ENCODING SPECIFICITY:
EVALUATION OF ASSOCIATIVE ASYMMETRY

by

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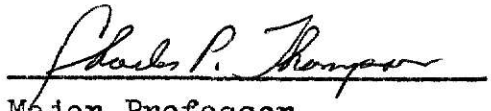

Major Professor

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INTRODUCTION

The principle of encoding specificity was presented initially by Tulving and Osler (1968) in an attempt to explain the results of an experiment which investigated the use of retrieval cues in aiding recall of to-be-remembered (TBR) words. TBR words had been provided for study on a single trial, in the presence or absence of study cues, which were weak normative associates of the TBR words. Recall testing for the TBR words was performed in the presence or absence of these weak associative cues. Results showed that cue words facilitated recall of TBR words only when they were presented both at the study and testing phases. Providing weak associates as cues only during recall testing actually led to poorer performance than if no cues were provided.

These results were interpreted by Tulving and Osler (1968) to suggest that specific retrieval cues facilitate recall if and only if the information about them and their relation to the TBR words is encoded at the same time as the information about the membership of the words in a specific list. This is essentially the encoding specificity hypothesis.

A more rigid test of this hypothesis was provided by a series of experiments by Thomson and Tulving (1970). This study entailed the presentation of TBR words either alone or in the context of weak normative associates, and the subsequent testing of the effectiveness of extralist cues (which were strong normative associates of the TBR words) under the two types of encoding

conditions. Results showed that extralist cues facilitated recall only when the TBR words had been presented as single items in the list. According to the authors of this study, however, the results were not entirely unequivocal. Thomson and Tulving (1970) pointed out that it is not known to what extent the pairing of TBR words with specific study cues may have reduced the capacity of extralist cues to produce TBR words as implicit responses at time of testing.

Largely for this reason, Tulving and Thomson (1973) modified their paradigm for testing the encoding specificity hypothesis in a series of experiments that was directed at testing the generation-recognition theory of memory retrieval.

Generation-recognition Models

The generation-recognition models assume that retrieval of stored information consists of two successive stages: (a) implicit generation of possible response alternatives, and (b) recognition of one of the implicitly generated alternatives according to certain criteria of acceptability.

Efficient retrieval cues, including extralist cues, facilitate prompted recall because they lower the probability that existing information in the memory store cannot be found. Note that the encoding stage is of little importance, so long as it does not interfere with the capacity of the extralist cue to produce the TBR word as an implicit response. In contrast, the encoding specificity principle maintains that the TBR word must

be encoded with reference to the cue to enable the cue to be effective. Tulving and Thomson (1973) have asserted that their experiments demonstrating recognition failure of recallable words provide data inconsistent with the generation-recognition models.

Recognition Failure of Recallable Words

In the Tulving and Thomson (1973) experiments, subjects studied a list of TBR words (e.g., CHAIR) which were accompanied by specific cues selected from weak normative associates of the TBR words (e.g., GLUE). After studying the word list, subjects were requested to generate free-association responses to strong extra-experimental associates of the TBR words, such as TABLE. Following this procedure, the subjects were asked to pick out those generated words which had been on the study list. Subsequently, subjects were given a prompted-recall test involving the original study cues (e.g., GLUE) in an attempt to determine the extent to which information about TBR words (e.g., CHAIR) was available in the memory store.

Results showed that under the conditions used, a sizeable proportion of the generated words that could not be recognized could be recalled when subjects were provided the original study cues (e.g., GLUE).

Tulving and Thomson (1973) point out that the recognition failure of recallable words is an empirical result that cannot occur according to the generation-recognition theories of recall

and recognition (e.g., Kintsch, 1970; Norman, 1968; Shiffrin and Atkinson, 1969). Information recovery through the two sequential phases of a prompted recall situation (generation and recognition), according to the earlier generation-recognition models, should not be more effective than through only one of the two (recognition). Since the results of the Tulving and Thomson (1973) study show that under certain conditions cued recall (supposedly involving generation and recognition) produces superior retrieval to recognition (alone), it appears likely that the earlier generation-recognition models require revision.

Criticisms of the Encoding Specificity Data

Edwin Martin (1975) has expressed the opinion that the phenomenon of "recognition failure of recallable words" demonstrated by Tulving and Thomson (1973) is largely attributable to a discrepancy between semantic properties of encoded TBR words and the semantic interpretation of corresponding recognition-test words. Martin points out that the word LIGHT in the cue-TBR word pair HEAD-LIGHT is not the same as the word LIGHT in the free-association pair DARK-LIGHT. Martin argues that homography is not a yes-no classification, and that all words are ambiguous to some degree in the absence of a determining context.

In an earlier study, Tulving (1974) attempted to test the semantic hypothesis of Martin (1975). The experimental paradigm used entailed holding the lexical identity of TBR words constant

while examining the effectiveness of various retrieval cues as a function of semantic overlap between encoding context of the TBR word and the retrieval cue. Retrieval of TBR words was tested with extralist cues following the presentation of the TBR words in one of three input contexts: (a) in the company of cue words whose dominant semantic meaning was relatively incongruous with that of the TBR words and the extralist cues, (b) with cue words whose meaning was congruous with that of the semantic TBR words and the extralist cues, and (c) with cue words that were identical with the TBR words. For instance, the Incongruous context was represented by the pair GLUE-CHAIR, the Congruous condition by the pair FURNISH-CHAIR, and the Identical condition by CHAIR-CHAIR. The extralist retrieval cue was TABLE.

It was assumed by Tulving that the semantic information contained in the retrieval cue TABLE would be most compatible with the stored information about the TBR word CHAIR presented in the CHAIR-CHAIR compound, somewhat less compatible with CHAIR presented in the FURNISH-CHAIR compound, and least compatible with information about CHAIR that had appeared as a part of the GLUE-CHAIR compound.

Results showed very little support for Martin's (1975) hypothesis. Some facilitation of retrieval of TBR words by extralist cues was observed under conditions where TBR words had been encoded in relation to cue words semantically much more compatible with both TBR words and extralist cues, in comparison with re-

trieval of TBR words encoded in relation to less congruous cues. However, this facilitation was rather small and statistically not reliable.

Other criticisms concerning the Thomson and Tulving (1970) paradigm, demonstrating that strong extralist associates are ineffective retrieval cue for TBR words studied in the context of weak associative cues, have centered around its methodology. Among the more vocal opponents have been Santa and Lamwers (1974), who have pointed out that subjects in the Thomson and Tulving (1970) study were not explicitly informed of the relation between the strong extralist associates and the TBR words. Santa and Lamwers showed that when informed of the relation between cues and TBR words, subjects are readily able to use this semantic information with virtually no intrusions. This latter result has led Santa and Lamwers to suggest that subjects were not simply guessing from semantic memory.

Watkins and Tulving (1975) have subsequently pointed out that the results of earlier extralist cuing studies (e.g., Thomson and Tulving, 1970) are best regarded as merely suggestive of access difficulties in recognition. This is due to the fact that the earlier extralist cuing paradigm did not involve subjects attempting to recognize TBR words in the test phase. It could possibly be argued that pairing of a weak normative associate (e.g., GLUE) with a TBR word (e.g., CHAIR) could later inhibit the implicit generation of the TBR word from its strong

extralist associate (e.g., TABLE). With a change in basic paradigms used, later experiments involving recognition failure of recallable words (e.g., Tulving and Thomson, 1973; Watkins and Tulving, 1975) are not subject to the criticism that the TBR word can not be implicitly generated by subjects at time of test. In the new paradigm, subjects are asked to recognize the TBR words from either a set of their own free-association responses or from a set of experimenter-provided words. The recognition failure paradigm avoids other methodological criticisms leveled at the Thomson and Tulving (1970) extralist cuing paradigm, such as those by Santa and Lamwers (1974) discussed earlier.

The generality of the recognition failure of recallable words has been questioned by Santa and Lamwers (1974), Light, Kimble, and Pellegrino (1975), and others. Some of this criticism has centered around the use of set inducing practice lists, subjects' generation of recognition items, use of a recognition task subject to strong response biases - contrasted with a forced-choice recognition task, and other methodological features incorporated within Tulving and Thomson's (1973) paradigm.

In subsequent experiments, Watkins and Tulving (1975) demonstrated that recognition failure of recallable items is a rather robust phenomenon, with many of the procedural details of the original (Tulving and Thomson, 1973) experiments proving to be largely superfluous, including the set inducing practice lists and unusual features of the recognition task.

Interpretations of Recognition Failure of Recallable Words

Tulving and his associates have used the empirical results demonstrating recognition failure of recallable words to support their principle of encoding specificity and the importance of episodic memory relative to general theories of associative memory. In this view, what is of importance is the "unique" episodic memory trace. Interactions between episodic and semantic memory are not denied, indeed, utilization of semantic memory is necessary for the very perception and comprehension of the episodic event. Still, the major emphasis is placed on the episodic encoding operations as demonstrated by the wording of the encoding specificity principle: "Specific encoding operations performed on what is perceived determine what is stored, and what is stored determines what retrieval cues are effective in providing access to what is stored (Tulving and Thomson, 1973, p. 369)."

Various approaches to recognition failure stressing associative continuity theories have resulted for the most part in little success. Martin's (1975) hypothesis concerning recognition failure of recallable items, which involved a semantic interpretation, was tested by Tulving (1974) in an earlier experiment. Results of the Tulving (1974) study were not consistent with Martin's (1975) semantic hypothesis. Other studies (e.g., Newman and Frith, 1975) stressing semantic interpretations of recognition failure of recallable items have continued to work

with the extralist cuing paradigm of Thomson and Tulving (1970). Tulving and his associates, however, have previously noted the limitations of the extralist cuing paradigm as supportive evidence of the encoding specificity principle. Instead, they advocate focusing upon the recognition failure paradigm, which is amenable to more conclusive results in connection with the debate over the relative merits of the encoding specificity principle versus the generation-recognition models of memory retrieval.

Among the approaches taking a semantic direction which may eventually show some success include studies by Pellegrino and Salzberg (1975a, 1975b). Pellegrino and Salzberg (1975b) have interpreted the results of their encoding specificity studies in terms of a semantic feature model which incorporates features of earlier stimulus sampling models. Within this theory, recognition probability is determined by the degree of overlap between the originally encoded semantic features and the test features of a lexical item. This degree of overlap is hypothesized as being dependent upon three factors: (a) the size of the potential semantic feature pool, (b) restrictions upon feature sampling at time of study, and (c) restrictions upon feature sampling at time of test.

This simple stimulus sampling model assumes that a positive recognition decision occurs if the originally encoded feature sample and the test sample overlap on at least one feature.

Pellegrino and Salzberg (1975b) provide an equation which gives the probability of overlap (P_o) of two independent random samples drawn from a pool of features of size N.

$$P_o = 1 - \frac{(N - S_i)!(N - S_o)!}{N!(N - S_i - S_o)!} \qquad \text{for } S_i + S_o \leq N.$$

S_i and S_o represent the sizes of the input and output samples respectively. As the size of the feature pool (N) increases, the probability of overlap (P_o) decreases with fixed values of S_i and S_o. Alternately, as S_i increases, P_o increases for fixed values of N and S_o; and as S_o increases, P_o increases for fixed values of N and S_i.

Unfortunately, this model has not been put to a critical test as there have not been any quantitative estimations of the parameters (S_i, S_o, and N) proposed by Pellegrino and Salzberg.

A Proposed Explanation of Recognition Failure of Recallable Words

It should be noted at the outset that the theoretical approach which will be elaborated upon in this paper is, as far as this author is able to determine, consistent with the principle of encoding specificity and the theory of episodic memory as advocated by Tulving and his associates. There are, however, probably differences in areas of emphasis, especially in the proposed explanation of recognition failure of recallable words set forth in this paper.

Specifically, the hypothesis to be developed here is that the mechanism underlying recognition failure of recallable words

in the recognition failure paradigm (e.g., Tulving and Thomson, 1973; Watkins and Tulving, 1975) is the formation, during presentation, of episodic associations between cue and TBR words which are asymmetrical[1]. Further, these asymmetrical episodic associations are exaggerated by asymmetrical interference effects during the free-association task. To adequately develop this hypothesis, the reasons for the assumptions underlying it must be made explicit. The assumptions will first be listed, then elaborated upon.

The assumptions are as follows: (1) the functional memory unit in most associative learning paradigms, and specifically in the recognition failure paradigm, is a higher order memory unit containing functional representations of the cue and TBR words, (2) there is often a distinct asymmetry of association between the study cue and TBR word, (3) study cues are likely to function as "control elements" in subjects' encoding-retrieval schemas, (4) subjects' expectations of task demands determine the type of encoding-retrieval schemas utilized, and (5) the free-association task increases the asymmetry of the associations between cue and TBR words because of interference effects which predominantly affect the backward associations between TBR words and study cues.

Finally, the most basic assumption of my theoretical approach is that success of attempted retrieval is dependent upon the completeness with which the episodic memory traces encoded at

time of input are reinstated at the time of attempted retrieval. That is the essence of the encoding specificity principle which, in turn, appears to be a more cognitive elaboration of (and consistent with) the principle of reinstatement of stimulus conditions. According to this "S-R" learning principle, retrieval is assumed to be dependent upon the completeness with which the stimulus conditions at the time of input are reinstated at the time of attempted retrieval (Hollingworth, 1928; Melton, 1963).

Since I have stated that the reinstatement of the episodic memory traces is critically important for retrieval, let me now describe the rationale for the assumptions which, taken together, elaborate upon the presumed nature of the episodic memory traces at the time of retrieval.

Concerning most paired-associate learning tasks, and the recognition failure paradigm in particular, functional representations of the study cue and TBR word are assumed to be encoded at time of input to form a higher order memory unit which is the episodic memory trace (assumption 1). The distinction between nominal and functional memory units has been made in connection with associative learning processes and organizational processes in memory (e.g., Asch, 1969; Tulving, 1968; Underwood, 1963). Functional memory units are the idiosyncratic memory traces encoded by the subject in the presence of the nominal study items at time of input.

Retrieval success, according to the encoding specificity

principle, is dependent upon the completeness of reinstatement of the episodic memory trace at time of attempted retrieval..

In the recognition failure paradigm, reinstatement of the episodic memory unit during attempted retrieval is more probable in the presence of the study cue alone compared with the TBR word alone. This is demonstrated by the recognition failure of recallable words (e.g., Tulving and Thomson, 1973; Watkins and Tulving, 1975).

It can easily be inferred that the forward association between the study cue and the TBR word must be stronger than the backward association between the TBR word and the study cue (assumption 2). Given the study cue, the TBR word in many cases can be recalled with little difficulty; given the TBR word, the study cue can be recalled only infrequently (Tulving, 1972; Tulving and Thomson, 1973). Therefore, it is possible to argue that recognition failure of recallable words results from the weak associations between the TBR words and study cues. That is, the weaker backward association between the TBR word (e.g., CHAIR) and the study cue (e.g., GLUE) is less likely to result in the reinstatement of the episodic memory unit containing the pair of words upon presentation of the nominal TBR word. In contrast, the presentation of the study cue alone would be more likely to result in the reinstatement of the episodic memory unit containing functional representations of the paired-associate items if the forward association is stronger than the backward association. The

recognition task and subsequent cued-recall task in the recognition failure paradigm appear to rely upon the backward and forward episodic associations between the associated input words respectively. This evaluation concerning the associative asymmetry in the recognition failure paradigm is given some credence by the fact that there is considerable evidence pointing toward a dominance of forward associations over backward associations in many associative learning tasks (e.g., Giurintano, 1972; Owens, Werden, and Marshall, 1974).

Thus, the important point seems to be in examining why the backward associations existing between the TBR words and study cues are so weak. It is hypothesized that two major factors are responsible for the apparent associative asymmetry between study cues and TBR words in the recognition failure paradigm: (a) processes involved during the study phase, and (b) interference effects from the free-association task.

It appears likely that processes exist in the study phase of many associative learning paradigms which contribute to produce effects of associative asymmetry. Instructions and practice trials within the recognition failure paradigm are similar to those used in most paired-associate learning tasks. The task stresses separate functions for the two items in each pair: the first functioning as a retrieval cue and the second as a TBR item.

If reinstatement of the episodic memory trace is important

for attempted retrieval, then study cues in the recognition failure paradigm may serve as "control elements" to the episodic memory units (assumption 3). The concept of a "control element" has been used by Estes (1972) in connection with stimulus sampling theory. Tulving and Thomson (1973) have succinctly remarked that the study cues in their paradigm of recognition failure of recallable words may function as "control elements" or "codes" that govern the access to the complex of stored information about the TBR word. However, they also ask: "Why were the input cues, and not the target items, control elements; why not both (Tulving and Thomson, 1973, p. 368)?"

In the same study, a reasonable answer is provided for this question: "In our experiments, encoding of target words was influenced by the list cues present at input and by the subjects' expectations that they would be tested with those cues (Tulving and Thomson, 1973, p. 369)." It should also be kept in mind that subjects in this type of experiment receive several practice lists as a rule, in which they are provided the study cues and asked to retrieve the TBR words which were paired with each study cue.

Thus, I suggest that subjects are likely to generate retrieval schemas at the time of study (assumption 4). Subjects' schemas or strategies would be aimed at optimizing their performance on subsequent prompted-recall tasks. Subjects' expectations that they would be given the study cues at time of attempted retrieval

appear to be a likely influence upon the strategies they adopt for encoding the nominal word pairs. Along these very lines, Ciccone and Brelsford (1975) have demonstrated that subjects adopt differential processing strategies in encoding nominal stimuli which depend upon their task expectations.

Given an associative learning task in which subjects expect to be represented with a study cue and asked to give a TBR word, it is plausible to expect that subjects would adopt encoding strategies which would utilize the study cues for retrieval.

In this type of situation, the forward association between the study cue and TBR word would likely receive more attention at time of study by the subject. Thus, the subject is likely to adopt a strategy in which the study cue is a control element to decode a forward association to retrieve the TBR word of the functional memory unit. Owens, et al. (1974) have shown this type of result, in which the asymmetry of association in a paired-associate task was due to the ease of decodability of the forward association compared to the greater difficulty in decoding the backward association.

The preceding paragraphs have elaborated upon hypothetical processes within the study phase of the recognition failure paradigm which may account for part of the apparent associative asymmetry involved in the recognition failure of recallable words. However, the study phase is only a small part of a complex set of experimental manipulations within the recognition

failure paradigm. The next important question appears to be: What effect, if any, do the post-study experimental manipulations in this paradigm have upon the hypothetical associative asymmetry between study cues and TBR words?

In response to that question, it is quite reasonable to assume that the free-association task in the recognition failure paradigm produces significant retroactive inhibition for the backward associations between TBR words and study cues, but probably much less interference for the forward associations between study cues and TBR words (assumption 5). This appears to be quite obvious since subjects generate approximately 70 to 80% of the TBR words as responses to their corresponding high associative extralist cues in the free-association task whereas virtually none of the study cues are generated in the free-association task.

The new associations between the TBR words and their high associative extralist cues are likely to interfere with the accessibility of the original associations formed between the TBR words and their study cues. However, there appears to be little reason to expect an equivalent amount of interference with the accessibility of the original episodic associations formed between the study cues and TBR words. This line of reasoning assumes that both backward and forward associations exist and are largely independent of each other. The forward associations between study cues and TBR words are expected to receive less in-

terference from the free-association task since few study cues are generated by the task.

Thus, it is assumed that the free-association task in the recognition failure paradigm increases the associative asymmetry between study cues and TBR words produced in the study phase of this paradigm.

In summary, the recognition failure of recallable words is hypothesized to be critically dependent upon the associative asymmetry between study cues and TBR words. Further, that associative asymmetry is generated and exaggerated by the experimental manipulations in the recognition failure paradigm. Associative asymmetry is pictured as the critical feature since it is assumed that attempted retrieval is dependent upon the completeness of reinstatement of the total episodic memory unit encoded at time of input. The two major processes hypothesized to be responsible for the apparent associative asymmetry include: characteristics of the study phase of the recognition failure paradigm (assumptions 1-4), and asymmetrical retroactive inhibition generated by the free-association task (assumption 5).

Evidence Supporting the Asymmetry Hypothesis

Support for the theoretical approach to recognition failure of recallable words presented in the previous section has been provided by Watkins and Tulving (1975). First, concerning the importance of the free-association task in experiments demonstrating recognition failure of recallable words, Watkins and

Tulving (1975) have demonstrated a dramatic reduction of recognition failure (proportion of recalled TBR words not recognized) when the free-association task is eliminated from the Tulving and Thomson (1973) paradigm. Over a series of 5 experiments containing the free-association task, Watkins and Tulving (1975) found recognition failures ranging from .36 to .62. In contrast, with the free-association task eliminated (experimenter-provided distractors used on the recognition task), the recognition failure varied from .16 to .26 (related and unrelated lures, and free- and forced-choice recognition instructions).

I have interpreted these results as indicating the extent of retroactive inhibition affecting the backward associations between TBR words and study cues. The magnitude of the recognition failure remaining when the free-association task is eliminated is interpreted as representing the degree of associative asymmetry generated during the study phase of the recognition failure paradigm.

Final cued recall of the TBR words is also higher (approximately .74) when the free-association task is eliminated, compared with the 5 experiments utilizing a free-association task (.48-.63) (Watkins and Tulving, 1975). Thus, it may be that the free-association task produces some retroactive inhibition for the forward associations between study cues and TBR words as well as for the backward associations.

Some Conflicting Evidence

Of special interest are the probabilities of prompted recall of study cues, conditionalized for recognized TBR words, for the 6 experiments of the Watkins and Tulving (1975) study. For the 5 experiments utilizing the free-association task, the probabilities of prompted recall of study cues, conditionalized for recognized TBR words, varied from .32 to .44. These results are contrasted with probabilities of .72 and .71 (free- and forced-choice recognition instructions respectively) when the free-association task was eliminated.

Thus, it would appear that the free-association task heightens the phenomenon of recognition failure of recallable words by decreasing the accessibility of the complex of information in the episodic memory unit through the backward association from the TBR word.

However, the relatively low probabilities of prompted recall of study cues to recognized TBR words tend to suggest problems for the assumption that the completeness of reinstatement of the total episodic memory unit is critically involved with attempted retrieval. If this assumption is appropriate, then why isn't prompted recall of study cues to recognized TBR words near perfect performance? Also, one must ask why prompted recall of study cues to recognized TBR words is so low (.32-.44) when the free-association task is included in the recognition failure paradigm (Watkins and Tulving, 1975). An attempt will be made at reconciling the conflicting evidence presented.

Reconciling the Conflicts

I will first consider the condition in which the free-association task is eliminated from the recognition failure paradigm. Here, prompted recall of study cues to recognized TBR words is fairly high (approximately .72), but not perfect (e.g., Watkins and Tulving, 1975; Tulving and Thomson, 1973). Less than perfect performance may simply be due to subjects' failure to encode every TBR word in context to its corresponding study cue. This could involve both intentional (i.e., idiosyncratic encoding strategies) and unintentional (i.e., time limitations) factors. Thus, the episodic memory traces accessed at time of attempted retrieval would not be expected to contain representations of the study cues in some instances. Also, there would be some probability that a given recognition response would be a guessing response. These two factors may reasonably explain why prompted recall of study cues to recognized TBR words is not perfect in the situation where there is no free-association task.

Now, let us consider why prompted recall of study cues to recognized TBR words is so low when the free-association task is included in the recognition failure paradigm. There are a number of possible explanations why these values are significantly lower than those where the free-association task is eliminated.

First, one should consider the effects of the retroactive inhibition upon the accessibility of the episodic memory traces

at time of attempted retrieval. The interference effects may result in subjects only being able to partially reinstate the original episodic memory traces at time of attempted retrieval. If this were the case, then subjects may be able to utilize the partially reinstated memory traces to increase their recognition hit rates, but still be unable to retrieve the respective study cues for the recognized TBR words. From this explanation, one would expect that the probabilities of prompted recall of study cues to recognized TBR words would be highly correlated with subjects' confidence ratings of their recognition responses.

Some support for this interpretation of the low probabilities of prompted recall of study cues to recognized TBR words is provided by Watkins and Tulving's (1975) data on subjects' confidence ratings of recognition responses. In the Watkins and Tulving (1975) study, subjects gave confidence ratings for their recognition responses both under free- and forced-choice instructions. The probability of recalling the study cues of the recognized TBR words was found to increase sharply with the confidence of recognition. The study cues to recognized TBR words under the free-choice instructions were recalled with probabilities which increased from .11 through .21 to .67 with increasing confidence of recognition. For the correctly recognized TBR words under the forced-choice instructions, the corresponding probabilities were .13, .14, and .64. These latter results appear to be striking evidence supporting the notion that the recognition failure of

recallable words is strongly influenced by the weak backward associations between TBR words and study cues.

Another related factor is the possibility that the retroactive inhibition from the free-association task may significantly alter subjects' response biases. Thus, guessing could become a more important aspect of subjects' recognition responses. This may not be a dramatic factor, but simply contribute to the effects discussed in the previous explanation. If there is a change in response bias, then there should be an accompanying change in the false-alarm rate for the recognition responses. This point does not appear to have been addressed explicitly by previous research.

As yet there has been only partial empirical support for these explanations of the prompted-recall probabilities for study cues to recognized TBR words. Hopefully, the present research will add stronger support for these explanations as well as for the theoretical approach to recognition failure of recallable words outlined in this paper.

Evaluation of Associative Asymmetry in the Recognition Failure Paradigm

I have suggested that associative asymmetry is critically involved in the recognition failure of recallable words. Empirical results (e.g., Watkins and Tulving, 1975; Tulving and Thomson, 1973) appear to suggest that this interpretation is correct. These same results also appear to suggest that several

factors may contribute to the hypothesized associative asymmetry. It should also be kept in mind, however, that the complex set of procedures in the Watkins and Tulving (1975) and Tulving and Thomson (1973) experiments are within-subject manipulations. Therefore, it is quite difficult to deduce accurately from these results which procedures contribute appreciably to the hypothesized associative asymmetry.

A between-subjects design is necessary to appropriately evaluate the magnitude and source(s) of associative asymmetry in the recognition failure paradigm. Using a between-subjects design, the two major factors hypothesized as the sources of the phenomenon of recognition failure of recallable words were evaluated by the current research. These two factors included: (a) the set-inducing effects upon encoding produced by the study phase of the recognition failure paradigm, and (b) the differential effects of retroactive inhibition produced by the free-association task. Along with standard set-inducing manipulations, the design included different set inducing manipulations. These different set-inducing manipulations were geared toward making subjects encode TBR words or study cues as control elements with equal probabilities. This involved different instructions in conjunction with a practice list which was tested with a mixed set of prompts including both study cues and TBR words. Further, to evaluate the magnitude of asymmetry, the experiment compared prompted recall of the entire set of study cues with prompted

recall of the entire set of TBR words (both conditions following study of the critical list, and following the free-association task).

In summary, the purpose of the research conducted was to determine the existence, magnitude, and locus of the effects of associative asymmetry involved in the recognition failure of recallable words.

METHOD

Subjects. One hundred and twenty-eight undergraduate psychology students who volunteered their services participated in this experiment. Subjects received extra-credit for participating in the experiment.

Design. The experiment was a 2x2x2x2 factorial. All 4 independent variables were between-subjects factors. They included: Instructions (standard or different), Cue Type (TBR words or study cues), Time of Test (following study of the critical list or following the free-association task), and List (form A or B). The "standard" instructions group received written instructions and practice trials in which one item of each pair was stressed as a study cue and the other as a TBR word. The other half of the subjects received instructions ("different") making prompted recall of either associate appear equally probable (see Appendix I). In conjunction with these instructions, a practice trial was given featuring prompted recall of a mixed list of cue and TBR words.

List was a control factor expected to produce non-significant differences. Since results showed no significant difference in performance for the two forms ($F < 1$), the design was collapsed to a 2x2x2 factorial.

Each subject was presented both lists, in counterbalanced order. The first presentation was a practice list, with study of the list followed by prompted recall of the TBR words for half the subjects and prompted recall utilizing a mixed list of

study cues and TBR words for the other half of the subjects. The second list was the critical list for each subject, and its presentation was followed by the different procedures for subjects falling into the different cells of the design.

Materials. The 2 study lists (24 pairs of associates) were composed of the weak associate cues and TBR words selected from the two lists used by Tulving and Thomson (1973) and by Watkins and Tulving (1975). These items were initially selected from free-association norms (Bilodeau and Howell, 1965; Riegel, 1965) to conform to the following criteria: (a) the TBR word is a low-frequency (mean of 1% for the whole set) associate to its weak associate cue, (b) the TBR word is a high-frequency associate to its strong cue (mean of 52%), and (c) weak and strong cues of a given TBR word are not associatively related to each other in the norms (see Table 1).

The study list were presented by means of a slide projector, with the cues being typed in lowercase letters above the capitalized TBR words. Testing booklets were used for the series of procedural tasks in the experiment.

Procedures. Subjects were tested in groups, with approximately 4 subjects per group. At the beginning of the session, the subjects were given booklets in which the successive test or task sheets were interspersed with filler pages, the latter being used to prevent previewing. The study lists were presented at a 3-second per pair exposure rate by means of a slide projector.

TABLE 1

Materials Used in the Construction of Study Lists and Experimental Tasks

Form A			Form B		
Weak cue	Strong cue	TBR word	Weak cue	Strong cue	TBR word
ground	hot	COLD	hope	low	HIGH
head	dark	LIGHT	stem	long	SHORT
bath	want	NEED	whiskey	lake	WATER
cheese	grass	GREEN	moth	cat	FOOD
stomach	small	LARGE	cabbage	square	ROUND
sun	night	DAY	glass	soft	HARD
pretty	sky	BLUE	country	closed	OPEN
cave	dry	WET	tool	finger	HAND
whistle	tennis	BALL	memory	fast	SLOW
noise	blow	WIND	covering	lining	COAT
glue	table	CHAIR	barn	clean	DIRTY
command	woman	MAN	spider	eagle	BIRD
fruit	bloom	FLOWER	crust	bake	CAKE
home	bitter	SWEET	deep	bed	SLEEP
grasp	infant	BABY	train	white	BLACK
butter	rough	SMOOTH	mountain	leaf	TREE
drink	tobacco	SMOKE	cottage	hate	LOVE
beat	ache	PAIN	art	boy	GIRL
cloth	lamb	SHEEP	adult	labor	WORK
swift	stop	GO	brave	strong	WEAK
lady	king	QUEEN	door	color	RED
blade	scissors	CUT	roll	carpet	RUG
plant	insect	BUG	think	dumb	STUPID
wish	soap	WASH	exist	human	BEING

Immediately following the presentation of each list, subjects engaged in a distractor task of counting backwards by 3's from a presented 3-digit number for 30 seconds. Following the distractor task for the first-presented list, half of the subjects were provided with the 24 study cues randomly ordered on a recall sheet with instructions to write down the TBR word next to its corresponding cue, or at the bottom of the sheet. The other half of the subjects (those receiving instructions indicating that either of the associates in a pair were equally likely to be designated as the TBR word) were provided with a mixed list of 12 study cues and 12 TBR words randomly ordered on a recall sheet. Instructions were to write down the item from the list next to its corresponding associate, or at the bottom of the sheet.

An outline of the basic methodology used in the experiment is provided in Table 2.

Following the distractor task for the second study list, 2 groups of subjects from each of the 2 instructions conditions were tested for prompted recall of the TBR words, and study cues respectively. These 4 groups of subjects comprised the Immediate Testing condition. Prompted-recall testing of the critical list involved presentation of the entire set of 24 items (either study cues or TBR words) for all groups, and was conducted in the same manner as the prompted-recall test for the first list. Three minutes were given for the recall of the list.

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TABLE 2

Basic Methodology:

Schematized Sequence of Procedures

Step	Group	Procedure	Time	Example*
1a	1 - 8	List 1 presented	72 sec	hope - HIGH
1b	1 - 8	Counting task	30 sec	957.nine-fifty-four...
1c	1 - 4	Cued recall of List 1	3 min	hope - <u>high</u>
1c	5 - 8	Prompted recall of List 1	3 min	hope - <u>high</u> SHORT - <u>stem</u>
2a	1 - 8	List 2 presented	72 sec	glue - CHAIR
2b	1 - 8	Counting task	30 sec	562.five-fifty-nine...
2c	1 & 5	Prompted recall for TBR words	3 min	glue - <u>chair</u>
2c	2 & 6	Prompted recall for study cues	3 min	CHAIR - <u>glue</u>
3a	3 & 4 7 & 8	Free-association stimuli presented	8 min	table ____ ____ ____ ____
3b	3 & 4 7 & 8	Free-association responses made		table <u>chair</u> <u>top</u> <u>desk</u> <u>room</u>
4	3 & 7	Prompted recall for TBR words	3 min	glue - <u>chair</u>
4	4 & 8	Prompted recall for study cues	3 min	CHAIR - <u>glue</u>

* Underlined items refer to responses made by subjects. Lowercase example items denote study cues and capitalized example items denote TBR words.

The remaining 4 groups of subjects (those making up the Delayed Testing condition) were presented a sheet containing the 24 strong cues for the second list (following list presentation), and asked to produce 4 free-association responses to each randomly ordered strong cue on the list. Eight minutes were allowed for this task.

Following the free-association task, one group of subjects from each of the 2 instructions conditions was tested for prompted recall of the TBR words. The final 2 groups of subjects were tested for prompted recall of the study cues. Prompted-recall procedures were the same as those for the respective groups under the Immediate Testing condition.

RESULTS

The data of major importance are the number of words correctly recalled by subjects when provided with recall prompts. Each recall prompt was always one of the list words, and the word requested was always the word presented with it during list presentation. Incidentally, none of the subjects used the option given with the prompted-recall instructions to place responses at the bottom of the recall sheet. Therefore, this option did not figure into the scoring of any measure.

The critical list was always the second list presented to each subject, with the first list being a practice list. There were two forms of the study list, with the function of each form alternating for different halves of the subjects. That is, half of the subjects received Form A as the practice list and Form B as the critical list, with the order of the forms reversed for the other half of the subjects.

Since there were no significant differences in performance for the two forms of the study list ($F < 1$), all analyses reported are collapsed across the two forms of the study list. In all analyses, the acceptable level of significance was set at .05.

Table 3 summarizes the data for subjects' prompted-recall performance on the critical list.

Prompted Recall (Critical List)

The prompted-recall scores for the critical list were analyzed by means of a 2x2x2 analysis of variance (see Table 4).

TABLE 3

Summary of Basic Data:

Prompted-recall Performance (Critical List)

Mean Number of Words Recalled

Time of Test	Type of Cue	Instructions	
		Standard	Different
Immediate	Study cue	14.75	17.44
	TBR word	11.25	14.62
Delayed	Study cue	12.31	13.63
	TBR word	6.50	6.12

TABLE 4

Analysis of Variance

for Prompted-recall Performance (Critical List)

Source	Degrees of Freedom	Mean Square	F
Instructions (I)	1	98.00	5.193 *
Time of Test (Test)	1	760.50	40.299 *
Cue Type (Cue)	1	770.28	40.817 *
I x Test	1	52.53	2.784
I x Cue	1	2.00	0.106
Test x Cue	1	98.00	5.193 *
I x Test x Cue	1	11.28	0.598
Ss/Groups	120	18.87	

* $p < .05$

The analysis demonstrated that Different Instructions (those aimed at producing associative symmetry) produced higher prompted-recall performance (mean of 12.95 words recalled) than did the Standard Instructions (mean of 11.20 words recalled), $F(1,120) = 5.193$, $MS_e = 18.87$. The data also show that prompted-recall scores for subjects presented with the experimenter-designated study cues as prompts (mean of 14.53 words recalled) were higher than the prompted-recall scores for subjects presented with the experimenter-designated TBR words as prompts (mean of 9.63 words recalled), $F(1,120) = 40.817$, $MS_e = 18.87$. Subjects who were tested immediately (30 second delay) following presentation of the study list (mean of 14.52 words recalled) showed superior prompted-recall performance compared with subjects who were tested following the free-association task (mean of 9.64 words recalled), $F(1,120) = 40.299$, $MS_e = 18.87$.

Instructions did not interact with Cue Type or Time of Test or the combination of these two variables. There was, however, an interaction between Cue Type and Time of Test, $F(1,120) = 5.193$, $MS_e = 18.87$. Those data were subjected to a Newman-Keuls test which is presented in Table 5 and the data are presented graphically in Figure 1. As can be seen in Figure 1, both the study-cue prompt and the TBR-word prompt conditions show forgetting over the interpolated free-association task and that forgetting is reliable. However, the forgetting is more marked in the TBR-word prompt condition than the study-cue prompt condi-

TABLE 5

Newman-Keuls Test*

for the Test x Cue Interaction

Mean Number of Words Recalled			
Test after free-association task		Test after list study	
TBR-word prompt	Study-cue prompt	TBR-word prompt	Study-cue prompt
6.31	12.97	12.94	16.09

* Means underlined by the same line are not reliably different. All other possible comparisons are significant at the .05 level.

Figure Caption

Figure 1. Mean number of words recalled for the Time of Test x Cue Type interaction (critical list). Note that the design is collapsed across Instructions.

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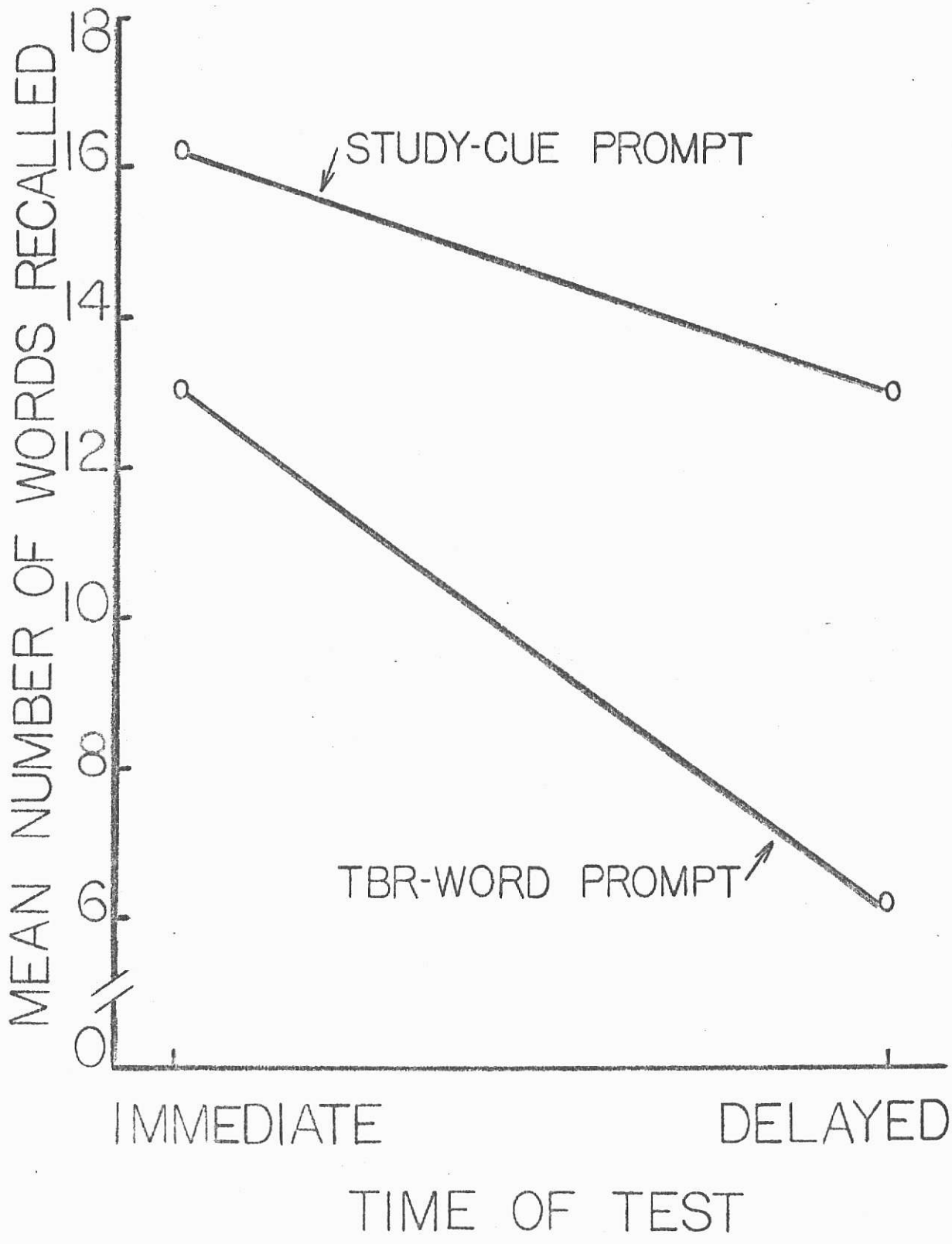
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STUDY-CUE PROMPT
TBR-WORD PROMPT
IMMEDIATE
DELAYED
TIME OF TEST

tion, which produces the interaction. Also of importance is the comparison which shows that for the Immediate Testing condition, prompted-recall scores for subjects receiving the study-cue prompts (mean of 16.09 words recalled) were higher than prompted-recall scores for subjects receiving the TBR-word prompts (mean of 12.94 words recalled).

Intrusion Errors (Critical List)

Any response given by a subject to a prompt which was incorrect was counted as an intrusion error. A post hoc analysis of variance was performed on the intrusion errors made by subjects on the prompted-recall test for the critical list. The appropriateness of this analysis is dependent upon the assumption that a functional relationship likely exists between subjects' prompted-recall performance and the number of intrusion errors they commit.

Since Instructions did not interact with the other factors, the intrusion-error analysis was performed on a collapsed 2x2 design. The data for the intrusion errors is presented in Table 6, and the analysis of variance performed on these data is summarized in Table 7.

The data show that subjects tested following the free-association task (mean of 3.95 intrusion errors) made more intrusion errors than subjects tested immediately following the critical study list (mean of 1.42 intrusion errors), $F(1,124) = 21.89$, $MS_e = 9.37$.

TABLE 6

Summary of Data for

Intrusion Errors (Critical List)

Cue Type / Time of Test	Mean Number of Intrusion Errors		
	Immediate Testing	Delayed Testing	Mean
Study-cue prompt	1.53	3.03	2.28
TBR-word prompt	1.31	4.88	3.09
Mean	1.42	3.95	

TABLE 7

Analysis of Variance

for Intrusion Errors (Critical List)

Source	Degrees of Freedom	Mean Square	F
Test	1	205.03	21.89 *
Cue	1	21.13	2.26
Test x Cue	1	34.03	3.63
Ss/Groups	124	9.37	

* $p < .05$

The Time of Test by Cue Type interaction only approached statistical significance, $F(1,124) = 3.63$, $.07 < p < .05$, $MS_e = 9.37$. However, a Newman-Keuls test (see Table 8) showed that for the Delayed Testing condition, subjects receiving the TBR-word prompts (mean of 4.88 intrusion errors) made more intrusion than subjects receiving the study-cue prompts (mean of 3.03 intrusion errors). Under the Immediate Testing condition, intrusion errors were not significantly different between subjects receiving study-cue prompts and subjects receiving TBR-word prompts.

Prompted Recall (Practice List)

Subjects in the Different Instructions condition were tested on their practice list with a mixed list of 12 experimenter-designated study cues and 12 experimenter-designated TBR words as prompts. Therefore, Cue Type was a within-subject variable on the practice list for this half of the subjects.

Even though this was the first list presented to these subjects and Cue Type was a within-subject variable, it is reasonable to assume that an evaluation of possible associative asymmetry is appropriate for this half of the subjects on the practice list. The prediction of associative asymmetry for the between-subjects analysis for the critical list should also be appropriate for the within-subject analysis of the prompted-recall performance for subjects receiving the mixed group of prompts for the practice list. An evaluation of associative

TABLE 8

Newman-Keuls Test*

for Intrusion Errors (Critical List)

Mean Number of Intrusion Errors			
Test after list study		Test after free-association task	
TBR-word prompt	Study-cue prompt	Study-cue prompt	TBR-word prompt
1.31	1.53	3.03	4.88

* Means underlined by the same line are not reliably different. All other possible comparisons are significant at the .05 level.

asymmetry for the Standard Instructions condition on the practice list is not appropriate since these subjects received only study-cue prompts on the practice list.

An analysis of variance of the prompted-recall performance by subjects in the Different Instructions condition is summarized in Table 9.

The data show that more words are recalled in connection with the experimenter-designated study cues as prompts (mean of 8.59 words recalled) relative to the use of the experimenter-designated TBR words as prompts (mean of 7.88 words recalled), $F(1,63) = 8.77$, $MS_e = 1.80$.

TABLE 9

Analysis of Variance: Prompted-recall Performance with Different Instructions (Practice List)

Source	Degrees of Freedom	Mean Square	F
Cue	1	15.82	8.77 *
Subjects	63	9.75	
Cue x Subjects	63	1.80	

* $p < .05$

DISCUSSION

The results of this experiment provide empirical support for the hypothesis that the phenomenon of recognition failure of recallable words is partly a product of associative asymmetry created by the paradigm developed by Tulving and his associates (e.g., Tulving and Thomson, 1973; Watkins and Tulving, 1975).

These data show that associative asymmetry is present immediately following study of the critical list of paired-associate words (preceded by one practice list). In addition, prompted-recall performance for subjects receiving a mixed group of prompts for their practice list also demonstrated the same type of associative asymmetry. That is, forward associations were stronger than backward associations (inferred from prompted-recall performance).

It was found that the associative asymmetry existing after list study increased significantly following the free-association task. This increase in the associative asymmetry following the free-association task is assumed to be due to the differential amounts of retroactive inhibition created by the subjects' generation of responses to the high extralist associates of the TBR words. An alternative explanation is that this increased associative asymmetry could be due to differential decay of the two types of associations over the course of the time period used. This explanation does not appear tenable for a number of of reasons. First, there is little or no research evidence to

support the notion of a significant amount of long-term-memory forgetting due to passive decay over such a short period of time. Second, such an explanation could not handle the finding by Watkins and Tulving (1975) that recognition failure of recallable words is largely eliminated when the free-association task of Tulving's paradigm is substituted by a noninterfering picture-drawing task.

Analysis of the intrusion errors is also consistent with the interrelated notions of differential retroactive inhibition and associative asymmetry produced by the free-association task. For the Delayed Testing condition, subjects receiving the TBR-word prompts made more intrusion errors than subjects receiving the study-cue prompts. This result indicates differential problems of accessing the original episodic memory events (those encoded during list presentation) from the two types of prompts. The greater number of intrusion errors with the TBR-word prompts and the increase in associative asymmetry are both likely due to the differential effects of retroactive interference caused by the nature of the free-association task. The difference in intrusion errors is not likely due to a simple response bias between the two types of prompts since intrusion errors for the two types of prompts were not significantly different for the Immediate Testing condition.

Different encoding instructions in conjunction with a mixed group of prompts for the practice list were employed in an at-

tempt to reduce or eliminate associative asymmetry following study of the input list. Previous research has indicated the difficulty of producing associative symmetry in paired-associate learning tasks (e.g., Giurintano, 1972). Thus, it was not a complete surprise that my instructions failed to produce a reduction in associative asymmetry. However, there was an increase in prompted-recall performance for the instructions designed to eliminate associative asymmetry. This finding was totally unexpected. It is not immediately obvious why the new instructions generated better recall than the standard instructions. One possible explanation is that the new instructions caused subjects to integrate the word-pairs more thoroughly into functional memory units. If this were the case, then either associate as a prompt would be more likely to automatically elicit the corresponding associate as a response.

There is still a need to find encoding instructions that will consistently eliminate the associative asymmetry formed in paired-associate learning tasks. One possible technique that should be explored is the utilization of an incidental learning task. For example, subjects could be shown pairs of weakly associated word-pairs and asked to rate the pairs on their ability to form an integrated image with the words. Another possible line of research could involve the use of word-pairs that are totally unrelated, in the hope of producing symmetrical associations between the words in a pair.

To summarize, the explanation proposed by this study for the phenomenon of recognition failure of recallable words is that reinstatement of the originally encoded episodic memory events differs dramatically in the presence of the two types of associates (study cues and TBR words). The findings of significant associative asymmetry following the study phase and increasing after the free-association task of the recognition failure paradigm lend considerable support toward this explanation. What appears to be necessary at this point is a reliable technique for eliminating associative asymmetry from the study phase of typical paired-associate learning tasks such as that in the recognition failure paradigm. Such a technique along with a non-interfering substitute task for the free-association procedure would allow a direct assessment of the magnitude of the effect of associative asymmetry on the phenomenon of recognition failure of recallable words.

LIST OF FOOTNOTES

FOOTNOTE PAGE

APPENDIX I

Standard Instructions*

Please do not turn the pages of your test booklet until you are signaled to do so by the researcher.

You will be presented pairs of words by means of a slide projector, with 3 seconds between each pair. Your task will be to remember the capitalized word in each pair, but you should pay attention to the relation between the two words as it may help you remember the capitalized word.

Following presentation of the last pair of items in the list, you will see a slide with a 3-digit number on it. As soon as you see it, you are to begin counting backwards by threes from this number outloud, but quietly to avoid disturbing other participants in the study. For example, if you were presented the number 835, you would immediately begin counting: "eight-thirty-two, eight-twenty-nine, eight-twenty-six, etc." You are to count as quickly as possible to keep occupied during this 30-second period. At the end of this period, the researcher will signal you to turn to the first page of your test booklet.

Further instructions will be provided at the top of each page of your test booklet. Are there any questions?

* Note: Instructions for the Different Instructions condition were generated by using the above instructions, but replacing the underlined portion with the following: "... one of the items in the pair, but no designation will be provided at the time of presentation of the items. However, you should pay attention to the relation between the two words as it may later help you remember the critical words from the pairs of items."

APPENDIX II

Cued-recall Task for Form A*

Please write down the capitalized word which was paired with each of the words below from the list of paired words you have just seen presented on slides. Place your responses in the blanks beside each corresponding word below, or at the bottom of the page if necessary.

command	_____	fruit	_____
swift	_____	glue	_____
pretty	_____	blade	_____
head	_____	home	_____
drink	_____	sun	_____
wish	_____	noise	_____
cheese	_____	plant	_____
grasp	_____	stomach	_____
bath	_____	cave	_____
cloth	_____	lady	_____
ground	_____	butter	_____
whistle	_____	beat	_____

* Note: The recall task for Form B was generated simply by replacing the study cues from Form A with those from Form B (see Table 1). These tasks were used both for the practice list and the critical list (see Table 2 for any needed clarification).

APPENDIX III

Prompted-recall Task Using TBR-word Prompts (Form A)*

Please write down the word which was paired with each of the capitalized words below from the list of paired words you have just seen presented on slides. Place your responses in the blanks beside each corresponding capitalized word below, or at the bottom of the page if necessary.

MAN	_____	FLOWER	_____
GO	_____	CHAIR	_____
BLUE	_____	CUT	_____
LIGHT	_____	SWEET	_____
SMOKE	_____	DAY	_____
WASH	_____	WIND	_____
GREEN	_____	BUG	_____
BABY	_____	LARGE	_____
NEED	_____	WET	_____
SHEEP	_____	QUEEN	_____
COLD	_____	SMOOTH	_____
BALL	_____	PAIN	_____

* Note: The recall task for Form B was generated simply by replacing the TBR words from Form A with those from Form B (see Table 1). These tasks were used only for the critical list (see Table 2 for any needed clarification).

APPENDIX IV

Prompted-recall Task with Mixed Prompts (Form A)*

Please write down the word which was paired with each of the words below from the list of paired words you have just seen presented on slides. Place your responses in the blanks beside each corresponding word below, or at the bottom of the page if necessary.

command	_____	FLOWER	_____
GO	_____	glue	_____
pretty	_____	CUT	_____
LIGHT	_____	home	_____
drink	_____	DAY	_____
WASH	_____	noise	_____
cheese	_____	BUG	_____
BABY	_____	stomach	_____
bath	_____	WET	_____
SHEEP	_____	lady	_____
ground	_____	SMOOTH	_____
BALL	_____	beat	_____

* Note: The recall task for Form B was generated simply by relacing corresponding words from Form A with those from Form B (see Table 1). These task were used only for the practice list under the Different Instructions condition (see Table 2 for any needed clarification).

APPENDIX V

Free-association Task for Form A*

For each of the 24 words in the list below, please generate 4 additional words which you relate to or associate with it. Four blank spaces are provided adjacent to each of the 24 words for your responses. Do not chain your responses to each other; give words that you associate individually with the word provided.

hot	_____	_____	_____	_____
dark	_____	_____	_____	_____
want	_____	_____	_____	_____
grass	_____	_____	_____	_____
small	_____	_____	_____	_____
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
soap	_____	_____	_____	_____

* Note: The free-association task for Form B was generated by replacing the strong extralist cues from Form A with those from Form B (see Table 1). These tasks were used only between study of the critical list and the recall task for the critical list (see Table 2 for any needed clarification).

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ENCODING SPECIFICITY:
EVALUATION OF ASSOCIATIVE ASYMMETRY

by

CARL ARTHUR BARTLING

B. S., Northeast Missouri State University, 1974

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

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KANSAS STATE UNIVERSITY
Manhattan, Kansas

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ABSTRACT

Recent research demonstrating the phenomenon of recognition failure of recallable words has been cited by Tulving and his associates as strong support for the encoding specificity principle: "... the memory trace of an event and hence the properties of effective retrieval cue are determined by the specific encoding operations performed by the system on the input stimuli (Tulving and Thomson, 1973, p. 352)." The purpose of my experiment was to determine if the recognition failure paradigm produces, and the phenomenon of recognition failure of recallable words can be understood in terms of, associative asymmetry (stronger forward associations) from: (a) the set-inducing effects upon encoding produced by the study phase of the recognition failure paradigm, and (b) the differential effects of retroactive inhibition produced by the free-association task. Results showed a significant magnitude of associative asymmetry present after the study phase, and a significant increase in the associative asymmetry following the free-association task. The results of the experiment are consistent with the encoding specificity principle and with the notion that effective retrieval is dependent upon the successful reinstatement of the episodic memory events encoded at time of input.