Unlearning as a function of the number of acquired interpolated responses*

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A medium-frequency response list was followed by either high- (Group H) or low- (Group L) frequency interpolated lists in an A-B, A-C, A-D paradigm. Group H acquired the greatest number of interpolated responses and recalled the least number of B responses. Except for the weak B responses of Group L, recall of a specific B response was independent of the number of interpolated responses which were associated to its stimulus.

Unlearning in the A-B, A-C paradigm of negative transfer refers to a reduction in the availability of A-B or original learning (OL) following A-C or interpolated learning (IL). Tests of the elicitation hypothesis of unlearning have led to conflicting results (Goggin, 1968; Postman, 1965). One consistent finding, however, is that as the number of different acquired IL responses increases, as measured by a stringently scored MMFR test, OL recall decreases (Goggin, 1968, Table 2; Postman, 1965, Table 3).

Counterconditioning and the notion of the suppression of a response set are two possible interpretations of this inverse relationship between the degree of IL and OL recall. According to the counterconditioning view (Barnes & Underwood, 1959), unlearning is a result of the interaction between specific OL and IL responses having the same stimulus (A_i) in common, i.e., Response B_i is replaced by Response C_i . Thus, the probability of recalling B_i decreases as the number of IL responses associated to A_i increases. According to the suppression notion, however, unlearning is a result of the interaction between entire classes of OL and IL responses and not between specific OL and IL responses. The set of OL responses is suppressed during the acquisition of the set of IL responses (Postman, Stark, & Fraser, 1968). The degree to which the OL response set is suppressed is perhaps in some manner a function of the number of IL responses acquired.

The purpose of the present experiment was to determine the locus at which unlearning was affected by the number of different acquired IL responses. In this experiment, the number of responses acquired during IL as measured by performance on test trials was manipulated by the language frequency of the response words.

METHOD

One control and two experimental

groups composed a retroactive inhibition design. The experimental groups conformed to an A-B, A-C, A-D paradigm, while the control group (Group C) learned and recalled a single list. Five paired-associate lists of 10 pairs each were constructed with two-digit numbers as stimuli and two-syllable nouns as responses. The experimental groups differed in terms of the frequency of the nouns which were used as response terms during IL. The two IL lists of Group H had response terms which occurred 235 or more times per million (Kucera & Francis, 1967), while the two IL lists of Group L had response terms which occurred 4 times per 18 million (Thorndike & Lorge, 1944) and did not appear in Kucera & Francis (1967). The OL list had response terms which occurred 50-52 times per million and was the same list for all three groups. The OL list was determined from a pilot study using an equal-interval method (Underwood, 1965). Ninety-one Ss selected one of five lists of nouns, whose frequency they felt most nearly bisected the frequency range established by the high- and low-frequency word lists, which were to be used as response terms during IL. The list the majority (30%) of Ss selected was used for the response terms during OL.

The OL and IL lists were presented on a Stowe memory drum, using alternate study and oral test trials. The stimuli were presented in four different orders during study trials and in four other orders during test trials. The pairs and the stimuli alone were presented at a 3-sec rate. The OL list was learned to a criterion of 8/10 correct responses, followed 1 min later by IL. The two IL lists were each presented for four study and test trials. There was a 10-sec interval between presentations of the IL lists, during which time E moved the shutter exposing the second list. Control Ss worked on arithmetic problems for the length of the IL interval, which was 9 min 30 sec.

The written MMFR test began 1 min after the IL interval. A sheet of

paper was provided S on which the stimuli were arranged in numerical order with as many lines next to each stimulus as there were responses paired with it. Experimental Ss were allowed 4 min and control Ss 1 min 20 sec for recall.

Introductory psychology students volunteered for the experiment for course credit. There were 48 Ss, 16 in each group. The Ss were assigned randomly to the different conditions.

RESULTS

The mean number correct on the last OL test trial was 8.63, 8.34, and 9.00 for Groups C, H, and L, respectively. The mean number of trials to criterion for the groups was 5.19 and did not differ significantly among them [$F(2,45) = 1.34$, $p > .05$], indicating that the groups were of equal learning ability.

In order to determine the number of different responses that were acquired during IL, the mean number correct on the last test trial of each IL list was summed. These values are given in the first row of Table 1 and show that significantly more high- than low-frequency IL responses were acquired [$F(1,30) = 4.53$, $p < .05$].

A stringent scoring procedure was used by which a recalled OL response was counted correct only if it was paired with its proper stimulus. The means and standard deviations of these recalled OL responses also are presented in Table 1. Two orthogonal comparisons were conducted on the means. First, comparing Group C with the mean of Groups H and L verified the presence of retroactive inhibition [$F(1,45) = 39.95$, $p < .01$]. Second, OL recall of Group L was significantly better than that of Group H [$F(1,45) = 21.33$, $p < .01$].

Table 2 shows the total number of OL or B responses recalled ($\bar{B}$) or forgotten ($\bar{B}$) according to stringent scoring, when 0, 1, or 2 IL responses were associated to A_i as measured by IL test trials. The frequency data of Groups H and L were analyzed by a likelihood ratio chi-square test (Rao, 1952). Responses B_i and $\bar{B}_i$ were independent of the number of IL responses associated to A_i for Group H [$\chi^2(2) = 2.90$, $p > .20$]. There was a

Table 1
Number of Words Acquired During IL,
Mean, and Standard Deviation (SD)
of OL Words Recalled

Group	C	H	L
Number Acquired	—	13.13	10.00
Mean OL Recalled	8.00	2.94	5.94
SD OL Recall	1.37	1.82	2.08

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Table 2
Total Frequency of Response B or $\bar{B}$ When Zero, One, or Two Responses
Were Associated to the Same Stimulus During IL

Response	Group H				Group L			
	Number of Interpolated Responses							
	Zero	One	Two	Total	Zero	One	Two	Total
$\bar{B}$	4	9	34	47	28	36	31	95
B	8	28	51	87	4	21	24	49
Total	12	37	85	134	32	57	55	144

dependent relationship present in Group L [$\chi^2(2) = 10.18, p < .01$], however. The lack of independence between specific OL and IL responses of Group L was further analyzed by dividing the OL responses into weak and strong ones according to the number of reinforcements they received during OL. Any response tied at the median rank was split so that one-half of it was classified as weak and the other half as strong. For the strong responses, B_i and $\bar{B}_i$ were independent of the number of IL responses associated to A_i [$\chi^2(2) = 2.50, p > .25$]. For weak B responses of Group L, on the other hand, there was a dependent relationship [$\chi^2(2) = 10.79, p < .01$]. The probability of weak B_i recall was .79, .43, and .31 for 0, 1, and 2 IL responses associated to A_i , respectively.

DISCUSSION

Recall of OL was lower when IL consisted of high- rather than of low-frequency responses. It is possible that language frequency was more similar between the OL and IL responses of Group H than of Group L, which would have resulted in more unlearning for the former group (cf. Friedman & Reynolds, 1967). Perhaps IL word frequency per se also could have been responsible for these results in that the degree of IL learning was higher for Group H than for Group L.

The data showed that as the number of words acquired during IL increased, OL recall decreased, which agrees with the findings of Goggin (1968) and Postman (1965). The possibility of

increased response competition at recall for Group H compared to Group L does not appear to be a tenable explanation for these findings, since the employed MMFR test was thought to be free of response competition (Keppel, 1968). Furthermore, the mean number of OL responses incorrectly paired with their stimuli at recall was very small (.50 and .19 for Groups H and L, respectively).

A counterconditioning interpretation of the obtained inverse relationship would maintain that the probability of B_i recall decreased as the number of IL responses associated to A_i increased. Analyses of Table 2, however, showed that B_i recall was independent of the number of corresponding IL responses associated to A_i , which confirms the results reported by Martin (1971) and Wichawut & Martin (1971). There was, on the other hand, a dependency between B_i and C_i for the weak B responses of Group L. Wichawut & Martin (1971) also found a tendency toward dependence between B_i and C_i at recall when both responses were considered weak. The low-frequency IL responses of Group L also could be considered weak in comparison to high-frequency IL responses of Group H because of the former's slower acquisition rate.

Thus, except for weak OL responses of Group L, unlearning appears not to occur at the level of specific pairs and instead probably occurs at the level of list-defined response sets. According to Postman et al (1968), the acquisition

of the set of IL responses leads to the suppression and, hence, unavailability of the set of OL responses at recall. It is not readily apparent how OL suppression is affected by the number of acquired IL responses. Perhaps, on the basis of the present results, suppression of the OL response set in the paradigm of negative transfer is a function of the speed at which the IL responses are acquired or a function of the number of responses incorporated in the IL response set.

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