Successive tests of short-term retention¹

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Retention of individual trigrams was studied for six successive tests with counterbalancing of the retention interval of the previous test. Recall after an 18-sec retention interval was found to become progressively worse in line with findings by Keppel and Underwood. Intrusions during the sixth test were found to display a recency effect.

Keppel & Underwood (1962) have examined the role of proactive inhibition (PI) in the short-term retention of individual trigrams. They compared recall on the first test with that on succeeding tests. Their first two experiments showed that at an 18-sec retention interval, a substantial decrement occurred on the S's second test as compared with the first. A smaller additional decrement was found on the third test. Their third experiment resulted in a progressive deterioration in recall after an 18-sec retention interval for six successive tests. In contrast, at a 3-sec retention interval, after an initial impairment of recall for the first few tests, there tended to be some improvement. This interaction of retention interval with successive tests was interpreted as a confirmation of a prediction made on the basis of the action of PI in list learning studies.

One inference that could be drawn from Keppel and Underwood's third experiment is that PI accumulates indefinitely over successive tests so that no steady state or asymptote in total amount of PI can be expected. By this reasoning, continued testing should eventually produce chance recall. However, such is not the finding in experiments that have involved many tests in succession. For instance, Loess (1964) found a steady state at a substantial level of recall.

There are at least two possible reasons for the discrepancy between the third experiment of Keppel and Underwood and other studies. One involves their use of a short intertest interval. They waited 10 sec from the signal for recall to the beginning of the next test.² Loess (1964) used 22 sec for this interval, while Peterson (1967) used 30 sec. It has been found (Peterson & Gentile, 1965) that recall of individual items is directly related to the length of this interval.

A second possibility is that the particular sequence of retention intervals in the third experiment of Keppel and Underwood biased recall. The 3- and 18-sec retention conditions were alternated for a given S, so that a 3-sec test was always followed by an 18-sec test, and vice versa. It could be argued that a 3-sec retention interval on Test *n*-1 would be expected to result in poorer recall on Test *n* than an 18-sec interval, since the items presented on the successive tests would occur closer in time with a 3-sec retention interval on Test *n*-1. The S is instructed to recall the last trigram presented, which involves a discrimination of recency.

Such discriminations have been shown to be inversely related to the time between two events being judged (Yntema & Trask, 1963).

An experiment was designed which in general followed the procedures of the third experiment of Keppel and Underwood. However, the sequences of tests were counterbalanced so that a test of a given retention interval was preceded equally often by a 3- as by an 18-sec retention test. It was considered that if a marked progressive trend occurred in spite of balancing of the previous tests, the short intertest interval would be the likely causal factor. A more direct test of the effect of the retention interval of the previous test would be made on the sixth test, which was in all cases one involving an 18-sec retention interval. By using a substantial number of Ss, it was hoped to build up the reliability of the comparison of the number correct following a 3-sec retention interval as contrasted with that following an 18-sec retention interval.

Method

The Ss were 120 introductory psychology students at Indiana University. A memory drum mounted in a 2 x 3 ft black screen presented the trigrams for a 2-sec exposure and then turned to a 3-digit number from which S counted backward by three. An interval timer controlled duration of the light on the S's side of the screen. This was the signal for S to recall. It also activated an electric clock which E stopped by pressing a telegraph key when S had spoken the third letter of his response.

Four practice tests were given in which Ss counted backward by three from a number appearing in the aperture of the screen. No verbal items were presented in these practice tests. In the experiment proper, S read aloud the trigram, and then began to count from the number exposed in the drum aperture.

The six trigrams which were used had no letters in common, and were of 21% Wittmer value (Underwood & Schulz, 1960, p. 320). They were SZK, TLN, BQD, RWJ, XMG, and CFP.

Half of the Ss were tested at a 3-sec retention interval on the first test, while the remainder were tested initially at an 18-sec interval. Half of the Ss tested initially at 3 sec were again tested at 3 sec on Test 2, while the others were tested at 18 sec. Those Ss tested initially at 18 sec were similarly divided. The counterbalancing continued until the sixth test, at which test all of the Ss were tested after an 18-sec interval.

Results

Table 1 shows the proportions of correct recalls over successive tests for the two retention intervals. It can be seen that a progressive decrease in correct recall was found at the 18-sec retention interval. The results of Keppel and Underwood are replicated in this respect,

their proportions on the first and sixth tests being very close to the present results, as can be seen by comparison with their Fig. 4.

Recall after a 3-sec retention interval in the present study does not show a significant difference from that after an 18-sec retention interval. The Zs for Tests 1 through 5 are .39, 1.07, .75, .92, and 1.3. Failure to find significant differences was not due to an inadequate number of Ss, since there were 60 Ss per condition in the present experiment, while only 48 Ss per condition were used in the Keppel and Underwood study. An inspection of the slopes of the lines connecting the recall proportions for the two retention intervals suggests an interaction similar to that found by Keppel and Underwood. Although the 3-sec condition produced poorer recall than the 18-sec condition on the second and third tests, the difference is in the opposite direction on the fourth and fifth tests.

Performance on the sixth test was found to be correct in .43 of the cases when the previous retention interval was 18 sec, while .42 of the responses were correct when that interval was 3 sec. The manipulation of previous retention interval clearly made no difference in recall on the following test.

It was found that 74% of the errors on the sixth test involved intrusions, i.e., a letter from a previous presentation occurred erroneously. The source of these intrusions is displayed in Fig. 1. There was a recency effect, for the most frequent source of an erroneous letter was the immediately preceding test, Test 5. Intrusions from the first test were infrequent on Test 6.

Latencies were taken only for the first test, since differences in frequencies correct were expected on later tests, and interpretation would be difficult. There were four incorrect responses in the 3-sec condition on the first test, and three errors in the 18-sec condition. The mean latency for correct responses on Test 1 was found to be 2.68 sec for the 3-sec retention interval and 2.41 for the 18-sec interval. This difference was not significant ($t = .54$, $df = 111$).

Discussion

The data support the conclusion that the progressively decreasing recall found by Keppel and Underwood with

Fig. 1. Source of intrusions on the sixth test.

an 18-sec retention interval did not result from alternation of the two retention conditions. The use of a short intertest interval remains a reasonable factor. Proactive interference is a function of recency of the interfering material. The intrusion data of the present experiment suggest this, as do previous findings that PI is less when intertest intervals are long. The evidence that PI decreases with time is in direct opposition to the view that PI increases with time, a view held by Keppel & Underwood (1962).

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Notes

1. This research was facilitated by Grant GB 3977 from the National Science Foundation.
2. G. Keppel, personal communication.

Table 1

Proportions of trigrams correctly recalled in successive tests

Retention Interval (sec.)	Test Number					
	1	2	3	4	5	6
3	.93	.72	.58	.58	.65	
18	.95	.80	.65	.50	.53	.42