

The recall of repeated items in immediate memory tests¹

H. C. A. DALE AND A. McGLAUGHLIN, DEPARTMENT OF PSYCHOLOGY, UNIVERSITY OF HULL, England

In general, the recall of a single repeated item was not enhanced on its second presentation. Different repeated items occurring subsequently, however, did show superior recall under certain circumstances. A possible interpretation is that recall is enhanced on repetition only when the Ss expect the item to be presented again.

Hebb's (1961) demonstration that the repetition of items in a multi-trial immediate memory task enhances their recall led him and also Melton (1963) to conclude that some form of structural trace results from a single presentation of an item. In other words, the implication has been that material required only for immediate retention is registered, albeit imperfectly, in long term memory (LTM).

Some restriction upon the generality of this conclusion must be accepted as a result of Cohen & Johansson's (1967) observations that the recall of repeated items is enhanced only when they have been overtly recalled on their first presentation. The phenomenon is also absent if the rate of presentation is increased from 1 digit per second to 4.

In the experimental procedure employed by Hebb and copied by Cohen and Johansson the same item is presented on the 3rd, 6th, 9th, 12th, 15th, and 18th positions in a series of 21. Thus the repeated item is presented on a total of six occasions. Furthermore the first repetition occurs early in the series. The procedure adopted by Melton (1963) which also used multiple repetition must also have involved a repetition early in the series although the procedural details are not adequately described.

The question which prompted the experiment to be reported, is whether the recall of repeated items is enhanced under other circumstances. In particular we question (1) whether the phenomenon will occur when the first repetition occurs relatively late in the series and (2) whether the effect transfers to a subsequent repetition involving a different item.

Method

A basic list of 21 items was prepared. Each item consisted of a 9 digit message. All 10 possible digits were employed and their order in a message was random with the constraint that no digit was repeated and no runs of longer than three were present. In addition, the items were scrutinized and those with detectable connotations (e.g., 1968) were rejected.

Five conditions were run. In Condition 1 the 6th item was replaced by a repetition of the 3rd and the 18th item was replaced by a repeated presentation of the 15th. Thus for this condition the critical positions were 3, 6, 15, and 18. The complete design is detailed in the table of results. It can be seen from this that the first repetition occurred in Position 6 for Condition 1, Position 9 for Condition 2, Position 12 for Condition 3, and Position 18 for Condition 4. Thus Conditions 1-4 constituted a series in which the first repetition occurred at successively later points. Condition 5, by contrast, had a succession of repeated items: item 3 was repeated in Position 6, item 9 in Position 12, 15 in Position 18, and 17 in Position 20. (This contrasts with Hebb's procedure in which one item was repeated more than once.)

The items were read aloud at a rate of one per second by E who was paced by a metronome. Recall was written on recorders which have been described by Leonard & Carpenter (1965). These are manually operated paper strip devices in which the S can write a single item and then move it out of sight. A ratchet in the movement mechanism prevents back-tracking. The Ss, who were tested in groups, were instructed to write out each item as soon as E had finished reading. An invigilator checked that these instructions were obeyed. When recall was incomplete, the S marked the position of each missing digit with a dash. Twelve seconds after the end of the presentation E called out "Ready," and after three further seconds he began reading the next item. No practice items

were given since these would interfere with the design of the experiment. The Ss were familiarized with the recorders by writing their names and moving the paper on so that these disappeared from view.

All the Ss were young, newly enlisted men. Eighteen were run in each condition.

Results

The number of digits correctly recalled was scored. Improvement on repetition was basically measured by subtracting the score on the first presentation from that on the second presentation. To control for any general trend in performance this basic measure was modified by subtracting the difference between the average scores of the immediately adjacent items. Thus for items 15 and 18 the computation was:

$$(18 - 15) \left(\frac{17 + 19}{2} - \frac{14 + 16}{2} \right)$$

[An exception to this general computation was made for the 17-20 item comparison in Condition 5. The use of item 18 in the correction formula would be inappropriate, so item 16 alone was used in place of $\frac{1}{2}(16 + 18)$.]

The table shows for each critical item the mean score on both its first and its second presentation. The numbers in brackets are the means of the adjacent items used to correct for trend. The appropriate number of degrees of freedom for the values of t quoted is 17 in every instance.

It is noteworthy that significant values of t are obtained only in Condition 5 where a succession of repeated items occur. Values of t for the first repeated item generally decrease the later in the series this repetition occurs. In Condition 4 where the first (and only) repeated item was in the 15th and 18th positions, performance was actually inferior on the second presentation.

In no single condition was a significant improvement in recall obtained with the first repetition. Nor was the improvement significant when the combined results of Groups 1-4 were analyzed ($t = 0.96$).

With a second repeated item a considerable improvement was noted when this followed closely upon the first and both occurred early in the series (i.e., Condition 5). Slightly less transfer occurred when both were relatively late (Condition 3) and none when they were more widely separated (Conditions 1 and 2).

With three regularly spaced but different repeated items, a steadily increasing effect was obtained (Group 5). The data indicate that it was not fully transferred to the 17-20 repetition which did not conform to this spacing. The enhancement on repetition of the 17-20 item, however, was not significantly less than that found with the 15-18 item ($t = 0.96$).

Discussion

The results of Hebb's original experiment showed a gradual improvement in the recall scores of the off repeated item. Melton seized upon this as evidence of a succession of increments to the registration of the item in LTM and used this evidence to marry STM and LTM. In Condition 5 of the present experiment we have demonstrated that a similar improvement occurs when different items are repeated. This implies that the extent to which items are being registered in LTM on their first presentation is increasing. Furthermore the relatively poor results for the 17-20 item suggest that this enhancement is not general. The repeated items formed a simple pattern in this condition and the 17-20 item failed to conform to the pattern. It is as though the Ss had come to expect every third item to be critical. With 15 sec response time they possibly had an opportunity to rehearse and it seems parsimonious to suppose that they did this.

Clearly this interpretation cannot completely account for the results. We might reasonably suppose that Ss initially expect a new item on each trial. To detect a repetition they must remember the first presentation of an item. First time round then any enhancement must be due to an LTM component which arose incidentally. We have seen that this is negligible. It is likely to be sufficient.

Table 1
Mean Number of Digits Correctly Recalled on the First and Second
Presentation of the Repeated Items

Cond.	Present.	Critical positions				
		3-6	6-9	9-12	15-18	17-20
I	1st	3.39 (4.08)			5.56 (4.86)	
	2nd	5.72 (4.97)			6.67 (5.67)	
	t	1.47			0.47	
II	1st		4.67 (3.92)		4.89 (3.81)	
	2nd		5.06 (3.94)		4.83 (4.33)	
	t		0.55		Negative	
III	1st			3.44 (3.97)	4.00 (4.14)	
	2nd			4.11 (3.92)	5.33 (4.25)	
	t			1.20	1.68	
IV	1st				5.39 (4.75)	
	2nd				5.11 (5.17)	
	t				Negative	
V	1st	4.83 (4.75)		4.00 (4.61)	3.77 (5.36)	5.11 (6.00)
	2nd	5.11 (4.69)		5.56 (4.31)	6.11 (4.78)	5.56 (4.61)
	t	0.58		2.04*	3.72**	1.75*

* $p < 0.05$; ** $p < 0.005$

however, to alert Ss to the occurrence of repetitions and once alerted we can expect them to prepare, through rehearsal, for subsequent repetitions. If these fail to arise within the next part of the sequence the Ss might reasonably discount the evidence of the first repetition and drop the rehearsal strategy. If they subsequently arise, but appear only on certain predictable trials, then the Ss might reasonably confine their rehearsal efforts to these trials.

This interpretation is speculative, but it accounts for our results more adequately than the hypothesis that some increments on repetition are due to the automatic registration of information in LTM which Melton postulates. It gains some support from ancillary evidence presented in Hebb's original paper. His Ss were interrogated immediately after the 19th trial, whereupon 25 of the 40 reported an awareness that "there had been some repetition in the series." It is possible that the improvement evident in the

overall results had been due solely to the contribution of these twenty five.

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NOTE

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