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ABSTRACT

Number of stimulus items presented together (one, three or five) and instructions to organize were studied in a multitrial free recall experiment with 83 educable retarded adolescents. Results of individual sessions in which Ss were asked to recall 15 common words indicated that presentation of three stimuli together produced the highest subjective organization but that this blocking did not influence overall number of correct responses. Blocking did, however, extend the recency effect in the serial position curve. Instructions to organize resulted in neither higher organization nor more correct responses. (Author/CL)

Blocking and Instructions to Organize in the Free Recall and Subjective Organization of EMR Adolescents

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Abstract

Number of stimulus items presented together (1, 3, or 5) and instructions to organize were studied in a multitrial free recall experiment with EMR adolescents. The results indicated that presentation of 3 stimuli together produced the highest subjective organization but that this blocking did not influence overall number of correct responses. Blocking did, however, extend the recency effect in the serial position curve. Instructions to organize resulted in neither higher organization nor more correct responses. Discussion of the results emphasized the lack of correlation between organization and amount recalled in the developmentally young.

Blocking and Instructions to Organize in the Free Recall and Subjective Organization of EMR Adolescents

The study of organizational strategies in memory in retarded subjects is of interest because of the suggestion that retarded individuals are deficient in such strategies (Spitz, 1966). If organization is missing or infrequent then it becomes important to determine under what conditions this organization can be increased and whether these same conditions will lead to increased recall. Studies with conceptually related stimuli have found significant clustering under certain conditions, e.g., presenting stimuli in a clustered arrangement (Gerjuoy, Winters, Pullen, & Spitz, 1969), and requesting the stimuli in a clustered arrangement (Gerjuoy & Spitz, 1966). Studies in retardation which have investigated organizational processes using unrelated stimuli, i.e., subjective organization (SO), have not been numerous. Gallagher (1969) compared moderately retarded and CA equal normals in a free recall task and found no difference in SO between the two populations. Since he did not report level of SO for either group, it is impossible to ascertain whether significant SO occurred. Herriot and Cox (1971) found significant amounts of SO in both mongoloid and nonmongoloid retarded subjects using only six stimuli and simultaneous presentation.

One variable that has been investigated in studies of organizational processes in memory has been blocking. With conceptually related stimuli, blocking, or the presentation of categorized word lists in groups of stimuli according to their category structure, has been found to facilitate both recall and clustering in comparison to random presentation of the lists.

This phenomenon has been repeatedly demonstrated with normal adults (e.g., Dallett, 1964; Cofer, Bruce & Reicher, 1966; Puff, 1973), normal children (Cole, Frankel, & Sharp, 1971; Moely & Shapiro, 1971; Kobasigawa & Orr, 1973), and mentally retarded subjects (Gerjuoy & Spitz, 1966; Gerjuoy et al., 1969). Explanations of the effect range from suggestions of the development of retrieval plans (Bower, Clark, Lesgold, & Winzenz, 1969) to a more classical contiguity approach (Wallace, 1970).

Paralleling the research with blocking in categorized lists have been studies exploring the effect of consistently grouping unrelated stimuli during presentation trials. Such experiments, however, have not been nearly so numerous, nor have their results been so clear-cut. Shapiro and Bell (1971) studied blocking of pairs of items that had been previously scaled to be easy or difficult to organize. They found better recall and SO when easy to organize pairs were blocked and presented simultaneously. Only SO was facilitated, however, when hard to organize pairs were blocked and presented together. Further, both Gianutsos (1972) and Tzeng and Hung (1973), using procedures which induced grouping by threes, found that grouping facilitated recall in the last three serial positions but did not, in general, increase the probability of recall. Since both of these experiments used only a single trial free recall procedure, the blocking could not lead to the development of stable associations which might, in turn, have led to high SO as well as to high recall.

Blocking of unrelated words in a multitrial free recall situation does not seem to have been studied with normal children. Jablonski (1974), in a comprehensive review of the free recall literature in children,

fails to cite any relevant studies. No directly pertinent experiments with retarded subjects could be found, either. However, Herriot (1972) used a procedure which indirectly may have resulted in blocking. He required, in one of his experimental conditions, that subjects label the simultaneously presented stimuli in the order of the previous recall phase. This labelling might have strengthened associations that had led to the original recall order. When results from this condition were compared to results from a random labelling condition, it was found that SO, but not recall, was facilitated.

In the present experiment, blocking was investigated more extensively in a 15-trial free recall situation. Blocking of stimuli by threes and by fives was compared with a standard sequential presentation. In addition, an instructional variable was manipulated. Many studies (e.g., Moely & Jeffrey, 1974; Ornstein, Trabasso, & Johnson-Laird, 1974) have found that instructions or training to organize material in certain ways have led to both increased organization and recall. An interaction between blocking and instructions was predicted. Instructions to organize were expected to facilitate both organization and recall more in the blocking conditions than in the sequential recall condition.

Method

Subjects

The subjects were 90 educable mentally retarded adolescents enrolled in intermediate, junior high, or high school special education classes in the New York City Public School System. Table 1 present the IQ, CA and reading grade information for the subjects in each of six treatment groups.

Insert Table 1 about here

The subjects were randomly assigned to the six treatment groups with the restriction that the number of subjects in each group be approximately equal at all times. Seven subjects who began the experiment did not complete it; two of these subjects refused to continue and five were dropped because of experimental error or excessive noise and interruptions.

Stimuli and Apparatus

The stimuli were 15 common words which were selected from the Gerjuoy & Winters (1969) list of word association norms for adolescent retardates. None of the words in the list had any measured association strength to any other list word according to these norms. The stimuli were printed on 18.5 cm x 18.0 cm light blue oaktag cards. For the unblocked condition (G1), a single word was printed on a card; for blocking by threes (G3), three words were vertically printed per card; and for blocking by fives (G5), five words appeared on a card. The timing apparatus consisted of (1) a flashlight converted to an electric timer and set to flash every 2 sec to time the presentation of stimuli and (2) a stopwatch to time the 60 sec recall period. In addition, poker chips were used as tokens to give knowledge of results for number correct after each trial; candy rewards were used as incentive objects.

Design

Presentation grouping and instructions to organize were the two main independent variables. Three levels of grouping, (G1, G3, G5) were factorially combined with two levels of instructions (I, NI) to yield six different between-subject treatment groups. In addition, the independent variable of trials was of importance in some analyses.

All subjects were given 15 free recall trials. The arrangement of stimuli differed for different presentation groups across these trials. For G1 the words were arranged in 15 different presentation orders according to a Latin square. Thus, each stimulus appeared in each serial position once and only once throughout these different orders. Further, these 15 orders were arranged in 15 different sequences of trials by another Latin square, so that each order appeared in a given position in the sequence only once. Each of the 15 subjects in the two G1 groups (G1-I, G1-NI) was randomly assigned to one of these sequences.

For G3 and G5 the grouping treatments required a slightly different arrangement. The words were randomly grouped into five clusters of three words for G3 and three clusters of five words for G5. For both G3 and G5, three different groupings were made to counteract the possible effect of some single salient cluster. Thus, G3 and G5 each consisted of three levels which varied not in their actual words, but in the clusters of words that were presented together. Once these different clusters had been selected, the order of words within a single cluster and clusters within a trial was arranged to satisfy the following criteria: 1) Each stimulus item appeared in each serial position of the list only once. 2) Each cluster appeared in each portion of the list (each 1/5 for G3 and each 1/3 for G5) equally often across all 15 trials. 3) The order of items within clusters varied from trial to trial, but repeated three times throughout the 15 trials for both G3 and G5. All of these criteria were met by the different list groupings of G3 and G5. Five subjects were randomly assigned to the different list groupings within G3 and G5 and each of these subjects received a different sequence of the orders.

Each of these sequences was comparable to one of the sequences in G1. Thus, as much as possible, order, sequence, and serial positions effects were comparable across groups.

Procedure

Subjects were run individually. Each subject was read instructions appropriate to his group. The NI groups received standard free recall instructions while the I groups were given examples of how they could form mediators, i.e., they were given sample words (e.g., pen and paper) and were told how they might associate them (You write with a pen on paper.). In addition, the G3-I and G5-I subjects were told that the same words would always appear together in the same groupings. Subjects in all groups were told that they would receive feedback after each trial in the form of tokens and that at the end of the game they could trade their accumulated tokens for a prize. Three different sized prizes were available. The smallest prizes would go to subjects who had between 100-149 correct over all 15 trials; the medium-sized prized were available for subjects who had 150-199 correct; the largest prizes were given to subjects who got 200 or more right.

Two practice trials were given prior to the start of the experimental sessions. The practice trials were just like the experimental sessions except that digits were used instead of words. For both the practice and the experimental trials, stimuli were presented both visually and auditorially at 2 sec per word. For G1, a new card was exposed every 2 sec and the experimenter read the word aloud. For G3 and G5 a new card was exposed every 6 and 10 sec respectively, but a word was read aloud every 2 sec in the order in which it was printed on the card. A 60 sec free recall

period immediately followed the presentation of the last stimulus item. Recall was oral with the experimenter manually transcribing as well as tape recording what was said. After the 60 sec recall period, the subject was told how many words he had correctly recalled and given the appropriate number of tokens. After the 15th trial, each subject was asked how he had remembered the words and his response was recorded. Then, his tokens were counted and he was allowed to choose a prize.

Results

Mean correct responses

The number of correct responses was determined for each subject for each block of three trials. The overall means for G1, G3, and G5 were, respectively, 10.03, 10.41, and 10.54. The mean for the I group was 10.10 and for the NI it was 10.54. None of these small differences was statistically significant. A Blocking (3) x Instructions (2) x Trial Blocks (5) analysis of variance yielded only one significant effect which was that of Trial Blocks, ($F(4,336) = 172.33$, $p < .01$), indicating that performance did improve over trials.

Subjective organization

SO was measured by the $ARC_{\alpha/X}$ score as described by Pellegrino (1971, 1972). Three different SO measures were calculated: 1) Bi-directional relationships of pairwise or unit size 2 organization (SO_2); 2) Unordered relationships for unit size 3 (SO_3); and 3) Unordered relationships for unit size 5 (SO_5). It was considered important to examine unit sizes 3 and 5 as well as the more traditional unit size 2, since the blocking treatment into threes and fives might be expected

to induce organization in these size units. The SO socre was determined for each subject for each of four blocks of three pairs of trials, not considering the first two trials of the experiment since SO is not expected to develop this early. Table 2 present the means for the different experimental conditions. Several observations may be made about these means: 1) G3 produces larger SO_2 and SO_3 scores than does

Insert Table 2 about here

either G1 or G5; 2) Very little organization is measured by SO_5; 3) SO increases across trial blocks; 4) There is little difference in SO for the different instructional groups. Separate analyses of variance (Blocking (3) x Instructions (2) x Trial Pair Blocks (4)) for SO_2 and SO_3 indicated significant main effects of Blocking (SO_2 : ($F(2,84) = 8.51$, $p < .01$; SO_3 : ($F(2,84) = 7.32$, $p < .01$) and Trial Pair Blocks (SO_2 : ($F(3,252) = 2.64$, $p = .05$); SO_3 ($F(2,84) = 4.39$, $p < .01$). The only significant effect for SO_5 was that of Trial Pair Blocks ($F(3,252) = 2.96$, $p < .05$). The Instructions variable was not significant in any of the analyses.

Clustering

Since significant amounts of SO were found, especially in G3, it became important to ask whether the subjects were organizing according to the blocked stimulus words. Thus, a clustering analysis was done using the appropriate blocks as "category" groups. Clustering scores were calculated according to

$$ARC = \frac{R - E(R)}{maxR - E(R)}$$

where R = total number of observed category repetitions.

maxR = maximum possible number of category repetitions.

E(R) = expected or chance number of category repetitions.

The characteristics of this score are described by Doenker, Thompson and Brown (1971).

The mean clustering scores for subjects in G3-I, G3-NI, G5-I and G5-NI were, respectively, .39, .63, .42, .35. A Blocking (2) x Instructions (2) analysis of variance of these scores found no significant differences. Thus, although moderately high amounts of clustering occurred, it occurred equally for all treatment groups.

Serial position

In addition to secondary organization, as is measured by SO and clustering, the effects of the independent variables on the primary organization of serial position were also of interest. Figure 1 is a serial position curve which indicates large recency and smaller

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Insert Figure 1 about here

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primacy effects for all blocking groups. However, whereas for G1 the recency effect is largest for the last presented items (SP15) and smaller for SP14, SP13, and SP12, for G3 the effect is large for the last three items and for G5 the effect is extended to the last five items. A Blocking (3) x Instructions (2) x Serial Position (15) analysis of variance confirmed the significance of both the main effect for Serial Position ($F(14,1176) = 36.26$, $p < .01$) and the Blocking x Serial

Position interaction ($F(28,1176) = 2.10$, $p < .01$. No other effects were significant.

Once the primacy and recency effects were confirmed, more detailed information about the locus of these effects was sought. In order to assess whether consistent patterns of responding were present in the recall protocols, the input serial positions of items outputted in the critical positions in recall were determined. The output positions that were considered critical were the first three (or five in the case of G5) to examine whether the recency effect was the result of extending the capacity of short-term memory, and the last (n) item to determine whether SP1 was frequently retrieved last. Table 3 presents the results

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Insert Table 3 about here

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of these analyses for G1, G3, and G5. An examination of this Table lends support to the hypothesis that the last presented items were the first ones outputted. For G1, only SP14 and SP15 are affected, whereas in G3, SP13, 14, and 15 are outputted most often in the first, second, and third positions, respectively, and in G5, the effect is extended to SP11 and SP12 as well. The examination of the nth output item did not yield any compelling evidence. An additional analysis of the output positions of SP1, similarly, did not reveal any trends.

Correlations of free recall and subjective organization

Since blocking had differential effects on free recall and SO performance, it was of interest to determine the relationship, if any, between these two dependent variables. Two Pearson product-moment correlations were computed using mean SO_2 and mean free recall scores over trials and, also, the mean

scores over just the last block of trials. The r for all trials was .19; the r for just the last block was .00. Neither of these rs was significant.

Verbal descriptions

Only one subject was able to give a detailed description of an organizational strategy. Most subjects said either "I don't know" or gave responses such as "I heard them in my head." Thus, no analysis of these data could be made.

Discussion

Of the two variables that were manipulated only one, that of blocking, showed significant effects. The instructional variable produced no significant differences in any of the dependent measures. It should not be concluded, however, that instructions cannot affect performance with this subject population. The instructions that were given in this experiment were merely suggestive and only very limited practice was allowed for the subject to learn to follow them. Thus, future investigators interested in this variable would be wise to make the instructions more salient by perhaps providing more extended training or manipulating pay-offs for following instructions.

The blocking variable was effective in both improving recall from later serial positions and increasing secondary organization. The extension of the recency effect induced by the blocking is consistent with other research with retarded individuals which indicates that providing external structure on information can improve their channel capacity (Spitz, 1973). Most of the previous work, however, has been solely

with short-term memory tasks and fewer items. This experiment, then, extends this finding to the free recall situation with more stimulus input.

The effect of blocking on SO was greatest when blocking was in threes. The blocking by fives may have contained too much information for the subject to process together so that it was broken down, thus approximating the single item presentation. The G1 and G5 SO scores were, in fact, very similar. Of further interest would be an examination of the effectiveness of blocking by twos and fours to determine where the phenomenon has its maximal effect.

Clustering analyses were performed to discover whether subjects were actually recalling items in the subjective groupings created by the blocking. The moderately high clustering score confirms that for both G3 and G5, the two blocking groups, this, in fact, was happening. This result is in marked contrast to the SO phenomenon where blocking by fives did not facilitate organization more than single item presentation. This discrepancy points out that the two measures, although both calculating a degree of secondary organization, are really quite different. Clustering provides an estimate of a subject's recall order on any given trial with a fixed structure. SO, on the other hand, measures the subject's own consistency of recall order from one trial to the next. Thus, it is certainly possible for them to be incongruent. The data from this experiment indicate that blocking by both threes and fives causes clustering whereas blocking by threes is better than blocking by fives for producing higher SO. Blocking by threes, then, apparently produces more consistent ordering from trial to trial.

The failure to find significant correlations between SO and free recall indicates a lack of correspondence between the two measures. Much of the research in memory of normal adult subjects has found significant correlations (e.g., Tulving, 1962) and therefore has focused on the possibility of good organizational strategies causing improved recall. With developmentally young subjects, however, nonsignificant correlations between SO and recall have more frequently been found (e.g., Laurence, 1966; Gallagher, 1969). It thus seems that organization functions very differently at different developmental stages. Improving memory performance in the nonadult subject, then, may not be best approached by attempting to improve organization, even though this technique works for the normal adult. Borrowing a concept from a slightly different cognitive task, these data suggest that a mediational deficiency rather than a production deficiency is characteristic of the young and/or retarded subject in this task. Orderly input leads to orderly retrieval and, by inference, to orderly storage, but this does not facilitate recall, presumably because the developmentally young subject is unable to act upon the stimuli in the same way the older or more intelligent subject is. What the nature of this act may be is, of course, still open for speculation and should be one of the major focal points for future research in this field.

One final note is that this experiment treated blocking as both the simultaneous presentation of items and the ordering of the same items together from trial to trial. At this time, then, it is not possible to separate the effects of these two component variables, although good guesses can be made. For example, Cole, et al. (1971),

when presenting items in blocked order, but not simultaneously, found no extension of the recency effect. So, it is probable that this particular effect was the result of simultaneous presentation rather than consistent grouping. Additional experiments are being planned which will separate these two variables.

In summary, then, this study found blocking of previously unrelated items to be effective in 1) improving recall from recently presented items, 2) increasing SO, 3) forming stable clusterable groups. Blocking, however, did not lead to an overall improved recall. Further, since organization and recall were not significantly related, future investigations aimed at identifying variables which increase recall in the long-term memory system may have to look at other than organizational variables.

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Table 1

Means and Standard Deviations of IQ, CA, and Reading Grade for Treatment Groups

Group	N	IQ		CA		Reading grade	
		Mean	SD	Mean	SD	Mean	SD
G1-I	15	65.13	6.44	15.83	1.30	2.79	.74
G1-NI	15	67.00	6.71	15.99	1.36	2.76	.79
G3-I	15	62.06	7.73	15.63	1.51	2.75	.88
G3-NI	15	64.40	7.36	15.96	1.62	3.09	1.12
G5-I	15	64.60	6.70	15.74	1.46	2.95	.90
G5-NI	15	64.06	6.78	16.23	1.34	3.03	1.46

Table 2

Subjective Organization in Units of 2, 3, and 5 as a Function of Blocking Instructions and Trials

	SO_2					SO_3					T
	Trial Pair Blocks					Trial Pair Blocks					
	1	2	3	4	$\bar{X}$	1	2	3	4	$\bar{X}$	1
Groups											
Instructions											
G1	.01	.05	.08	.13	.07	.01	-.01	.04	.07	.02	-.0
G3	.20	.15	.13	.15	.16	.07	.08	.07	.09	.08	.0
G5	.08	.11	.16	.08	.11	.05	.03	.08	.09	.06	.0
$\bar{X}$					.11					.05	
No Instructions											
G1	.03	.07	.06	.13	.07	.02	.01	.04	.02	.02	.0
G3	.13	.12	.23	.21	.17	.05	.08	.15	.14	.11	.0
G5	.02	.06	.06	.09	.08	.02	.03	.10	.02	.04	.0
$\bar{X}$					.10					.06	

Table 2

Subjective Organization in Units of 2, 3, and 5 as a Function of Blocking Instructions and Trials

SO_2				SO_3					SO_5				
ial Pair Blocks				Trial Pair Blocks					Trial Pair Blocks				
2	3	4	$\bar{X}$	1	2	3	4	$\bar{X}$	1	2	3	4	$\bar{X}$
.05	.08	.13	.07	.01	-.01	.04	.07	.02	-.01	.04	.03	.02	.02
.15	.13	.15	.16	.07	.08	.07	.09	.08	.01	.04	.05	.02	.03
.11	.16	.08	.11	.05	.03	.08	.09	.06	.02	.01	.07	.04	.03
			.11					.05					.03
.07	.06	.13	.07	.02	.01	.04	.02	.02	.04	.01	.01	.03	.02
.12	.23	.21	.17	.05	.08	.13	.14	.11	.00	.08	.03	.12	.05
.06	.06	.09	.06	.02	.03	.10	.02	.04	.02	.02	.06	.02	.03
			.10					.06					.03

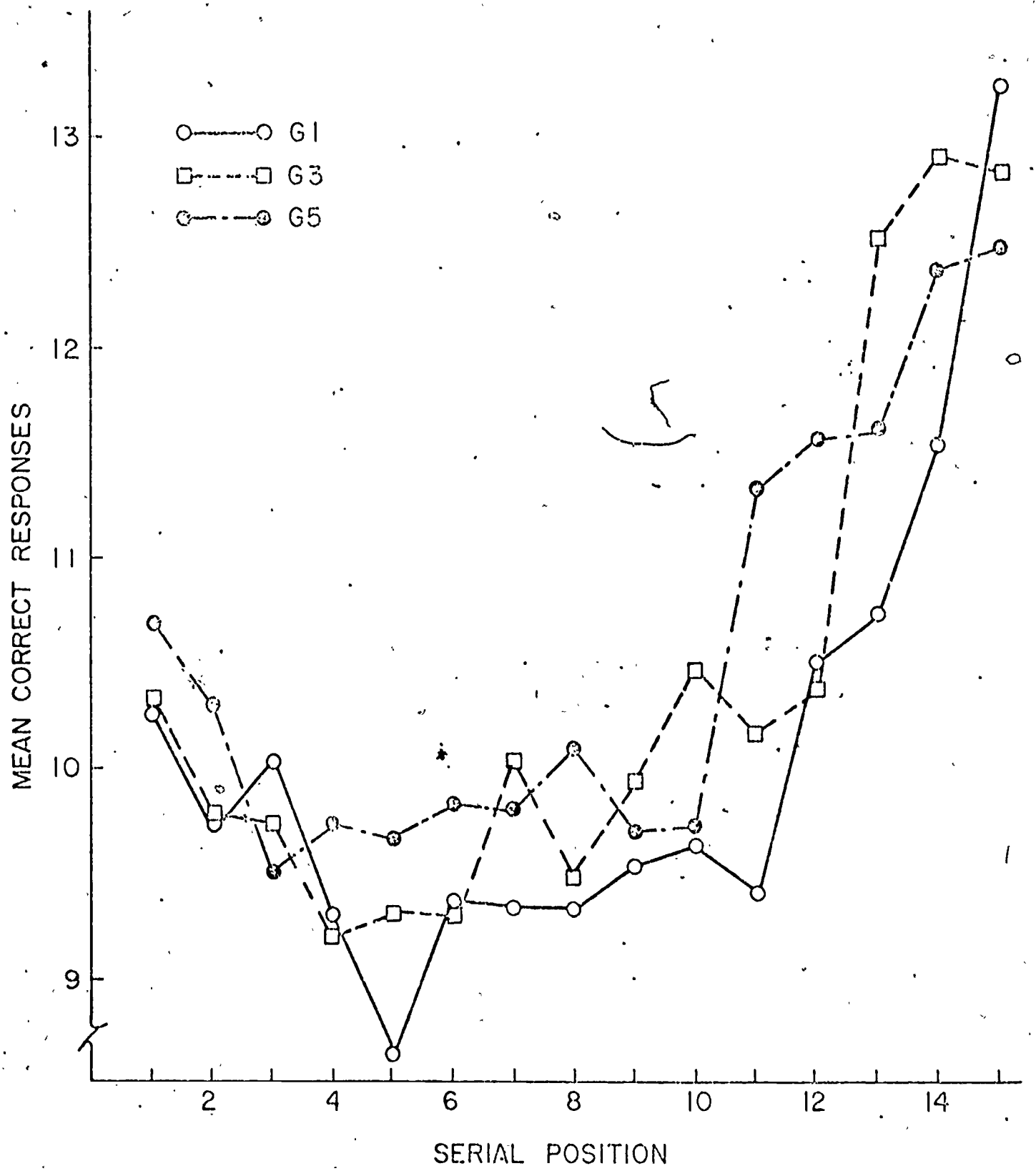
Table 3

Input Serial Position of Items (in %) Outputted in Different Positions

Output Position	Input Serial Position					
	15	14	13	12	11	1
G1					--	
1	46	7	9	5	4	9
2	10	27	9	7	6	4
3	9	9	10	10	6	6
n	3	4	7	7	6	7
G3						
1	9	10	48	4	3	5
2	9	48	7	4	8	3
3	48	7	6	8	3	2
n	3	4	3	8	5	8
G5						
1	17	8	7	7	35	6
2	11	20	13	24	6	2
3	11	16	23	10	5	5
4	15	14	9	6	9	6
5	13	7	6	7	4	8
n	3	6	5	5	4	8

Figure Caption

Figure 1. Serial position curves for different blocking conditions.


G1
G3
G5
13
12
11
10
9
MEAN CORRECT RESPONSES
2
4
6
8
10
12
14
SERIAL POSITION