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THE EFFECT OF CHANGED LIST 2 FUNCTIONAL STIMULI ON RETROACTIVE INHIBITION IN THE A-B, A-D PARADIGM

by

Martin J. Doherty

A Thesis Submitted to the Faculty of the
Graduate School of Loyola University
in Partial Fulfillment of the
Requirements for the Degree of
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CHAPTER I

INTRODUCTION

In 1940, Melton and Irwin proposed that learning a list of words when one has earlier learned a comparable list impairs the memory of the first-learned list in two ways: (1) the words of the first list are less available, i.e., less likely to come to mind, when List 1 memory is tested than if there had been no interpolated learning (IL); (2) whatever List 1 words are available may not be correctly given on a test of memory because of competition from and confusion with List 2 words. This compound explanation of retroactive inhibition (RI) is called the two-factor theory; it has usually been applied to the paired-associate situation, particularly where the interpolated pairs have the same left-hand ("stimulus") terms as List 1 but different right-hand-("response") terms. The factor mentioned second — which is usually called the competition factor — is identified with those recall situations where the subject can produce the two response terms that go with a particular stimulus term but can only guess which response is from List 1 and which from List 2. Once the reality of the competition factor has been established, it can, of course, be presumed to operate in situations where the subject has been instructed to give only one response. The reality of the factor mentioned first — which will be called "unavailability" — was demonstrated when Barnes and Underwood (1959) introduced modified, modified free recall (MMFR), a measure of RI that is not influenced by the competition factor

(cf. Martin, 1971, p. 319). There is yet, however, considerable controversy about what are the psychological processes that produce unavailability of List 1 items.

Melton and Irwin (1940, p. 200) explained unavailability as the result of a process of weakening or unlearning of List 1 associations that occurs while List 2 is learned, whenever the two lists are related as A-B, A-D.[1,2] This weakening was compared directly with extinction in classical conditioning (although, as Barnes and Underwood point out, the analogy is more accurately to counterconditioning). The Melton and Irwin explanation of unavailability led to this factor being called "unlearning." The purely descriptive term, unavailability, is used here because there are other explanations of the non-competition factor. The unlearning-competition version of the two-factor theory is commonly called "associative interference theory" (e.g., Martin, 1971, p. 316).

The most important rival hypothesis is called response-set suppression theory (Postman, Stark, & Fraser, 1968); it maintains that unavailability is not the result of disruption of the association between the two members of a pair but the result of a set developed during IL to give only List 2 responses. This proposal accords with the fact that usually only a little RI is observed after the second relearning trial; such a rapid change suggests the operation of set. Note that the point

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[1]The Melton and Irwin study involved serial lists, so that A for them represented the stimuli of the learning and testing situation. However, nearly all subsequent research on the two-factor theory has involved paired-associate (PA) lists, where A represents the "stimulus" member of the pair.

[2]Some authors label this paradigm A-B, A-C.

of disagreement is not the adequacy of the two-factor theory — this is generally accepted. The issue is the nature of one of the factors.

There is at present considerable interest in developing a satisfactory explanation of the unavailability of the B terms in the A-B, A-D paradigm. It may be that both Postman, et al.'s response suppression and Melton and Irwin's unlearning occur during List 2 learning; but investigators are currently polarized on the issue, some favoring the response suppression hypothesis (Birnbaum, 1970; Postman & Stark, 1969; Tulving & Psotka, 1971) and others unlearning (Anderson & Watts, 1971; Delprato, 1971; Weaver, Rose & Campbell, 1971). The issue has crystallized in the form of a controversy over whether unavailability is a list phenomenon or a pair-specific phenomenon. There are, of course, other aspects of the unavailability factor that require explanations; but this particular question is currently the focus of attention and readily leads, as will be apparent, to another important question. Postman, et al. say that unavailability results from List 2 (A-D) interfering with List L (A-B) to produce both the suppression of all List 1 responses (B's) and the readiness to give List 2 responses (D's) when presented with A. The associative interference theory says that unavailability results from the clash of specific associations, a specific A-D with a specific A-B; therefore, unavailability does not come and go <u>en bloc</u>, since it depends on pair-specific conflict, not conflict between sets of responses.

Weaver at al. (1971) proposed to resolve the issue by using a homogeneous List 1 followed by a mixed List 2. If recall of A-B pairs was equivalent for those with A-D IL and those with C-D IL, then item-specific unlearning has not been demonstrated. However, the results

were that reliably more A-B, C-D pairs were recalled. This cannot be explained as the suppression of List 1 responses by List 2 learning, since List 2 had a differential effect on List 1 pairs according to whether the stimulus relationships were A to A or A to C. This is evidence, then, that unavailability is at least partly an item-specific phenomenon. Weaver et al. observe that their data could be interpreted as reflecting the suppression of individual responses whenever an initial (A-B) association is followed by one that is A-D. They say, however, that to modify response-set suppression theory so that it becomes item-specific is to make it identical, for all practical purposes, to the associative unlearning position. This is not exactly true; it is true that the Postman, et al. version of the role of set in producing unavailability is essentially about lists. However, one can distinguish two independent aspects to this proposal — the issue of list versus specific item and the issue of change of set versus weakening or destruction of the association; and the latter issue can be raised strictly in terms of the individual pair. That is, of the unavailability resulting from processes that operate at the level of the individual pair rather than at the level of list, is all of it due to set? There are, then, two rival hypotheses that might explain the Weaver et al. results. One, retaining from the Postman et al. hypothesis only the notion of set, is that the List 1 responses are unavailable because at recall the subject has been set by IL so that List 1 responses are suppressed and List 2 responses are readily available — it being understood that such suppression can operate on isolated responses as well as on a group of responses. The other, a direct application of the Melton-Irwin hypothesis, is that the List 1 responses are unavailable

because during IL they were weakened or destroyed. Notice that the most basic difference between the two positions is with respect to the "independence hypothesis" (Barnes & Underwood, 1959) — Postman accepts the independence hypothesis (two associations involving the same stimulus can coexist) and Melton and Irwin seem to reject it, suggesting that in order for A-D to exist A-B must be destroyed.[3] This way of stating the two hypotheses has the advantage of suggesting an operational difference between them: the process of recovering availability of List 1 responses (i.e., relearning) should be quicker when a change of set is involved than when the association has been destroyed.

In view of the Weaver et al. results and also of the results of many list differentiation studies (e.g., McCrystal, 1970; Strand, 1970; Underwood & Ekstrand, 1967), it appears that unavailability is caused by both pair-specific and list-wide processes. It may likewise be true that both change of set and disruption of associations operate to reduce the availability of List 1 responses at recall, though obviously not on the same pair at the same time. When might one process be at work, and when the other? Preliminary to answering this question, it is necessary to say more about the set process that might cause unavailability. Postman called it a response suppression set; but, since only pair-specific processes are being considered here, it may be more useful to emphasize the perceptual aspect of the set, an emphasis that is suggested by the current interest in the stimulus term of an association (cf., for example: Asch, 1969; Martin, 1968; Schneider & Houston, 1968; Thompson & Tulving, 1970). From this point of view, unavailability is the result

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[3] Adams, Marshall, and Bray (1971) have pointed out that this same difference exists in theories of extinction, a process which has been suggested as a model for the unavailability factor. A Hullian theory holds that during extinction the original association is inhibited but not destroyed. Guthrie holds that the original association is destroyed.

of a set — established during IL — to perceive the A terms in a way that leads to the List 2 response terms rather than to the List 1 response terms. This type of explanation implies that a nominal stimulus — e.g., an A term — may be associated with two or more different functional stimuli (a functional stimulus being the way the nominal or objective stimulus is perceived or coded). A discussion of variable functional stimuli and the A-B, A-D paradigm can be found in Martin (1971; see especially pp. 327-329).

It is here proposed that unlearning of List 1 will occur during IL to the extent that the functional stimuli in the two lists are identical. Presumably, identical functional stimuli causes pronounced competition involving the B and D responses during List 2 learning. List 2 is learned only when this competition is eliminated; and it is eliminated by the unlearning of the A-B association. Evidence for such unlearning is: (a) B is unavailable, i.e., there is no tendency to respond with B when A is presented; this is measured by MMFR (b) relearning of A-B requires several trials. It is difficult to be precise about this; there will be some savings because, for one thing, functional stimulus identity is never absolute — stimulus sampling occurs (cf. Deese & Hulse, 1967, p. 133) — and for another thing, learning-to-learn is a factor. It is sufficient to say that relearning will be slower than in a condition with variable functional stimuli.

The difference between unlearning and change of set is that the latter occurs when the functional stimuli of List 1 and List 2 are quite different, because the common A term has been "recoded" early during List 2 learning. It has frequently been hypothesized that the later during List 2 learning that this recoding occurs, the greater

the amount of unlearning that will occur (Garskof, 1968; Keppel, 1968, p. 183; Slamecka, 1966; Weaver, 1969); so that the effects of a delayed recoding would be indistinguishable from the effects of no recoding. When A is recoded early during the transfer task, response competition and so negative transfer is reduced, since the recoded A does not tend to elicit B; and relearning is faster, since the unlearning that is the effect of response competition has not occurred. The effects of a change of set are presumed to dissipate when the subject's set becomes readjusted so that he once again perceives the A terms with the List 1 functional stimuli. This change is viewed as being more easily and rapidly accomplished than relearning after unlearning.

Confirmation of these ideas requires that two nominal A-B, A-D conditions — in only one of which the functional A varies — yield the differences in transfer and RI mentioned above. Note that the issue of explaining the unavailability factor is linked directly in the theory to performance on the transfer task, so measures of both List 2 learning and List 1 memory should be taken. A complication here is that relearning scores are not a competition-free measure of RI; in other words, they are not a direct measure of unavailability. Relearning scores are misleading, however, only if competition has a variable effect on relearning <u>trends</u> (the measure that is at issue in this study) depending on whether or not substantial recoding occurs. It is assumed that this does not occur.

What specifically are the conditions in which the functional stimuli vary and what are the conditions in which they remain identical? The following is a description of the attempt to manipulate functional stimulus variability that was made in this study; it is probably only one of a number of ways it may be done. Two principles are the basis of

the method used. First, Brown and Read (1970) and Martin (1971, p. 324, 330) have proposed that functional stimuli need not result from selection of some part of the nominal stimulus; several different functional stimuli can be generated from the same nominal stimulus by successive reinterpretations of the unaltered nominal stimulus. This idea was taken a step further in this study, and it was assumed that the subject may use stimulus augmentation (i.e., the functional stimulus has more letters than the nominal stimulus) as he does stimulus selection and stimulus reinterpretation to generate different functional stimuli. Second, Houston (1967) and Solso (1968) have shown that stimulus selection can be influenced by the response term (cf. also Martin, 1971, p. 328). This principle was adapted to the present study by assuming that stimulus augmentation can be influenced by the choice of response terms. An attempt was made to induce this augmentation by using as List 2 response terms associates of the augmented stimulus, i.e., the intended functional stimulus in List 2.

The difference between the two primary conditions of this study was that during List 2 learning stimulus augmentation was presumed to occur in one but not in the other, this being controlled by the choice of the List 2 response term. For example, consider the List 1 pair, LAW-BUTLER. On List 2, subjects in one condition transferred to LAW-TOWER, in the other to LAW-GARDEN. Garden is an associate of lawn (Postman, 1970), so it was expected that when LAW is paired with GARDEN the subjects are influenced to use lawn as the functional stimulus, not law, which presumably was used in List 1; but when LAW appears in List 2 with TOWER, it was expected that the functional stimulus is law, just as it presumably was in List 1. Stimulus recoding or reinterpretation

or augmentation is a type of mediation — as that term is used by Bugelski (1962), not in the narrow sense of "chaining" — since all mediation involves recoding the nominal stimulus in a way that leads the subject from the stimulus term to the response term. Mediation in this sense is the basis for what is called "redintegrative memory" by Horowitz and Prytulak (1969, pp. 519-521). It follows that the case of identical functional stimuli is an example of rote learning, since if mediation were involved in the learning of either List 1 or List 2 the functional stimuli could not be the same in both lists — assuming only what seems to be incontestably true, viz., that the same mediator cannot get a subject both from A to B and from A to D.

A third condition differed from the two primary conditions only in that List 2 response terms were associates of the nominal List 2 stimulus terms (e.g., LAW-JUSTICE after LAW-BUTLER). Two opposing influences on relearning were at work in this condition. On the one hand, the functional stimuli in both lists are presumed to be the same, an interference-producing factor. On the other hand, the fact that List 2 is made up of pre-experimental associates should be a potent factor for enhancing list differentiation and so reducing interference. The primary function of this condition was to serve as a comparison to the recoding condition with respect to relearning scores; it is similar to that condition (assuming that the functional stimuli change there as predicted) in having the list differentiation factor of a List 2 composed of pre-experimental associates, and it is different in that the functional stimuli remain the same. Because list differentiation is more pronounced for this third condition — the List 2 pairs in the recoding condition are nominally not pre-experimental associates — much of

the interference normally produced by unchanged functional stimuli might be overcome; therefore, it was expected that the two conditions would be similar on relearning scores.

The fourth condition of this study was one identical to the experimental condition with variable functional stimuli except that the stimulus terms in List 2 were the augmented versions of the List 1 stimulus terms (e.g., LAWN-GARDEN as opposed to LAW-GARDEN). This is an A-B, A-D paradigm, which might be expected to produce about the same or slightly less negative transfer than the third condition (Kausler, 1967, p. 370); the two conditions are comparable in that List 2 for both is composed of associated pairs. However, since the functional stimuli vary in the fourth condition but remain the same in the third, the latter condition should exhibit more interference on both the transfer and relearning tasks. Another function of the fourth condition is that it serves as a comparison to the primary condition in which the subject is expected to augment implicitly.

Finally, each primary or experimental condition was compared with a control condition that was different from its experimental counterpart only in that the stimulus terms of List 1 and List 2 were different.

CHAPTER II

METHOD

Design

The experiment was an A-B, A-D interference study, with six independent groups. For three of the groups, List 2 pairs were A-D with respect to List 1 pairs: (a) Experimental-1 (Exp-1), in which the List 2 responses were associates of the augmented stimuli — this was the primary condition with changed functional stimuli on List 2; (b) Experimental-2 (Exp-2), in which the responses were unrelated to the stimuli — this was the primary condition with unchanged functional stimuli on List 2; and (c) Associates Control (Assoc), in which the responses were associates of the nominal List 2 stimuli. For a fourth group, the Augmented Control (Aug), List 2 was A-D with respect to List. 1. The materials in this condition were the same as those in Exp-1, except that the List 2 stimuli were augmented versions of the List 1 stimuli. For the remaining two groups, Control-1 and Control-2, List 2 pairs were C-D with respect to List 1 pairs.

Lists

Each of the six conditions was replicated, i.e., was represented by two different List 1 - List 2 - List 1 sequences, all lists in the experiment being composed of eight pairs of words. List 1 for all conditions had as stimulus terms CVCs in the 99-100% range of association value (Archer, 1960) and as responses common words that are among

the most frequent 40% in the Kucera and Francis (1967) norms. Two sets of eight CVCs were constructed, ambiguous words being excluded; and also two sets of response words, all having no fewer than four letters and no more than three syllables. From these, four different lists were made by combining the stimulus sets and the response sets; care was taken to avoid pairing words that might be pre-experimentally associated. Two of the four lists were List 1 for all conditions but Control-1 and Control-2, for which the two remaining lists were List 1. List 2 for all conditions had as stimulus terms the same two sets of CVCs used for List 1, a set for each replica of the condition—except for the Aug condition, where the stimulus words were augmented versions of the CVCs (e.g., LAWN, not LAW). The other conditions differed on List 2 according to the response terms used, of which there were three varieties: (a) in the Exp-2 and Control-2 conditions, the response terms were the same as those used for List 1 in the respective condition; (b) in the Exp-1, Control-1, and Aug conditions the response terms were associates to the augmented stimulus terms, as determined from either published norms (Palermo & Jenkins, 1964; Postman & Keppel, 1970) or from the responses given on an association test by a group of 19 subjects who were not a part of the experiment proper; and (c) in the Assoc condition the response words were associates to the CVC stimulus terms, as determined by the methods just mentioned. Four different orders of each list were prepared, and the order used to start a learning sequence was varied systematically.

Procedure.

After general PA instructions (based on Runquist, 1966, p. 512), List 1 was presented by the anticipation method on a memory drum at a

2:2-sec. rate with a 4-sec. intertrial interval, to a criterion of one perfect trial plus three overlearning trials or three consecutive perfect trials, whichever came first. Next, List 2 was briefly introduced as either the same sort of list with different words or the same sort of list with identical stimulus words, depending on the paradigm. The procedure for List 2 learning was the same as for List 1. Relearning of List 1 followed immediately upon List 2 learning, with an interval only for instructing the subject that he was about to be retested on List 1 and that he should attempt to anticipate the responses the first time through. The relearning criterion was one perfect trial plus one overlearning trial.

Subjects

In each condition 20 subjects were used, 10 for each replication of the condition. The 120 subjects in all, 62 male and 58 female, were undergraduate students in the introductory psychology course at Loyola University, Chicago; participation in experiments was a course requirement. The subjects were assigned to the various List 1 — List 2 — List 1 sequences in blocks of 12 in the order of their appearance in the laboratory. The order of sequences within blocks was determined using a table of random numbers.

CHAPTER III

RESULTS

Original learning

The mean number of trials to the criterion of one perfect trial varied among conditions from 9.6 to 14.0 in replication A. The range in replication B was from 5.6 to 0.6. A one-way analysis of variance in each case indicated no significant differences among conditions (the *F* for replication A was less than 1; the *F* for replication B was 2.02, which, with 5 and 54 *df* has a probability greater than .05). However, a planned comparison of the mean performances for the two replications indicated that A was more difficult than B (*t* = 4.67, 108 *df* — probability less than .001). This can be attributed to the greater formal similarity among the stimulus terms in replication A. When the results from each replication were combined for each of the six conditions, the means ranged from 8.4 to 10.7. One-way analysis of variance yielded an *F* less than 1, indicating for the combined results what had been found for each replication individually — the six conditions were not different with respect to List 1 learning. The statistical analyses of the transfer and relearning data were based on the combined results of both replications.

Transfer

Two kinds of transfer data were analyzed. The average number of correct responses made in each condition over the first four trials of List 2 are plotted in Figure 1. Two-way analysis of variance (Condi-

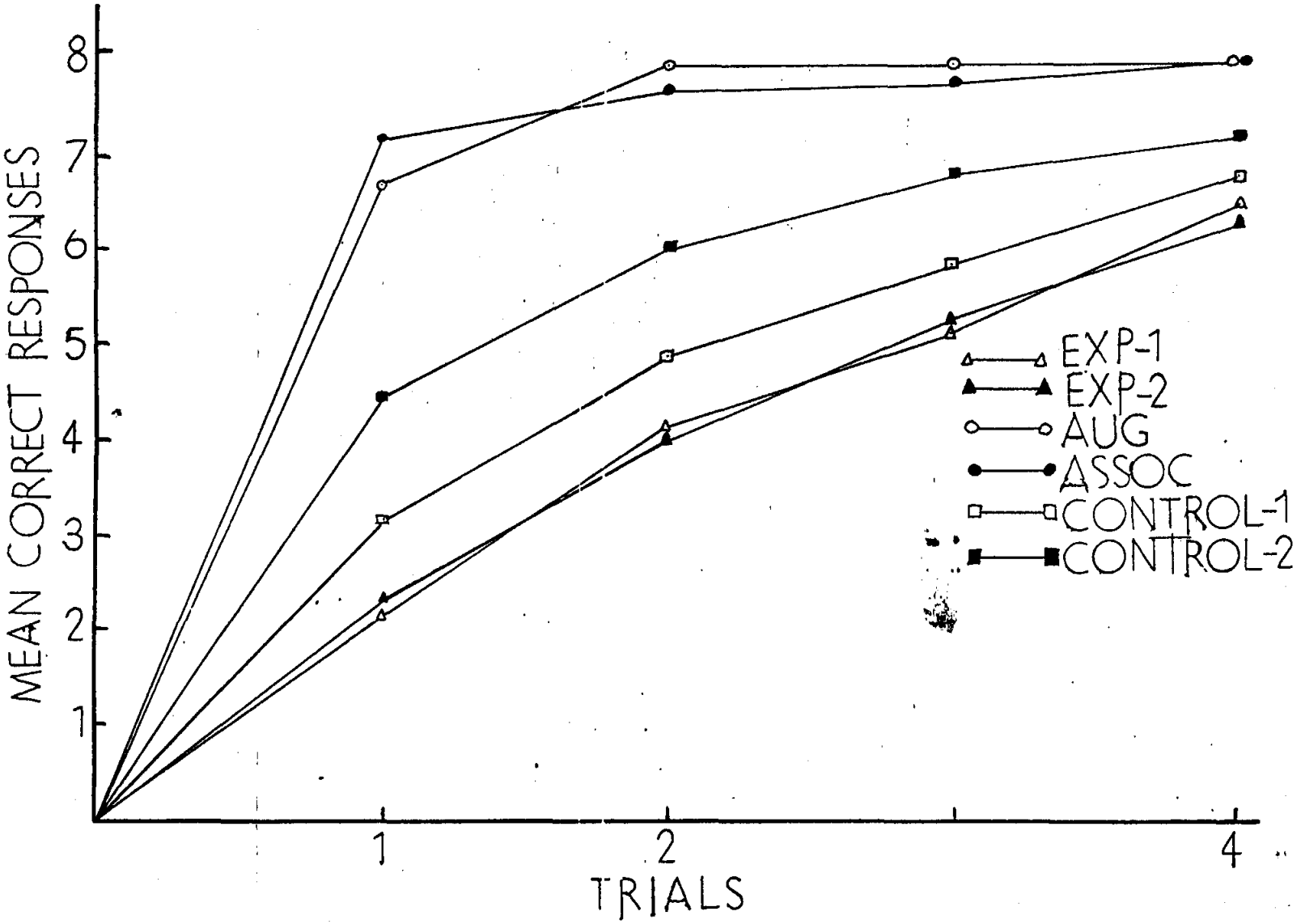

Figure 1. Mean Number of Correct Responses for Each Condition on the Transfer Task.

tions X Trials) for the case of repeated measures on one variable — Trials — indicated that both independent variables and the interaction between them were associated with true differences in performance; the smallest F was 9.6, which has a probability less than .001. Preparatory to making more specific comparisons, the performance of each subject was averaged over the four trials and the mean of these data for the 20 subjects in each condition was found. These are listed in Table 1. The difference between either the Assoc or the Aug conditions (their means are identical) and closest of the other four conditions, Control-2, yielded a t with a probability of less than .001. The difference between Control-2 and Control-1 was found to have a probability of less than .01; the meaning of this difference is not clear. The difference between Control-1 and either Exp-2 or Exp-1 was not significant. These results indicate that the prediction of more negative transfer in those conditions where the functional stimulus did not change was not verified. That is, the performance of Assoc subjects was not inferior to that of Aug subjects; and, more importantly, Exp-2 subjects were not inferior to Exp-1 subjects.

The other measure of transfer was number of trials used in reaching the criteria. The means for each condition are also listed in Table 1. The overall pattern of these results is similar to the pattern that resulted from using only the first four trials, although in a few details the data are slightly more favorable to the theory behind the experiment. For example, the difference between Exp-1 and Exp-2 is in the predicted direction but not significant ($t = .80$, 38 df). The difference between Control-1 and Control-2 has disappeared, but Exp-2 subjects required significantly more trials to learn List 2 than

Table 1

Performance on Transfer List

Condition	Measure of Performance	
	Mean Correct per Trial (first four trials)	Trials to Criterion
Exp-1	4.5	8.6
Exp-2	4.6	9.5
Assoc	7.7	3.9
Aug	7.7	3.8
Control-1	5.2	7.9
Control-2	6.1	7.2

did the corresponding control group, Control-2 (probability of the difference was less than .05); this was not true of the difference between Exp-1 and Control-1. The marked difference between the Aug and Assoc conditions and the rest was a repetition of what was found earlier.

Relearning

Two kinds of relearning data were analyzed, based on measures similar to those used for transfer. The average number of correct responses made by each conditions over the first three trials of relearning are plotted in Figure 2. Twelve of the 120 subjects gave all items correctly on the first two relearning trials and so did not have

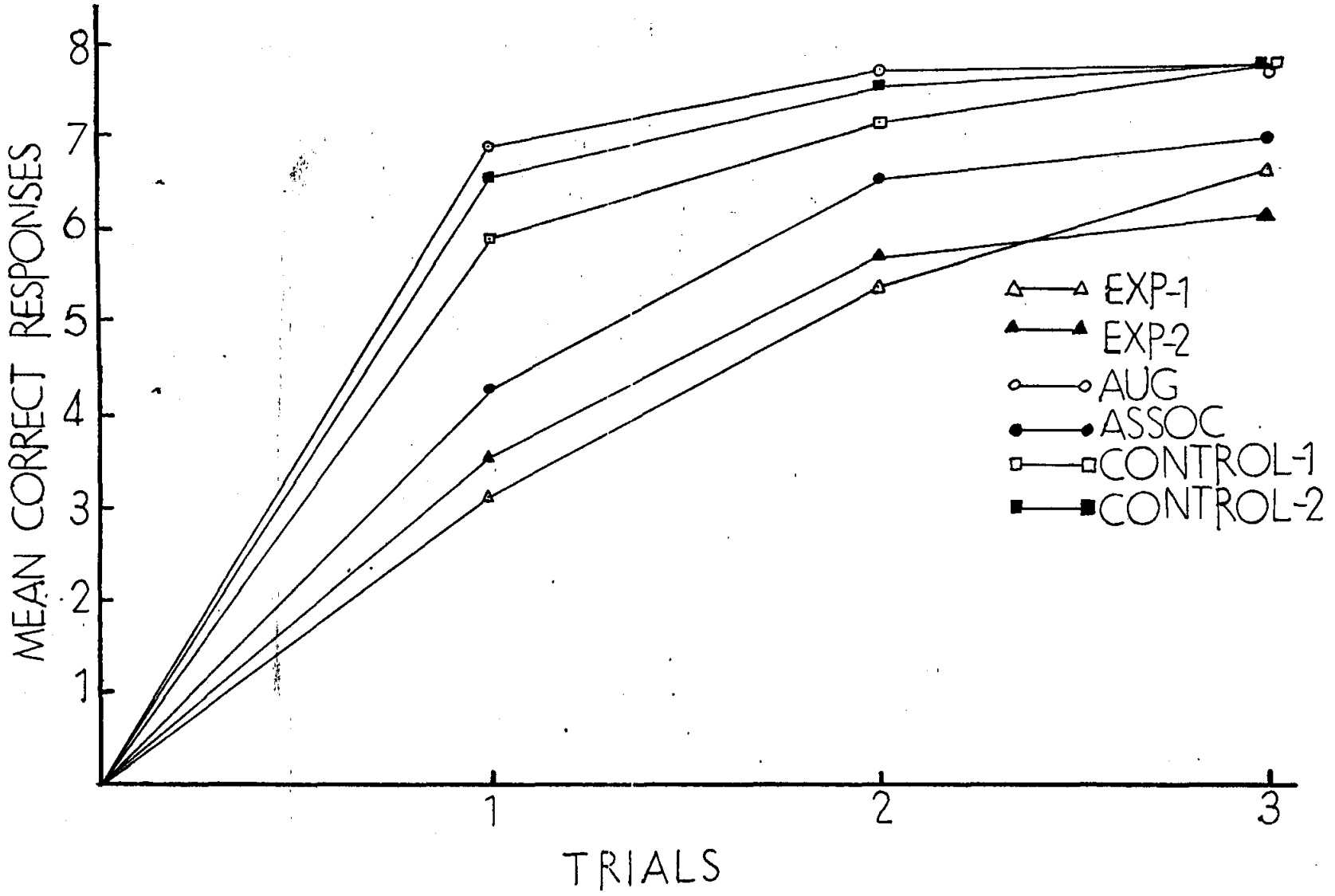

Figure 2. Mean Number of Correct Responses for Each Condition on the Relearning Task.

a third trial. These people (6 in Aug, 1 in Control-1, and 5 in Control-2) were given a perfect score for a hypothetical third trial so that they might be included in the analysis. The same sort of analysis of variance that was used for the transfer data revealed that, again, both independent variables (Conditions and Trials) and their interaction were significant sources of variability, yielding probabilities of less than .001 (the smallest F was 6.3, with 10 and 228 df). That fraction of the interaction variability due to just the Exp-1 and Exp-2 conditions was isolated and tested as a planned comparison, because of the prediction that RI would dissipate faster for Exp-1 than for Exp-2. The trend is in the predicted direction, as is apparent in Figure 2; but it just failed to be significant (F = 2.89 with 2, 228 df, when 3.04 is associated with probability less than .05). Preparatory to making specific comparisons on the main effect of Conditions, the performance of each subject was averaged over the three trials and the mean of these data for the 20 subjects in each condition was found. These are listed in Table 2. In terms of significant differences, these means fall into three clusters. Aug, Control-1, and Control-2 did not differ among themselves; but the difference between Assoc and Control-1, the closest mean of the three to Assoc, yielded a t of 3.4 —with 118 df the probability is less than .001. Assoc, in turn, was significantly (probability less than .02) different from Exp-1 and Exp-2. Also listed in Table 2 are the number of trials used in reaching the criterion. The same results were found with this measure as with number correct, except that the difference between Assoc and Exp-1 was not reliable.

Table 2

Relearning Performance

Condition	Measure of Performance	
	Mean Correct per Trial (first three trials)	Trials to Criterion
Exp-1	5.0	5.9
Exp-2	5.1	6.3
Assoc	6.0	4.9
Aug	7.4	2.9
Control-1	7.0	3.6
Control-2	7.3	3.3

CHAPTER IV

DISCUSSION

The results of the experiment did not support the hypothesis that the RI observed in A-B, A-D is produced by two different processes, one that operates when functional stimuli vary from list to list and the other when functional stimuli are constant. The comparison that bears directly on the hypothesis is that between Exp-1 and Exp-2; and these two groups performed similarly in both the transfer and relearning situations — although in the latter situation the crucial comparison, which involved rate of dissipation of RI, just missed significance. A hypothesis should, however, not be abandoned unless it has been adequately tested and refuted. There are, in this case, some grounds for supposing that the method used did not provide a valid test of the hypothesis — specifically, it is doubtful that for the subjects in Exp-1 the functional stimuli varied as expected. Unfortunately, there was no systematic attempt to get information on this from the 20 Exp-1 subjects; but of the 6 or 7 who were questioned after the experiment, only 1 claimed to have noticed that List 2 responses were associates of augmented List 2 stimuli. It is likely, then, that very few Exp-1 subjects recoded the A term during List 2 learning. There is evidence for this, as well, in the transfer performance of Exp-1 subjects. If they were in general noticing the fact that LAW-GARDEN can be profitably modified to LAW(N)-GARDEN, their performance should, at some point during transfer, come to resemble that of Aug more than that of Exp-2; but this did not

happen. Therefore, it is reasonable to conclude that functional stimuli did not change any more with the Exp-1 pairs than with the Exp-2 pairs — that is to say, they changed very little.

Do the data from the Exp-2 condition support the prediction that when functional stimuli do not change the Melton-Irwin notions of non-independence of associations and disruption of OL associations during IL apply? This experiment does not allow a definitive answer to the question; but by proposing a hypothetical condition with variable functional stimuli that would yield results between the Exp-2 results and the Control-2 results, it can be argued that the RI data support the Melton-Irwin notions and the transfer data do not. The Melton-Irwin explanation of RI implies that during relearning the subject must "start from scratch" so far as the associations concerned. There will be some savings because other factors in PA learning — such as stimulus discrimination, response learning, warmup, and learning to learn — are not destroyed by IL; but savings will be relatively low. The savings in this experiment (calculated in the usual way — cf. Underwood, 1966, p. 544) for the criterion of one perfect trial were 39% for Exp-2 and 73% for Control-2. These figures are inflated by the large amount of stimulus discrimination (which is unaffected by IL) that was saved in Replication A; the savings for Replication B alone were 25% in Exp-2 and 64% in Control-2. Obviously, the low savings conforms to the idea that Exp-2 subjects started from scratch. Also, the difference between Exp-2 and Control-2 is large enough to accommodate a hypothetical group with variable functional stimuli that would yield an intermediate performance. The transfer data, however, provide little support for such speculation. There was a difference of two pairs, 25%, between Exp-2 and Control-2 over the first

three transfer trials; after that the difference decreases, as the Control-2 performance approaches the maximum. This does not seem to be as much negative transfer as would be predicted by the Melton-Irwin hypothesis, and seems that a hypothetical condition with variable functional stimuli could be little different (one pair?) from Exp-2.

The absence of pronounced negative transfer in Exp-2 suggests that the Melton-Irwin hypothesis is not completely adequate, which, in turn, calls into question their basic assumption — their rejection of the independence hypothesis. Evidence from this and other experiments supports that assumption. Subjects in the Assoc condition — an A-B, A-D paradigm — averaged seven pairs correct out of eight on the first anticipation trial on List 2. Surely, the corresponding A-B associations had not been obliterated in one trial. More likely, the Assoc subjects had learned and were retaining two associations involving the same stimulus. Jung (1970) has demonstrated this directly. He found that subjects have moderate success at learning List 2 in an A-B, A-D paradigm even though List 2 learning is interrupted after each trial by a trial of List 1 relearning. In other words, the subjects were able to maintain simultaneously two associations involving the same stimulus.

Nevertheless, if the independence hypothesis is modified by adding one word, rejecting it can be a tenable position, despite the above evidence. If the term "stimulus" is taken to mean "functional stimulus," so that the independence hypothesis asserts that two associations involving the same functional stimulus can coexist, then rejection of it can be an important postulate in any explanation of negative transfer and RI. There is a complication here. It is the opinion of some (e.g., Thompson & Tulving, 1970) that the condition of complete functional stimulus similarity never exists: e.g., the way that LAW is coded as LAW-BUTLER is being

learned is different from the way that LAW is coded as LAW-TOWER or LAW-JUSTICE is being learned. From this point of view, rejection of the modified independence hypothesis is irrelevant. However, rejection can remain a useful attitude, which would express itself in such a statement as: To the extent that two associations are based on similar functional stimuli, they will be difficult to acquire and maintain together.

A complete explanation of negative transfer and RI in the A-B, A-D paradigm will probably involve both pair-specific and list-differentiation factors (Birnbaum, 1972). When list differentiation is minimal, an explanation in terms of pair-specific factors can be quite powerful if it is based on the idea that individual pairs differ in the degree of functional stimulus similarity from List 1 to List 2, even though they are alike in having nominal stimulus identity. When functional stimuli are quite different — a condition unsuccessfully attempted in this study with LAW-BUTLER, LAW-CARDEN — the expectation is for an amount of negative transfer and RI comparable to that found in an A-B, C-D paradigm. As the functional stimuli approach the asymptote of complete similarity, the expectation is for progressively more negative transfer and RI. In the absence of conditions promoting list differentiation, the basic cause of differences in similarity must almost surely be the response terms. The search for those characteristics of response terms that influence functional stimulus similarity could involve important issues in memory.

CHAPTER V

SUMMARY

This study investigated the possibility that two different hypotheses about retroactive inhibition in the A-B, A-D paired-associate paradigm are each correct. In the context of Martin's (1968) ideas of encoding variability, it was hypothesized that List 2 learning destroys A-B associations when the functional stimuli are identical in both lists and establishes a set to give List 2 responses when the functional stimuli are markedly different. The response words of List 2 were chosen so as to promote similar list-to-list encoding of the stimulus words in one condition and different encoding in another. There were, in addition, two C-D control conditions and two auxiliary control conditions. It was assumed that the evidence of which process had occurred would appear in the transfer and relearning data, the destruction process producing more severe negative transfer and retroactive inhibition.

Male and female undergraduates (N= 120—20 subjects per condition) learned two lists of pairs of words and immediately relearned the first list. The main finding was that the two primary conditions were not different in the amount of negative transfer or retroactive inhibition. It was suggested that this need not be interpreted as evidence against the hypothesis, since the method used may not have been effective in producing functional stimulus variability where that was intended.

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Appendix A - Lists

Task		Condition									
		Exp-1	Exp-2		Assoc		Aug	Control-1		Control-2	
Replication A											
OL	beg	label	beg	label	beg	label	beg	label	fad	tower	fad	tower
	sin	detail	sin	detail	sin	detail	sin	detail	law	ridge	law	ridge
	far	album	far	album	far	album	far	album	war	supper	war	supper
	lab	supper	lab	supper	lab	supper	lab	supper	sir	middle	sir	middle
	rum	tower	rum	tower	rum	tower	rum	tower	sew	north	sew	north
	fat	north	fat	north	fat	north	fat	north	hat	album	hat	album
	tin	middle	tin	middle	tin	middle	tin	middle	bus	detail	bus	detail
	bet	ridge	bet	ridge	bet	ridge	bet	ridge	ten	label	ten	label
IL	beg	start	beg	image	beg	plead	begin	start	beg	start	beg	image
	sin	ballad	sin	paper	sin	wrong	sing	ballad	sin	ballad	sin	paper
	far	dairy	far	butler	far	distance	far	dairy	far	dairy	far	butler
	lab	factory	lab	museum	lab	chemistry	labor	factory	lab	factory	lab	museum
	rum	gossip	rum	pension	rum	alcohol	rumor	gossip	rum	gossip	rum	pension
	fat	destiny	fat	doubt	fat	grease	fate	destiny	fat	destiny	fat	doubt
	tin	color	tin	chorus	tin	iron	tint	color	tin	color	tin	chorus
	bet	worse	bet	humor	bet	guess	better	worse	bet	worse	bet	humor
Replication B											
OL	fad	paper	fad	paper	fad	paper	fad	paper	beg	image	beg	image
	law	butler	law	butler	law	butler	law	butler	sin	paper	sin	paper
	war	image	war	image	war	image	war	image	far	butler	far	butler
	sir	doubt	sir	doubt	sir	doubt	sir	doubt	lab	museum	lab	museum
	sew	chorus	sew	chorus	sew	chorus	sew	chorus	rum	pension	rum	pension
	hat	pension	hat	pension	hat	pension	hat	pension	fat	doubt	fat	doubt
	bus	humor	bus	humor	bus	humor	bus	humor	tin	chorus	tin	chorus
	ten	museum	ten	museum	ten	museum	ten	museum	bet	humor	bet	humor
IL	fad	blur	fad	tower	fad	trend	fade	blur	fad	blur	fad	tower
	law	garden	law	ridge	law	justice	lawn	garden	law	garden	law	ridge
	war	comfort	war	supper	war	battle	warm	comfort	war	comfort	war	supper
	sir	wail	sir	middle	sir	mister	siren	wail	sir	wail	sir	middle
	sew	gutter	sew	north	sew	needle	sewer	gutter	sew	gutter	sew	north
	hat	evil	hat	album	hat	glove	hate	evil	hat	evil	hat	album
	bus	chest	bus	detail	bus	truck	bust	chest	bus	chest	bus	detail
	ten	racket	ten	label	ten	number	tennis	racket	ten	racket	ten	label

APPROVAL SHEET

The thesis submitted by Martin J. Doherty has been read and approved by members of the Department of Psychology.

The final copies have been examined by the director of the thesis and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the thesis is now given final approval with reference to content and form.

The thesis is therefore accepted in partial fulfillment of the requirements for the degree of Master of Arts.

July 31, 1972
Date

Signature of Advisor