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NOTES

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The effect on word recall when storage and retrieval cues differ

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Ss were presented 32 stimulus words from the Underwood & Richardson (1956) norms over six presentation-recall trials. The independent variable was the trial of presentation of retrieval information in the form of category names. These were presented between presentation and recall on Trials 2, 4, or 6 for the three experimental groups. Two control groups were also used; one was presented the category information before recall trials started, and one was never presented the information. The major finding was a decreased recall on trials in which the information was presented. Also, category clustering increased on trials subsequent to the information trial, but number of words recalled did not differ from the control group on subsequent trials.

Earhard (1969) gave Ss several presentation-free recall trials with a list of unrelated words. The major independent variables she manipulated were the trial and the point in the trial (either before the presentation or between presentation and recall) in which the Ss were asked to recall the words in alphabetical order. She reasoned that the more trials an S had with his subjective storage-retrieval system, the larger the recall decrement would be when the S was asked to change the system to one of alphabetical recall. She also hypothesized that there would be a larger decrement if the instructions to recall

alphabetically were given immediately following a presentation rather than immediately preceding a presentation. These hypotheses were based on the assumption that Ss store words in some manner such that the several words are functionally dependent rather than completely independent. Her hypotheses were supported.

Hudson (1969) reported a similar study where words from the Underwood & Richardson (1956) norms were used as stimuli. The Ss were presented 32 words, eight from each of four categories, and were asked for a single recall after four presentations. The major independent variable was locus of instructions concerning the fact that the words could be categorized along with the category names. The information-before (IB) group was given the instructions before the presentations began, the information-after (IA) group was given the information after the fourth presentation, which was immediately before recall. The no-information (NI) group was given no indication that the words could be categorized. The major findings were that the IB and NI groups did not differ in number of words recalled but that both were significantly superior to the IA group. It was also found that the IB group had a significantly higher clustering index than either the IA group or the NI group, between which there was no difference. Hudson (1969) interpreted these findings as indicating that retrieval information must be stored with the target words in order to be effective, which is in line with

the hypothesis that words are stored in some dependent manner.

The present study was designed to extend the findings of Hudson (1969), using a paradigm similar to that of Earhard (1969). Specifically, the hypothesis was that Ss would show a drop in recall on the trial in which information about the categorical nature of the words was given but that on subsequent trials the recall would increase relative to a control group, as would the clustering index.

SUBJECTS

The Ss were 50 student volunteers from Mississippi State University.

MATERIALS

Thirty-two words were selected from the Underwood & Richardson (1956) norms, eight words from each of the categories—round, white, smelly, and small. The particular words used were the same as the low-variability list of Hudson (1969). A Stowe memory drum was used for word presentation.

PROCEDURE

Ten Ss were assigned at random to each of three experimental and two control groups. All Ss received six presentation-recall trials. The independent variable was the trial during which information was given. The three experimental groups were given the information on Trial 2, Trial 4, or Trial 6 and are referred to as Condition 2, Condition 4, and Condition 6. They were given the information between presentation and recall of the indicated trial. One control group was given this information before presentation-recall trials began and will be referred to as Condition 0. The other control group was never given the information and will be referred to simply as the control group.

All Ss were run individually and were assigned to one of the five groups as they appeared for testing. The words were presented at a 4-sec rate. Six different random orders of the words were used, with the starting order for each S being determined at random. After the words were presented for a given trial, E spoke a three-digit number, and S counted backward by twos from it for 15 sec. On a trial in which information was given, this was done in lieu of the number counting and took approximately the same amount of time. On this critical trial the Ss were told that the words could be put into one of four categories and were told the category names. They were also given a card on which the category names were typed and told they could keep it for the remaining trials. Recall time was 2 min on each trial.

RESULTS AND DISCUSSION

The data of primary interest is a

Table 1
Mean Number of Words Recalled for the Information Groups and No Information Group on the Critical Trials

Information Condition	Trial		
	2	4	6
Information	15.5	22.1	22.8
No Information	18.6	24.6	26.5

comparison of the three experimental groups with the control group on the trial in which the information was given (critical trial). The mean number of words recalled for these six subgroups is presented in Table 1. It should be noted that the cells for the information groups are independent, while the cells for the control groups are the same 10 Ss in each case.

For lack of a more appropriate statistic, the three control groups were treated as independent and a 2 by 3 completely randomized factorial analysis of variance was performed. Thus, there were three trials (2, 4, and 6) and two conditions (information or no information). The analysis indicated that the main effect for trials was significant, $F(2,54) = 17.11$, $p < .001$, as would be expected. The main effect for the information condition was also significant, $F(1,54) = 7.46$, $p < .01$. The Trials by Information Condition interaction was < 1.00 . It should be noted that both the above main effects would be significant at the same level even with a more conservative number of error-term degrees of freedom.

Other analyses indicated that the information groups did not recall more words than the control group on trials

subsequent to the critical trial.

The data for the clustering index are presented in Table 2. The clustering index used was one presented by Dunn (1969), which is similar for most recall protocols to one presented by Hudson & Dunn (1969). The general trend in the data is clear, even though statistical analysis between groups at each trial are generally of only marginal significance. On the trial in which information was given there was no increase in clustering, but by at least the second following trial the clustering index had risen rather sharply. This was true even for Condition 0, where the information was given prior to the presentation-recall trials.

The fact that the number of words recalled did not increase relative to a control group on trials subsequent to the critical trial, while the clustering index did, is probably due to the fact that with only four categories of words the storage-retrieval system presented to the S in the form of the categorical information is no more efficient than the subjective storage-retrieval system that each S imposes on the words. If the number of categories were increased to 10 or more there likely would be a subsequently increased recall.

It would be expected that, as Earhard (1969) found, the more presentation-recall trials prior to the presentation of information, the larger the decrement in recall on that trial. In this study, the largest decrement did occur for Condition 6, but the Information Condition by Trials interaction was not significant. This points up a methodological difficulty with this

study. During a postexperimental inquiry, the Ss were asked if they made use of the category information given. Approximately 80% of the Ss in Condition 0 and Condition 2 reported that they did make use of the information, while only 35% of the Ss in Condition 4 and Condition 6 reported such usage. Appropriate modification of the instructions would probably increase the number of Ss who make use of the information late in the trials and, hence, would probably result in a larger recall decrement for these Ss. It should be noted that Ss in Earhard's (1969) study who did not attempt to recall the words alphabetically were dropped from the study.

These data, in general, support the hypothesis that Ss store words with appropriate retrieval cues and that use of another system of retrieval results in a recall decrement for the critical trial which is erased when the Ss have subsequent opportunity to store words with the newly given retrieval cues. The study leaves untouched the more interesting question of how the S is able to recall nearly as many words as the control group even though he supposedly is using a retrieval system inappropriate to the retrieval cues stored with the words.

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Table 2
Conditions X Trials Mean Clustering Indexes

Condition	Trial					
	1	2	3	4	5	6
0	.93	1.22	2.36	2.88	3.11	2.65
2	.05	.89	.96	1.95	2.33	2.73
4	.45	1.06	1.54	1.80	2.63	3.02
6	.89	1.42	1.30	1.71	1.64	1.99
Control	.89	.84	1.22	1.61	1.36	1.63