INFORMATION TO USERS

This dissertation was produced from a microfilm copy of the original document. While the most advanced technological means to photograph and reproduce this document have been used, the quality is heavily dependent upon the quality of the original submitted.

The following explanation of techniques is provided to help you understand markings or patterns which may appear on this reproduction.

1. The sign or "target" for pages apparently lacking from the document photographed is "Missing Page(s)". If it was possible to obtain the missing page(s) or section, they are spliced into the film along with adjacent pages. This may have necessitated cutting thru an image and duplicating adjacent pages to insure you complete continuity.

2. When an image on the film is obliterated with a large round black mark, it is an indication that the photographer suspected that the copy may have moved during exposure and thus cause a blurred image. You will find a good image of the page in the adjacent frame.

3. When a map, drawing or chart, etc., was part of the material being photographed the photographer followed a definite method in "sectioning" the material. It is customary to begin photoing at the upper left hand corner of a large sheet and to continue photoing from left to right in equal sections with a small overlap. If necessary, sectioning is continued again — beginning below the first row and continuing on until complete.

4. The majority of users indicate that the textual content is of greatest value, however, a somewhat higher quality reproduction could be made from "photographs" if essential to the understanding of the dissertation. Silver prints of "photographs" may be ordered at additional charge by writing the Order Department, giving the catalog number, title, author and specific pages you wish reproduced.

University Microfilms

300 North Zeeb Road
Ann Arbor, Michigan 48106

A Xerox Education Company

THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

FALSE RECOGNITION IN RETARDED AND NORMAL SUBJECTS

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

DOCTOR OF PHILOSOPHY

BY

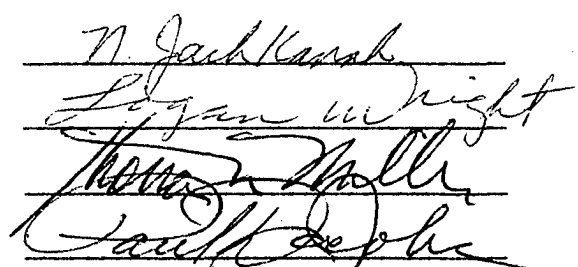
JULIA D. LEVY

Norman, Oklahoma

1972

FALSE RECOGNITION IN RETARDED AND NORMAL SUBJECTS

APPROVED BY



DISSERTATION COMMITTEE

ACKNOWLEDGMENTS

The author wishes to express her appreciation to Dr. N. Jack Kanak, Committee Chairman, whose suggestions and criticisms were invaluable in the completion of this dissertation. Appreciation is also extended to the other committee members, Drs. Logan Wright, Paul Jacobs, and Thomas Miller for their assistance.

A special thanks goes to Mrs. Madelane Dennis, Dr. Babe Eubanks, and Mr. Austin, administrators for the Midwest City-Del City Public Schools, and to the principals and teachers of the various schools for their aid and cooperation in providing subjects.

The author is also grateful to Mr. James Duffy and Dr. Leslie Levy for their valuable assistance with the statistical analyses.

Special thanks to my husband, Les, for his encouragement during the preparation of this dissertation.

TABLE OF CONTENTS

FALSE RECOGNITION IN RETARDED AND NORMAL SUBJECTS

INTRODUCTION

The terms mental retardation or mental deficiency imply a deviation from normal learning ability. Several investigators (Penny, Seim, & Peters, 1968; Milgram, 1968; Luria, 1957) have suggested that one source of difference in learning between normal and retarded individuals is that the retardates show a lessened ability to use mediation. Mediation is often defined as a covert or implicit verbal response. For example Adams (1967) in discussing paired associate learning refers to mediation as the imposing of implicit verbal response chains between the stimulus and response. He goes on to state that this link may be a one word association or a more elaborate language sequence like a sentence. The present study was designed to investigate differences in implicit mediational responses of normal and retarded children.

Bousfield, Whitmarsh, and Danick (1958) distinguished between two types of implicit or covert responses made in the perception of a verbal stimulus. They defined the representational response (RR) as the response which was made to the stimulus item in the act of perceiving it and which represented that item. The second type of implicit response was referred to as the implicit associative response (IAR) and was assumed to be produced by the properties of the RR. The IAR might be another word which

had been associated with the stimulus in the past, e.g., the stimulus "dog" might arouse the IAR "cat".

Underwood (1965) hypothesized that if a word which was the assumed IAR to a word presented to a subject (S), later actually occurred in the list, S might falsely recognize that word as having occurred before due to confusion between the RR and the IAR. Underwood presented college students with a continuous recognition list and asked them to indicate whether each item had been heard earlier in the list. Embedded in his list were critical stimulus words (CS words) which were assumed to elicit specific IARs as determined by word association norms. The assumed IARs occurred later in the list as experimental words (E words). There were five types of CS words. For A_1 and A_3 words the assumed IAR was an antonym, the CS word being presented once for A_1 words and three times for A_3 words prior to the presentation of the E word. The remaining classes of CS words were converging associations (CV), e.g. bread as an E word to butter and crumb; superordinates (SO), e.g. tree as an E word to palm and elm; and sense impressions (SI), e.g. round as an E word to doughnut. Underwood found that for classes A_3, CV, and SO the number of false recognitions to E words was greater than to control words (C words) which had not been preceded by words for which they were IARs.

Wallace (1967) suggested that retardates had a weaker or less frequent occurrence of IARs than normal subjects and should thus show less difference in number of false recognitions between E and C words. He presented 100 words from Underwood's list aurally to 76 institutionalized retardates and 31 college students. The Ss were asked to circle yes or no on a sheet of paper depending on whether the word had or had not been read before. This task proved too difficult for many of the retarded subjects and 36 were discarded with analyses based on the remaining 40. Results indicated

that retarded as well as normal subjects had significantly more false recognitions to E than C words. Wallace also reported a significant interaction between class of S and type of word with the absolute difference in mean number of false positives to E and C words appearing considerably smaller for the retarded Ss than for the college Ss for all classes of E words but the SO category.

Since the normals in the Wallace study differed from the retardates on IQ, mental age (MA), chronological age (CA), institutionalization, and number in the group in which they were run, it was not possible to determine which of these factors was important for the difference between the groups in amount of false recognition. The present study replicated the Wallace study while controlling CA, MA, institutionalization and number of S tested together in order to determine if the difference in performance between the two groups would still exist. Denny (1964) suggested that studies reporting mentally retarded Ss inferior to normal Ss on discrimination tasks might be partially explained by an attention deficit for retardates when not in a face-to-face with the experimenter (E) situation. Since Ss in Wallace's (1967) study were run in groups such an attention deficit might have contributed to his results. Therefore, subjects in the present study were tested individually.

Some specific predictions were made on the basis of theory about mental retardation and previous mediational studies with retardates. Since several writers (Kessler, 1966; Papania, 1954; Korstvedt, Stacy, & Reynolds, 1954) had suggested that the retardate was more concrete than the normal individual it was hypothesized that retarded Ss would give more false recognition responses than normals to words representing sense impressions

such as "red" when they were preceded in the list by a word with which they were usually associated such as "rose".

The clustering of conceptually related items in recall when the items have been presented in a random order is assumed to indicate the occurrence of some type of mediational process. Stedman (1963) compared matched MA normal and retarded Ss on a stimulus list containing words from various semantic categories and found that the two groups tended to cluster different types of words in free recall. For the normal Ss action of (e.g., dog barks), synonyms, and superordinates were the high clustering categories. The retardates clustered more on coordinates and contrast (opposites) which were the lowest clustering classes for the normals. Based on Stedman's results it was predicted that the retarded group would show a greater number of false recognitions to A_1 and A_3 words than to CV words. It was also hypothesized that retarded Ss might give more false positives than normals to CS words from the SO category since these words are coordinates.

Method

Subjects. Subjects consisted of three groups of 30 children each drawn from the Midwest City-Del City Oklahoma School System. The first group (Group R) was composed of retarded children from special education classes. Subjects in this group had IQ's ranging from 58 to 75 with a mean of 68.27 and a standard deviation (SD) of 8.0 and mental ages ranging from 8 years 0 months to 10 years 5 months (mean MA = 8 years 9.4 months, S.D. 7.98 months). Chronological ages ranged from 10 years 11 months to 15 years 6 months (mean C = 159.2 months, S.D. = 15.4 months). Two Ss from Group R were discarded because of perservation of one response and

Table 1

Critical Stimulus, Experimental, and Control Words

Class	CS words	E words	Position	C words
A_1	Bottom	Top	57	Down
	Give	Take	67	Good
	Day	Night	85	Low
	Man	Woman	96	Rich
A_3	Rough	Smooth	77	Weak
	False	True	80	Dirty
	Hard	Soft	89	Short
	Slow	Fast	97	Girl
CV	Butter, Crumb	Bread	64	Bridge
	Sugar, Bitter, Candy	Sweet	74	Salt
	Warm,Chill,Freeze,Frigid,Hot,Ice	Cold	76	Cloud
	Dark, Heavy, Lamp, Match	Light	88	Leg
SO	Peach, Grape, Apple, Pear	Fruit	79	Cloth
	Robin, Sparrow, Bluejay, Canary	Bird	95	Flower
SI	Bandage, Chalk, Milk, Rice, Snow	White	92	Red

were replaced. The other two groups of subjects were children from regular classes with IQs above 90. Subjects in Group MA were matched to the retardates on the basis of mental age (Mean MA = 8 years 9.4 months, S.D. = 8 months) and those in Group CA were matched on the basis of chronological age (mean CA = 159.2 months, S.D. = 15.2 months). Differences were not more than 3 months and in most cases were less. In those instances where information on the occupation of the head of the household was available an attempt was made to match Ss on occupational level as given in Hollingshead's scale (Hollingshead, 1957). When occupational information was not available, Ss in various groups were drawn from the same school or a school in a district with families of a similar socioeconomic level.

Word List. The 100 word recognition list consisted of four types of words; 36 critical stimulus (CS) words assumed to elicit specific IARs, 15 experimental (E) words of the assumed IARs to the CS words, 15 control (C) words or words similar in kind to the E words but not preceded in the list by words for which they were IARs, and 21 filler (F) words presumed to be neutral with respect to all other words. The CS, E, and C words were those used by Wallace (1967) and appear in Table 1. There were five classes of CS words. Both classes A_1 and A_3 consisted of words for which the assumed IARs (E words) were antonyms of the CS word. The CS words for A_1 items were presented only once prior to the corresponding E word while the A_3 CS words occurred three times before presentation of their E words. Converging assiciations (CV) was the third class of CS words. The superordinate (SO) class was made up of specific instances of a category as CS words followed later by the category label as the E word. The final

type was sense impressions (SI) with the E word being a sense impression such as "white" which, according to normative data, was elicited frequently as an associate to a CS word such as "snow". The C words occurred two positions away from the corresponding E word and occurred before the E word half of the time and after the E word half the time. According to the Thorndike-Lorge General Count (1944) 13 of the CS words had a frequency of occurrence of over 100 times per million words, 8 occurred more than 50 times per million, and the remaining 15 occurred at a rate of less than 50 times per million. Thirteen of the E words had a frequency of over 100 per million words and two had a frequency count of over 50 times per million. The frequency for 12 of the C words was over 100 per million, two occurred more than 50 times per million words, and only one had a frequency count of less than 50. The 21 filler words were taken from the Palermo and Jenkins (1966) norms and were not associates to any of the other words. All but five of these words had a frequency of over 100 times per million words according to the Thorndike-Lorge general count (1944).

Procedure. The Ss were run individually. Each S was told that a list of words would be read to him and that he was to tell the experimenter whether or not each word had occurred previously by saying "yes" if he had heard the word read in the list before and "no" if he believed that the word had not been read before. The word list was read at a rate of one word every 10 seconds and was presented by a tape recorder. The number of each word was given before the word, and then the word was read twice in succession. A practice trial of 10 words unassociated to words in the recognition list was given. If the S said "yes" to the first one or two words on the practice list, suggesting that he did not fully

comprehend the instructions, the tape was stopped and S was told to say "yes" only if a word was read again as another number. This was necessary with some Ss from all groups. The recognition list was given following the completion of the practice trial. The response to each word was recorded by the experimenter. After the recognition task S was asked to respond to each CS word with the first word he thought of as a post hoc check on the assumed IARs. Word recognition sheets were scored for number of false recognitions to each of the five types of E words and their corresponding C words, for number of false recognitions to coordinates (CO) as indicated by positive responses to any of the "fruit" or "bird" words after the first had been presented, and for accurate identification of actual repetitions.

Results and Discussion

A one way analysis of variance (ANOVA) on the number of accurate recognitions of actual repetitions (R) revealed a significant group effect ($F = 11.55$, df = 2/87, $p < .001$). The possible perfect score was 13, and Group CA showed the most accurate identification of repeated words with a mean score of 11.57 followed by Group MA with a mean of 10.30 and Group R with a mean of 8.73. A series of t-tests indicated that the means of all groups differed significantly from one another at the .025 level. These results are in accord with Wallace's (1967) findings that normals gave a more accurate performance than retardates. The difference between the two normal groups can probably be explained by the fact that the older group (Group CA) had more experience with learning tasks and tests. Another possible contributing factor to this difference may be that older subjects were more motivated to perform well on this type of task.

Table 2

Means for Transformed Scores for the Various Classes of Experimental Words and the Corresponding Control Words

	A_1	C	A_3	$\underline{C}$	CV	$\bar{C}$
Group R	1.2583	1.3137	1.2983	1.2453	1.3767	1.1950
Group MA	1.0457	1.0110	1.1423	1.0697	1.2293	1.0697
Group CA	1.1573	1.1957	1.2413	1.1013	1.4267	1.1013
	SO	C1	SI	1C	Tot E	Tot C
Group R	1.1523	.9607	.8273	.9127	5.9137	5.6363
Group MA	1.0290	.8907	.7250	.8103	5.1720	4.8510
Group CA	1.0020	.9830	.7080	.7933	5.5350	5.1740
	C0					
Group R	1.470					
Group MA	1.215					
Group CA	1.030					

A_1 = antonyms presented once prior to the E word

A_3 = antonyms presented 3 times prior to the E word

CV = converging associates, e.g. "butter" and "crumb" prior to "bread"

SO = superordinates such as "fruit" following "apple", "pear", etc.

SI = sense impressions, e.g., "white" following "snow", "milk", etc.

A_1, C, A_3, $\underline{C}$, CV, and $\bar{C}$ each based on 4 words

SO and C1 each based on two words

SI and 1C each based on 1 word

C0 based on 6 words

When number of false recognitions to the various types of E words and their corresponding C words were tabulated there were many zero scores and the means and standard deviations (SD) appeared to be correlated. Therefore, as in the Wallace (1967) study,the data was transformed by adding .5 to each score and then taking its square root. The means for all transformed scores appear in Table 2. A 3 x 2 repeated measures ANOVA for groups and type of word (E vs. C words, the repeated factor) resulted in a significant effect for type of word ($F = 12.77$, df = 1/87, $p < .01$) with all groups giving more false recognitions to E than to C words. This significant effect is consistent with Wallace's (1967) results and lends support to the idea that IAR's did occur for retardates as well as for normals and were confused with RRs.

The main effect for groups and the interaction between groups and type of word did not reach significance at the .05 level although the groups effect did approach significance ($F = 2.38$, df = 2/87, $p < .10$) with Group R giving the highest mean number of false recognitions to both E and C words followed by Group CA and then Group MA. These results are discrepant with those of Wallace who found a significant interaction between class of S and type of word using both original and transformed data. Wallace reported that the nature of the groups x type of word interaction was that the absolute difference between means of false recognitions to E and C words was considerably smaller for the retarded group than for the college group. In the present study the differences in mean false positives to E and C words increased successively from Group R to Group MA to Group CA. These differences between means thus follow the same pattern as those in the Wallace study although they are much smaller. While in the present study retarded Ss responded with a greater number of false recognitions than did

normals to both E and C words, in the Wallace experiment the retarded Ss gave more positive responses to C words than did the normals, and the normals gave the more positive responses to E words than retardates did.

Wallace's retarded and normal groups differed on a combination of factors including MA, CA, IQ, institutionalization, and number in group during testing. The normal groups in the present study were matched with the retarded group for MA or CA, all subjects were noninstitutionalized, and all subjects were tested individually. The discordant results between the two studies might be explained by the fact that there were more factors differentiating groups in the Wallace study. It is thus conceivable that it was the combination of factors working together which accounted for his significant interaction.

In addition to looking at the differences between means for E and C words a one way ANOVA was performed on the absolute differences in number of false alarms to E and C words for each subject. This analysis indicated that there were no significant differences between groups for this measure. However, while only 6 Ss in each of the normal groups gave more false recognitions to C than to E words, there were 11 Ss in the retarded group who did so. These figures suggest that proportionally there were more retardates than normals who failed to produce the assumed IARs.

Three classes of E words, classes A_1, A_3, and CV, had 4 E words and 4 corresponding C words. A 3 x 6 repeated measures (class of word was the repeated factor) ANOVA on the transformed scores for these measures and their controls showed no significant group effect, but there were significant effects for class of word ($F = 27.98$, df = 5/435, $p < .001$) and the interaction of groups x class of word ($F = 3.24$, df = 10/435, $p < .01$). A series of Tukey's tests indicated that for all Ss combined there was no

significant difference in false recognition responses to A_1 words and their corresponding C words, but there were significantly greater numbers of false recognitions to A_3 words than to the appropriate C words (q = 5.75, df = 6/435, $p < .05$) and to CV words than to their controls (q = 7.59, df = 6/435, $p < .01$). The finding of signiticant E word-C word differences for classes A_3 and CV but not for class A_1 is consistent with the results of both Underwood (1965) and Wallace (1967) and lends support to the assumption that frequency of IAR arousal is an important factor in the production of false recognitions. The IARs for all classes except A_1 were assumed to be elicited with a frequency greater than one.

A finding which appears peculiar to the present study was that there were significantly more false alarms to CV words than to A_3 words (q = 7.59, df = 6/435, $p < .01$). This difference is accounted for by the fact that when means for classes of E words and the corresponding C words were examined by Group A_3 differed significantly from its controls for only Group CA (q = 5.18, df = 6/145, $p < .05$) while CV differed significantly from its C words for all three groups (Group R q = 6.70, $p < .05$; Group MA q = 5.93, $p < .05$; Group CA q = 12.22, $p < .05$; df = 6/145). False recognitions to A_3 words thus appears to be an increasing function of mental age since the greatest number of positive responses was given by the normal CA group who had higher MAs than the other two groups.

It had been hypothesized that retarded Ss would produce more false recognitions to A_1 and A_3 words than to CV words. Not only were the differences between these means nonsignificant as indicated by Tukeys tests, but they varied in a direction opposite to that predicted with the mean for CV being largest. The prediction that retardates would show a greater tendency to respond falsely to A_1 and A_3 words was made on the basis of Stedman's (1963) results which indicated that in free recall retardates

tended to group opposites and coordinates more than any other classes of words. The present task was a recognition task instead of a free recall task and Jung (1968) has stated that different processes are operating in the two types of tasks. A free recall task requires S to reproduce the stimulus material without external cues while a recognition task does not, but in recognition S must be able to discriminate between correct items and distractors. Also Stedman's (1963) results involved the grouping of words which were all actually presented, and the measurement taken in the present study was of false recognitions to words not actually presented but assumed to occur as IARs to presented words.

A 3 x 2 repeated measures (type of word was the repeated factor) ANOVA for class SO and the corresponding C words resulted in a significant effect for type of word with more false recognitions to E than to C words ($F = 9.68$, $df = 1/87$, $p < .01$) but no significant effect for groups or the group x type of word interaction. Underwood (1965) found that college students gave more false positives to superordinates than to controls, but Wallace (1967) failed to replicate his results. The present results indicate that retardates as well as normals produced superordinates as IARs.

It had been predicted that retarded Ss would give more false recognitions to the SI word than would normals. Seven of the retardates did falsely recognize "white" while only one S in Group MA and none in Group CA did so. However, Ss in all groups gave more positive responses to the C word than to the SI word. The post hoc word association test revealed that in many cases "white" was not among the three most frequent responses to the CS words. Thus it may not have been elicited very often as an IAR. One word is not, of course, representative ov the other possible E words representing sense impressions. Further study with more words of this type would be

needed to determine whether retardates and normals respond differentially to sense impression relationships.

A one way ANOVA for false recognitions to CO words revealed the expected groups effect ($F = 11.55$, df = 2/87, $p < .001$) with Group R giving more false positives than both Group MA ($t = 2.66$, $p < .01$) and Group CA ($t = 4.81$, $p < .005$).

The word association test for the CS words indicated that in the majority of cases the assumed IAR was among the three most frequent responses given to its CS. In many cases the assumed IAR was the primary response to the CS. As mentioned above it was only for the SI category that the assumed IARs did not occur with appreciable frequency in word association. Thus the word associations for the children in the present study appear to follow the same pattern as the adult norms from which Underwood constructed his list. The normal CA group tended to give the assumed IARs more in word association than did the other two groups which would be expected since they are older and therefore more likely to give responses similar to adult normals. Further study with lists constructed from children's norms is advisable although at present with the limited children's word association norms available it is difficult to find enough words representing different classes of E words yet unassociated with one another.

In summary the major finding of the present study was that for total E and C words there were significantly more false recognitions to E than to C words but no significant groups effect which lends support to the idea that retardates as well as normals produced the assumed IARs and had a tendency to confuse them with RRs. There was no significant interaction.

References

Adams, J. A. Human memory. New York: McGraw-Hill, 1967.

Bousfield, W. A., Whitmarsh, G. A., & Danick, J. J. Partial response identities in verbal generalization. Psychological Reports, 1958, 4, 703-713.

Denny, M. R. Research in learning and performance. In H. A. Stevens & R. Heber (Eds.). Mental retardation. Chicago: The University of Chicago Press, 1964, pp. 100-142.

Hollingshead, A. B. The two factor index of social position. New Haven, Connecticut, 1957. (mimeographed)

Jung, J. Verbal learning. New York: Holt, Rinehart & Winston Inc, 1968.

Kessler, J. W. Mental subnormality. Psychopathology of childhoood. Englewood Cliffs; Prentice Hall, 1966, pp. 166-199.

Korstvedt, A., Stacy, C. L., & Reynolds, W. F. Concept formation of normal and subnormal adolescents on a modification of the Weigh-Goldstein-Scheerer Color Form Sorting Test. Journal of Clinical Psychology, 1954, 10, 88-90.

Luria, A. R. The role of language in the formation of temporary connections. In B. Simon (Ed.) Psychology in the Soviet Union, Stanford: Stanford University Press, 1957.

Milgram. N. A. The effect of verbal mediation in paired associate learning in trainable retardates. American Journal of Mental Deficiency, 1968, 72, 518-524.

Palermo, D. S., & Jenkins, J. J. Oral word association norms for children in grades one through four. Research Bulletin No. 60, Department of Psychology, Pennsylvania State University, 1966.

Papania, N. A qualitative analysis of vocabulary responses of institutionalized mentally retarded children. Journal of Clinical Psychology, 1954, 10, 361-363.

Penny, R. K., Seim, R., & Peters, R. D. The mediational deficiency of mentally retarded children: I the establishment of retardates mediational deficiency. American Journal of Mental Deficiency, 1968, 72, 626-630.

Stedman, D. J. Associative clustering of semantic categories in normal and retarded subjects. American Journal of Mental Deficiency, 1963, 67, 700-704.

Thorndike, E. C., & Lorge, I. The teacher's word book of 30,000 words. New York: Columbia University, 1944.

Underwood, B. J. False recognitions produced by implicit verbal responses, Journal of Experimental Psychology, 1965, 70, 122-129.

Wallace, W. P. Implicit associative response occurrence in learning with retarded subjects: A supplemtary report. Journal of Educational Psychology, 1967, 58, 110-114.

APPENDIX A

PROSPECTUS

PROSPECTUS

INTRODUCTION

The concept of mental retardation implies a deficit in ability to learn, and there have been many proposals as to what mechanism or mechanisms account for this deviation from normal learning. Theoretically any study seeking information on how and why the retardate's learning and cognitive processes differ from those of the normal subject offers a potential contribution in practical application. The more one knows about the learning and cognitive processes of the retardate and the ease with which he uses them, the more possible it becomes to tailor learning experiences to his specific needs.

Several writers (e.g., Rossi, 1962; Penny, Seim, & Peters, 1968; Milgram, 1968; Luria, 1957) have suggested that one of the ways in which the retarded individual differs from the normal subject is in a lessened ability to use mediation. Mediation is often conceptualized as a covert or implicit verbal response. The present study will attempt to investigate the occurrence of such implicit responses with a procedure seldom used with retardates. The procedure referred to is the method of false recognition which was introduced by Underwood (1965).

Underwood (1965) used a method of continuous recognition in which the subject (S) was presented aurally with a series of words and was requested to indicate whether or not each stimulus item had occurred earlier in the list. Previously Bousfield, Whitmarsh, and Danick (1958) had distinguished between two types of implicit or covert responses made in the act of perceiving a verbal unit. The representational response (RR)

was the response made to the stimulus item in the act of perceiving it. It represented the item. The second type of implicit response was referred to as an implicit associative response (IAR) and was assumed to be produced by the properties of the RR. The IAR might be another word which had been associated with the stimulus item in the past, e.g., the stimulus sugar might arouse the IAR sweet. Underwood hypothesized that if a word which was the assumed IAR to a word presented to S, later actually occurred in the list, S might falsely recognize that word as having occurred before due to confusion between the RR and the IAR.

Underwood employed a stimulus list containing five different types of critical stimulus words (CS words) which were assumed to elicit specific IARs. The assumed IARs occurred later in the list as experimental words (E words) and were known to be elicited with appreciable frequency as responses to their respective CS words according to word association norms. The A1 and A3 CS words consisted of words for which the E word or assumed IAR was an antonym for the CS word. The words for A1 appeared only once while the A3 words were presented three times prior to the occurrence of the corresponding E word. The third class of CS words consisted of converging associations (CV), e.g., bread as an E word for butter. The fourth class of CS words was superordinates (SO). Thus the CS words oak and elm might be followed after a time by the E word tree. The final type of CS word was the class of sense impressions (SI), e.g., the E word round following the CS doughnut.

The results of Underwood's study indicated that for classes A_3, CV, and SO the frequency of false recognitions for the E words was much greater than for control words (words assumed not to have been preceded in the list by words for which they were IARs) while there was no statistically

significant effect for the A_1 and SI subclasses of E words. The fact that A_1 words did not produce false recognitions beyond the number for control words was interpreted as indicating that frequency of IARs was a critical variable. The IARs for all other categories of CS words had presumably all been elicited with a frequency greater than one. While the IARs for the SI class had also been assumed to have been elicited a number of times because of elicitation by several CS words, the associative strength between the CS words of this class and the corresponding E words was not as great as for the other CS subclasses, and Underwood mentions this factor as a possible explanation of the failure of SI words to produce a significant number of false recognitions.

Before explaining how Underwood's procedure might be utilized in investigating mediational differences between retardates and normals it would seem useful to review the literature on false recognition to see what other variables have been associated with it. Many of the later studies like the Underwood study used primary associates from word association norms in determining assumed IARs. Jung and Weber (1968) criticized such a procedure and showed that the responses given in word association tests varied to a certain extent with administrative procedures. When all instances of a given category were presented consecutively for a blocked condition they found that fewer superordinates were given as associates compared to a nonblocked condition in which each set of five consecutive stimulus words consisted of one item from each category. These authors noted that it was possible that superordinates might have occured frequently as IARs under the blocked presentation but the Ss were reluctant to give the same response repeatedly. They also reported that a

significantly greater number of superordinates were given as associates under a speeded condition in which Ss were told to respond as rapidly as possible than under a relaxed condition where such instructions were omitted. In spite of the fact that there is some error involved in using word association norms for predicting assumed IARs such norms would seem to remain the best estimates available at the present time.

Davis (1967) did a study intended to partially replicate Underwood's study (1965) but with the stimulus items presented visually rather than aurally and to investigate recognition memory for homophone pairs on the same kind of recognition memory task. There were eight categories of CS items. Categories A_1 and A_3 were made up of CS and E items taken from Underwood's list. Categories WW_1 and WW_3 consisted of word-word homophone pairs, e.g., steak-stake, whose first member was presented one or three times respectively. The final four categories were symbol-word homophone pairs whose members should elicit the same response (SW_1-S and SW-S_3) such as three-3 and pairs which should elicit different meaning responses (SW_1-D and SW_3-D), presented one and three times respectively) such as why-Y. As in Underwood's study Ss did falsely recognize words which were strong associates of words which had occurred earlier. Contrary to Underwood's results, however, there was no significant difference in the number of false recognitions to the E words for the A_1 CS words and those for the A_3 CS words. When members of a homophone pair had different meanings the number of false recognitions to the second member was not significantly greater than the number of false recognitions to control words (C words). When the symbol-word homophone pairs had identical meanings as well as auditory identity false recognition rates were high.

Wallace (1967a) attempted to demonstrate that false recognition could be produced by verbal habits acquired from paired-associates (PA) training. One group of Ss learned 12 A-B pairs and another learned 12 C-B pairs, i.e., the two groups had different stimulus words but common response words. Following PA training both groups received the same projector presented 100 word recognition list (RL) and were told to indicate whether or not each word had occurred earlier in RL. Each A word, the stimulus PA word for Group A-B, was presented twice in the first half of RL. In the second half of RL each primary normative associate (A') to A words and each B word from PA were presented along with some words which were actually repeated from the first half of the list (R) and some neutral (N) words, which appeared for the first time and were presumed neutral to the other words. There were significantly more false recognitions to B words than to A' words for Group A-B while more A' than B words were falsely identified as having previously occurred by Group C-B. Thus there was a significant interaction effect. Wallace interpreted these results as indicating that the learning of A-B associations in the laboratory by Group A-B resulted in the B words becoming dominant IARs to A words for that group.

In an investigation designed independently of Wallace's (1967a) study Norman and Hall (1971) also carried out an experiment intended to test whether the occurrence of false recognitions would extend to words which acquired their association through laboratory learning. Their procedure differed from that employed by Wallace. Norman and Hall had two groups, a relevant training group and an irrelevant training group, perform three successive tasks. The nature of Task 1 was the factor which distinguished

the two groups. For the relevant training group Task 1 consisted of learning a 12 item PA list to a criterion of 12 consecutive correct trials. Eight of these PA pairs consisted of a critical stimulus (CS) word as a stimulus and a neutral control word (C word) as a response. For the irrelevant training group Task 1 was the PA learning of a 7 pair list with each pair consisting of a 3 digit random number and 2 randomly selected letters. Task 2 for both groups consisted of the crossing out of all n's and p's on a sheet of randomized letters.

The third task for all Ss was a test of false recognition consisting of a 79 word list. Five types of words appeared in this list: (a) CS words from the relevant group's Task 1 (4 of these were presented once and 4 were presented three times); (b) C words which were the neutral words which had served as laboratory trained associates to CS words for the relevant training group; (c) E words, the most common associates to the CS words as measured by the Bousfield, Cohen, Whitmarsh, and Kincaid norms (1961); (d) F words, filler pairs from relevant Task 1; and (e) new filler words which were presented three times. When CS words were presented three times the relevant training group, which had learned the C words as PA associated to the CS words did falsely recognize the C words as frequently as the E words while for the irrelevant training group there was a significantly greater number of false recognitions to E than to C words ($p < .05$).

At the same time as the above study Norman and Hall performed a second experiment which was designed to determine whether false recognition through a mediated chain could be demonstrated and also to study more systematically false recognition of common associates as a function of

the number of presentations of the stimulus word. As in Experiment I there was a relevant and an irrelevant training group which differed only in the nature of Task 1. For Task 1 the relevant training group learned a 12 item PA list to a criterion of 12 consecutive correct trials. The pairs were made up of neutral C words as the stimuli and CS words as the responses (or laboratory-induced IARs). The irrelevant training group had the same Task 1 as the corresponding group in Experiment 1. Task 2 was the same neutral task given to both groups in Experiment 1. Task 3 for both groups consisted of indicating for each word in a 200 item list whether it had appeared in the list before. The list consisted of: (a) 12 C words from Task 1, each presented three times; (b) 6 CS words from Task 1, which were presented once after their corresponding C words but before the E words associated with them (referred to as CS_1 words); 6 CS words from Task 1, which were presented after their corresponding C words and also after their E words (referred to as CS_2 words); (d) E_1 words, common associates to CS_1 words; (e) E_2 words, common associates to the CS_2 words; (f) new CS words (5 sets of 4 words each which were presented one, two, three, four, and five times; (g) new E words corresponding to the new CS words; and (h) filler words presented one, two, or three times.

A higher frequency of false recognitions to E_2 words for Ss in the relevant training group would presumably be indicative of mediated generalization since these E words followed their C words but preceded their CS words and the CS words had been learned as PA responses to the C words (C-->(IAR) CS_2-->(IAR) E_2). The number of false recognitions of E_2 words for the relevant and irrelevant training groups, 40 and 34 respectively, did not reach a statistically significant difference.

The recognition list also contained five sets of four E words which were preceded by their CS words and were used to study how the number of presentations of CS words affected false recognition. The number of false recognitions was 29, 47, 53, 99, 114, and 84 for E words whose corresponding CS words were presented 0, 1, 2, 3, 4, or 5 times respectively. The authors reported that tests for both linear and nonlinear trends were statistically significant with number of false recognitions appearing to be a continuous function of the number of presentations of the CS words although there was a leveling effect after three presentations. Hall and Kozloff (1970) presented results consistent with those above. They found that when CS words were presented 1, 3, 5, or 7 times false recognitions of associates first increased then decreased with the decrease also starting at 5 presentations.

A series of later studies by Wallace (1969) was designed to test further the idea that B words could become dominant IARs to A words through A-B PA learning. Experiment I (Exp. I) was essentially a replication of the study by Wallace (1967a). Two groups of Ss were given PA learning prior to RL. One group, Group A-B, received A-B pairs and the other group, Group C-B, received C-B pairs. The critical classes of words in RL were A, A', and B words. Each A word appeared twice in the first half of RL. The B responses in PA appeared once in the second half of RL. The subjects were instructed to indicate that they had seen a word before only if it had appeared in RL although PA words might be in the recognition list. Responses to A' words were not affected by the different conditions. There were significant differences between groups in mean number of false recognitions to B words; Group A-B 4.91, Group C-B 1.36, Group C .95

($p < .01$) and to A words; Group A-B 2.95, Group C-B 1.64, Group C 1.45 ($p < .05$). The author pointed out that between task confusion had apparently not all been eliminated since Group A-B made more errors to A words than any other group and was the only group which had received A words during PA learning.

Wallace then reasoned that if PA associative strength were indeed responsible for Group A-B's increased errors to B words, procedures designed to reduce A-B associative strength should result in a lower number of false recognitions to B. Experiment II (Exp. II) tested these predictions. It was hypothesized that learning an A-D PA list after A-B learning should result in unlearning of A-B associations and thus lead to a reduction of errors to B words on a subsequent recognition task. It was also predicted that errors to B words would be higher with higher original learning (OL) to A-B pairs. Four groups learned two PA lists prior to RL. Three of these groups represented the A-B, A-D paradigm and differed only in the degree of A-B learning. The fourth group, Group A-B', learned A-B pairs followed by A-B' pairs where B' words were natural language associated to B words.

Neither paradigm manipulation nor degree of original learning produced significant differences in false recognition rates to B words. There was no evidence for unlearning with the false recognition measure. In fact, the direction of differences in the absolute scores was opposite to the predicted direction. Wallace believed that there were two possible explanations for the failure to demonstrate unlearning with the false recognition measure. The first possibility was that ten practice trials with A-D pairs was not sufficient to weaken A-B associations enough to interfere with the occurrence of B as an IAR to A in RL. The second

possibility he mentioned was that the initial increase of errors to B following A-B PA learning was not due to specific A-B implicit associations but to something else.

Wallace noted one advantage given to the C-B group in Exp. I but not given to Group A-B. When the first B word appeared in RL it was the first "old" PA item for Group C-B. If the S in Group C-B recognized B words as PA items and was aware that none of them had been presented earlier in RL this could have been an added cue which aided in reducing errors to B words. Experiment III (Exp. III) eliminated such an added cue by employing a mixed PA list with both A-B and C-B pairs. It was hypothesized that if increased error rates to B words in Exp. I had been due to specific IAR associations there should be more errors to B words previously paired with A words. If the increased errors had been due to general PA-RL confusion, the increased errors should be equal for A-B and C-B pairs.

The mean number of false recognitions to B words for the PA groups were 2.58 for B words previously paired with A words and 2.22 for those previously paired with C words. The PA groups made significantly more errors to C-B B words and to A words than did a control group (C) which was given only RL. The absolute difference in errors to A-B B words and C-B B words although it did not quite reach significance was reported as consistent with the interpretation that at least part of the increased false recognition rate to B words following PA training might be due to A eliciting B as a specific IAR early in the recognition task. Because of the PA groups' high false recognition rate to B words paired with C words and to A words Wallace concluded that the bulk of error increase following PA learning was due to a general confusion between the two lists (PA and RL).

Wallace (1968) carried out an experiment designed to determine if instructions to learn primed the occurrence of IARs and thus increased the occurrence of false recognition responses. The stimulus list used consisted of 200 words of four different types; critical stimulus or CS words, experimental (E) words which were either the assumed IARs to CS words or formally similar to CS words, control (C) words for E words, and filler items. There were three classes of relations between CS words and their corresponding E word. Class A represented an antonym relationship, for class CV the CS and E words were converging associates, and for class FS the two sets of words were formally similar (e.g., dry and cry preceded try). There were three groups of Ss which differed in the treatment given to them during the first half of the stimulus list. The incidental learning group (Group INC) received no instructions to learn. This group was given an orienting task intended to insure that they respond to each word. The task consisted of writing down a single letter which if omitted from the word would have the least effect on its pronunciation. The other two groups were intentional learners who were instructed prior to the reading of the first 100 words to learn as many words as they could. Group INT-O performed the letter-omission task while Group INT-U was given no orienting task.

The groups performing the orienting task made more errors to Class FS than to Classes A and CV, while the group not required to perform the orienting task made more errors to Classes A and CV, resulting in a significant interaction. The similarity between the performance of Group INT-O and Group INC did not allow for a clear evaluation of the effect of instructions. The author stated that the conclusion dictated by his results

was that the absence of instructions to learn did not reduce IAR occurrence below the level to which it was reduced by performing the specific orienting task used. He suggested that since the orienting task directed Ss to the individual letters of the words it may have reduced the occurrence of meaningful and integrated RRs and IARs.

Several investigators have demonstrated that synonymity is also a basis for false recognition. Anisfeld and Knapp (1968) noted that in everyday conversations people often paraphrased and interpreted this fact as an indication that in coding information for memory individuals retain basically the semantic content. They hypothesized, therefore, that synonyms would produce more false recognitions than would control words. Their results, based on an aurally presented continuous recognition task, supported the experimental hypothesis.

Fillenbaum (1969) likewise found significantly more false recognition errors to synonyms than to control words. Fillenbaum compared frequency of false recognitions to antonyms, synonyms, and control words in an effort to resolve some theoretical questions about the way material was understood and stored for memory. Fillenbaum considered two possible explanations of why synonyms were falsely recognized as having already occurred in the Anisfeld and Knapp study (1968). The first explanation was that a word might be represented in memory by a set of attributes. If for some reason some of these features were lost, then a word such as a synonym which also had many of the same characteristics might be falsely identified as a previous item. The alternative explanation considered was that a word might be stored as a core concept rather than as a complex of attributes. In that case, a synonym would also tend to be falsely recognized more often than a control word since it embodied the same core concept. The crucial

test of the adequacy of the two theoretical positions was assumed to be the comparison of the number of false recognitions to synonyms and antonyms matched for associative strength to their preceding words. If explanation one were true and words were stored as feature complexes, antonyms as well as synonyms would be falsely recognized since for opposites all semantic markers except one would be the same. If words were stored as a basic concept, on the other hand, there should be less false recognition to antonyms as the essential meaning would be the opposite of the original stimulus.

There was no significant difference in the frequency with which false recognitions were made to antonyms and synonyms. The author interpreted these results as supporting the idea that words are stored in memory in terms of some type of attribute complex. Fillenbaum also reported a significant difference in number of false recognitions to the antonyms matched for associative strength with the synonyms and antonyms of lower associative strength, which suggests that the strength of associative relationship between CS and E items is a factor determining amount of false recognition.

A third study focusing on the effect of synonymity in producing false recognition was carried out by Grossman and Eagle (1970) who discovered a methodological error in the Anisfeld and Knapp (1968) procedure which they felt cast serious doubt on the results of that study. The error referred to was that the associates and synonyms compared were not only related to a previously presented stimulus word but often were also related to one another. It was, therefore, not possible to tell which semantic relationship affected false recognition. Indeed, it was possible that the false recognitions occurring were the result of the combination of factors.

A major purpose of the Grossman and Eagle study (1970) was to investigate the relative roles of synonymity, antonymity, and associative relationships while at the same time attempting to control for a confounding of these factors by using stimulus words having a relationship to only one related word. Additional purposes for the study were to investigate the relationship of associative strength between presented and subsequent words and number of false recognitions and to study the effects of attentional conditions on the kinds of false recognition responses made. Two experiments were run. In Experiment I (Exp. I) the stimulus list was presented separately from the recognition list. There were four different groups of Ss, each group given a different attention condition. Group 1 received both the stimulus and the recognition lists under normal focal attention conditions. Group 2 was given the stimulus list under focal attention conditions but received the recognition list under distraction. Group 3 was given both stimulus list under distraction and the recognition list under focal attention. The method of continuous recognition was used in Experiment II (Exp. II). The critical stimulus words and experimental words were those used in Exp. I. The words were presented under normal focal attention only.

The data from Exp. I indicated that there were no significant interactions between attention group and type of false recognition response. The same pattern of false recognition responses was shown by the groups separately or combined. In both experiments there were a significant number of false recognition responses to synonyms and common associates but not to antonyms. Spearman rank correlations between number of false recognitions to synonyms, antonyms, and associates and their strength of

association to the stimulus words were not statistically significant and were slightly negative rather than positive. It was also reported that there were no significant differences between male and female Ss on number of false recognition responses.

There was one group of investigators who failed to find a significant false alarm rate for synonyms. Mandler, Pearlstone, and Koopmans (1969) in a series of experiments designed to investigate the effects of organization and semantic similarity on recall and recognition reported that the presence of synonyms in a recognition list had no effect on the number of false recognitions. The authors interpreted these results as indicative that perceptual as well as semantic features were used in memory storage. There were several procedural differences between their studies and those reporting false recognition to synonyms which might account for the discrepancy of results. While the previously reported studies had used a brief exposure to an aurally presented list, the Mandler, Pearlstone, and Koopmans methodology involved sorting words printed on 3 x 5 inch cards a number of times. Not only was there a difference in exposure time and mode of presentation, but the possibility exists that the categorization task may have aided memory encoding. Although the use of synonym fillers did not produce an increase in false recognitions in the Mandler et al. study it was not entirely without effect. When synonym fillers rather than random fillers were present there was a decrease in the number of correctly identified old items. The authors suggested that the presence of synonyms as fillers lowered the Ss' confidence in identifying old items.

More recently Anisfeld(1970) raised the argument that requiring Ss to remember a list of words is not necessarily representative of the kind of memory demands the individual is faced with in everyday life. His major point was that language is generally used to communicate and that single words don't communicate much except in the context of answering questions. He then set out to investigate false recognition with what he considered to be the minimal propositional unit, the adjective noun phrase. Anisfeld's reasoning was that a phrase such as "black dress" makes an assertion about a dress. Subjects were presented with a preceding phrase (Pr), an antonymous associative phrase (A), a synonymous phrase (Sy), or a control phrase (C). The mean false recognition rate for the A and C categories were almost identical, but there was a significantly greater amount of false recognition to synonym phrases than to control phrases. Previous studies had found false recognitions to antonyms when single words were used. Anisfeld suggested that the different findings for words and phrases may be because a phrase asserts something and has a relatively clear and prescribed referential identity. It is therefore coded mainly for what it stands for and the synonymous phrases stand for essentially the same thing while the antonymous relations do not.

Hall (1969) did a study in which he made a direct investigation of the effect of related words on the confidence level with which Ss rated words old or new. Hall gave each of two groups of fifth graders two aurally presented word lists having either a two minute interval (SI) or a fifty-five minute interval (LI) between lists. When the second list was presented the S was told to decide if each word had occurred on List 1 and choose his response from four options; O=definitely old word, o=probably old,

n=probably new, and N=definitely new. List 2 contained 36 words, 13 of which were associates to CS words from List 1. There was a higher rate of false recognitions to E than to C words, but no significant effect for interlist interval nor for interaction of interlist interval and type of word. The proportion of "old" judgements made with high confidence was significantly related to type of word (mean proportion .80 for repeated or R words, .51 for E words, and .40 for C words $p < .01$). The mean proportion of "new" judgements approached but did not reach statistical significance (.54, .58, and .72 for R, E, and C words respectively).

Hall, Sekular, and Cushman (1969) suggested another measure which might provide an estimate of IAR frequency. They used a two list visual recognition task, had Ss push a toggle switch in one direction for "new" and another direction for "old" and measured reaction time. They found that words actually repeated were judged old more quickly than falsely recognized E words ($p < .01$) and that for words that were not falsely recognized C words were judged new more quickly than E words. Hall, Sekular, and Cushman believed that this added decision time was evidence for the occurrence of IARs, and therefore suggested that false recognition rate gives an underestimate of IAR occurrence. These investigators explained their results with a model which was a slight modification of a signal-detectability theory of recognition memory performance given by Parks (1966). The model assumed that when a word is given to a S it is accompanied by a registration of perceived familiarity. The distribution of the perceived frequency of R, C, and E words would be essentially the same before List 1 was presented. Following the presentation of List 1 there would be three partially overlapping distributions of perceived

frequency and that anything above that value will be judged old. The area of the C and E distributions which exceed the criterion value would determine the probability of false recognition.

As previously stated the Mandler, Pearlstone, and Koopmans (1969) results suggested that perceptual as well as semantic features are used in encoding material for memory storage. There are a few studies dealing directly with the effects of perceptual features such as phonetic or formal similarity on false recognition, either separately or in combination with other factors. Eagle and Ortof (1967) were interested in the question of whether reduced attention to a stimulus influenced the way in which that stimulus was coded and stored for memory. Subjects were required to listen to a list of words while carrying out a digit symbol coding task (distraction condition) or with no distraction and were then given a recognition task. It was predicted that if reduced attention blocked the analysis of stimulus imput that a group receiving stimuli under distraction should show more clang associates in their recognition errors than a group given the words under focal attention. Each line in the recognition list contained eight words. Within each set of eight there were two subsets of four words; the related words which included the stimulus word, a medium associate, a distant associate, and a clang associate (a word acoustically similar to the stimulus word) and another set of control or unrelated words which consisted of an unpresented stimulus, its medium, distant, and clang associates. For the distraction group there were significantly more clang errors made in the related than the unrelated category while the errors for the focal attention group were randomly distributed between the related and unrelated categories. These results supported the hypothesis that reduced attention blocks analysis as evidenced in a greater incidence of clang errors.

A second experiment was carried out in order to rule out the possibility that the above findings were a result of failure of perceptual discrimination rather than a memory phenomenon occurring subsequently to discrimination. During presentation of the stimulus list the tape was stopped at two points and S was requested to write down the last word presented. There were only four instances of misperception for the distraction group and in only one instance could the misperception be considered to be of the clang associate variety. There were six misperceptions for the focal attention group. As in Experiment I there were significantly more related than unrelated clang associate errors for the distraction group but not for the focal attention group. The authors noted that since the distraction group did not show a greater number of misperceptions than the focal group these results cannot be explained as an initial failure to perceptual discrimination. The differences they said must therefore reflect the way in which the items were stored in memory. It was suggested that because of distraction some words were stored primarily on the basis of assonance.

Anisfeld (1969) did a study designed to investigate the effects of semantic and phonetic relations on false recognition under two presentation rates of two and five seconds. The semantically related words (s words) were mostly antonyms and converging associates and the phonetically related words rhymed with the critical stimulus words. The two presentation rate conditions did not differ in the total number of errors to semantically related and rhymed words. The author pointed out that the failure to find a difference between the two conditions does not necessarily mean that the time factor plays no role in this kind of recognition task. He suggested

that it is possible that Ss in the five second group did not make use of the extra time available in a task relevant way. Both semantic and phonetic relations produced a greater number of false recognitions than did control words. Wallace (1968) had found no false recognition for phonetically related words under conditions of focal attention. A possible explanation for the contradictory results may have been the amount of time between the critical stimuli and the E words, which was greater for the Wallace study. Anisfeld (1969) suggested that the phonetic traces may fade more rapidly than the semantic traces.

Underwood and Freund (1968) suggested that recognition learning might be interpreted in terms of the frequency theory used by Ekstrand, Wallace, and Underwood (1966) to explain verbal discrimination learning. It was assumed that at least for some Ss there would be an IAR for some words, e.g., the IAR blue might occur to the stimulus sky. Underwood and Freund pointed out that in a certain sense the IAR on the learning trial acts as an interpolated word which also has situational frequency. Therefore, if the IAR or interpolated word was included on the recognition test along with a neutral word, more errors should involve the interpolated word. Underwood and Freund employed a procedure which forced some Ss to produce IARs explicitly. There were four groups of Ss. Group I was given a list of 40 critical stimulus (CR) words and pronounced each word as it appeared. An immediate recognition test was given. The Ss in Group F were forced to pronounce not only the CR but a word appearing to the right of the CR word, although they were instructed that they would be tested only for CR words. Group F also received an immediate recognition test. There were four subgroups in Group F differing in adjacent words. In each subgroup

for 10 CR words the adjacent words were A words (high associates), for 10 they were N words (neutral words),for 10 F words (formally similar usually clang associates), and for 10 numbers. There were four sublists so that across Ss each CR word had appeared with all four kinds of adjacent items. Adjacent items were printed in lower case letters while CR words were in capital letters. Group D was given the same treatment as Group I except that the recognition test was delayed for 24 hours. Group FL-D was treated the same as Group D but in addition to the delayed recognition test received a free-recall test immediately following the learning trial. All Ss received the same recognition test consisting of 40 sets of four words each. Each set of four contains a CR word, an A word, an N word, and a F word. During the recognition test the S was asked to rate his confidence in his decision on a five point scale.

For Group I the A words were responsible for the greatest number of errors with the number of errors to N and F words about the same. The A words again accounted for the greatest number of errors in Group F, but there were also appreciably more false recognitions to F words than to N words. The type of adjacent item appeared to determine the maximum frequency of a given type of error which gave some support to the frequency theory discrimination explanation of recognition. When the A word was the adjacent word nearly 80% of the errors were to A words, when the adjacent word was the F word 70% of the errors were to F words, and when the adjacent item was an N word approximately 55% of the errors were to N words. With the numbers or irrelevant adjacent items the greatest number of errors were to A words with only slightly less to F words. The fact that

acoustical or formal similarity produced results similar to those produced by high associates only when an adjacent response was forced was interpreted as indicative that in the normal learning situation words are not remembered primarily for their formal properties. Confidence ratings were always higher when an associate was chosen as an error than when other alternatives were chosen and the authors believed this was indicative that the S had limited his choice to one or two alternative responses. The delayed recognition test resulted in 24% forgetting.

In summary, many stimulus variables have been investigated in relation to false recognition of associates to critical stimulus words. False recognition has been shown to occur to antonyms (Underwood, 1965; Davis, 1967; Fillenbaum, 1969; Anisfeld, 1969), converging associates (Underwood, 1965; Anisfeld, 1969), honophone pairs with identical meaning (Davis, 1969), and synonyms (Anisfeld & Knapp, 1968; Fillenbaum, 1969; Grossman & Eagle, 1970). Mandler, Pearlstone, and Koopmans (1969) failed to find a significant false recognition rate to synonyms, but this might have been due to a number of procedural differences between their studies and the other studies. Anisfeld (1970) demonstrated a significant number of false recognitions to synonym phrases but not to antonym phrases and speculated that the coding processes for communicative phrases was different from that for single words. Phonetically related or rhymed words have also evoked false recognitions (Anisfeld, 1969; Eagle & Ortof, 1967). Eagle and Ortof (1967) found that a significant number of clang associate errors occurred for a distraction group but not for a focal attention group and postulated that distraction led to a reduced analysis of stimuli and a tendency to storage on the basis of assonance. Some disagreement exists as to the effect of associative strength between CS and E words on false alarm rate.

Investigations have also focused on procedural variables and how they might affect false recognition rate. False recognition has been shown to occur with both aural presentation (Underwood, 1965) and visual presentation (Davis, 1967). False recognition has also been produced by laboratory acquired associates (Wallace, 1967a; Norman & Hall, 1971; Wallace, 1969), although Wallace (1969) demonstrated that a large part of the increased false recognition rate was due to general confusion between the paired associate list and the recognition list. The results of two studies (Hall & Kozloff, 1970; Norman & Hall, 1971) indicate that as the number of CS presentation increases the number of false recognitions first increases then levels off or decreases with the decrease beginning at about 5 presentations. Anisfeld (1969) reported no difference in number of false recognitions under a 2 or 5 second presentation rate. No differences in false recognitions to synonyms, antonyms, and common associates were noted between groups under conditions of either focal attention or distraction (Grossman & Eagle, 1970).

Only a few studies have investigated the relationship of false recognition to subject variables such as developmental level or mental retardation. Hall and Ware (1968) reported two studies in which false recognition procedures were employed to study IAR production in young children. The first experiment was designed to determine whether the false recognition phenomenon reported for adults was reproducable with young children. A 16 word list was presented aurally to 86 children ranging in age from five to seven years of age. Ss were run individually and instructed to repeat each word and to try to remember the words. After fifteen minutes a 24-word list was presented and S was asked to identify the words which had occurred in the first list. Experimental words (E words)

were strong natural-language associates to CS words on the free-learning (FL) list but had not appeared in FL themselves. The rate of false recognition to E words was more than twice that to C words. There was no significant relation of either sex or age to false recognition rate, but the absence of age differences was not interpreted to mean that IAR produced false recognition was independent of age since sampling from the age levels was not random and there was reason to suspect the presence of a bias.

Experiment II was conducted to investigate (a) the modifiability of IARs by preliminary PA training and (b) age differences in IAR produced false recognition. There were two groups of Ss, five and six year olds who had just completed kindergarten and eight and nine year olds who had just completed third grade. Each S was given a FL list followed by a recognition list as in Exp. I. Prior to FL, however, all Ss were given PA training with six pairs of words, with low within- and between-pair associations. There were seven conditions of words in the recognition list, three words per condition. BE words had occurred as responses in PA learning and their PA stimuli were presented in FL. BC words had also occurred in PA but their stimuli did not occur in FL. $A'E_1$ words were natural-language associates of the PA stimuli that appeared in FL. A'C words were natural-language associates of PA stimuli that did not appear in FL. $A'E_2$ words were natural-language associates of the words that appeared in FL but not in the PA list. C words had not occurred earlier and were not associates of any of the words that occurred earlier, and R words actually had occurred in FL. Several hypotheses were made. First it was predicted that if PA training resulted in the establishment of PA responses as IARs there should be more false recognitions to BE words

(PA stimuli) than to BC words. Second if natural language associates ($A'E_1$ words) were temporarily extinguished during PA then presentation of the PA stimuli in FL would not elicit $A'E_1$ as IARs and false recognition to these words would be reduced. Third if IARs were occurring during FL, $A'E_2$ words would be falsely recognized more often than would C words. Fourth it was expected that older children would show more false recognitions than would younger children since mediational processes apparently increase with age. An analysis of variance was performed to examine the main effects and interactions among (a) appearance of PA stimuli during FL, (b) type of associate (BE, $A'E_1$, BC, A'C) and (c) grade level. The only significant F was for type of associate with more false recognitions of experimental (BE and BC) than of natural associates (A'E and A'C). The author interpreted these results as indicating that a number of Ss were unable to distinguish between a word occurring in PA or earlier in FL. They believed that neither natural nor experimental IARs occurred in FL at either age and suggest the possibility that PA training temporarily extinguished the usual IARs but was not sufficient to establish the PA responses as IARs during FL. The standard experimental and control conditions ($A'E_2$ vs C) at the two age levels were compared by analysis of variance. There were more false recognitions to $A'E_2$. The interaction between condition and age was also significant indicating more IAR produced false recognitions for younger than older children. These results were opposite to the anticipated results. Instead of interpreting the results as indicative that IAR production decreases rather than increases with age the authors suggested that it was more plausible that the older children though producing as many or more IARs were better able

to discriminate between the previous occurrence of a word on the list and its previous occurrence as an IAR only.

Wallace (1967b) suggested that retardates have a weaker or less frequent occurrence of IARs and should thus show less difference than normals in number of false recognitions between words presumed to have occurred as IARs earlier in a list and words presumed not to have occurred as IARs. The recognition list consisted of 100 words from Underwood's (1965) 200 word list with the same five types of critical stimulus and E words: A_1 (antonyms appearing once prior to the presentation of the corresponding E words), A_3 (antonyms appearing three times), CV (converging associates), SO (superordinates), and SI (sense impressions). The subjects were 76 institutionalized retardates ranging in IQ from 39 to 80 and in age from 12.0 to 19.9 years and 31 college students. The Ss were run in groups; one large group for normals and several smaller groups of retardates. Each S was given three sheets of paper containing numbers from 1 to 100 with the words yes and no following each number. The Ss were told that they would hear a list of words and for each word they were to ask themselves if they had heard that word before. If the word had occurred for the first time they were to circle no and if it had been read before they were to circle yes. The words were presented by tape recorder at a ten second rate with each word spoken twice in succession and the number read before each word. Apparently the procedure was much too difficult for the retardates as data from 36 of the original 76 had to be discarded for failure to comprehend the instructions and analyses were based on the remaining 40 retardates. The retardates as well as the normals had significantly more false recognition to E than to C words. There was

also a significant interaction between class of S and type of word with the absolute difference in mean number of false recognitions to E and C words appearing considerably smaller for the retarded Ss than for the normal college Ss for all classes of E words but the SO category. Wallace noted that the interaction suggested that retardates may have responded with fewer or weaker IARs than the normals or that they showed less RR-IAR confusion. Arvidson and Brown (1969), however, suggested that an alternative explanation in terms of Anisfeld and Knapp's (1969) concept of feature coding would be that retardates encode words differently than normals do.

Denny (1964) suggested that studies reporting mentally retarded Ss inferior to normals on discrimination tasks may be partially explained by an attention deficit for retardates when not in a face to face with the experimenter (E) situation. Since Ss in Wallace's (1967b) study were run in groups, such an attention deficit might have been a factor contributing to his results.

The normals in the Wallace study differed from the retardates on IQ, mental age (M.A.), chronological age (C.A.), institutionalization and number in group. It is thus not possible to determine which of these factors was important to the differences between the two groups in amount of false recognition. Denny (1964) suggested that in studies comparing normal and retarded Ss it is advisable to use two control groups, a normal group matched to the retarded group for M.A. and a normal group matched to the retarded group for C.A. in order to delineate whether a low M.A. - low IQ deficit or a low IQ deficit exists. A low M.A. - low IQ deficit refers to inferior learning performance for retarded as compared to matched C.A. normals, while a low IQ deficit refers to an inferior learning performance

related specifically to IQ and identified when retarded Ss are compared to normals of the same M.A. Goulet (1968) suggested that, in paired associate learning comparisons at least, whether or not a difference is found in the performance of normal and retarded Ss of equal M.A. seems to depend in part on whether or not the retardates are institutionalized. The present study will attempt to replicate the Wallace study with more adequate controls in order to determine if a difference in the performance of retardates and normals on a false recognition task will still exist when the above factors are controlled.

By looking at theory about mental retardation and at mediational studies with retardates it is possible to make some specific predictions. It has been suggested that the retardate is more concrete than the normal subject or is bound more closely to his own realm of experience and is less able to abstract common properties of objects and events (Kessler, 1966; Papania, 1954; Korstvedt, Stacy, & Reynolds; 1954). If this is the case the retarded S might give more false recognition responses than the normal S to words which represent sense impressions such as cold or red and are usually associated with critical stimulus words.

Several investigators (Stedman, 1963; Evans, 1964; Rossi, 1963) have found that in free recall retardates like normals show a tendency to cluster or group conceptually related items although they have been presented in a random order. The clustering phenomenon is assumed to indicate the occurrence of some type of mediational process. Stedman (1963) in a study comparing matched M.A. normal and retarded Ss on a stimulus list containing various semantic categories found that the two groups of subjects tneded to cluster different types of words during recall. For the normal Ss action of, synonyms, and superordinates were the high

clustering categories. The retardates, on the other hand, tended to cluster on coordinates and contrast (opposites) which were the two lowest clustering classes for the normals. Based on these findings it might be expected that the retardates would show a greater tendency to falsely recognize A_1 and A_3 E words than words in the other CS groups when given a recognition task. They might also falsely recognize some of the CS words for the SO category since these words are coordinates by virtue of being members of the same category.

Method

Subjects. There will be three groups of 30 Ss each, a retardate group, a normal group matched to the retarded group on the basis of mean C.A., and a normal group matched to the retarded group on the basis of mean M.A. Retarded Ss will be noninstitutionalized and will range in IQ from 50-70 and will have a mental age from 9-11 years. Normal Ss will have an IQ above 90. Subjects in all three groups will be taken from the same school system (probably the Midwest City-Del City Schools). All three groups will be approximately equated for cultural background as determined by Hollingshead's Two Factor Index of Social Position (Hollingshead, 1957) if the necessary information is available. The two factors which the Hollingshead index uses in determining social position are the education and occupation of the head of the household.

Word list. The list will consist of four different types of words. Critical stimulus (CS) words will be assumed to elicit specific IARs. Experimental words (E words) will be the assumed IARs to the CS words and will occur in the word list at some point following the occurrence of the corresponding CS word. Control (C) words will be similar in kind to the E words but will be assumed not to have been preceded in the list by words

for which they are IARs. Filler words will be presumed to be neutral with respect to E words and other words and will be used so that a specific repetition frequency can be built up. The CS, E, and C words will be those used by Wallace (1967b) and appear in Table 1. There will be five classes of CS words. Both classes A_1 and A_3 will consist of words for which the assumed IARs (E words) are antonyms of the CS word. The CS words for A_1 items will be presented only once prior to the occurrence of the corresponding E word while the A_3 CS words will occur three times before the presentation of their E words. The third class of CS words will consist of converging associations (CV). The superordinate (SO) class will be made up of specific instances as CS words followed later by the category label as the E word. The final type of CS words will be sense impressions (SI) with the E word being a sense impression such as white which is elicited frequently as an associate to a CS word, e.g., snow. The C words will occur two positions away from the corresponding E word and will occur before the E word half the time and after it the rest of the time.

Procedure. The Ss will be run individually. The S will be told that a list of words will be read to him and that he is to tell the experimenter (E) whether or not each word has occurred previously by saying yes if he has heard the word read before. A practice trial of 10 words will be given. The response to each word will be recorded by E. The word list will be read at a rate of one word every 10 seconds. Following the recognition list S will be asked to respond to each CS word with the first word which comes to his mind. This post hoc word association test will serve as a check on the accuracy of assumed IARs.

The data sheets will be scored for number of false recognitions, for C words, for E words, and for each separate class of E words. A groups of class of words analysis of variance will be run in order to detect any group, word class, or interaction effects.

References

Anisfeld, M. False recognition produced by semantic and phonetic relations under two presentation rates. Psychonomic Science, 1969, 17, 366-367.

Anisfeld, M. False recognition of adjective - noun phrases. Journal of Experimental Psychology, 1970, 86, 120-122.

Anisfeld, M., & Knapp, M. Association, synonymity, and directionality in false recognition. Journal of Experimental Psychology, 1968, 77, 171-179.

Aridson, R. M., and Brown, C. R. Problems in studying implicit association responses. Psychological Reports, 1969, 24, 799-805.

Bousfield, W. A., Ehen, B. H., Whitmarsh, C. A., and Kincaid, W. D. The Connecticut free association morons (ONR Tech, Rep. No. 35, (contract No. 631) (O A Stoirs: University of Connecticut, 1961. (cited in Norman and Hall, 1971).

Bousfield, W. A., Whitmarsh, G. A., & Danik, J. J. Partial response identitiew in verbal generalization. Psychological Reports, 1958, 4, 703-713.

Davis, G. A. Recognition memory for visually presented homophones. Psychological Reports, 1967, 20, 227-233.

Denny, M. R. Research in learning and performance. In H. A. Stevens & R. Heber (Eds.). Mental Retardation. Chicago: The University of Chicago Press, 1964, pp. 100-142.

Eagle, M., & Ortof, E. The effect of level of attention upon "phometic" recognition errors. Journal of Verbal Learning and Verbal Behavior, 1967, 6, 226-231.

Ekstrand, B. R., Wallace, W. P., & Underwood, B. J. A frequency theory of verbal-discrimination learning. Psychological Review, 1966, 73, 566-578.

Evans, R. A. Word recall and associative clustering in mental retardates. American Journal of Mental Deficiency, 1964, 69, 413-418.

Fillenbaum, S. Words as feature complexes: False recognition of antonyms and synonyms. Journal of Experimental Psychology, 1969, 82, 400-402.

Grossman, L., & Eagle, M. Synonymity, antonymity, and association in false recognition responses. Journal of Experimental Psychology, 1970, 83, 244-248.

Hall, J. W. Effects of IAR occurrence during learning on confidence in judgments during recognition. Journal of Experimental Psychology, 1969, 79, 578-580.

Hall, J. W., & Kozloff, E. E. False recognitions as a function of number of presentations. American Journal of Psychology, 1970, 83, 272-277.

Hall, J., Sekular, R., & Cushman, W. Effects of IAR occurrence during learning on response time during subsequent recognition. Journal of Experimental Psychology, 1969, 79, 39-42.

Hall, J. W., & Ware, W. B. Implicit associative responses and false recognition by young children. Journal of Experimental Child Psychology, 1968, 6, 52-60.

Hollingshead, A. B. The Two Factor Index of Social Position. New Haven, Connecticut, 1957. (Mimeographed)

Jung, J., & Weber, S. Can implicit associative responses be measured by word association tests? Psychological Reports, 1968, 22, 921-925.

Kessler, J. W. Mental Subnormality. Psychopathology of Childhood. Englewood Cliffs: Prentice Hall, 1966, pp. 166-199.

Korstvedt, A., Stacy, C. L., & Reynolds, W. E. Concept formation of normal and subnormal adolescents on a modification of the Weigh-Goldstein-Scheerer Color Form Sorting Test. Journal of Clinical Psychology, 1954, 10, 88-90.

Luvia, A. R. The role of language in the formation of temporary connections. In B. Simon (Ed.) Psychology in the Soviet Union, Stanford: Stanford University Press, 1957.

Mandler, G., Pearlstone, E., & Koopmans, R. S. Effects of organization and semantic similarity on recall and recognition. Journal of Verbal Learning and Verbal Behavior, 8, 410-423.

Milgram, N. A. The effect of verbal mediation in paired associate learning in trainable retardates. American Journal of Mental Deficiency, 1968, 72, 518-524.

Norman, C. P., and Hall, A. E. Effects of learning on false recognitions. Journal of Experimental Psychology, 1971, 87, 326-330.

Papania, N. A qualitative analysis of vocabulary responses of institutionalized mentally retarded children. Journal of Clinical Psychology, 1954, 10, 361-363.

Parks, T. E. Signal-detectability theory of recognition-memory performance. Psychological Review, 1966, 75, 44-58.

Penney, R. K., Seim, R., & Peters, R. D. The mediational deficiency of mentally retarded children: I The establishment of retardates mediational deficiency. American Journal of Mental Deficiency, 1968, 72, 626-630.

Rossi, E. D. Associative clustering in normal and mentally retarded children. Unpublished doctoral dissertation. Temple University, 1962.

Stedman, D. J. Associative clustering of semantic categories in normal and retarded subjects. American Journal of Mental Deficiency, 1963, 67, 700-704.

Underwood, B. J. False recognitions produced by implicit verbal responses. Journal of Experimental Psychology, 1965, 70, 122-129.

Underwood, B. J., & Freund, J. S. Errors in recognition learning and retention. Journal of Experimental Psychology, 1968, 78, 55-63.

Wallace, W. P. False recognition produced by laboratory established associative responses. Psychonomic Science, 1967a, 7, 139-140.

Wallace, W. P. Implicit associative responses occurence in learning with retarded subjects: A supplementary report. Journal of Educational Psychology, 1967b, 58, 110-114.

Wallace, W. P. Incidental learning: The influence of associative similarity of formal similarity in producing false recognition. Journal of Verbal Learning and Verbal Behavior, 1968, 7, 50-54.

Wallace, W. P. Influence of prior paired associate learning on false recognition. Psychological Reports, 1969, 25, 803-810.

APPENDIX B

MENTAL AGES IN MONTHS FOR THE RETARDED GROUP AND THE MATCHED MA NORMAL GROUP

Mental Ages in Months Retardate Group

99	100	110
97	101	118
96	102	125
106	98	107
102	99	105
96	115	116
100	98	99
101	118	110
106	98	114
103	118	105

$\overline{X}$ = 105.40 SD = 7.98

Mental Ages in Months Normal MA Groups

101	106	107
110	118	116
106	126	99
99	95	96
102	108	101
103	100	95
101	99	107
108	99	113
98	97	113
104	118	118

$\overline{X}$ = 105.43 SD = 8.03

APPENDIX C

CHRONOLOGICAL AGES IN MONTHS FOR THE RETARDED GROUP AND THE MATCHED CA NORMAL GROUP

Chronological Age in Months Retardate Group

146	150	178
138	156	164
135	160	175
147	147	156
138	183	157
131	174	176
143	177	181
142	169	162
164	165	159
155	167	186

$\overline{X}$ = 159.37 SD = 15.38

Chronological Age in Months Normal CA Group

133	173	163
141	164	176
139	180	159
142	157	176
147	156	156
147	158	170
148	164	180
146	179	168
144	176	159
129	163	184

$\overline{X}$ = 159.23 SD = 15.16

APPENDIX D

IQ's FOR EACH GROUP OF SUBJECTS

IQ's Group R

70	73	66
70	65	75
71	64	75
72	69	71
75	58	67
73	66	66
70	60	59
73	70	68
68	63	72
69	70	60

$\overline{X}$ = 68.27 SD = 4.78

IQ's MA Group

105	107	91
108	120	116
110	133	106
108	106	97
94	106	101
94	102	98
101	97	102
113	104	104
109	105	106
104	93	116

$\overline{X}$ = 105.20 SD = 8.69

IQ's	CA	Group
93	121	113
90	102	114
106	106	106
102	97	91
111	--	--
117	101	123
113	118	119
118	94	118
117	91	123
96	--	91

$\overline{X}$ = 107.07 SD = 11.24

APPENDIX E

THORNDIKE-LORGE FREQUENCY COUNT FOR CRITICAL STIMULUS, EXPERIMENTAL, AND CONTROL WORDS

Thorndike-Lorge Frequency General Count

Frequency Per Million

Class	CS Words	E Words	C Words
A_1	Bottom A	Top AA	Down AA
	Give AA	Take AA	Good AA
	Day AA	Night AA	Low AA
	Man AA	Woman AA	Rich AA
A_3	Rough A	Smooth A	Weak A
	False A	True AA	Dirty A
	Hard AA	Soft AA	Short AA
	Slow A	Fast AA	Girl AA
CV	Butter AA Crumb 18	Bread A	Bridge AA
	Sugar AA Bitter A Candy 32	Sweet AA	Salt AA
	Warm AA Chill 43 Freeze 32 Frigid 2 Hot AA Ice AA	Cold AA	Cloud AA
	Dark AA Heavy AA Lamp A Match A	Light AA	Leg AA
SO	Peach 29 Grape 34 Apple A Pear 21	Fruit AA	Cloth A
	Robin 48 Sparrow 22 Bluejay 1 Canary 8	Bird AA	Flower AA
SI	Bandage 14 Chalk 13 Milk AA Rice 38 Snow AA	White AA	Red AA

AA = 100 or more times per million

A = over 50 but less than 100 per million

APPENDIX F

INSTRUCTIONS

Instructions Recognition Task

We are going to play a game to see how well you can remember. You will hear a list of words read and for each word you are to ask yourself if that was read before. If the word has not been said before say "no". If the word has been read in the list before say "yes". The number of each word will be given before the word is read, and then the word will be said twice to make sure you understand the word. After the word is read you are to say "yes" or "no" right away. Remember if the word has been read before say "yes". If the word has not been read before say "no". Do you have any questions?

(Questions were answered)

We will practice with a few words before going on to the long list. Are you ready for the first word?

(If the Ss said "yes" to the first one or two words on the practice trial suggesting that he did not fully comprehend the instructions, the tape was stopped and Ss was told)

I want you to say yes only if a word is read again as another number, for example if "dog" is number one and then number four. Each word will be read twice after the same number only to make sure you understand the word. You do not count that.

After Practice Trials

Fine. Now we will go on to the longer list. Remember if the word has been read before say "yes". If it has not been read before say "no".

Instructions Word Associations

Now I am going to read some words and each time I read a word I want you to tell me the first word that you think of when you hear that word. For example, if I read "dog" you might think of "cat". So you would say "cat". We will try one or two words to make sure you understand. Table _____ Door _____ Good. Now we will do the same thing with some more words.

Are you ready?

(E then reads through a randomly ordered list of the critical stimulus word recording S's response to each word.)

APPENDIX G

PRACTICE WORD LIST

Practice Trial List

1. Dog
2. Toy
3. Comb
4. Plate
5. Cup
6. Dog
7. Fork
8. Book
9. Read
10. Comb

APPENDIX H

WORD RECOGNITION LIST

Word Recognition List

1. Frigid
2. Ocean
3. Peach
4. Rough
5. Dark
6. Cry
7. Apple
8. Tell
9. Guns
10. Day
11. Bandage
12. Sugar
13. You
14. Joy
15. Pear
16. At
17. Man
18. Hammer
19. Slow
20. Joy
21. Match
22. Lamp
23. Rough
24. Cars
25. Slow
26. Milk
27. Hot
28. Ocean
29. At
30. Thinner
31. You
32. Heavy
33. Tell
34. Chalk
35. Tobacco
36. Freeze
37. Canary
38. Bottom
39. Hard
40. False
41. Then
42. Crumb
43. House
44. Ice
45. Square
46. Needle
47. Warm
48. Butter
49. Snow
50. Slow
51. Candy
52. False
53. Rough
54. City
55. Hand
56. Numbers
57. Top
58. It
59. Down
60. Give
61. Sparrow
62. Bridge
63. Bitter
64. Bread
65. Good
66. Chill
67. Take
68. Rice
69. Bluejay
70. Hard
71. False
72. Salt
73. Grape
74. Sweet
75. Weak
76. Cold
77. Smooth
78. Cloud
79. Fruit
80. True
81. Cloth
82. Dirty
83. Hard
84. Robin
85. Night
86. Leg
87. Low
88. Light
89. Soft
90. Red
91. Short
92. White
93. Flower
94. Rich
95. Bird
96. Woman
97. Fast
98. What
99. Girl
100. Chair

APPENDIX I

WORD ASSOCIATION LIST

Word Association List

1. grape _____
2. heavy _____
3. sugar _____
4. day _____
5. pear _____
6. warm _____
7. bitter _____
8. slow _____
9. sparrow _____
10. chill _____
11. rough _____
12. canary _____
13. rice _____
14. peach _____
15. ice _____
16. hard _____
17. snow _____
18. freeze _____
19. robin _____
20. bottom _____
21. candy _____
22. hot _____
23. milk _____
24. match _____
25. crumb _____
26. false _____
27. give _____
28. dark _____
29. man _____
30. frigid _____
31. apple _____
32. bandage _____
33. lamp _____
34. chalk _____
35. butter _____
36. bluejay _____

APPENDIX J

SCORED FOR FALSE RECOGNITIONS TO VARIOUS TYPES OF WORDS

Scores For False Recognitions to Various Types of Words

	A_1			C		
	R	MA	CA	R	MA	CA
1.	1	0	3	1	0	3
2.	0	0	0	2	1	0
3.	2	0	0	2	1	0
4.	2	1	0	3	0	0
5.	0	1	2	0	1	2
6.	2	0	0	4	0	2
7.	3	1	0	3	2	1
8.	0	0	1	0	0	3
9.	1	3	1	0	3	1
10.	1	0	2	0	0	2
11.	1	0	0	0	0	0
12.	2	0	2	4	0	3
13.	0	0	0	0	0	3
14.	3	0	2	1	0	2
15.	4	3	1	3	2	1
16.	1	3	1	1	3	1
17.	1	2	0	2	2	0
18.	4	1	1	2	0	0
19.	1	1	3	3	0	2
20.	2	3	1	1	2	1
21.	2	0	1	2	0	0
22.	1	0	0	0	0	0
23.	3	1	3	2	2	3
24.	0	1	1	2	2	2
25.	0	1	1	1	0	0
26.	2	1	0	0	0	0
27.	0	0	1	0	0	1
28.	0	0	0	3	0	1
29.	0	0	1	2	0	0
30.	0	0	2	0	0	0
	39	23	30	44	21	34

Sources for False Recognitions to Various Types of Words

	A_3			C		
	R	MA	CA	R	MA	CA
1.	2	0	3	0	0	3
2.	2	2	1	4	2	1
3.	2	1	2	0	0	1
4.	0	0	0	0	0	0
5.	0	0	0	0	1	1
6.	4	1	3	2	1	2
7.	3	3	0	2	3	0
8.	3	1	3	0	0	2
9.	1	3	0	0	3	0
10.	0	0	2	0	0	1
11.	0	0	0	1	0	0
12.	2	0	2	4	0	0
13.	1	0	4	0	0	1
14.	1	1	2	2	0	0
15.	4	3	2	4	2	2
16.	1	0	0	1	3	2
17.	2	1	0	2	2	0
18.	1	2	2	4	0	0
19.	1	1	1	2	0	2
20.	1	3	0	1	3	0
21.	4	0	1	3	1	0
22.	0	0	1	0	0	0
23.	1	2	4	2	1	1
24.	1	3	2	1	1	1
25.	0	1	1	0	1	3
26.	0	1	0	0	0	0
27.	0	1	1	0	0	1
28.	1	0	0	2	0	0
29.	3	0	1	3	0	1
30.	1	0	0	0	1	0

Scores For False Recognitions to Various Types of Words

	CV			$\overline{C}$		
	R	MA	CA	R	MA	CA
1.	3	0	4	0	0	3
2.	1	1	0	0	1	1
3.	4	1	1	1	1	1
4.	2	0	0	0	0	0
5.	0	2	1	0	0	0
6.	3	3	1	4	2	1
7.	4	3	1	2	2	1
8.	1	1	2	0	1	0
9.	1	2	0	0	2	0
10.	0	1	3	1	0	0
11.	0	0	0	0	0	0
12.	3	2	2	4	1	2
13.	0	0	2	0	0	2
14.	3	0	3	2	1	1
15.	3	4	2	3	2	1
16.	3	2	3	2	3	1
17.	2	3	2	3	2	0
18.	1	1	1	2	0	9
19.	1	0	3	2	0	3
20.	1	4	1	1	2	0
21.	1	1	3	3	0	2
22.	0	0	1	0	0	1
23.	3	2	4	0	1	2
24.	2	2	2	1	1	1
25.	0	1	3	0	2	0
26.	2	0	1	0	0	0
27.	0	0	4	1	0	2
28.	2	1	0	2	0	0
29.	3	0	1	0	0	0
30.	0	0	1	1	0	1

	SI			1C		
	R	MA	CA	R	MA	CA
1.	0	0	0	1	0	0
2.	1	0	0	0	0	0
3.	1	0	0	1	1	0
4.	0	0	0	0	0	0
5.	0	0	0	0	0	0
6.	1	0	0	1	0	0
7.	0	0	0	0	1	0
8.	0	0	0	1	0	1
9.	0	0	0	0	0	0
10.	0	0	0	0	0	0
11.	0	0	0	0	0	0
12.	1	0	0	1	0	1
13.	0	0	0	1	0	0
14.	0	0	0	1	0	0
15.	1	0	0	1	1	0
16.	0	0	0	1	1	0
17.	0	1	0	1	0	0
18.	1	0	0	0	0	0
19.	0	0	0	0	0	0
20.	0	0	0	0	0	1
21.	0	0	0	0	0	0
22.	0	0	0	0	1	0
23.	0	0	0	0	0	0
24.	0	0	0	0	1	0
25.	0	0	0	1	0	1
26.	0	0	0	0	0	0
27.	0	0	0	0	0	0
28.	0	0	0	0	0	1
29.	1	0	0	0	0	0
30.	0	0	0	1	0	0

	SO			Cl		
	R	MA	CA	R	MA	CA
1.	2	0	2	2	0	2
2.	1	1	0	1	1	1
3.	2	1	0	1	1	0
4.	1	1	0	0	0	0
5.	0	0	0	0	0	1
6.	2	1	0	2	0	0
7.	2	0	0	0	1	0
8.	1	1	0	0	0	0
9.	1	2	0	0	2	0
10.	0	0	2	0	0	1
11.	1	0	0	0	0	0
12.	2	0	1	2	0	1
13.	0	0	2	0	0	1
14.	0	0	2	1	0	0
15.	2	1	2	1	1	0
16.	2	2	1	1	1	1
17.	2	2	0	0	1	0
18.	2	1	1	0	1	0
19.	1	0	2	0	0	2
20.	1	1	0	0	1	1
21.	1	0	0	2	0	1
22.	0	0	0	0	0	1
23.	0	1	1	1	0	2
24.	0	2	0	1	0	0
25.	0	1	1	0	0	1
26.	0	0	0	0	1	0
27.	0	1	0	0	0	0
28.	2	1	0	1	0	0
29.	1	0	1	0	0	0
30.	0	0	1	0	0	1

	R	MA	CA
1.	3	1	4
2.	3	3	0
3.	1	3	0
4.	3	0	0
5.	0	0	2
6.	4	1	0
7.	5	2	1
8.	0	0	0
9.	0	1	0
10.	3	0	0
11.	0	0	0
12.	4	2	1
13.	2	0	2
14.	3	0	0
15.	6	3	0
16.	2	4	0
17.	3	4	1
18.	5	1	0
19.	2	3	3
20.	0	2	0
21.	2	0	1
22.	0	0	0
23.	2	1	1
24.	0	1	1
25.	0	0	0
26.	0	1	0
27.	1	1	0
28.	3	1	1
29.	4	0	1
30.	0	1	3

APPENDIX K

ACCURATE RECOGNITIONS OF ACTUAL REPETITIONS

Recognition of Actual Repetitions

	R	MA	CA
1.	9	12	13
2.	7	11	11
3.	8	11	13
4.	9	9	12
5.	6	12	13
6.	4	11	13
7.	13	13	12
8.	11	7	12
9.	8	13	12
10.	11	9	12
11.	1	9	8
12.	9	7	11
13.	5	12	10
14.	7	12	12
15.	7	11	13
16.	13	8	13
17.	9	13	10
18.	8	11	11
19.	13	9	12
20.	12	13	10
21.	10	8	11
22.	7	11	11
23.	13	12	12
24.	11	12	10
25.	12	3	10
26.	12	10	12
27.	7	9	11
28.	7	10	12
29.	6	12	13
30.	8	10	12

APPENDIX L

SUMMARIES FOR ANALYSES OF VARIANCE

Summary of Analysis of Variance on Accurate Recognition of Repetitions (AR)

Source	SS	df	MS	F	p
Between subjects	120.87	2	60.44	11.55	<.001
Within subjects	455.53	87	5.23		

Simple Effects

1.	Rvs MA;	$t = 2.66$,	$p < .01$
2.	Rvs CA;	$t = 4.81$,	$p < .005$
3.	MAvsCA;	$t = 2.15$,	$p < .025$

Summary Analysis of Variance on Total False Recognitions to Experimental and Control Words

Source	SS	df	MS	F	p
Between Subjects	338.12	89			
A (Groups)	17.55	2	8.77	2.38	<.10 NS
Subject w. groups	320.57	87	3.68		
Within Subjects	36.13	90			
B (E vs C words)	4.60	1	4.60	12.77	<.01
AB	.06	2	.03	.08	NS
B x Subject w. groups	31.47	87	.06		

Summary One Way Analysis of Variance for Absolute Difference in Number of False Recognitions to E and C Words

Source	SS	df	MS	F	
Between Subjects	.83	2	.415	1.59	NS
Within Subjects	22.71	87	.261		

Summary Analysis of Variance on A_1, A_3, CV and Corresponding Control Words

Source	SS	df	MS	F	p
Between subjects	97.10	89			
A (Groups	3.16	2	1.58	1.46	NS
Subj. w. groups	93.94	87	1.08		
Within Subjects	13.27	450			
B (kind of word)	3.05	5	.61	27.98	<.001
AB	.70	10	.07	3.24	<.01
B x subj. w. groups	9.52	435	.0218		

Summary 3x2 Repeated Measures Analysis of Variance on

False Recognitions to SO Words and Their Controls

Source	SS	df	MS	F	p
Between subjects	13.93	89			
A (Groups)	.29	2	.145	.072	NS
Subj. w. gorups	13.64	87	.157		
Within subjects	6.31	90			
B (SO vs C)	.61	1	.61	9.68	<.01
AB	.23	2	.115	1.82	NS

Summary One Way Analysis of Variance and T-test on

False Recognitions to Coordinates (CO)

Source	SS	df	MS	F	p
Between subjects	2.93	2	1.47	5.63	<.01
Within subjects	22.71	87	.26		

Simple Effects

1.	R vs MA;	t = 1.92,	p < .05
2.	R vs CA;	t = 3.38,	p < .005
3.	MA vs CA;	t = 1.46,	p < .10 NS

APPENDIX M

THE THREE MOST FREQUENT RESPONSES ON THE WORD ASSOCIATION TEST

The Three Most Frequent Responses on Word Association Test

The number following a response represents the number of Ss out of 30 giving that response

CS Word	Associations		
A_1	Group R	Group MA	Group CA
Bottom	Top 16	Top 21	Top 28
Give	Take 8 Gave 5 Up 2 Receive 2	Gave 4 Take 3 Me 2 Have 2 Up 2	Take 21 Receive 3 Gave 2
Day	Night 26	Night 27	Night 27
Man	Woman 27	Woman 18 Lady 3 Girl 2 Men 2	Woman 29
A_3			
Rough	Smooth 5 Hard 5 Soft 5	Smooth 6 Tough 6 Soft 6	Smooth 10 Soft 6 Hard 5
False	True 15 Teeth 7 Real 2	True 7 Teeth 7 Real 3	True 21 Teeth 3 Fake 2 Artificial 2
Hard	Soft 14	Soft 14 Easy 5 Heavy 2 Work 2	Soft 26
Slow	Fast 24	Fast 25 Poke 3	Fast 29

CS Word	Associations		
CV	Group R	Group MA	Group CA
Butter			
	Milk 7	Bread 7	Bread 12
	Bread 4	Milk 4	Milk 4
	Toast 3	Toast 2	Soft 2
		Yellow 2	
Crumb			
	Bread 8	Bread 5	Bread 16
	Cookie 3	Cracker 3	Piece 5
	Cracker 3	Cookie 2	Bird 2
		Crumble 2	Little 2
		Crumbs 2	
		Piece 2	
		Pieces 2	
Sugar			
	Sweet 17	Sweet 14	Sweet 20
	Salt 4	Salt 8	Salt 7
	Cup 2		
	Sour 2		
Bitter			
	Sour 7	Didn't know word 5	Sweet 15
	Sweet 4	Butter 3	Sour 10
	Butter 3	Better 3	
		Good 3	
		Batter 3	
Candy			
	Sweet 10	Sweet 7	Sweet 16
	Fruit 2	Sugar 3	Food 2
	Store 2	Eat 2	Good 2
	Hard 2	Gum 2	Pop 2
	Eat 2	Good 2	Sugar 2
		Food 2	
Warm			
	Cold 15	Cold 16	Cold 18
	Hot 10	Hot 10	Hot 6
Chill			
	Cold 20	Cold 11	Cold 18
	Bumps 3	Warm 4	Warm 6
		Freeze 3	Hot 3

CS Word	Associations		
CV con't	Group R	Group MA	Group CA
Freeze	Cold 14 Warm 5 Hot 2 Hard 2 Ice 2	Cold 10 Warm 4 Hot 3	Cold 17 Water 2 Ice 2 Snow 2
Frigid	Didn't know word 7 Frigerator 4 Gidget 3	Didn't know word 13 Frigerator 2 Cold 2 Freezer 2	Cold 11 Didn't know 5 Frigerator 2 Freezer 2
Hot	Cold 22 Warm 2	Cold 22 Not 2	Cold 28
Ice	Cold 8 Water 5 Cream 4	Cold 18 Water 3 Cube 3	Cold 14 Cream 6 Water 4
Dark	Light 14 Day 6 Night 5	Light 17 Night 6 Day 3	Light 27 Night 3
Heavy	Light 10 Sad 3 Hard 2 Skinny 2 Low 2	Light 16 Hard 2 Box 2 Large 2	Light 20 Soft 3 Small 2
Lamp	Light 23 Shade 2 Bulb 2	Light 22 Table 3 Bulb 2 Shade 2	Light 21 Table 3 Post 2 Shade 2
Match	Fire 13 Strike 3 Light 2	Fire 15 Light 5 Hot 3	Light 10 Fire 10 Box 2

CS Word	Associations		
SO	Group R	Group MA	Group CA
Peach			
	Pear 11	Fruit 11	Pear 14
	Fruit 4	Pear 5	Tree 5
	Eat 4	Tree 4	Fruit 3
Grape			
	Fruit 8	Fruit 14	Vine 6
	Orange 6	Juice 3	Fruit 5
	Eat 3	Purple 3	Cherry 4
	Vine 3		
Apple			
	Orange 7	Fruit 9	Pear 12
	Pear 6	Pear 5	Tree 5
	Fruit 3	Eat 3	Fruit 4
	Tree 3	Red 3	
Pear			
	Apple 11	Fruit 9	Peach 11
	Fruit 4	Apple 4	Apple 6
	Tree 4	Peach 3	Fruit 5
	Peach 4		
Robin			
	Bird 20	Bird 23	Bird 18
	Fly 2		Sparrow 4
Sparrow			
	Bird 16	Bird 19	Bird 23
	Arrow 3	Robin 2	Robin 3
	Flying 2	Arrow 2	
		Bluejay 2	
Bluejay			
	Bird 21	Bird 23	Bird 21
	Robin 3	Nest 2	Blue 4
	Fly 2		
Canary			
	Bird 15	Bird 10	Bird 19
	Cage 3	Didn't know 6	Sing 2
	Bluejay 3	Boat 2	
		Berry 2	
		Dog 2	

CS WORD	Associations		
SI	Group R	Group MA	Group CA
Bandage			
	Cut 8	Cut 7	Hurt 8
	Tape 4	Hurt 6	Sore 6
	Hurt 3	Sore 2	Cut 5
	Bandaid 3	Knee 2	
Chalk			
	Board 13	Board 13	Board 17
	Write 6	Write 6	Write 4
	Chalkboard 3	Chalkboard 3	
		White 3	
Milk			
	Water 6	Drink 8	Good 4
	Drink 4	Water 5	Drink 3
	Cow 3	Cow 4	Water 3
		White 4	Cow 3
Rice			
	Food 6	Food 13	Food 7
	Eat 3	Sugar 3	China 3
	Oatmeal 2	Wheat 2	Wheat
	Cereal 2		
	Gravy 2		
	Wheat 2		
Snow			
	Ice 6	White 9	White 6
	Cold 4	Cold 4	Rain 6
	Rain 3	Ice 4	Cold 5