In the same way, disruptions in recall are predicted when parts that are crucial to the schematic structure of the material are missing or when events take place in other than the expected order. These types of inferences, intrusions, and disruptions in recall have been found in children's memory for related sentences (Barclay & Reid, 1974; Paris & Lindauer, 1977; Paris, Lindauer & Cox, 1977), pictures (Brown, 1976b), scenes (Mandler & Robinson, 1978), and connected prose (Brown, 1976a; Brown & French, 1976).

Schematic structures have also been found to guide comprehension and recall of story narratives. Research has shown that both children's and adults' recall of well-structured stories conforms to the organization of categories of story information defined by a story grammar (Mandler & Johnson, 1977; Stein & Glenn, 1979; Thorndyke, 1977). When the logical organization of stories is

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violated in scrambled and interleaved stories, subjects tend to reorder the stories in recall according to an ideal story grammar (Glenn, 1978; Mandler, 1978; Mandler & DeForest, 1979; Poulsen, Kintsch, Kintsch & Premack, 1979; Stein & Nezworski, 1978). Although story schemata operate for children in much the same way as adults, younger children's comprehension and memory appear to be more influenced by these structures than older children and adults, especially in recall of deformed stories (Mandler, 1978; Mandler & DeForest, 1979; Poulsen et al., 1979). Younger children display a stronger tendency to repair interleaved and scrambled story sequences in the direction of a canonical story sequence. Similar developmental differences are found in children's recall of organized and unorganized scenes (Mandler & Robinson, 1978).

Nelson has proposed that knowledge about events organized as scripts is a particularly important type of schema organizing young children's knowledge (Nelson, 1978; Nelson, Fivush, Hudson, & Lucariello, 1983; Nelson & Gruendel, 1981). Based on Schank and Abelson's (1977) original formulation, a script is defined as a spatially and temporally organized frame that organizes a sequence of actions around a central or goal act. Scripts are used to predict the order of necessary and optional acts that can be expected to occur whenever the event is encountered or referred to. Studies of children's reports of what happens in familiar events have demonstrated that preschool children have script-like knowledge about familiar events; even 3-year-olds are able to give accounts that are temporally accurate, general in form, and consistent in content, sequence, and level of generality over time (Nelson, 1978; Nelson & Gruendel, 1981).

Research on script processing in comprehension and memory has shown that both adults and children use schematically organized event representations to guide recall of script-based stories. For example, Bower, Black, and Turner (1979) found that adults tend to repair misordered stories in recall in the direction of a canonical script. In a study of children's recall of script-based stories, McCartney and Nelson (1981) found that 5- and 7-year-old children recalled the main acts

rather than the details from a story about a familiar event (dinner and bedtime).

The present experiment investigates the role of familiarity and logical structure in the organization of children's event knowledge using a story recall paradigm. Preschool and first-grade children recalled script-based stories in three conditions: (a) when the story conformed to a canonical script, (b) when the goal of the event was deleted, and (c) when the sequence of actions was misordered. One story was about a very familiar but less logically sequenced event, a birthday party, and the other story was about a presumably less familiar but more logically sequenced event, making cookies.

Children's event representations were expected to influence quantity, selection, sequencing, and intrusions in recall in much the same way that other schematic structures affect recall. For example, stories about events that conform to canonical scripts should be remembered better than stories in which information is deleted or the event is misordered. Familiarity with events and the logical structure of the events were also predicted to affect children's recall. Although these factors are confounded in the two events, birthday party and making cookies, it must be recognized that in working with real-world knowledge structures (as opposed to constructed stories), it is not always possible to deconfound experience and order constraints. However, the effects of familiarity and logical structure were expected to show up in different measures of story recall. Tentative predictions about children's story recall were generated from these considerations.

First, we expected children to recall more information from stories about a more familiar event than from stories about a less familiar event because children's representations of more familiar events are more elaborated. Prior research showed that children mention more acts when reporting what happens at a birthday party than when reporting what happens when making cookies (Nelson, Note 1). This suggests that young children have had more experience with birthday parties because children's script reports tend to become more elaborated with experience (Fivush, 1982). We therefore expected that

children would recall more information from the birthday party story than from the making cookies story.

Our second set of hypotheses concerned the effects of the logical structure of the events on children's recall. Because real-world events vary in their temporal and causal structure, children's event representations reflect that variability. For example, at a birthday party, core acts such as playing games, eating cake, and opening presents may occur in any order. Consequently, there is considerable variation across children in the order in which they mention these acts in their script reports (Nelson, Note 1). For making cookies, children tend to report acts such as mixing cookie dough, putting cookies in the oven, and taking them out in the same sequence because of the temporal and causal relationships between these acts. This suggests that children's representations of making cookies are more logically organized than their representations of birthday parties. Children's memory for a story about making cookies that conforms to the canonical sequence should be temporally accurate because the representations guiding recall are also logically sequenced. In contrast, children's recall of a story about a birthday party could reflect the temporal sequence of their representations of the event without necessarily ordering the constituent acts in the same way as presented in the story because the story presents only one of a number of canonical sequences. Thus, sequencing of recall should be more accurate for the making cookies story than for the birthday party story. Further, because making cookies is a logically structured event, sequencing in recall for this story should be more disrupted by deformations of the event sequence than for the birthday party story.

Our hypotheses regarding the effects of goal deletions on children's recall were more speculative. According to Schank and Abelson (1977), goals motivate script formation and organize script structure. This suggests that deletion of goal information could disrupt children's recall. However, research on children's use of story schemas in recall has shown that deletion of story categories has little effect if this information is readily inferred (Stein, 1979). Thus, the relative im-

portance of goal information to recall could interact with effects of familiarity. If children can easily infer the goal of a familiar event from the sequence of acts presented in the story, recall could be unaffected. For the less familiar event, the goal might not be so apparent and deletion of goal information could cause a decrease in amount recalled (Thorndyke, 1977).

In general, we predicted that effects of script structure on children's recall would be more apparent for preschool children because younger children tend to depend more on automatic retrieval structures (Hudson & Fivush, in press; Mandler, 1978). Both immediate and delayed recall 1 day later were studied with the expectation that effects of schematic processing would be more evident in delayed recall, as reconstructive memory would come more into play (Bartlett, 1932).

Method

Subjects

Thirty first-grade children (13 girls and 17 boys; mean age, 6 years 8 months; age range, 6 years 2 months to 7 years 2 months) and 29 preschool children (15 girls and 14 boys; mean age, 4 years 9 months; age range, 4 years 4 months to 5 years 2 months) participated in the study. Children attended a university-affiliated elementary school in New York City representing a mixed socioeconomic status population.

Materials

Two stories, one about a birthday party and one about making cookies, were constructed. Each consisted of a goal statement and nine acts frequently mentioned by preschool children when asked to report what happens in these events (Nelson, Note 1). Although the two stories were equal in length, because children report more acts when asked about birthday parties (presumably due to more experience with that event), the birthday story reflected children's previous accounts better than the cookies story. For example, whereas children might report "you put stuff in the bowl," this is presented in the cookies story as "They put flour and sugar in the bowl," and "George stirred in some chocolate chips and the chopped nuts."

For each story, a goalless and a misordered version was also constructed. In the goalless versions, the initial goal statements were replaced by neutral setting statements. There was no mention of a party or cookies in the stories after the goal statements so children had to infer the goals from the sequences of acts. In the misordered story versions, two pairs of acts in each story were presented out of sequence. The texts of the canonical stories, the misordered versions, and the setting statements used in the goalless versions are shown in Table

Table 1
Story texts

Birthday party	
Canonical version	One day it was Sally's birthday and Sally had a birthday party. Sally's friends all came to her house. Sally's friends brought presents with them. Everybody played pin the tail on the donkey. Sally blew out all the candles on the cake. Then Sally and her friends ate the cake. They had some chocolate and vanilla ice cream. Everybody had peppermint candy, too. Sally opened her presents and found lots of new toys. Then it was time for Sally's friends to go home.
Misordered version	One day it was Sally's birthday and Sally had a birthday party. Sally's friends all came to her house. Sally opened her presents and found lots of new toys. ^a Everybody played pin the tail on the donkey. Then Sally and her friends ate the cake. ^a They had some chocolate and vanilla ice cream. Everybody had peppermint candy, too. Sally blew out all the candles on the cake. ^b Sally's friends brought presents with them. ^b Then it was time for Sally's friends to go home.
Setting statement	One day Sally was waiting by the window and looking for her friends.
Making cookies	
Canonical version	One day George and his mother decided to make some cookies. They got out a mixing bowl. They put flour and sugar in the bowl. George's mother chopped some nuts. George stirred in some chocolate chips and the chopped nuts. They mixed the dough until it was ready. They spooned the dough on to the pan. They put the pan in the oven. After a while, George's mother took the pan out of the oven. Then George and his mother ate them all up.
Misordered version	One day George and his mother decided to make some cookies. They got out a mixing bowl. They put the pan in the oven. ^a They put flour and sugar in the bowl. George stirred in some chocolate chips and the chopped nuts. ^a They mixed the dough until it was ready. They spooned the dough on to the pan. ^b George's mother chopped some nuts. ^b After a while, George's mother took the pan out of the oven. Then George and his mother ate them all up.
Setting statement	One day, George and his mother were in the kitchen together.

^a Misordered-consistent acts. ^b Misordered-inconsistent acts.

1. Girls heard stories with female characters and boys heard stories with male characters.

Design and Procedure

One third of the children in each age group were assigned to a control group or to one of two experimental conditions, respectively. The control group heard the

canonical versions of both stories. One experimental group heard the misordered birthday story and the goalless cookies story and the other experimental group heard the misordered cookies story and the goalless birthday story.

Stories were tape-recorded and played to the children in a counterbalanced order. At the beginning of the first session, children listened to two warm-up items to fa-

miliarize them with the procedure. After the first story was played, children were asked to recall the story with the instruction, "Tell me the story, the most you can remember." When children paused or stopped, they were asked "Anything else?" or "What happened next?" until they could not remember anything more. Then the same story was played for them again and children were asked to recall it again. The next day, children were asked to recall both stories in any order they could. At the end of the second session, children were also asked to give a title to the stories to see if they could state the goal of the stories. All children were seen individually and responses were tape-recorded and transcribed.

A mixed-model design with age (preschool and first grade) and condition (canonical, goalless, and misordered) as between-subject factors and story (birthday and cookies) and recall trial (first, second, and delayed) as within-subject factors was used for analysis.¹

Results

Coding

Each protocol was scored for the number of units recalled and the order of recall. There were 10 units in each story: the goal or setting statement and nine acts. Each sentence of the stories contained key words that expressed the main idea of the unit. These words or semantically equivalent constructions had to be present in the protocol to give credit for recalling that unit. Two types of intrusions were also coded: additions and transformations. Additions included intrusions of additional acts or details that were not stated in the story, such as "They sang 'Happy Birthday' " or "They got out the mixing bowl and a spoon." Transformations of story material included changes in details (e.g., "They played musical chairs"), partial recall of acts (e.g., "She found new toys"), or condensing of more than one act into a single general act (e.g., "They baked the cookies"). Two judges independently coded 25% of the protocols and achieved 90% agreement. One of these judges coded the remainder of the transcripts.

Quantity of Recall

The mean number of story units recalled in each story for each age group over the three recall trials is displayed in Figure 1. As expected, first graders recalled more than preschool children, $F(1, 51) = 13.80, p < .001$, and more acts were recalled from the birthday story than from the cookies story, $F(1, 51) = 8.20, p < .01$. There was also an effect of recall trial on amount recalled, $F(2, 102) =$

$39.97, p < .001$. Newman-Keuls post hoc tests showed that the mean number of units recalled increased from the first to the second recall trial ($p < .05$) and decreased in the delayed recall trial ($p < .05$). Because it had been predicted that the effects of familiarity in amount of recall would be more apparent for younger children, a priori tests were carried out on the number of units recalled from each story by preschool and first-grade children. As predicted, age differences in amount of recall were found in recall of the less familiar cookies story but not for the birthday story ($p < .05$).

Surprisingly, there was no effect of condition on quantity of recall. Deformations in the script structure of the events apparently did not affect the number of story units children recalled. However, the deformations may have affected selectivity in recall. Further analyses were conducted to determine whether story manipulations influenced which story units children recalled.

Selectivity in Recall

Each story contained five different categories of script information: (a) a setting or goal, (b) ordered acts (those acts left in sequence when the stories were misordered), (c) misordered-consistent acts (those acts in the misordered pairs that remained consistent with the temporal structure of the event), (d) misordered-inconsistent events (those acts in the misordered pairs that are inconsistent with the temporal structure of the event), and (e) the final act or ending (see Table 1). Because the ordered acts, the misordered-consistent acts, and the ending acts remained consistent with the canonical structure of the events in all story versions, recall of these categories was not expected to vary across story versions. However, because goal information should be more important to the structure of the event than setting informa-

¹ Condition is actually both a within- and a between-subjects factor because children in the control group heard only canonical stories whereas children in the experimental groups heard one of each type of deformed story. Because the goalless and misordered story versions were expected to affect recall of the birthday party story and the making cookies story differently, condition was treated as a between-subjects factor to clarify analyses of effects of story manipulations on recall.

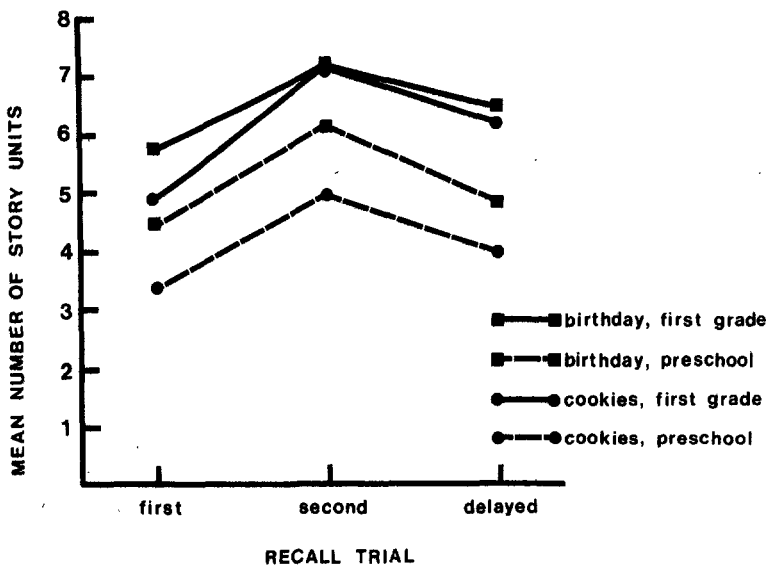


Figure 1. Mean number of story units recalled by age, story, and recall trial.

tion, goal statements should be better recalled that the setting statements in the goalless versions. Poor recall of logically inconsistent acts would also be expected, resulting in poorer recall of the misordered-inconsistent acts in the misordered stories.

The proportion of each child's recall of each of the five types of information categories over the three recall trials was computed for both stories. These proportions (converted by arcsine transformations) were

entered into five separate 2 × 2 × 3 (Age × Story × Condition) analyses of variance (ANOVAs) for each type of story unit. The mean proportions of recall for each information category are shown in Table 2.

Main effects of age were found on the proportion of recall of each category: setting/goal, $F(1, 53) = 7.51, p < .01$; ordered acts, $F(1, 53) = 14.52, p < .001$; misordered-consistent acts, $F(1, 53) = 5.37, p < .05$; misordered-inconsistent acts, $F(1, 53) = 12.07,$

Table 2
Mean Proportion of Event Categories Recalled by Story and Condition

Condition	Event category				
	Setting/goal	Ordered	Misordered-consistent	Misordered-inconsistent	Ending
Birthday party					
Canonical	.83	.54	.59	.47	.62
Goalless	.78	.51	.47	.56	.61
Misordered	.98	.57	.59	.37	.68
M	.87	.54	.55	.47	.64
Making cookies					
Canonical	.88	.44	.48	.46	.77
Goalless	.65	.48	.52	.57	.82
Misordered	.93	.36	.38	.37	.65
M	.82	.43	.46	.46	.74

$p < .001$; and endings, $F(1, 53) = 11.53, p < .01$. Thus, the higher recall scores for older children were due to their recalling a greater proportion of each category of script information than younger children. The main effects of story on recall of ordered acts, $F(1, 53) = 5.50, p < .05$, and misordered-consistent acts, $F(1, 53) = 11.53, p < .01$, also indicated that higher proportions of each of these categories were recalled in the birthday story than in the cookies story. As expected, there were no main effects of condition on recall of these categories.

In general, the only effects of condition on children's recall were local effects on recall of particular categories of script information. Condition interacted with story in recall of the setting/goal statements, $F(2, 53) = 13.13, p < .001$, and misordered-inconsistent acts, $F(2, 53) = 5.25, p < .01$. Post hoc tests showed that children recalled the setting statement less often than the goal statement in the cookies story ($p < .05$) but there were no significant differences for recall of the birthday story. A further Age \times Story \times Condition interaction, $F(2, 53) = 3.51, p < .05$, indicated that poorer recall of the setting statement in the goalless cookies story was significant for preschool but not first-grade children ($p < .05$).

Only preschool children's recall was affected by the absence of goal information and only for recall of the story about the less familiar event. However, goal deletion had no effect on recall of any other category of script information. Children of both ages had no trouble stating the goals of both goalless stories on the second day, although the goal of the cookies story was sometimes inferred as making a cake. (This confusion also occurred in the canonical and misordered recall conditions and suggests that children may have general scripts for baking that encompass baking cookies and cakes.) Children also tended to include inferred goal information in recall. In recalling the goalless birthday story, 30% of the first graders and 60% of the preschool children mentioned a birthday, whereas 10% of the first graders and 44% of the preschool children referred to making something in their recall of the cookies story. Chi-square tests on these percentages showed that preschool children added goal infor-

mation to the goalless stories more often than did first graders, $\chi^2(1) = 4.50, p < .05$, although there was no difference across stories. These results demonstrate that the goals of both events were easily inferred and may explain why there was no decrease in recall of the goalless stories.

Post hoc tests on the Story \times Condition interaction effect on recall of misordered-inconsistent acts showed that these units were recalled less frequently in the misordered version of the cookies story than in other versions ($p < .05$), but differences in recall across conditions in the birthday story were not significant. It is not clear whether selective forgetting of misordered-inconsistent cookies acts was caused by disruption in the logical structure of the event or by children's relative lack of familiarity with the event. Because misordered-inconsistent acts violated the logical structure of both events and children recalled these acts more often in the birthday story, familiarity could account for this finding. However, children may have been able to recall misordered-inconsistent acts in the misordered birthday story by reordering the acts according to a canonical sequence. This could be accomplished by reordering a relatively small number of acts into a number of possible sequences. For example, blowing out candles must occur before eating cake, but these acts are unrelated to playing games, opening presents, and eating ice cream and candy. Similarly, friends bringing presents must occur before opening presents, but this inconsistency could be repaired by moving friends bringing presents closer to the beginning of the story or by placing opening presents towards the end. In order to recall the misordered-inconsistent acts in the cookies story while preserving the logical structure, children must reorder the acts into one canonical sequence. The easier solution would be to simply eliminate these units. Thus, poor recall of misordered-inconsistent acts in the misordered cookies story may be caused by children's attempts to maintain the logical structure of the event that has more temporal constraints than a birthday party.

Temporal Sequencing

Accuracy in sequencing story information was first assessed by computing Kendall's

correlation coefficients comparing recall sequence to the presented story sequence for each protocol. The mean correlations are shown in Table 3. An ANOVA performed on these sequencing scores showed that accuracy increased with age, $F(1, 41) = 7.50, p < .01$, and children sequenced the cookies story more accurately than the birthday story, $F(1, 41) = 11.02, p < .01$. Newman-Keuls tests carried out on the Age \times Story interaction, $F(1, 41) = 7.42, p < .01$, showed that preschool children were significantly less accurate than first graders in sequencing the birthday but not the cookies story ($p < .05$). The Age \times Story \times Condition interaction, $F(2, 41) = 5.63, p < .01$, indicated that older children were quite accurate and consistent in sequencing across stories and conditions, with slightly lowered scores in the misordered versions. Younger children's sequences varied more across stories and conditions.

In general, these sequencing scores are quite high and reflect, for the most part, very accurate sequencing. Also, the lack of a main effect of recall indicates that children were consistent in their sequencing of story units over time. Surprisingly, there was no main effect of condition on accuracy of sequencing even for recall of the more logically structured story. Indeed, preschool children appear to sequence the misordered cookies story better than all others. It had been expected that children would repair the temporal violations on the misordered stories by reordering the misordered acts and thereby lowering their sequencing scores. However, it was also possible that children simply did not recall one or both of the acts in the misordered act pairs in order to preserve the canonical sequence of the event. Selective for-

getting of misordered acts (as found in children's recall of the misordered-inconsistent acts in the cookies story) could account for the relatively high sequencing scores for children's recall of the misordered stories.

A further analysis examined children's strategies for organizing recall of the misordered acts in the misordered stories. For this analysis, misordered acts were not differentiated as consistent and inconsistent. Instead, we looked at recall of causally related act pairs. For example, blowing out candles is causally related to eating cake, and chopping nuts is related to putting chopped nuts into the cookie batter. In the misordered stories, one of these acts becomes logically inconsistent. For each act pair, elimination of one of the acts would resolve the inconsistency although it need not be the inconsistent act.

Four strategies for recalling misordered act pairs were identified. Children could either: (a) recall both acts as presented in the story, (b) eliminate one of the misordered acts, (c) eliminate both of the misordered acts, or (d) recall both acts but reorder them to conform with a canonical script. A proportion score for use of each strategy was computed for all children who heard the canonical and misordered stories. The score was computed by dividing the number of times each strategy was used by the maximum number possible ($2 \text{ pairs} \times 3 \text{ recalls} = 6$). An ANOVA with age, story, and condition as between-subject factors and strategy type as the within-subject factor was performed on these proportions (converted by an arcsine transformation). The mean proportions of strategy use are displayed in Table 4.

There was a main effect of strategy, $F(3, 213) = 19.21, p < .001$, and strategy interacted with age, $F(3, 213) = 4.21, p < .01$, story $F(3, 213) = 5.13, p < .01$, and condition, $F(1, 213) = 6.50, p < .001$. Results from post hoc tests can be summarized as follows: In general, the most frequently used strategies were elimination of one or both acts; eliminating one act was more common in the birthday story than in the cookies story, whereas eliminating both acts was more common in the cookies story. These results are consistent with results of the proportion of recall of misordered acts. Further, reordering the acts occurred more frequently in the

Table 3
*Mean Sequence Scores by Age, Story,
and Condition*

Condition	Birthday party		Making cookies	
	Pre-school	First grade	Pre-school	First grade
Canonical	.78	.95	.83	.98
Goalless	.65	.95	.87	.98
Misordered	.69	.86	.93	.82
<i>M</i>	.70	.92	.87	.92

Table 4
Mean Proportions of Strategy Use by Age, Story, and Condition

Condition	Strategy			
	Recall in presented order	Eliminate one act	Eliminate two acts	Re-order acts
Birthday party				
Preschool				
Canonical	.23	.35	.40	.02
Misordered	.09	.52	.32	.08
First grade				
Canonical	.43	.38	.17	.02
Misordered	.15	.53	.22	.05
<i>M</i>	.23	.45	.28	.05
Making cookies				
Preschool				
Canonical	.26	.42	.32	.00
Misordered	.05	.12	.67	.17
First grade				
Canonical	.45	.20	.35	.00
Misordered	.12	.38	.35	.15
<i>M</i>	.22	.28	.42	.08

misordered condition, and recall of the acts in the order given in the story occurred more frequently in the canonical condition. Preschool children recalled acts in the order presented in the story less often than did first-grade children and eliminated both acts in recall more than older children (all effects, $p < .05$).

Thus, children tended to repair the temporal violations of the misordered stories by omitting one or both of the acts that were presented out of sequence. When both acts in a misordered pair were recalled, children tended to reorder the acts to their correct position in the temporal sequence. Preschool children had greater difficulty than first graders in recalling both acts and were more likely to reorder acts.

Inspection of the intrusions in recall in the misordered stories showed that when children recalled the misordered acts, they often transformed the acts to make sense according to a canonical script. For example, one child changed "Stuart's friends brought presents with them" when it appeared at the end of the story to "They all took par-presents

[home] with them." These types of transformations accounted for 40% of the instances when misordered act pairs were recalled in the presented order.

Intrusions in Recall

In general, the number of intrusions in recall was low and almost all were script relevant. Other than character-name confusions, there was no transferring of information from one story to the other; children were able to keep both stories separate in recall.

Because the number of intrusions was so small, both types of intrusions (additions and transformations) were collapsed for analysis. An ANOVA of the number of intrusions in recall revealed main effects of story, $F(1, 52) = 38.94$, $p < .001$, and recall trial $F(2, 104) = 5.28$, $p < .01$. More intrusions occurred in recall of the cookies story ($M = 1.10$) than the birthday story ($M = .44$). One explanation of this effect is that the less familiar cookies story was not as closely based on children's event reports as was the birthday story. So, for example, putting the pan in the oven and taking it out was often remembered as "They baked the cookies" and the various acts involved in mixing the dough were often recalled as "They made the dough." These transformations of the story are more similar to how children describe the event (Nelson, Note 1) than to how the event is described in the story.

The effect of recall trial was also as expected, assuming that constructive memory processes are involved. Newman-Keuls tests showed that the number of intrusions did not vary significantly from the first to the second recall trial ($M = .75$ and $.63$, respectively) but increased significantly to $.94$ in the delayed recall trial ($p < .05$).

Discussion

This study provides evidence of children's use of scripts in story recall. Level of recall of all stories was generally high and sequencing was generally accurate for both age groups. As predicted, children recalled more information from the story about the presumably more familiar event (birthday party) and sequenced acts more accurately in the more logically structured event story (making

cookies). There was also evidence of script-relevant intrusions in the children's recall at both ages, especially in the delayed recall trial. This finding indicates that children's recall became more schematic over time.

Contrary to our expectations, quantity and sequencing in recall were relatively unaffected by story manipulations that deleted goal information and misordered causally related acts. These findings are particularly surprising in light of research on children's use of story and scene schemata in recalling scrambled material (Mandler, 1978; Mandler & De Forest, 1979; Mandler & Robinson, 1978; Poulsen et al., 1979). These studies generally found disruptions in recall as a result of violations in the schematic structure of material to be recalled. There are two lines of evidence that can clarify this discrepancy. First, although the goal was not explicitly stated in the goalless stories, children at both ages were able to infer the goals of both events. Thus, the appropriate event representations were available for comprehension and retrieval of script information and there were no disruptions in processing, which would be expected if children's event representations were not available because the goal was not evident. Second, because the misordered stories contained only two misordered act pairs, it was relatively easy for children to treat these acts as discrepant or unexpected information and eliminate them in recall. Use of this general strategy maintained the logical sequence of the events and did not significantly affect quantity and sequencing measures. Perhaps children would rely more on a reordering strategy if the event sequences were scrambled or interleaved.

However, results did reflect predicted age differences in the effects of script structure on children's recall. First-grade children were relatively less affected than preschool children by story manipulations and differences between the two events (assumed to reflect familiarity or logical structure). The level of older children's recall was high in all conditions in both stories (but far from ceiling), their sequencing of recall was generally accurate and consistent, and they were consistent in which parts of the stories they recalled over conditions and recall trials. The deletion of goal information from the beginning of the

stories had no effect on first graders' recall. They were able to recall misordered acts in a nonlogical sequence, although they tended to selectively forget one of the acts in a misordered act pair.

In contrast, preschool children seemed to rely more on the activation of familiar event representations than did older children. Their recall was best for the story about the more familiar event (birthday party) and they had least difficulty sequencing the more logically structured event story (making cookies). Preschool children also added goal information to the goalless stories more often than did first graders, which suggests that they had trouble distinguishing inferred goals from the information actually presented in the stories. In addition, younger children were less able to recall information that did not match their event representations. When goal information was deleted from the story about a less familiar event, preschool children had difficulty remembering setting information. Similarly, younger children were more likely to resolve logical inconsistencies in the misordered stories by simply eliminating both of the acts in the misordered act pairs and were less able to order acts as they were presented in the stories.

These results suggest that flexibility in the use of script structures in recall increases with age. Children's recall at both ages was influenced by their generalized event representations, but first graders remembered discrepant or unexpected information better than preschool children. This trend is consistent with previous studies finding greater flexibility in recall of stories and scenes by adults and older children (see Mandler, 1978, and Mandler, 1983, for reviews). Although younger children are able to use schematic structures to guide retrieval automatically, with age children may also be able to use these structures more deliberately and are not necessarily limited to only one automatic retrieval mechanism (Hudson & Fivush, in press; Mandler, 1978). Age differences in effects of script structures on children's story recall may reflect a developmental progression from a schema-bound dependence on implicit and automatic use of familiar schemata to a more explicit and deliberate use of schemata in memory.

Reference Note

1. Nelson, K. *Children's long term memory for routine events*. Paper presented at the meeting of the American Psychological Association, New York, September 1979.

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