Absence of within-list PI and RI in short-term recognition memory[1]

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Tests were conducted for specific retroactive and proactive interference in short-term recognition memory for paired-associates. Ss studied a set of 17 bigram-digit pairs, some bearing an A-B, A-C relation to each other, some an A-B, A-B relation, and some were A-B, D-C control items. Following one study trial, S rated selected pairs (half correct, half incorrect) according to his confidence that the pair had been presented in the study list. Repetition items were recognized better than the others, but the RI and PI items were recognized with the same accuracy as their respective controls. The results suggest that the A-B and A-C pairs are stored independently, and that recognition of either pair is by comparison to a common criterion of strength, independent of other associates to the stimulus term.

The question of interest here is whether unlearning of specific competing S-R associations can be demonstrated in short-term memory by recognition tests. Whether specific interference is expected in recognition tests depends on our conception of how pair recognition occurs as well as whether we assume that learning A-C weakens the A-B association. Plausible alternatives for recognition of A-B following A-C learning are: (1) S searches through memory until he finds either associate to A, giving the recognition R only if the first one he finds matches the test pair; (2) S exhaustively searches for all Rs associated to A, and gives the recognition R only if the test R is the "strongest" of the Rs retrieved for A; or (3) S retrieves the memory trace of the test SR pair and gives the recognition R only if its strength exceeds a criterion. If A-C causes unlearning of an initial A-B association, then either of these rules predicts RI effects. If A-C and A-B are stored independently, then RI and PI effects are still expected by Rules 1 and 2, but not by 3. Rule 3 assumes that recognition of a given A-B pair depends only on its absolute strength and is independent of other associations to A. The following experiment was conducted to determine whether RI and PI effects would appear in short-term recognition memory.

Method

The experiment consisted of a study-then-test block on each of 15 different lists of S-R pairs. The stimuli were consonant bigrams of minimal intralist similarity, different in every list, and the responses in each list were all the digits 1-9. Each study list consisted of 17 pairs, divided into the first three "primacy buffer" items (never tested) followed by two sublists each of seven items as illustrated in Table 1. Three "interference" items occurred in Sublist 1, were repeated in Sublist 2 with a different response, and were then tested for recognition: for one item (RI+) the first-paired response was tested positively, for another (PI+) the second-paired response was tested positively, and for the third (I-) the test response was incorrect. The "negative" recognition tests with incorrect pairs were needed to assess false alarm rates. Two RI control items appeared in Sublist 1 but not in Sublist 2, and two PI control items appeared in Sublist 2 but not in 1. Two Repetition items were included with the same pairings in both sublists; this was to gauge sensitivity since any theory predicts benefits for such pairs. Items within each sublist were randomly ordered except that at least three items intervened between occurrences of the same stimulus. Following the study block, the nine tests schematized in Table 1 occurred in random order. To minimize recency effects at least three items appeared between an item's occurrence in Sublist 2 and its test appearance. All nine response digits were used in each list; incorrect test pairs were composed by interchanging responses of the negative test pairs of a list.

The pairs were displayed automatically on IEE display cells for 3 sec per pair on study trials and until S responded on test trials (usually 3 sec). Regarding each test pair, S was to ask himself, "Is this an S-R pairing that occurred in the list I've just studied?" He recorded his Yes-or-No judgment simultaneously with one of four confidence ratings ("pure guess" to "almost positive") by depressing one of eight labeled keys. There was no feedback regarding S's judgment. Rest periods 15 sec in duration occurred between successive lists. Thirty university students served as Ss.

Results

Recognition was measured by the proportion of Yes (acceptance) judgments to correct and incorrect test pairs, yielding hit rate and false alarm rate, respectively. List within the day had no effect upon these probabilities nor did the order of testing of items within the test block. Pooling items of similar type over lists and test positions, the average proportions obtained (each based on 450 observations) are given in Table 1.

The hit rates for RI vs RI Control items do not differ significantly nor do those for PI vs PI Control items. The hit rate for the Repetition items reliably exceeds the other four. There are no reliable differences among the false alarm rates for the four types of items, $F = 1.74$, $df = 3/87$. The PI and PI Control items combined have a significantly higher hit rate than the RI and RI Control items combined (a slight "recency" effect),

Table 1. Schematic representation of item types in Sublists 1 and 2, type of test, observed proportions of "acceptance" responses on test, and d'.

Item type	Sublist 1	Sublist 2	Test	Proportion	d'
RI +	BC-1	BC-2	BC-1	.68	1.14
PI +	DF-3	DF-4	DF-4	.70	1.06
I -	GH-5	GH-6	GH-8	.28	
RI Control +	JK-7	*	JK-7	.67	1.05
RI Control -	LM-8	*	LM-5	.27	
PI Control +	*	NP-9	NP-9	.74	1.20
PI Control -	*	QR-1	QR-6	.32	
Repetition +	ST-2	ST-2	ST-2	.90	2.03
Repetition -	VX-3	VX-3	VX-1	.29	

but this is partially offset by a slightly higher false alarm rate on the PI Control items.

These conclusions are unchanged if one uses the rating scale to plot memory operating characteristics and to extract d' measures presumably uncontaminated by criterion shifts (cf. Wickelgren & Norman, 1966). The MOCs plot as straight lines in normal-normal coordinates with the d' values as shown in Table 1. The d' for the Repetition items approximates twice that of the once-presented items. Still in this measure there is no evidence for either RI or PI.

Discussion

This experiment failed to find stimulus specific within-list RI and PI effects in short-term recognition memory. Apparently the pair A-B is recognized as well whether followed by A-C or D-C, and recognition of A-C is unaffected by whether a prior pair was A-B or D-B. The negative results cannot be attributed to low power of the experiment since the Repetition effect, predicted by any theory, appeared very reliably.

The absence of RI and PI here casts doubt on any simple notion of destructive storage, that studying A-C reduces the strength of A-B. The results are consistent with independent storage (of A-B and A-C) and Rule 3, that recognition of a given S-R pair is independent of other possible Rs associated to the stimulus. That is, the memory trace of the S-R pair retrieved for the recognition test is compared to a common criterion, with the recognition response given only if the trace exceeds the criterion. Wickelgren (1967) came to a similar conclusion when testing recognition memory for adjacent digit pairs embedded in a serial list of digits. In his words, short-term recognition memory (for pairs) is "independent of irrelevant associations." The signal detectability view of recognition memory (Wickelgren & Norman, 1966) easily describes these data. Given a common distribution of strengths for incorrect pairs, the theory also accounts for the rather surprising fact that false alarm rates are as high for Repetition (better learned) pairs as for once-presented pairs. Common sense would have suggested the opposite, that the better A-B is learned, the better one should be in detecting that A-X is a false pairing.

The present results differ from those of Garskof & Sandak (1964) and Postman (1962) who reported poorer associative matching (a kind of recognition test) of A-B following A-C learning than following a rest interval. The experiments differ in at least the following ways: (a) here A-B, A-C was compared to an A-B, C-D control rather than to an A-B-rest control; (b) our Ss merely studies each pair once, whereas their Ss had many overt anticipation trials with lists of such pairs; and (c) their associative matching test elicits complex list strategies for a set of items of varying strengths, whereas our test obtained a recognition rating for each pair separately, half tested positively and half negatively. The first two differences are probably crucial. The first factor merely shows that the more pairs of a given type learned, regardless of their specific relation to one another, the harder it is to retrieve information about any one of them—an effect interpretable in a number of ways. The second factor, overt responding, may be more relevant for application of the unlearning hypothesis since extinction is most plausible only when the prior response intrudes as an overt, nonreinforced error.

References

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Note

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