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ABSTRACT

A sorting-recall procedure was used to examine the relationship between study and recall organization in reflective and impulsive children at the first and fourth grade levels. Data regarding sorting latencies per trial and the number of trials required to achieve stable sorts were provided by two indirect measures of the deliberateness and ease with which children established stable organizations for stimuli while studying. Older and reflective children had longer sorting latencies, derived stable sorting categories in fewer trials, and had higher scores for recall and recall clustering than had younger, more impulsive children. However, within and between age groups, differences in recall organization did not appear when clustering scores were corrected for variations in children's sorting behavior while studying. It was concluded that the poor recall organization found among younger and impulsive children after a sorting task appears to be associated directly with inefficient study rather than with deficient retrieval monitoring behavior. The present results also contradict the assumption basic to much of the previous research on this topic, which maintains that a sort-to-stable-criterion procedure equates age groups on the degree of study organization. (Author/RAI)

Further Evidence that Children's Study Deficiencies Deter Successful Recall: A Study of Reflective and Impulsive Children

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Explanations of poor recall in young chilren must focus on behavior at two critical phases of task performance. On the one hand, the young child may fail to learn and encode symbols for presented stimuli through ineffective study behavior, thus precluding later reference to the items at recall. Alternatively, the items may be encoded successfully, but for the young child's lack of knowledge of appropriate retrieval strategies, or for his lack of a disposition or ability to exploit retrieval knowledge, he may perform poorly at recall. The purpose of this paper is to discuss some organization and recall data that bear on the importance of children's study behaviors for successful recall. At the same time, I want to argue along the lines of Tulving and Thompson's (1973) "encoding specificity hypothesis" that encoding and retrieval performance are not always independent, and that to attribute age related recall improvements to either set of processes, exclusively, requires the careful analysis of task requirements.

Our interest in study and retrieval explanations of recall development resulted through some early studies of children's recall following free-sorting activity (Lange and Hultsch, 1970; Lange and Jackson, 1974; Worden, 1975). Unlike the poor recall performance shown by young children under standard viewing-recall conditions (e.g., Cole, Frankel and Sharp, 1971), even the youngest of

our school-age subjects exhibited remarkably high recall scores and recall clustering scores after they established stable groupings for to-be-recalled stimuli in a multitrial free-sorting task. Since sorting would appear to be a powerful method of study activity, we concluded tentatively that when poor recall occurs for young children tested within other procedural paradigms it is primarily a result of inadequate study opportunities.

To assess more directly the incidence of study and retrieval failures in children's recall, Lange and Griffith (in press) used a recall-sort-recall procedure. Subjects were required to perform several viewing-recall trials (two for preschoolers, three for subjects at grade levels 1,4,7 and college) before a sort-to-stable-criterion task, and then one free-recall trial after sorting. The colored picture stimuli were not obviously related to one another on the basis of perceptual, associative or taxonomic criteria, and the viewing-recall format for presort trials was similar to that used in subjective organization studies, except that stimuli were presented in array form, rather than one-at-a-time. Children's personalized sorting schemes established on the final (criterion) sorting trial served as referents for deriving indices of recall clustering, both for the presort recall trials and for the postsort recall trial.

The data of the Lange and Griffith study are shown in Table 1. Although postsort clustering scores are moderately high, they are far from perfect (perfect clustering would be indicated by an Item Clustering Index (ICI) score of 1.00), and suggest that even when organization at study is presumed stable, the youngest of the children tested fail to use approximately 50 percent of that organization when ordering recall, i.e., the discrepancy between observed postsort clustering proportions and the maximum possible proportion of 1.00. On the other

hand, the large discrepancy between nominal clustering on presort trials and the moderate-to-high degrees of clustering after sorting suggests that very poor levels of clustering and recall found among young subjects in viewing-recall studies and subjective organization studies are largely attributable to inopportune study conditions which make it difficult for the young child to recognize or impose organization on the stimuli prior to recall. In other words, the young child is likely to rely on pre-established organizations of stimuli as means to guide and enhance recall, at least to moderate degrees, but only if he has the opportunity to establish organization beforehand.

Notwithstanding the study advantages of a sorting task for subsequent recall, Lange and Griffith (in press) corroborated earlier findings that children show only partial adherance to pre-established sorting structures when attempting to recall. Moreover, older children and adults showed greater degrees of reference to their sorts at recall, and consequently, had better recall performance. It appeared to us that two hypothesis were reasonable to account for these age trends. One, a retrieval-deficiency hypothesis, asserts that young children are simply less inclined than older subjects to refer to pre-acquired organization knowledge at recall. Lange and Griffith had referred to these potential deficiencies as "integration failures," i.e., failures to integrate organization knowledge with the requirements of the retrieval task. This view is particularly variable if it can be assumed that the sort-to-stable-criterion task equates age groups on the degree and compositional qualities of organizations established for to-be-recalled stimuli at study. However, an alternative argument is that for lack of adequate reflection and deliberateness while sorting, young children derive and learn stimulus organizations that are less homogeneous, and therefore, less salient

and accessible at retrieval. In this case, lower levels of postsort organization and recall would be attributed to inefficient study behavior, rather than to inherant deficiencies of subjects to actively exploit organization strategies when attempting to recall the items.

To examine these possibilities, an attempt was made to assess children's organization behavior both at study and at recall. A sorting-recall procedure was used in which first - and fourth-graders sorted non-categorized picture stimuli into groups of their own choosing prior to a trial of free recall. Sorting trials continued until subjects achieved stable sorting schemes, ones they could reproduce identically on a subsequent trial. Sorting latencies per trial and the number of trials required to achieve stable sorts served as indirect measures of the deliberateness and ease with which children established stable organizations for stimuli at study. We reasoned that subjects exhibiting long sorting latencies would reach the stability criterion in fewer trials by deriving categories that are more homogeneous and clearly-defined that those of short-latency subjects. Organization at recall(i.e., recall clustering) was measured in reference to compositions of children's sorting categories.

To examine the relationship between study and recall organization for same-age children, we sampled from each grade level(through an administration of Matching Familiar Figures Test) children known to differ in the deliberateness with which they perform perceptual and learning tasks; namely, children with reflective and impulsive conceptual tempos. Reflective children, who are more accurate in cognitive tasks than their impulsive peers, are more likely to confine their attention to task-relevant cues and to devote more time in considering response alternatives (Adams, 1972; Kagan, 1965; McKinney, 1973; Meussle, 1972). Thus, it was reasoned that reflective children in the present

sample (N = 12 at each grade level) would show greater facility than impulsives (N = 12 at each grade level) in deriving optimal organizations for stimuli at study. Following the assumption that deliberate study organization predisposes children to better organization at recall, it was hypothesized that age and conceptual tempo differences in clustering and recall disappear when variations in the latency and trials measures of sorting performance are partialled out of the analyses.

Table 2 summarizes the children's sorting and recall performance data, and Table 3 lists correlation coefficients between these measures. Since first and fourth graders performed with 14 and 20 stimuli, respectively, recall scores were converted to proportions of items recalled.

The fact that fourth graders received more stimuli than first graders could account for their longer pre-trial sorting latencies, $F(1, 44) = 10.92$ $p < .005$. However, fourth graders also showed the ability to derive stable sorting categories in fewer trials than first graders, $F(1, 44) = 7.58$, $p < .01$, which suggests that their longer sorting latencies were probably due to greater deliberateness in deriving suitable classiffcations for the items. As expected, reflective subjects devoted greater amounts of time per trial to sort the stimuli, $F(1, 44) = 15.55$, $p < .001$, and achieved stable sorts in fewer trials, $F(1, 44) = 6.60$, $p < .05$, than impulsives.

Outcomes of the recall and ICI clustering analyses also favored reflective children. Two-factor ANOVAS performed on arcsin-transformed ICI clustering proportions yielded significant main effects for conceptual tempo $F(1, 44) = 9.11$, $p < .005$, as well as for grade level, $F(1, 44) = 5.36$, $p < .05$, and a non-significant ($p > .05$) effect for the grade level x conceptual tempo interaction. The same analysis applied to transformed

recall proportions showed better recall among older children, $F(1, 44) = 24.47$, $p < .001$, and reflective children, $F(1, 44) = 9.31$; $p < .005$. Again, the grade level x conceptual tempo interaction was not significant ($p > .05$).

To determine whether poorer levels of clustering and recall among younger and impulsive subjects were primarily the result of failures to establish optimal organizations for stimuli at sorting, or alternatively, failures to make use of sorting structures at retrieval to guide and expand recall, additional analyses were performed. We reasoned that if retrieval failures were primarily reponsible, then older and reflective subjects should evidence higher levels of clustering and recall than younger and impulsive subjects, independent of the deliberateness of subjects' sorting behaviors. In contrast, if failures to organize and expand recall were due to less deliberate and less effective sorting behavior, then age and conceptual tempo difference should not be apparent after differences in sorting performance are partialled out of the analyses.

To examine these possibilities, the sorting-time and number-of-trials-to-sorting-criterion measures were combined to serve as single covariates in grade level x conceptual tempo analyses of covariance. For the recall data, this analysis yielded a significant main effect for grade level, $F(1, 44) = 13.07$, $p < .001$, but no main effect for conceptual tempo, or for the grade level x conceptual tempo interaction ($p > .05$). When applied to transformed ICI, clustering proportions, the covariance yielded no significant main or interactive effects ($p > .05$). Thus, while clustering effects found initially in the ANOVAS appear to have been dependent on the effectiveness of study organization, the age difference in amount of recall was at least partially independent of sorting performance.

Typically, investigators of children's free recall restrict their analyses to chronological age comparisons. The present results indicate that same-age children also differ widely, both in the deliberateness and ease with which they classify non-categorized stimuli at study and in the degree that they make use of pre-established organizations to order and expand verbal recall. Moreover, the individual differences detected here are associated with deliberateness of subjects' task performance. While reflective children take more time per trial than impulsives to classify stimuli in sorting task, they attain stable classifications in fewer trials and make greater reference to these classifications in recall, as evidenced by higher levels of clustering.

The major finding of the present study was that within- and between-age differences in recall organization fail to appear when clustering scores are corrected for variations in children's sorting behavior at study. Thus, poor recall organization found among younger children after a sorting task appears to be directly associated with inefficient study, rather than with deficiencies in retrieval-monitoring behavior. Analyses of the present data suggest that if subjects in the various age and conceptual tempo groups had classified stimuli at study with equal deliberateness and learned the sorts with equal ease, they would have realized similar levels of recall organization, reflecting similar tendencies to integrate organization knowledge with the retrieval task.

The theoretical significance of this finding for encoding and retrieval explanations of children's recall development warrants further comment. Sorting as a study method has at least two fundamental advantages for children's recall. First, it forces subjects to analyze similar and dissimilar features

of presented stimuli through subjects' attempts to achieve best-fit criteria for category inclusion. Perhaps more importantly, a multitrial sorting task induces subjects to overlearn category definitions, and thus, to learn symbols for categories that are salient and readily accessible for reference at recall. This function does not eliminate the need for retrieval processing. Study organizations must be used at retrieval if they are to affect recall (Emmerich & Ackerman, in press; Williams & Goulet, 1975). On the other hand, there is little evidence from sorting-recall research that young children must implement deliberately organizational strategies at retrieval in order to make use of organization knowledge acquired at study. In fact, the present finding that age differences in post-sort recall organization can be accounted for solely on the basis of differentially effective study behaviors would appear to refute this view. However, for other task procedures where potential retrieval cues are not overlearned at study, age-related differences in children's use of retrieval strategies are likely to have a much greater significance in accounting for the extent of recall organization. Kobasigawa (1974) has demonstrated this point in a viewing-recall study showing that young children realize greater benefit from the availability of retrieval cues at recall than older children. Alternatively, Geis and Hall (1977) found no age differences in recall among first, third and fifth graders when the children were required beforehand to process stimuli through direct questioning during a study period. Again, it appears that when effective retrieval cues for to-be-recalled stimuli are available for learning at study, it is a "study-deficiency hypothesis," that will best account for age differences in recall organization. However, in this case study and retrieval operations are not entirely independent in

the sense that effective study guarantees effective retrieval through the establishment of potential retrieval cues that are appropriate, salient and immediately accessible for use in the monitoring of recall.

It must be noted that the improvement in number of items recalled from the first to the fourth grade was evident even after recall scores were corrected for differences in children's sorting performance. In other words, older children are likely to have better recall for non-categorized stimuli even if the age groups were to take comparable amounts of study time and have comparable degrees of difficulty deriving categories for the items at study. Moreover, the age trends cannot be attributed to organizational factors, since there was no age effect for clustering in the covariance analysis. It appears that older children process and encode to-be-recalled stimuli in ways that are not detectible with the measures of study and recall organization employed in the present study.

Finally, the present results contradict the assumption basic to much of the previous sorting-recall research with children that a sort-to-stable-criterion procedure equates subject groups on the degree of study organization. Clearly, children perform sorting tasks with differing degrees of deliberateness and knowledge of item relatedness, and as a result, form sorts that are differentially effective for reference at recall.

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Table 1

Mean Recall and Clustering Proportions

Over Presort and Postsort Trials

(Lange and Griffith, in press)

	Trials			
Grade	Pre-1	Pre-2	Pre-3	Post
Preschool				
Recall	.44	.53		.72
ICI	.14(.15)	.20(.21)		.68
RR	.18	.22		.54
First				
Recall	.42	.50	.53	.70
ICL	.10(.11)	.11(.08)	.12(.12)	.56
RR	.12	.12	.13	.42
Fourth				
Recall	.45	.53	.58	.78
ICI	.14(.11)	.18(.18)	.21(.20)	.61
RR	.16	.20	.18	.54
Seventh				
Recall	.36	.47	.50	.70
ICI	.08(.08)	.12(.14)	.11(.12)	.61
RR	.14	.22	.16	.64
College				
Recall	.47	.62	.72	.86
ICI	.19(.17)	.23(.22)	.30(.30)	.73
RR	.28	.30	.34	.71

Note: Parenthesized ICI means were calculated in reference to subjects' initial sorting trials.

Table 2

Means of Sorting Behaviors and Recall and Recall Clustering (ICI) Proportions for Reflective and Impulsive Children at the First - and Fourth-Grade Levels

(N = 12 per cell mean)

	First Grade		Fourth Grade	
Performance Measures	Reflectives	Impulsives	Reflectives	Impulsives
No. Sorting Trials	4.08	5.25	2.83	4.00
Time per Sorting Trial (mins.)	2.60	1.34	3.53	2.40
Proportions of Items Recalled	.64	.51	.87	.75
Proportions of Items Clustered	.73	.29	.74	.56

Table 3

Pearson Product Moment Correlation Coefficients Between MFF Scores and Sorting and Recall Performance

(N = 48 for each coefficient)

Variable	1	2	3	4	5	6
1	1.00	-.62***	.50***	-.17	.17	.27
2	---	1.00	-.55***	.41**	.62***	-.50***
3		---	1.00	-.52***	.50***	.50***
4			---	1.00	-.43***	-.35
5				---	1.00	.66***
6					---	1.00

Variable 1 = MFF latencies

Variable 2 = MFF errors

Variable 3 = Mean sorting time per trial

Variable 4 = Number of sorting trials to stable criterion

Variable 5 = Transformed recall proportions

Variable 6 = Transformed ICI clustering proportions

*$p < .05$

**$p < .01$

***$p < .001$