Differences between retrieval cues in effectiveness as recall aids*

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Ss learned a single list of words to which two sets of cues were relevant. For both sets of cues, number of items per cue ranged from 2 to 16. Cues for which relevant items were relatively high-frequency free associates (conceptual cues) led to higher recall than did cues to which list items were relatively low-frequency responses (alphabetical cues). Free-recall instructions led to higher recall than did alphabetical cues to which more than six items were relevant, but recall from large conceptual categories was not inferior to free recall of the same items. The results suggest that rather than sharing a common limit on the number of items they can retrieve, cues vary in effectiveness. Thus, free-recall performance will be affected by the particular S units into which S organizes a set of words, as well as by the number of such units he uses.

It is well documented that, in the multitrial free-recall experiment, S imposes "subjective organization" (SO) on the material that he learns (e.g., Tulving, 1962; Bousfield, Puff, & Cowan, 1964). If learning progresses via the grouping together of items into "subjective units," then variability in free-recall performance may be a function of the number of units S uses or the number of items he can retrieve per unit. The present paper reports an investigation of the number of items retrievable per unit.

Cued recall experiments have consistently shown that for a particular type of cue, recall is negatively related to the number of items per cue. For example, Earhard (1967) found that proportional recall within alphabetical categories decreased as number of items per cue increased, and that free recall was superior to cued recall when alphabetical cues were relevant to more than six items. These data have been interpreted to mean that the number of items retrievable per unit is limited and that recall is primarily a function of the number of units used (Mandler, 1967). However, it is reasonable to expect that for a given set of words, cues can be devised which have varying probabilities of retrieving the items, and that free-recall performance can vary as a function of the effectiveness of the particular cues or units used, as well as the number of these units. The relatively poor performance of Earhard's cued Ss when presented with categories containing more than six items, then, could be the result of a cueing system able to retrieve a lower proportion of words than systems developed by uncued Ss.

It was hypothesized that cues for which items to be recalled are relatively high-frequency free associates would lead to higher recall than would cues for which relevant items are relatively low-frequency associates. It was assumed that on the average a word occurs as a response to a relevant conceptual category name more frequently than it occurs as a response to its initial letter. A list was constructed for which two sets of cues were relevant: alphabetical and conceptual. It was hypothesized that: (1) conceptual cues would lead to higher recall than would alphabetical cues, and (2) recall of items from large categories by Ss given conceptual cues would not be inferior to that of uncued Ss.

SUBJECTS

Seventy-five University of Southern California undergraduates served as paid Ss. Ss were divided randomly among three experimental groups, with the restriction that 60% of each group be male.

APPARATUS

Forty-eight words beginning with one of six letters were chosen from six categories in the taxonomic norms for category associates (Cohen, Bousfield, & Whitmarsh, 1957), so that each word was a member of both a conceptual and an alphabetical category. Each set of categories had one category with 2, 4, 6, 8, 12, and 16 members. In order of increasing size, the conceptual categories were *musical instruments, trees, animals, weather phenomena, occupations,* and *furniture,* and the alphabetical categories were *s, t, l, d, b,* and *c*.

General instructions were presented by tape recorder. Stimuli were presented at 2-sec intervals by means of a slide projector.

PROCEDURE

Three experimental groups were used, differing in which cues they received: alphabetical cues (A), conceptual cues (C), and no cues (F). Learning instructions and recall sheets were contained in booklets. Group C's instructions stated that certain words descriptive of words on the list would be printed on the recall sheet as cues to aid their recall, while Group A was told that the initial letters of the words would be printed on the recall sheet as cues to aid their recall; both groups were told to write each recalled word on a line underneath the cue to which it belonged. Group F was told to learn the words and to write them, one on a line, in the order in which they recalled them. Recall sheets for each cued group contained the appropriate cues and underneath each cue the correct number of lines for the category. Free recall sheets contained 48 lines. Cues were not visible during list presentation.

Words were presented in different orders on each of 12 trials. By applying six randomizations to the words in each of two basic orders, consisting of the alphabetical categories in order of increasing size and the conceptual categories also ordered by category length, 12 word orders were generated in which the two sets of categories had the same number of category mates adjacent to each other. Orders derived from the two basic orders were counterbalaned over trials.

Ss were given 2¼ min for recall. Since the order of the categories on the recall sheet might have affected number recalled within categories, a Latin square for order of orders was prepared. On each trial, then, cued groups contained Ss whose cues were arranged in each of six orders.

RESULTS

Table 1 shows the mean number of words recalled by the three groups on each two-trial block. The groups differed in amount of recall, with $F(2,72) = 10.76$, $p < .001$; a difference in rate of learning is indicated by a significant Groups by Trials interaction, with $F(10,360) = 2.45$, $p < .01$. In order to discover the locus of the difference among the groups in words recalled, both cued groups were separately compared to Group F. Group C's recall was significantly higher than Group F's, with $F(1,48) = 6.76$, $p < .05$, but Group F's and Group A's recall were not significantly different, with $F(1,48) = 3.20$, $.05 < p < .10$.

In order to see which set of categories Group F tended to use, ratio of repetition (Cohen, Sakoda, & Bousfield, 1954), or RR, was calculated separately for the two sets of categories. Table 2 lists the mean RRs for Group F. Analyses of variance performed on each type of RR revealed that conceptual RR increased significantly over trials but alphabetical RR did not,

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Table 1
Mean Recall on Two-Trial Blocks

Group	Trials					
	1-2	3-4	5-6	7-8	9-10	11-12
C	21.1	33.0	36.4	39.4	40.6	41.7
F	19.3	28.2	31.8	34.6	35.3	36.5
A	16.7	24.3	28.5	30.5	33.2	34.3

with $F(5,120) = 28.96$, $p < .001$ and $F(5,120) = .72$, respectively. Evidently there was no significant tendency for free-recall Ss to use an alphabetical organization, but there was a pronounced tendency for them to use the conceptual categories in organizing their recall.

Table 3 depicts mean proportional recall over all 12 trials from categories of each size. Recall from the conceptual and alphabetical categories are both presented for Group F. Total number of words recalled over 12 trials from the three shorter and the three larger alphabetical categories were compared for Groups F and A, while conceptual category recall was compared for Groups C and F. Groups F and A did not differ in their recall from the shorter alphabetical categories, with $F < 1$, but Group F recalled significantly more words than did Group A from the longer categories, with $F(1,48) = 6.55$, $p < .05$. Group C recalled significantly more words from short conceptual categories than did Group F, with $F(1,48) = 16.70$, $p < .01$, but the difference between the groups in recall from larger categories failed to reach significance, with $F(1,48) = 3.91$, $.05 < p < .10$.

DISCUSSION

Both hypotheses were supported. With number and size of categories held constant, cues to which list items were relatively high-frequency responses led to recall of more words than did cues to which list items were relatively low-frequency responses. Furthermore, free recall was not superior to cued recall from large categories for cues of this sort. In fact, conceptual cues led to higher overall recall than did free recall on a list with an average of eight words per category. These data indicate that retrieval cues vary in their effectiveness and that, given cues to which list items are high-frequency responses, cued recall need not become a handicap beyond six items per cue.

Table 2
Mean RR for Two-Trial Blocks, Group F

RR	Trials					
	1-2	3-4	5-6	7-8	9-10	11-12
Alphabetical	.161	.154	.163	.179	.169	.177
Conceptual	.394	.555	.584	.646	.629	.652

Table 3
Mean Proportional 12-Trial Recall as a Function of Category Length

Group	Category Length					
	2	4	6	8	12	16
C	.938	.813	.801	.761	.721	.668
A	.827	.614	.680	.577	.534	.543
F (Conceptual Categories)	.645	.636	.714	.676	.660	.591
F (Alphabetical Categories)	.687	.616	.687	.649	.652	.626

The present results are consistent with Earhard's (1967) finding that free recall is superior to alphabetical cued recall with more than six items per cue. Thus, Group F recalled more words than did Group A from the three categories containing more than six items. However, the present results are not consistent with Earhard's finding that alphabetical cued recall was superior to free recall for smaller category sizes. Alphabetical cues were no advantage for smaller categories in the present experiment. It seems probable that the relative effectiveness of cued and free recall will depend, not only on the number and size of the categories involved in cueing, but also on the relative effectiveness of the cues given to and the organizations developed by the respective groups of Ss. Where cued-recall and free-recall groups use the same organization, as the RR data indicate was the case here for Groups C and F, cued recall will be superior to free recall for smaller categories, presumably because the cues aid category recall (Tulving & Pearlstone, 1966). The relative effectiveness of cueing will diminish as category size increases, and hence category-recall becomes more probable for free-recall Ss. When, however, the free-recall group uses a set of units likely to allow retrieval of considerably more items per unit than those of the cued group, the advantage of cueing may disappear. The largest category size for which alphabetical cued recall is superior to free recall might almost be used as an index of the organizability of a list, or if subject characteristics were varied and list held constant, it might serve as an index of organizing skill of Ss.

In conclusion, it may be stated that the "limit" on the power of a retrieval cue evidently varies with the particular cue or type of cue used. The results of the present experiment suggest that in the free-recall situation the particular S units as well as the number of units S uses will affect his recall. S's skill in identifying subgroups of list items that share relatively strong associations with a cue will determine, in part, his free-recall performance.

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