Effect of stimulus presentation modes on children's recall and clustering¹

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Kindergarten and third-grade Ss were presented stimuli via visual, auditory, and audio-visual modes. Half of the Ss in each mode were instructed to label the stimuli overtly. In recall, older Ss did better than younger Ss, labelers performed better than nonlabelers, visual and audio-visual modes were more effective than the auditory mode; there was no Age by Mode interaction nor support for the additivity-of-cues hypothesis. Regarding clustering in recall, there were significant Mode, Trial, and Mode by Trial effects; however, contrary to previous findings, no Age or Age by Mode effects were found.

Researchers have often used "mode of stimulus presentation" as an independent variable in free recall studies. Recently, this variable has been studied in a categorical clustering paradigm. In this paradigm, a list of randomized stimulus items selected for their membership in E-defined categories (e.g., animals, foods), is presented to Ss for subsequent recall. The organization of the recalled stimulus items is then compared to the E-defined categories to determine instances of categorical clustering.

Rossi & Rossi (1965), in a developmental clustering study (Ss 2-5 years of age), employed three modes of stimulus presentation: an auditory presentation, in which the stimulus list was read to the S by the E; a visual mode, in which a picture of each item was displayed to the S while the E named the item; and an object mode, in which the real object (e.g., apple, sock) was presented to the S while it was named by the E. Results indicated that recall scores for the three presentation modes differed significantly, while clustering response measures did not. Trends, however, did suggest that the best clustering performance for most age levels occurred under the object mode. In addition, it appeared that younger Ss performed better under visual presentations, older Ss under the auditory modality.

As Rossi's visual modality included the verbal labeling of each stimulus item, no purely visual mode was implemented, thus limiting the possibilities for assessment of single vs combined modality effects. While clustering studies have not yet addressed themselves to this issue, recall studies present conflicting evidence. Van Mondfrans & Travers (1964) found no significant differential recall performance under visual and audio-visual modes, and asserted that combined sensory modes merely provided redundant stimulus input. More recently, however, studies by both Murray (1965) and Wong & Bleving (1966) have found that recall scores increase as the number of modalities in which stimulus cues are presented is increased (the additivity-of-cues hypothesis).

A related question also raised by Rossi's choice of presentation modes deals with the source and role of verbal stimulus cues in the recall-clustering situation. Hagen & Kingsley (1966) reported that when young children (6-8 years of age) labeled stimuli at the time of presentation, they evidenced better subsequent recall. Of interest to the present study is whether these S-produced verbal labels will similarly facilitate the clustering performance of young children. In addition, will E-produced labels, similar to those employed by Rossi, have the same effects as the S-produced ones?

Thus the present study was an attempt to clarify and elaborate upon the differential effects of presentation modes on the recall and clustering performance of 5- and 8-year-old

Ss. For this purpose an auditory (A), a visual (V), and a combined audio-visual (AV) mode of presentation were employed. To study the effects of verbal labels, both S- and E-produced, an additional set of A, V, and AV modes were used in which the Ss were instructed to name the word, picture, or word-picture combination presented. It was hypothesized that: (1) the AV mode of presentation would best facilitate clustering and recall for both age levels; (2) the V mode would be relatively better utilized by the 5-year-olds than by the 8-year-olds with the reverse being true for the A mode; (3) Ss in the label conditions would cluster and recall significantly better than their counterparts in nonlabel conditions.

SUBJECTS

The Ss were 96 boys and girls enrolled in a public elementary school in Minneapolis, Minnesota, 48 from kindergarten classes and 48 from the third grade (mean CAs of 5-4 and 8-4 years, respectively). Ss were randomly selected and assigned to experimental conditions.

STIMULUS MATERIALS AND APPARATUS

Twelve stimulus words were selected from the Thorndike-Lorge juvenile literature count so as to be equated for frequency of occurrence. These items could be organized into four conceptual categories: animals, articles of clothing, body parts, and vehicles, each comprised of three words. For the A mode of presentation, the words were read aloud by the E (via tape recording); for the V mode, pictures of the stimulus items were presented; in the AV mode, both the picture of the item and the stimulus name were presented to the S.

A tape recording of the 12 words, and slides pictorially representing each of the stimulus objects in line drawings, were prepared for presentation. A Carousel slide projector and a tape recorder were each used individually for V and A modes, respectively, and were coupled by the use of a Gerbrand electronic voice key for the AV mode. Recall data were also recorded on tape, and later transcribed.

PROCEDURES

The Ss were tested individually. Stimulus items were presented to 16 Ss of each age level, via one of the three modes. One-half of these Ss were instructed to recite the names of the pictures or stimulus words aloud (label condition). Finally, all Ss were instructed to remember as many stimulus items as possible.

In all three modes, the stimuli were presented to Ss in the first 2 sec of a 4-sec interval. The presentation of all 12 stimuli was followed by a 2-min recall period. When the verbal recall had been recorded, E said, "Good, now

Table 1
Mean Number of Words Recalled by Grades K and 3 according to Mode of Presentation and Label Condition

Mode of Presentation	Kindergarten		Third Grade	
	Label	Nonlabel	Label	Nonlabel
Auditory	6.46	5.88	8.58	8.04
Visual	7.58	6.29	10.00	9.50
Audio-visual	7.33	6.79	9.42	9.08

Table 2
Mean Transformed Clustering Scores of Grades K and 3 by Mode of Presentation and Label Condition

Mode of Presentation	Kindergarten		Third Grade	
	Label	Nonlabel	Label	Nonlabel
Auditory	.35*	.61**	.59*	.21
Visual	.75**	.72**	1.34**	.78**
Audio-visual	1.01**	.45*	1.23**	1.27**

** $p < .01$

* $p < .05$

Fig. 1. Clustering scores for each mode of presentation on the three presentation trials.

let's try again." The entire procedure was then repeated two more times. The intralist order of stimulus words (pictures) was randomized for each trial and two from the same category were never consecutively presented.

MEASURES OF CLUSTERING

Categorical clustering was assessed by the use of Bousfield's (1966) observed and expected Stimulus Category Repetition measure. The transformed clustering scores reported represent the differences between the observed and expected scores.

RESULTS AND DISCUSSION

Recall

An overall three-way analysis of variance (Age by Mode by Condition) with one repeated measure (Trials) indicated that all main effects were significant. The mean number of words recalled according to grade level, mode of presentation, and label condition is presented in Table 1. As expected, third graders recalled more stimulus items than kindergarteners ($F = 74.6$, $p < .01$); labeling Ss performed better than nonlabelers ($F = 5.3$, $p < .05$); and recall scores increased over trials ($F = 95.1$, $p < .01$). Differential modality data showed that recall under both V and AV modes of presentation was significantly better than under the A modality ($F = 6.1$, $p < .01$), but contrary to our hypothesis, the former two modes did not differ significantly from one another. An exhaustive set of multiple t comparisons analyzing for modality-recall effects (the total number of modalities and labeling components available in presentation being considered) found no support for the additivity-of-cues hypothesis. Such analyses compared the A, AV, and AV-label presentations, the V, AV, AV-label presentations, etc. These findings, taken with the main modality effects, suggest that the simple experimental addition of redundant cues may not facilitate a S's recall unless the cue is somehow "actively" incorporated into the S's recall-processing mechanism. If this be the case, then perhaps the S-produced verbal labels in the V-label presentation provided an auditory component similar to that already present (E-produced) and being utilized by the S in the AV mode. Seemingly, the source of the

additional auditory component may not be as important as the active presence of the component itself.

The only significant interaction found by overall ANOVA was an Age by Trial effect ($F = 8.0$, $p < .01$). This finding seems attributable to the fact that older Ss approached perfect recall on the third presentation trial. As no Age by Modality interaction was found, our hypothesis predicting relatively better recall by five-year-olds under the V mode, and by eight-year-olds under the A mode, was not confirmed. It can be seen in Table 1 that eight-year-olds made relatively better use of both the A and V modes. Data showing better recall for both five- and eight-year-olds under the V mode suggests that age "preferences" for different modalities (across this age range), as measured by recall scores, may not exist.

Clustering

The mean transformed clustering scores according to grade level, mode, and label condition are presented in Table 2. All but one of the mean scores are significantly greater than chance level clustering. A three-way ANOVA with one repeated measure found significant Mode ($F = 4.8$, $p < .05$), Trial ($F = 23.9$, $p < .01$), and Mode by Trial ($F = 6.5$, $p < .01$) effects. More specifically: Ss in the AV and V modes displayed significantly more clustering than Ss in the A mode, the former two modes showing no differential clustering; clustering increased from the first presentation trial to the third; and V mode clustering was better than that in the other two modes on the first trial, but by Trial 3, Ss in the AV mode did the most clustering. Figure 1 depicts this Mode by Trial interaction.

These data suggest that perhaps the AV mode provided too much information, too soon—the S not being able to utilize or incorporate the additional cues into his task-coping strategy—while the V mode on Trial 1 was most effectively utilized. On subsequent trials, however, the AV mode seemed to enhance clustering, suggesting again, as in recall, that if such additional cues are actively utilized by the S in his task-processing strategy, their potential utility may then be actualized.

The failure to find hypothesized Labeling or Age by Mode effects (both on overall and within-trial analyses), together with finding that clustering did not increase with age or correlate highly with recall, point out the need to reassess some of the implicit assumptions which presently guide developmental clustering research. Perhaps the relationships between recall and clustering, and between clustering and age, are more complex than previously assumed.

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NOTE

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