

Instructions and grouped presentation in free recall

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Subjects were presented either single items over trials for free recall, constant groupings of two words each over trials, increasingly larger groupings over trials, or progressively smaller groupings over trials. The nature of the grouped presentations had no effect on recall or organization; grouped presentation generally led to more organization than the single items, but the amount recalled was comparable in all cases. Instructions to use images led to more organized recall in some cases but increased recall only for the constant-size condition and hindered recognition somewhat in the changing-size conditions.

The present research was concerned with the effect of grouped presentation on free recall. Bower, Lesgold, and Tieman (1969, Experiment IV) used this method to test the hypothesis that recall of 'unrelated' words increases over trials partly because the subject's organizational units increase in size and integrity (e.g., Mandler, 1967; Tulving, 1968). On the assumption that simultaneous presentation of a subset of the list defines a useful organizational unit, Bower et al. structured over trials the sizes of the groupings of words presented for study. Subjects in an increasing-size condition were presented 3-word groupings on the first trial, 6-word groupings on the second trial, and 12-word groupings on the third. If subjects normally increase the size of their memory units over trials, this arrangement should facilitate recall. Subjects in a decreasing-size condition had the reverse sequence of groupings over trials. Bower et al. found greater recall and organization for the increasing-size condition, in apparent support of the 'chunking' interpretation of improved recall.

However, a recent report (Mueller and Overcast, 1975) questioned the use of the decreasing-size condition as a neutral baseline. The primary shortcoming is that if the increasing-size procedure *helps* subjects in their normal efforts to develop larger units, then the decreasing-size procedure would be expected to *hinder* those efforts. Thus, a more appropriate reference condition would be one that involves neither facilitation nor interference.

Mueller and Overcast (1975) used an arrangement with constant-size groupings over trials as the baseline condition in three experiments. Subjects in one constant-size condition were presented 3-word groupings each trial, and those in another had 12-word groupings each trial. In none of the three experiments did subjects in the increasing-size condition perform significantly better than those in the constant-size condition (in fact, in only one experiment did subjects in the increasing-size condition even perform better than those in the decreasing-size condition). Another reference condition had single-item presentation, to assess how much grouping per se contributed, as opposed to the *manner* of the grouping. The single-item condition showed less organization than the grouped conditions, but the amount recalled was comparable. The present study was a further investigation of the effects of grouped presentation, examining the effects of instructions and grouping size.

Bower et al. and Mueller and Overcast instructed all of their subjects to form images combining the words in a grouping presented for study. The intent of these 'imagery' instructions was to increase the likelihood that the groupings presented for study would serve as the functional memory units. However, it is possible that such instructions themselves induce sufficiently high levels of organization that effects due to changing the size of the groupings are masked. In other words, it seems possible that effects due to changes in the size of the study groupings might be more apparent if subjects were *not* told to form images during study. Therefore, half of the subjects in the present experiment were told to form an image uniting the words in a study grouping, while the other subjects received no such instructions.

Another factor examined in the present study was the absolute size of the study grouping. The smallest grouping used in the earlier studies was 3 words, with changes from 3 to 6 words and then 12 words over trials. Even if subjects normally incorporate more words into a chunk over trials, it is possible that such increments are too large to be useful. Therefore, the present study utilized groupings of 2, 4, and 8 words over trials, with the expectation that these smaller changes might be more manageable than was possibly the case in the earlier studies, thus maximizing any benefits of increasing the size of the groupings.

METHOD

Subjects

Eighty students from introductory psychology courses participated as subjects to fulfill course requirements. They were randomly assigned to the eight groups formed by the factorial combination of four *presentation conditions* (increasing-size, decreasing-size, constant-2, single-item study groupings) and

two types of *instructions* (general plus imagery instructions, general instructions only).

Materials

The word list was composed of 72 concrete nouns selected from the norms of Paivio, Yuille, and Madigan (1968). All had rated imagery greater than 5.10 and a Thorndike-Lorge frequency of at least 19 per million. They were randomly divided into 36 pairs for the 2-word study groupings. The pairs were then randomly combined to make the 4-word groupings, and these were then combined to make the 8-word groupings. The groupings were typed on 4-by-6-in. cards for presentation, with the original pairs maintaining their separate identity by appropriate spacing when larger groupings were formed.

The words within a pair also maintained the same spatial order on the card over trials, to minimize any confusion due to a change in their order. This was not done in Mueller and Overcast's study, and it is unclear whether it was done in the study by Bower et al., but it would seem to be the most favorable arrangement for demonstrating improvement due to increasing the size of the groupings.

Procedure

All subjects performed for three free-recall trials. Those in the *increasing-size* condition received study groupings of 2 words each on the first trial, 4 words each on the second trial, and 8 words each on the third. Those in the *decreasing-size* condition had the reverse sequence of sizes over trials. Those in the constant-size condition (*constant-2*) received the same groupings of 2 words each on every trial, with only the order of presentation of groupings varying. Subjects in all of these groups were told that the size of the study grouping might change or stay the same over trials. In each of these conditions, the multiple-word groupings were shown for a period of time that allowed 4 sec per word (8 sec, 16 sec, or 32 sec per card). Subjects in the *single-item* condition had the list presented one word at a time by a slide projector, at a 4-sec rate, with the order of the words changing over trials. After each complete presentation of the list, subjects had a 3-min written test of recall.

In addition to *general* instructions that emphasized the option to recall in any order, half of the subjects in each of the four presentation conditions received additional *imagery* instructions suggesting that they form mental images combining the words on a card as interacting in some way, with an illustrative example.

The third test of recall was followed by an unpaced test of recognition. Subjects were given a list of 144 words, the 72 old words plus 72 new words, and required to identify the words they had seen before in the experiment.

RESULTS

Recall

The average recall per trial is shown in Table 1 for each group. The only significant effect was the main effect of trials [$F(2, 144) = 507.75$, $MS_e = 19.52$], as learning occurred in all groups.¹ No other differences were significant [$F_s < 1.92$].

Table 1. Average recall per trial in each condition

	Presentation condition			
	Increasing	Decreasing	Constant-2	Single-item
Imagery instructions	30.43	30.13	36.87	35.03
No imagery instructions	33.57	34.33	33.57	35.37

Organization

Recall was scored for intertrial *repetitions* of 2 words, 4 words, and 8 words, these being the grouping sizes shown to subjects. An unordered criterion for repetitions was used, and Pellegrino's (1972) adjusted ratio of clustering (*ARC*) score was computed in each case. The average scores are shown in Table 2, averaged over trials.

Imagery instructions led to more organization in general [$F(1, 72) = 3.49, p < .07, MS_e = .02$], and all grouped presentation conditions showed more organization than the single-item condition [$F(3, 72) = 6.29, MS_e = .02$]. The interaction of instructions and presentation condition was marginally significant [$F(3, 72) = 2.54, p < .07, MS_e = .02$], as imagery instructions improved organization in the constant-2 and decreasing-size conditions but not in the increasing-size and single-item conditions. These effects were most apparent for intertrial repetitions of 2 words (see Table 2), as indicated by significant interactions of instructions by repetitions [$F(2, 144) = 5.54$], presentation condition by repetitions [$F(6, 144) = 7.01$], and instructions by presentation condition by repetitions [$F(6, 144) = 2.39$; all $MS_e = .01$].

Organization increased over trials [$F(1, 72) = 7.49, MS_e = .01$], but

Table 2. Average adjusted ratio of clustering score

Presentation condition	Intertrial repetitions		
	2 words	4 words	8 words
Imagery instructions			
Increasing	.39	.06	.00
Decreasing	.48	.08	.00
Constant-2	.50	.10	.00
Single-item	.25	.01	.00
No imagery instructions			
Increasing	.42	.05	.00
Decreasing	.31	.06	.01
Constant-2	.37	.04	.00
Single-item	.24	.07	.00

neither instructions nor presentation condition interacted with trials [$F_s < 1.08$]. There was a marginally significant triple interaction of instructions by presentation condition by trials [$F(3, 72) = 2.62, p < .06, MS_e = .01$]. This interaction indicated that the increase in organization over trials occurred in all subgroups, except for the decreasing-size condition with imagery instructions and the constant-2 condition without imagery instructions (both of which showed a decline over trials) and the single-item condition with imagery instructions (which remained virtually the same over trials). These effects were also greatest for intertrial repetitions of 2 words. The interaction of repetition size by trials was not significant [$F(2, 144) = 1.95$], as the number of repetitions of all sizes increased over trials. The interaction of presentation condition by repetitions by trials was not significant [$F(6, 144) = 1.97$], as would have been the case if subjects under one presentation condition were utilizing larger chunks over trials.

Recognition

Table 3 presents the average number of correct recognitions of old items for each subgroup. There were no main effects of instructions or presentation condition [$F_s < 1.12$]. The interaction of instructions by presentation condition was marginally significant [$F(3, 72) = 2.25, p < .09, MS_e = 19.44$], as imagery instructions increased recognition in the constant-2 and single-item conditions but reduced it in the increasing-size and decreasing-size conditions.

DISCUSSION

These results fail to support the hypothesis that larger study groupings over trials will facilitate performance. Recall was not improved by the increasing-size arrangement relative to either decreasing-size or constant-2 conditions. If anything, both increasing-size and decreasing-size arrange-

Table 3. Average correct recognitions in each condition

	Presentation condition			
	Increasing	Decreasing	Constant-2	Single-item
Imagery instructions	67.70	67.40	69.70	70.50
No imagery instructions	69.00	69.80	65.40	69.60

Note: Maximum score, 72.

ments led to somewhat worse performance than the constant-2 condition, as if the subjects under both former conditions experienced some interference due to the changing composition of study groupings over trials. This was the case for both types of instructions, and the pattern of results was much the same for recall and subjective organization. The grouped presentation conditions did show more organization than the single-item condition, but this advantage did not carry over to recall.

Thus, the previous failure to replicate the difference between increasing-size and decreasing-size conditions does not seem attributable to a change in the spatial order of the words in groupings over trials. Nor does the difference seem related in any simple manner to either imagery instructions or the absolute number of words in the study unit. Variations in the manner of sequencing subsets of different sizes might conceivably have some effect with nominal intralist relationships (e.g., instances of taxonomic categories) but would seem to be of little consequence with 'unrelated' words, since subjects seem to be able to compensate for most such variations.

Notes

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1. Effects described as significant involve $p < .05$ or better, unless noted otherwise.

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