DOCUMENT RESUME

ED 116 814 PS 008 307

AUTHOR	Siegel, Alexander W.; And Others
TITLE	The Primacy Effect in Young Children: Verbal Fact or Spatial Artifact?
INSTITUTION	Pittsburgh Univ., Pa. Learning Research and Development Center.
SPONS AGENCY	National Inst. of Education (DHEW), Washington, D.C.
PUB DATE	75
NOTE	15p.
EDRS PRICE	MF-$0.76 HC-$1.58 Plus Postage
DESCRIPTORS	*Early Childhood Education; Grade 1; Grade 2; Kindergarten; *Memory; Mnemonics; Models; *Primacy Effect; *Recall (Psychological); *Research Design
IDENTIFIERS	*Learning Research and Development Center; Serial Position Recall

ABSTRACT

In this study, a procedure was devised to experimentally separate the spatial and temporal task components of a serial-position recall task in an attempt to account for the primacy effect observed in experiments using this paradigm with young children and retarded subjects. A total of 48, 5- to 7-year-old, children were tested in a serial-position recall task under two conditions. In one condition, which replicated the procedure typically used, the spatial and temporal components were completely confounded; in the other, the spatial and temporal components were experimentally separated. The results provide strong evidence that the spatial component of the typical serial-position recall task, rather than the use of rehearsal, is largely responsible for the primacy effect found in the serial-position curves of young children. (Author/ED)

LEARNING RESEARCH AND DEVELOPMENT CENTER

1975/14

THE PRIMACY EFFECT IN YOUNG CHILDREN: VERBAL FACT OR SPATIAL ARTIFACT?

ALEXANDER W. SIEGEL, JUDITH P. ALLIK, AND JAMES F. HERMAN

THE PRIMACY EFFECT IN YOUNG CHILDREN: VERBAL FACT OR SPATIAL ARTIFACT?

Alexander W. Siegel, Judith P. Allik, and James F. Herman

Learning Research and Development Center

University of Pittsburgh

1975

The research reported herein was supported by the Learning Research and Development Center, supported in part by funds from the National Institute of Education (NIE), United States Department of Health, Education, and Welfare. The opinions expressed do not necessarily reflect the position or policy of NIE, and no official endorsement should be inferred. The authors wish to thank the Principal and teachers of the Shady Lane School for their cooperation. We would also like to thank Linda Manning for her assistance in testing the children.

Abstract

Five- to seven-year-old children were tested in a serial-position recall task under two conditions. In one condition, which replicated the procedure typically used, the spatial and temporal components were completely confounded; in the other, the spatial and temporal components were experimentally separated. The results provide strong evidence that the spatial component of the typical serial-position recall task, rather than the use of rehearsal, is largely responsible for the primacy effect found in the serial-position curves of young children.

THE PRIMACY EFFECT IN YOUNG CHILDREN: VERBAL FACT OR SPATIAL ARTIFACT?

Alexander W. Siegel, Judith P. Allik, and James F. Herman

University of Pittsburgh

A number of investigations of the development of short-term memory in children have employed serial-position recall tasks. The primacy and recency effects typically found have generally been interpreted as reflecting the use of verbal mnemonic strategies such as labeling and cumulative rehearsal. The present study addressed the following question: To what extent does the serial-position function that results from this paradigm actually reflect children's use of verbal mnemonic strategies?

The importance of rehearsal as a strategy for remembering is stressed by two current models of memory (Atkinson & Shiffrin, 1968; Waugh & Norman, 1965). In these models, rehearsal is identified as a process for transferring items from short-term memory to long-term memory. Short-term memory is conceptualized as a limited store that is easily disrupted by incoming items, rehearsal can transfer the items to the more permanent long-term store. In terms of the serial-position function, the initial items are retrieved from long-term store; middle items have not received enough rehearsal to have completed the transfer successfully. The recency effect that is found is attributed to recovery from an immediate sensory store or from short-term memory. Within this framework, the strategy of verbal rehearsal is assigned a very important role in memory, and it has understandably been of interest to developmental psychologists.

A serial-position recall task developed by Atkinson, Hansen, and Bernbach (1964) has frequently been used to investigate development of the rehearsal strategy. In their procedure, a child is shown a series of pictures, one at a time; the pictures are then placed face down in a horizontal row in front of the child. At the end of the series, the experimenter presents a cue card which is identical to one of the original pictures and asks the child to find its match. Because this task involves the recall of an ordered sequence of items, it is reasonable to assume that optimal performance would require a verbal strategy. Bartlett (1932) suggested that words or phrases are probably superior to visual images if the task is to establish an accurate order of sequence. Several studies by Paivio (1971) have supported this suggestion. Thus, it was thought that optimal performance on the serial-position recall task would involve (a) the assigning of a verbal label to each picture as it was presented, and (b) the rehearsal of the names in a cumulative fashion.

Atkinson et al. (1964) did not report a primacy effect with four- and five-year-olds. Donaldson and Strang (1969), using Atkinson et al.'s procedure, demonstrated that using the raw percentage of correct responses at each serial position as a measure of performance does not take into account the absolute frequency with which a given position was selected. Donaldson and Strang (1969) and Keely (1971) reanalyzed Atkinson et al.'s data by taking into account both the percentage of correct choices at a given position and the total percentage of choices at a given position. Using this "guess-correction" procedure, consistent primacy and recency effects were demonstrated for all ages in all three studies (i.e., Atkinson et al., Donaldson et al., and Keely). Bernbach (1967) postulated that the primacy effect reflected the use of a verbal rehearsal strategy. Numerous subsequent investigators have also drawn conclusions about the use of rehearsal on the basis of their subjects' performance at the primacy positions of the serial-position curve. The task has been used with both retarded (e.g., Detterman, 1974) and normal subjects who have ranged in age from preschool to adults (e.g., Hagen, Meacham, & Mesibov, 1970).

Recent evidence has indicated that younger children do not employ a cumulative rehearsal strategy when they are confronted with a request for ordered recall (Allik & Siegel, in press; Flavell, 1970; Hagen, 1972). However, the serial-position curves of these identified "nonrehearsers" continue to show a primacy effect. The present study was guided by the hypothesis that the primacy effect that has been found in serial-position recall tasks with nonrehearsing subjects could be attributed to the strong spatial component of the task. The stimuli themselves (pictures) have a strong spatial component. Furthermore, the first and last pictures in the series have the distinguishing characteristic of having another picture on only one side. Perhaps these spatial components of the task contribute to the primacy effect found with young children and retarded subjects.

In the serial-position recall task typically used with children, stimuli are presented one at a time, from left to right in front of the child. Thus, spatial order and temporal order are completely confounded. In the present study, a procedure was devised to separate experimentally the spatial and temporal task components. If spatial factors are responsible for the primacy effect, then this should be reflected in heightened retention of items located in the initial spatial locations, independent of their temporal order.

Method

Subjects. Eight boys and eight girls at each of three grade levels participated in the study. kindergarten (mean chronological age [CA] = 70 months), first (mean CA = 81 months), and second (mean CA = 95 months). The children were from mixed socioeconomic backgrounds, all attended a private elementary school in the city of Pittsburgh.

Stimuli and apparatus. Stimuli were 3 x 5-inch (7.62 x 12.7 cm) black and white line drawings of common objects and animals. The apparatus was an eight-room model ranch house with the contents of each room (approximately 10 x 10-inch [25.4 x 25.4 cm]) exposed. The rooms were laid out such that there was a unique, linear, but not straight line path from the first room (the porch) to the last room (the garage). Each room had distinctively colored walls and floors and was furnished with miniature furniture appropriate for a garage, kitchen, and so on. The spatial arrangement of the furniture was such that a 3 x 5-inch (7.62 x 12.7 cm) picture could be placed in the center of each room. A schematic diagram of the apparatus is presented in Figure 1.

Procedure. Children were tested individually. To insure that each child had an appropriate verbal label available for the stimuli, all children were required to label the pictures before testing began. The rooms of the house were pointed out and labeled by the experimenter. Following this, the experimenter presented eight pictures, one at a time, at the rate of approximately one per four seconds. After each picture was presented, it was placed face down in one of the rooms, with one picture per room. After the last picture in a series (8th) had been presented, the subject was shown a duplicate of one of the face down pictures and asked to point to the picture that matched the probe stimulus. Two probes were used on each trial. Each child was given a practice trial and four test trials in each of two experimental conditions. (The order of condition was counterbalanced.)

In the sequential condition, the eight pictures were placed in the rooms from left to right in a linear sequence on all four trials. over the four trials each spatial location was probed once for each subject. (Thus, as in the standard serial-position recall task, spatial order and temporal order were completely confounded.)

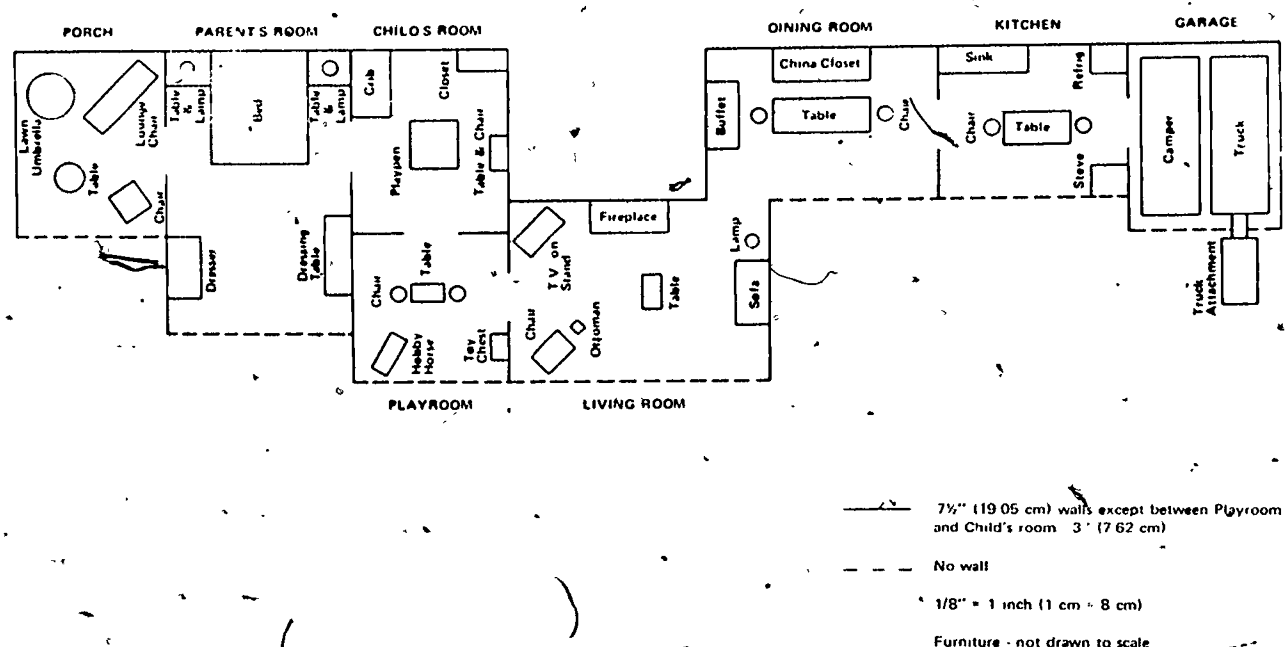

Figure 1. Schematic diagram of dollhouse.

In the <u>random</u> condition, the pictures were placed in the rooms in a different predetermined nonlinear sequence on each trial, with the restriction that neither the first nor the last temporally presented stimulus could be placed in either of the two terminal rooms. Over the four trials, each spatial location was probed once for each subject. (This experimental manipulation separates the spatial component of the stimulus array from the temporal order of item presentation.)

Results

The scores at each serial position for each subject were corrected for guessing (number of times a position was chosen and was correct/number of times that position was chosen) and were subjected to an arcsin transformation. To simplify the analyses, adjacent serial-position scores were paired (1-2, 3-4, 5-6, 7-8) and subjected to two separate analyses of variance.

To assess the extent to which the shape of the serial-position function was influenced by the spatial component of the task, performance at the paired spatial locations in the sequential condition was compared to performance at the paired spatial locations of the random condition. A 3 (Grade) x 2 (Sex) x 8 (Subjects/cell) x 2 (Conditions: Sequential vs. Random Spatial) x 4 (Serial Position pairs) mixed factorial analysis of variance was performed. Neither the main effect of grade nor sex nor the interaction of these with the other variables was significant, $F < 1$. Neither the main effect of condition, $F < 1$, nor the Condition x Serial Position interaction $F(3, 126) = 2.06$, $p < .10$, were significant. The main effect of serial position, however, was highly significant, $F(3, 126) = 6.94$, $p < .001$. The serial-position curves for the sequential and random spatial conditions are presented graphically in Figure 2. The first and second serial positions (1-2) represent performance at the first and second left-most rooms of the house, while the seventh and eighth serial positions

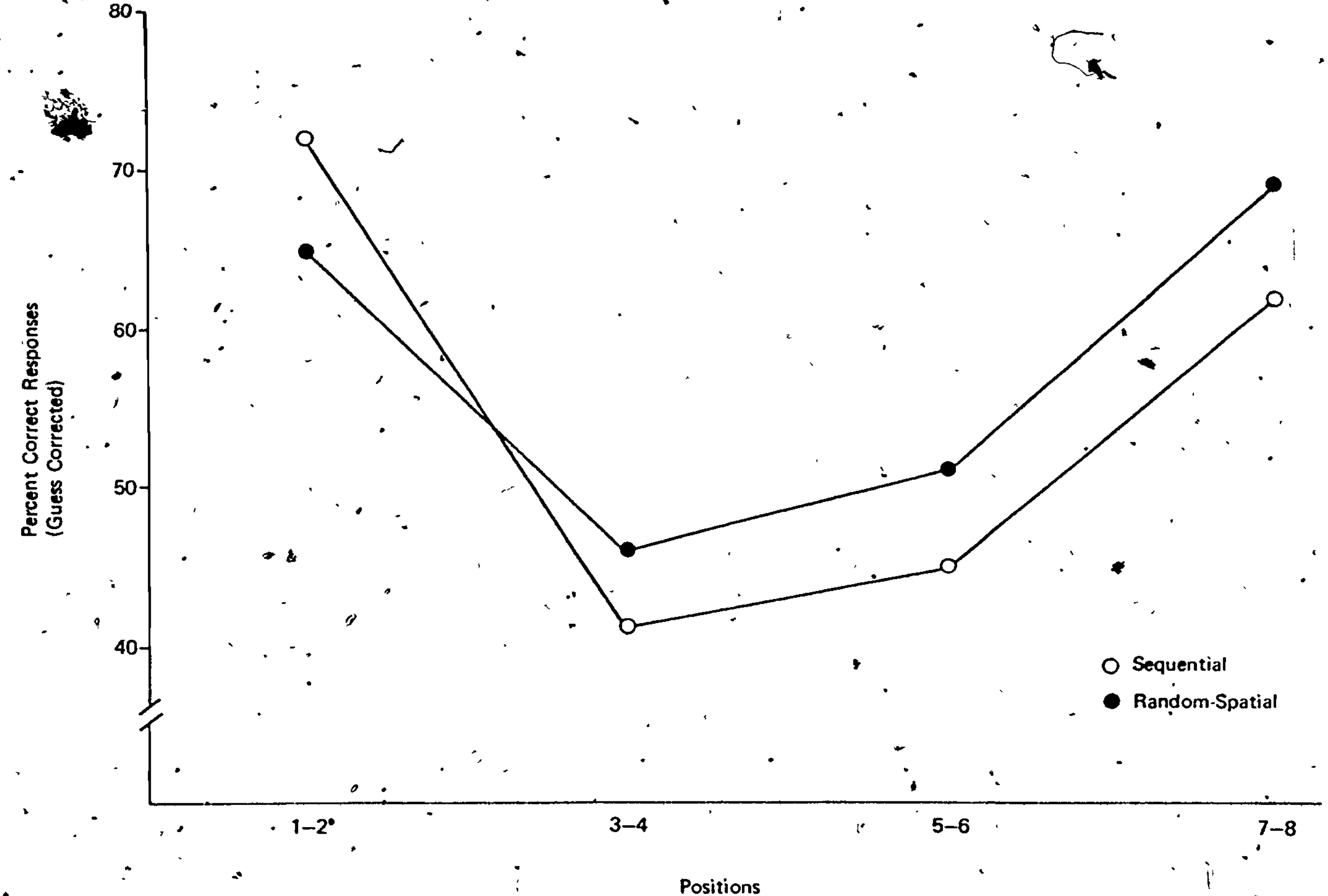

Figure 2. Percent correct responses for the sequential and random conditions as a function of spatial location.

represent performance at the rightmost two rooms. Thus, in this figure, serial position denotes the spatial location of the stimulus items. As can be seen in Figure 2, the shape of the serial-position function, as well as the overall level of performance, was quite similar in both the sequential and random conditions. The mean (guess-corrected) percentage correct responses at the four serial pairs of serial positions in the sequential condition were: 72%. 41%, 45%, 62%. The means for the random condition were: 65%, 46%, 51%. 69%. (Standard error of the mean, $\sqrt{MS_e/n}$ = .08.) Clearly marked primacy effects were found, even when the initial spatial positions were not the first temporal positions.

To assess the extent to which the shape of the serial-position function was influenced by the temporal component of the task, performance at the paired locations in the sequential condition was compared to the paired temporal positions in the random condition. In other words, an analysis was performed comparing performance on the temporal order in which the child saw the stimuli. In the sequential condition spatial and temporal order are completely confounded, they have been unconfounded in the random condition. To equate the number of responses at each temporal position, it was necessary to partition subjects at each grade level into groups of four. Contrary to the previous analysis, the Condition x Serial Position interaction was significant. $F(3,18) = 3.29$, $p < .05$. This interaction is portrayed graphically in Figure 3. The first and second serial positions represent the first and second cards seen by the subject, while the seventh and eighth positions represent performance on the last items that were presented. Thus, in this graph serial position represents the temporal position of the stimulus items. Clearly, there is no evidence for a primacy effect based on the temporal order of stimulus presentation. The mean (guess corrected) percentage correct responses at the four pairs of serial positions in the sequential condition were: 72%, 41%, 45%, 62%. The means for the four pairs of temporal serial positions in the random condition were: 58%, 55%, 53%, 56%. (Standard error of the mean, $\sqrt{MS_e/n}$ = .08.)

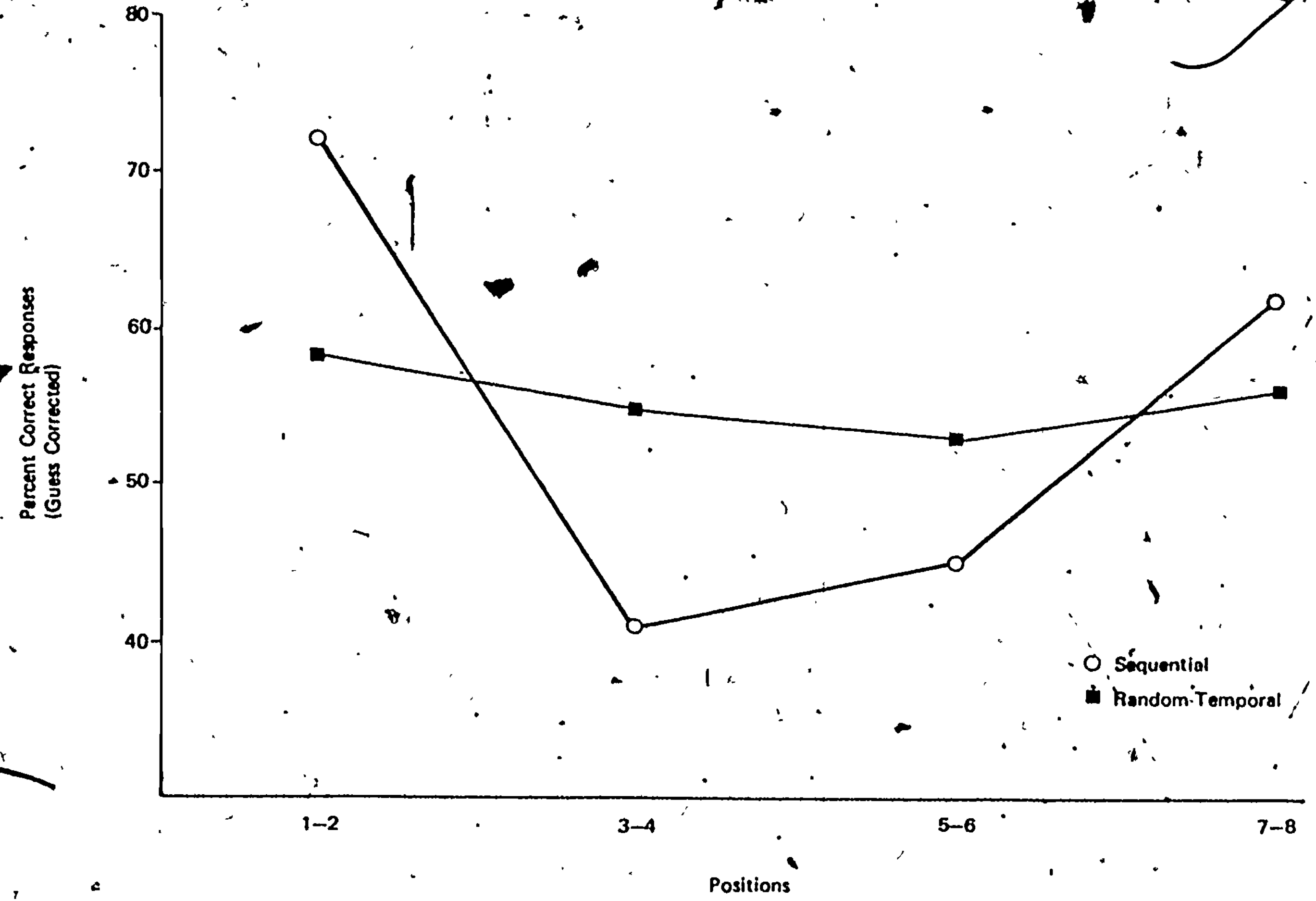

Figure 3: Percent correct responses for the sequential and random conditions as a function of temporal order.

Discussion

The results of this study provide strong evidence that the spatial component of the typical serial-position recall task, rather than the use of rehearsal, is largely responsible for the primacy effect found in the serial-position curves of young children. The fact that overall performance did not differ as a function of random or sequential presentation in itself suggests that cumulative rehearsal is not taking place in children of this age range. If it were, performance in the sequential condition would have been significantly higher than performance in the random condition. More importantly, significant primacy and recency effects were found both when the pictures were presented sequentially and when they were presented in a random spatial order. Note that when we look only at the temporal order of stimuli that are presented in the random condition, the resulting serial-position function is essentially flat. Removing the temporal component of the task does not influence the resulting serial-position curve, removing the spatial component of the task results in an essentially flat function.

Previous investigators (e.g., Hagen & Kail, 1973) have frequently interpreted the primacy effect found with young children or retarded subjects as reflecting the use of verbal strategies such as rehearsal. Our results suggest that this inference is no longer tenable. The serial-position curve may be telling us more about young children's spatial memory than about their verbal memory. Clearly, future investigations aimed at understanding children's use of verbal mnemonic strategies must employ tasks in which spatial and temporal components are not confounded.

References

Allik, J. P., & Siegel, A. W. The use of the cumulative rehearsal strategy: A developmental study. Developmental Psychology (in press).

Atkinson, R. C., Hansen, D. N., & Bernbach, H. A. Short-term memory with young children. Psychonomic Science, 1964, 1, 255-256.

Atkinson, R. C., & Shiffrin, R. M. Human memory: A proposed system and its control processes. In K. W. Spence & J. T. Spence (Eds.), The psychology of learning and motivation (Vol. 2). New York: Academic Press, 1968.

Bartlett, F. C. Remembering. Cambridge, England: Cambridge University Press, 1932.

Bernbach, H. A. The effects of labels on short term memory for colors with nursery school children. Psychonomic Science, 1967, 7, 149-150.

Detterman, D. K. Primacy effects in short-term memory with the mentally retarded. Child Development, 1974, 45, 1077-1082.

Donaldson, M., & Strang, H. Primacy effect in short-term memory in young children. Psychonomic Science, 1969, 16, 59-60.

Flavell, J. H. Developmental studies of mediated memory. In H. W. Reese & L. P. Lipsitt (Eds.), Advances in child development and behavior (Vol. 5). New York: Academic Press, 1970.

Hagen, J. W. Strategies for remembering. In S. Farnham-Diggory (Ed.), Information processing in children. New York: Academic Press, 1972.

Hagen, J. W., & Kail, R. V. Facilitation and distraction in short term memory. Child Development, 1973, 44, 831-836.

Hagen, J. W., Meacham, J. A., & Mesibov, G. Verbal labeling, rehearsal, and short-term memory. Cognitive Psychology, 1970, 1, 47-58.

Keely, K. Age and task effects in short-term memory of children. Perception and Psychophysics, 1971, 9, 480-482.

Paivio, A. Imagery and verbal processes. New York. Holt, Rinehart, & Winston, 1971.

Waugh, N. C., & Norman, D. A. Primary memory. Psychological Review, 1965, 72, 89-104.