Proactive inhibition of prompted items[1]

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Retention of three-item lists was measured after 15 sec of interpolated activity. Recall was either prompted by the first word of a list or it was not; lists were presented after a very short or after a relatively long intertrial interval. Data from Ss differing widely in age and educational background failed to support the hypothesis that prompted recall should result in less proactive inhibition than unprompted; proactive inhibition in short-term memory may accordingly represent a deficit in storage rather than retrieval.

Performance in a short-term memory (STM) task of the sort introduced by Peterson & Peterson (1959) declines over the first few tests in a closely spaced sequence, the maximum decline occurring between the first and second tests (Leeming, 1968; Loess, 1964; Keppel & Underwood, 1962). Many errors in recall, moreover, consist of intrusions from earlier lists, especially from the next to the latest (Fuchs & Melton, 1964).

These effects of proactive inhibition (PI) tend to be greatly attenuated by operations which presumably enhance the discriminability of recent items, e.g., by: (a) changing the mode of presentation,[2] (b) varying the class of material from which the items are drawn (Wickens, Born, & Allen, 1963), or (c) increasing the interval between successive tests from a few seconds to 2 min or more (Loess & Waugh, 1967). These results in turn suggest the PI exerted by one list in a series on its immediate successor may simply reflect S's inability to judge their relative recency. Both sets of items may be available in memory, but S may be unable to discriminate which set occurred later (Fozard, 1968; Yntema & Trask, 1963). The problem, in other words, may be one of retrieval rather than storage as such. If this is so, then providing S with a specific discriminative stimulus at the time of recall, e.g., giving him the first word of the short list to be recalled, should reduce PI, since the prompt should narrow the range of alternative responses available to him. Furthermore, items late in a sequence of tests should be recognized as readily as early ones, even though they may not be as accessible to recall. The major purpose of the present study was to test this hypothesis.

Another purpose of this study was to examine possible age-related differences in performance on the STM task under consideration. Talland (1967) found no such differences when successive lists were well separated in time. Performance in other STM tasks, however, does decline with age, particularly when tests are massed (Canestrari, 1968; Craik, 1968). Possibly, therefore, older Ss may be more susceptible to the effects of PI than younger ones.

METHOD

Twenty-five men of varied educational and occupational backgrounds, ranging in age from 25 to 65, were tested in groups of three to six. All were participants in a longitudinal study of normal aging.

The experimental units were 16 pairs of three-word lists. S attempted to recall each list after performing an interpolated task designed to minimize rehearsal of the list. Two seconds after the recall period for the first list of a pair, the second list was presented; pairs of lists were separated by an unfilled interval of 2 min. The words were all four-letter monosyllabic common nouns selected from Noyd's lists (Fuchs & Melton, 1964). No word or its homonym appeared in more than one list. Words were assigned randomly to lists, subject to the restrictions that no two words in any given list should start with the same letter, and that there be no obvious formal or associative relations between any of the three. The results of pilot studies showed the words to be highly intelligible.

The lists were of two sorts, *prompted* and *unprompted*. Both lists within a given pair were of the same sort. When a list was prompted, its initial member was spoken by E at the beginning of the recall period. The unprompted lists were recalled in the absence of any such cue.

Stimuli for the interpolated task were three-digit numbers, randomly selected with the restriction that within any number no digit should occur twice. The S's task was to transpose the digits in each number.

A pair of trials proceeded as follows. One second after a warning signal, a word-list was read at a rate of one word per second. It was then immediately presented again in the same order and at that same rate, the retention interval beginning immediately thereafter. During this interval, S heard five three-digit numbers, each read at a rate of one number per second and each followed by a 2-sec interval during which he was to write down the digits in the opposite order from that in which he had heard them. E then said "words," which was S's cue to write down the word-list he had heard most recently in the order in which it had been presented. On prompted trials, E also called out the first word of this list. Ten seconds were allowed for recall. E then said "stop," and 2 sec later another test began. Pairs of prompted and unprompted lists were presented in an unsystematic order, with the restriction that an equal number of each should appear within the first and second halves of the experiment.

The experiment proper was preceded by instructions, examples of the word-lists, and six practice trials on the digit-transposition task. Instructions emphasized that accuracy was equally important on both the memory and the transposition task. Ss were encouraged to guess on the recall task. A moving mask covered all of S's previous answers. Except for the instructions and the prompts, the lists of words and the numbers were prerecorded and presented over the loudspeaker of a high-fidelity tape recorder.

At the end of the experiment proper, S was given a list of all the words that had been presented for recall interspersed with an equal number of similar four-letter nouns that had not been presented. They were asked to circle every word that had appeared in an experimental list.

RESULTS AND DISCUSSION

The data were classified into two sets according to S's age: the younger, consisting of 13 men between the ages of 25 and 43; and the older, consisting of 12 men between the ages of 47 and 65. As preliminary analysis showed that level of performance did not change materially over the course of the experiment, data for all lists representing a given condition have been combined.

The fraction of trials in which all three items in a list were recalled in order of presentation [P(1, 2, 3)] is shown in Table 1. Within both age groups, there was a decline in performance from List 1 to List 2; surprisingly enough, the decline was greater when a prompt was given than when it was not. The probability that the second and third words in a list would be correctly recalled, given that the first was recalled correctly [P(2, 3|1)], was estimated for

Table 1
Recall of Prompted and Unprompted Items by Younger and Older Ss as a Function of List Position

		P(1, 2, 3)[a]		P(2, 3|1)[b]	
	Age	List		List	
Condition	Group	1	2	1	2
Prompt	25-43	.82	.60	.82	.63
	47-65	.66	.43	.68	.46
No Prompt	25-43	.66	.62	.77	.70
	47-65	.55	.41	.68	.58

[a] *Relative frequency with which Words 1, 2, and 3 were correctly recalled.*
[b] *Relative frequency with which Words 2 and 3 were correctly recalled, given that Word 1 was either correctly transcribed (Prompt) or correctly recalled (No Prompt).*

Table 2
Successful (r) and Unsuccessful ($\bar{r}$) Recognition of Second and Third Items in a List Following Their Successful (R) or Unsuccessful ($\bar{R}$) Recall

Condition	Age Group	List 1				List 2			
		R-r	R-$\bar{r}$	$\bar{R}$-r	$\bar{R}$-$\bar{r}$	R-r	R-$\bar{r}$	$\bar{R}$-r	$\bar{R}$-$\bar{r}$
Prompt	25-43	.58	.34	.04	.04	.47	.30	.07	.16
	47-65	.52	.30	.05	.13	.35	.30	.10	.25
No Prompt	25-43	.47	.37	.08	.08	.48	.27	.11	.14
	47-65	.45	.30	.10	.15	.40	.24	.10	.26

each S, and the averaged results are also shown in Table 1. The decline in this measure for both age groups from List 1 to List 2 was also larger when a prompt was given. [The slight increase in P(2, 3 | 1) over P(1, 2, 3) under the prompted condition occurred because S did not always transcribe the prompt correctly.]

An analysis of variance was performed on the P(2, 3 | 1) scores, with *recall condition* (prompted or unprompted) and *list position* within a pair (first or second) as within-S variables and age group as the between-S variable. The analysis showed that only the effect of list position [$F(1,23) = 24.23$, $p < .01$], and the interaction between recall condition and list position [$F(1,23) = 6.64$, $p < .01$], were statistically significant. Age differences were not.

The within-cell variances in the analysis just described were consistently larger for the older S under all conditions, a fact which could account for the failure to observe a statistically significant age difference. An application of the Mann-Whitney U test to the number of completely correct recalls achieved by Ss in the two age groups showed that the difference between groups was significant in the unprompted [$U(12,13) = 30$, $p < .02$], but not in the prompted condition [$U(12,13) = 41$, $p < .10$]. This result suggests that older Ss experience more difficulty in retrieval than do younger ones, and that prompting lessens the difficulty.

Of a total of 472 errors of recall, 57% were errors of omission. Most of the errors of commission (51%) were extraexperimental intrusions, while 34% were transpositions of current items and only 15% were intraexperimental intrusions. Intrusions from the next to the latest list accounted for 70% of the latter. The older Ss committed about 30% more errors of intrusion, about 70% more errors of order, and made about twice as many errors of omission than the younger.

Table 2 shows the relative frequency of correct and incorrect recognition of the second and third words in the lists classified according to whether or not they had been recalled. A correction for guessing applied to S's overall recognition performance showed that on the average, the estimates of recognition performance adjusted for guessing were only about .05 lower than those observed: the proportion of false positive responses was in general very low.

Averaging over both age groups, recognition of the words was 60% for the first prompted list in a pair and 50% for the second; the corresponding figures were 55% and 54%, respectively, for words from unprompted lists. Thus, it is more difficult to recognize as well as to recall the items in the second list of a prompted pair. However, the probability that a word would be recognized, given that it had not been recalled, remained approximately constant (at about .35) regardless of list position or prompting condition, suggesting that the PI deficit reflected in the recall of second-list items is one of storage rather than retrieval. If retrieval rather than storage were the problem, one would expect the conditional probability of recognizing a word to vary inversely with its probability of being recalled.

With respect to age, Table 2 shows that the older group's rate of failure to recall and to recognize is about twice that of the younger group. These results are compatible with the general finding that older Ss make more errors of omission (e.g., Talland, 1967, 1968) than do younger ones. In the present study, they also made more errors of commission, particularly in the unprompted lists. The finding of more errors of recognition is similar to that reported by Schonfield & Kline (1968), who found that performance declined with age in a dichotic listening task when items had to be recognized as well as recalled.

In summary, the data for both age groups fail to support the hypothesis that recall of the second list in a pair should be facilitated by prompting. Quite the opposite result was obtained. The reason for greater PI with prompted recall is not at all obvious. The data suggest, however, that storage and not retrieval is the critical variable underlying PI in short-term memory.

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NOTES

1. Supported in part by NICHD Grant No. 5 ROI HD00340-09, NIMH Grant No. 5 ROI MH 08119-06 to Harvard Medical School, and NSF Grant No. B 82309R to Massachusetts General Hospital (VAOPC Project 4-68). Miss Constance Willis prepared the stimulus materials and collected the data, and Misses Anne Pope and Jane Weinert assisted in the analyses. Thanks are due to Professor Laird Cermack for his critical review of this paper. This study was conducted in collaboration with the Boston VA Outpatient Clinic, Normative Aging Study, Benjamin Bell, M.D., Director.

2. A. W. Melton, personal communication, November 11, 1967.