Repeated items and decay in memory [1]

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Subjects were presented with a string of digits, following which they were required to judge which of two test digits occurred more recently in the list. As predicted by a trace-decay model, when the earlier of the test digits was repeated, performance was worse than in the control condition.

Yntema & Trask (1963) presented subjects with a continuing list of words. At irregular intervals a memory test was given wherein the subjects were asked which of a pair of test words had occurred more recently in the list. Performance became worse as the separation of the two words in the list was reduced. Increasing the number of items intervening between the second of the words in the list and the memory test had the same effect.

Such a result is consistent with the notion of there being, corresponding to each word, a single trace with nonlinear decay characteristics. At the time of decision the levels of the traces corresponding to the two words would be sampled, and the word whose trace was the stronger would be selected. Morton has suggested a model for language behavior (Morton, 1964, 1967; Morton & Broadbent, 1967) in which, implicitly, repeated presentations of the same word would affect the same trace. Such a supposition leads to the prediction that if the first of the two words were presented twice, the S's performance should be worse. Indeed, under the right conditions it is possible that the item presented first, and repeated, could seem as if it were the more recent of the two. This is illustrated in Fig. 1 where hypothetical time-courses of the traces corresponding to the two test words are sketched. On the second presentation of the first word, B, the level of the trace receives an additional increment which could raise it above the level of the trace for word A, given the right time relationships. Since we cannot at the moment make precise estimates of the time-course of the traces, we will be content with the more general prediction that accuracy will be lower when the first item is repeated. It seems unlikely, however, that any theory of memory which does include the notion of a decaying trace, such as an associative theory, could make such a prediction.

In the present experiment, digits were used as the stimuli instead of words. Lists of digits were read out to the Ss under three conditions: (1) Normal (N)—the two test digits occurred once each; (2) Before (B)—the first digit was repeated; (3) After (A)—the second digit was repeated. The third condition does not discriminate between theories since they would all predict that performance would be better than in either of the other two conditions.

The make-up of the three sets of lists was as follows, where x represents a digit other than B or A (and B and A are now digits):

N—(prestimulus digits) x x B x A (poststimulus digits) Test

B—(prestimulus digits) B x B x A (poststimulus digits) Test

A—(prestimulus digits) B x A x A (poststimulus digits) Test

There were three groups of Ss. For each group, the number of poststimulus digits remained constant throughout and the number of prestimulus digits was varied between four and seven. Digits other than the test digits were selected at random with the constraint that there not be more than two of the same digit adjacent. The digits were presented at a rate of one per sec, and a S might typically hear: "6, 1, 3, 7, 9, 4, 9, 0, 2, 5, 8, 5, 3 (pause of 1 sec) 9 or 2?" The ordering of the pair of test digits was balanced. Each group had 20 examples of each condition in random order, preceded by three practice lists which were not scored.

The three groups differed in the number of poststimulus digits, having eight, six, and four, respectively. The larger the number of poststimulus digits, the more difficult the task, though, as will be seen from Table 1, performance was close to the 50% point for all the groups. The difference between the conditions was, however, in the predicted direction for all the groups. Tests were made on the pooled data for all groups. By the Wilcoxon test performance in the A condition was better than in the N condition ($z = 3.04$, $p < .0012$) and, as predicted, performance in the B condition was worse than in the N condition ($z = 1.89$, $p = .029$). A test of the difference

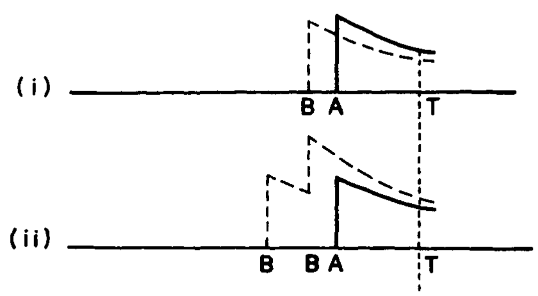

Fig. 1. The curves represent hypothetical levels of traces corresponding to two stimuli under condition (i) where each stimulus is presented once only, and (ii) where one stimulus, B, is repeated. The Ss decision as to which of the two stimuli occurred more recently is supposed to be based on the relative levels of the two traces at the time of testing, T.

Table 1. Mean Proportion of Correct Judgments

	Condition		
	B	N	A
Group 1 (N = 10)	.460	.505	.605
Group 2 (N = 10)	.470	.51	.62
Group 3 (N = 15)	.47	.53	.63
Total (N = 35)	.467	.517	.620

Note. –Each subject had 20 trials under each condition.

between proportions correct on the pooled data (Dixon & Massey, 1951, p. 195) gave similar results, the difference between B and N being different from zero at between 5% and 1% and the A-N difference being better than .5%.

The Ss were questioned after the experiment and mostly were under the impression that they had responded at random throughout. Nevertheless, the data indicate that the different conditions affected behavior in the manner predicted; that is, that information relating to individual items in excess of the immediate memory span is in an unordered state when the possibility of higher level organization is minimized. It' is not claimed that su(h wou.l. be the case under all experimental conditions.

Support for the present conclusiors is provided by Fozard & Yntema (1966), who rece'ntly performed a similar experiment using pictures as the stimuli, with essentially the same results.

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Note

1. At Yale University until June, 1968.