DOCUMENT RESUME

ED 074 443 CS 000 387

AUTHOR Pezdek, Kathy; Royer, James M.
TITLE The Role of Comprehension in Learning Concrete and Abstract Sentences.
INSTITUTION Massachusetts Univ., Amherst. Dept. of Psychology.
SPONS AGENCY National Center for Educational Research and Development (DHEW/OE), Washington, D.C.; National Science Foundation, Washington, D.C.
REPORT NO R-72-3
PUB DATE Dec 72
NOTE 36p.

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS *Abstraction Levels; College Students; Comprehension; *Learning Processes; *Pattern Recognition; Perception; *Reading Comprehension; Recall (Psychological); *Semantics; Word Recognition

ABSTRACT

A previous study by Begg and Pavio found that subjects presented with concrete sentences were able to detect subsequent changes in meaning better than changes in wording. In contrast, with abstract sentences, wording changes were detected with greater facility than were changes in meaning. The present study assesses the effect of comprehension on the recognition of meaning and wording changes with concrete and abstract sentences. Part of a group of 120 undergraduates at the University of Massachusetts was presented with sentences embedded in a context paragraph designed to increase comprehension. Results indicated that recognition for meaning changes in abstract sentences was significantly higher for the sentence-embedded group than for the group presented the sentences without the paragraphs. There was no appreciable difference between the groups in recognition of wording changes in abstract sentences or of both meaning and wording changes in concrete sentences. The results are discussed in light of recent models which propose different storage mechanisms for concrete and abstract sentences. Appendixes illustrating wording and meanings test sentences, contextual material presented to the experimental treatment group, and tables of analysis of variance are also provided. (Author/HS)

The Role of Comprehension in Learning Concrete and Abstract Sentences

Kathy Pezdek and James M. Royer

Report 72-3

December, 1972

Cognitive Processes Laboratory

Abstract

The Role of Comprehension in

Learning Concrete and Abstract Sentences

Kathy Pezdek and James M. Royer
University of Massachusetts

The purpose of the present study was to assess the effect of comprehension on the recognition of meaning and wording changes with concrete and abstract sentences. One group was presented the sentences embedded in a context paragraph designed to increase comprehension. Recognition for meaning changes in abstract sentences was significantly higher for the sentence-embedded group than for a group presented the sentences without the paragraphs. There was no appreciable differences between the groups in recognition for wording changes in abstract sentences, nor in recognition for both meaning changes and wording changes in concrete sentences. The results of the experiment were discussed in light of recent models which propose different storage mechanisms for concrete and abstract sentences.

The Role of Comprehension in Learning Concrete and Abstract Sentences[1]

Kathy Pezdek and James M. Royer[2]

University of Massachusetts

Begg and Pavio (1969) found that Ss presented with concrete sentences were able to detect subsequent changes in meaning in the sentences better than changes in wording. In contrast, with abstract sentences, wording changes were detected with greater facility than were changes in meaning. The interpretation given to these findings was that concrete sentences are stored as visual images whereas abstract sentences are stored as verbal strings. Johnson, Bransford, Nyberg, & Cleary (1972) have argued that the comparatively poor detection of meaning changes for abstract sentences reflects difficulties in S's comprehension of the sentences rather than providing conclusive evidence for a differential storage hypothesis. They demonstrated that the abstract sentences used in the Begg & Pavio (1969) study were more difficult to comprehend than the concrete sentences, and that the meaning change rule applied to the sentences (i.e., subject-object reversals) changed the meaning less for the abstract than for concrete sentences.

The intent of the present study is to demonstrate that the detection of meaning changes in abstract sentences can be increased by providing Ss with a treatment designed to increase comprehension of the sentences. One group of Ss in the experiment was presented the sentences embedded in a context paragraph designed to make the embedded sentences more comprehensible. Two control groups were presented the same sentences without the paragraph context. The expectation was that

the group receiving the paragraph embedded sentences would detect meaning changes in abstract sentences better than the control groups lacking the paragraph contexts.

Experiment I

METHOD

Subjects and Materials

One hundred and twenty undergraduate students from the University of Massachusetts served as subjects. They were run in groups ranging in size from five to twenty subjects.

Sixteen abstract (A) and 16 concrete (C) sentences of a constant structure were presented to the Ss. This structure was, "The (adjective) (noun) (past tense verb) a(n) (adjective) (noun)." (e.g., "The alternative version modified an established custom.") Words in the abstract and concrete sentences were equated for frequency on the basis of the Thorndike-Lorge (1944) word count. The imagery level of the nouns was evaluated when possible, based on imagery norms (Pavio, Yuille & Madigan, 1968). On the imagery scale of one to seven, the mean rating of the nouns of concrete sentences which had been formerly rated was 6.13 (11 sentences). The mean rating of the nouns of abstract sentences was 3.23 (11 sentences). Since all of the nouns used had not been rated by Pavio, Yuille & Madigan, it is important to note that these figures do not exactly represent the imagery level of the entire set of experimental sentences.

The paragraph-embedded group in the study was presented the sentences embedded in a context paragraph consisting of three sentences of similar length. The last sentence in the paragraph was always the experimental sentence. For example:

The woman on the committee refused to pass the bill until a phrase pertaining to woman's rights was included in it. The committee had never heard such a demand, but was forced to reword the bill. THE ALTERNATIVE VERSION MODIFIED AN ESTABLISHED CUSTOM.

The sentences and the context paragraphs are presented in appendix A of this paper.

Two types of changes were applied to the original sentences to produce the test sentences. Meaning changes were produced by interchanging the subject-noun and the object-noun in the sentences. The second type of change was in wording and involved substituting a synonym, matched with the original for frequency and imagery rating (when possible),for the subject-noun and leaving the rest of the sentence unchanged. These change rules were the same as those used in the Begg & Pavio study. For each sentence, meaning changes and wording changes were equally plausible. This was determined in a pilot study in which subjects rated all original sentences and test sentences. Sentences not unanamously rated as "sensible and plausible" were rejected.

The list of 32 sentences was subdivided into four sets of eight sentences. Within each set, four abstract and four concrete sentences were randomly arranged with the limitation that not more than two sentences of either type could occur in sequence. Each set of eight sentences was recorded on audio tape. A test session consisting of audio tape presentation of the changed or original sentences followed the presentation of each set of original sentences. Each

test set of eight sentences included two sentences with wording changes (W), two sentences with meaning changes (M) and four original sentences (O), arranged so that abstract and concrete sentences were equally represented in each type of test. This process of ordering sentences and determining the type of test to be applied to each sentence was carried out twice to arrive at different sequences for $Order_1$ and $Order_2$.

Design

Twenty subjects were randomly assigned to each condition in a two by three factorial design with between-subjects variables of list order (O_1 and O_2) and treatment groups (E, C_1, C_2). Additional within-subject variables of type of test sentence (W, M, or O) and level of concreteness of sentence (A or C) were included. The independent variable of particular interest was type of treatment. The experimental group (E) listened to a short paragraph providing a context to each test sentence. Each paragraph was presented within a 15 second time interval. The first control group (C_1) was allowed 15 seconds following each presented sentence to repeat and study the presented sentence. This control allowed for a comparison of conditions within this study. The second group (C_2) had an inter-sentence interval of five seconds to repeat and study the presented sentence. This control group was included to allow a comparison between the Begg & Pavio study and the present study (Begg & Pavio had on inter-sentence interval of 5 seconds).

Procedure

The experiment consisted of a familiarization task and an experimental task. In the familiarization task the Ss were first instructed

as to the requirements of the task and then presented with a practice set of six sentences. The practice sentences were generated in the same manner as the experimental sentences. The familiarization task consisted of two phases, an acquisition phase followed by a recognition phase. In the acquisition phase, four abstract and four concrete sentences were presented on audio tape. Immediately after the presentation of the last sentence in the set, the Ss were presented on audio tape a recognition test consisting of meaning or wording transforms of the original sentences or the original sentences. The task of the subjects was to listen to each test sentence, decide if the test sentence was "identical" to the originally presented sentence or "changed", and mark the corresponding space on a response protocol sheet. In addition, subjects were asked to rate their confidence in making each response on a five-point scale. The subjects had seven seconds to respond to each test sentence.

The procedures in the experimental task were identical to those used in the familiarization session. Four trial blocks, each consisting of an acquisition phase with eight sentences, followed by a recognition test on those eight sentences, were presented on tape in succession without interruption.

RESULTS

The analyses were conducted with several purposes in mind: 1) To assess the generalizability of the Begg & Paivio results under the conditions of the present experiment; 2) To assess the comparability of the two control groups in the experiment; and 3) to examine the effects of embedding the test sentences in the context paragraphs.

Two types of analyses were used to accomplish these purposes. In the first, the dependent variable was the proportion of correctly identified changed sentences or correctly identified identical sentences. The second type of analysis utilized both sensitivity (d') scores and "cutoff" values as dependent variables (Coombs, Dawes, & Tversky, 1970). Since the analyses of the signal detection values indicated that the treatments differentially effected the bias and sensitivity scores, these analyses will be of primary interest. Reference will be made to the proportion correct analysis when it is pertinent. It should be noted that there is some ambiguity involved in analyzing the signal detection parameters due to an arbituary decision which was necessary; namely, how to treat scores of 100% correct and 0% correct. The decision was to assign 100% correct Ss a Z score of +3 and 0% correct scores a Z score of -3. Because of this decision there was some distortion of the data. For example, the d' values computed from the mean proportion correct data were generally smaller than the same values computed by summing each Ss d' score and finding the average. This distortion did not, however, alter the pattern of outcomes in the experiment. Plots of the two ways of determining d' values appeared almost identical in direction and magnitude of differences.

Comparison with Begg & Pavio (1969) The proportion of hits results from the C_2 control group and the results from the Begg & Pavio experiment are presented in Figure 1 for comparison. It is apparent from examining the figure that the pattern of outcomes from the C_2 group is different from the Begg & Pavio study in that there was an effect for type of test sentence in the present study. That is, mean-

ing changes were recognized at a higher rate than wording changes for both concrete and abstract sentences. No such effect is present in the Begg & Pavio study. It is important to note, however, that the difference of differences between recognition of meaning changes and wording changes for abstract and concrete sentences was about the same for the two studies under consideration (28% for the Begg & Pavio study and 25% for the present study).

- - - - - - - - - - - - - -

Insert Figure 1 about here

- - - - - - - - - - - - - -

Comparison of the control groups. The C_2 group in the present study differed from group E in two respects: presentation time (5 vs. 15 sec.) and absence of the paragraph context. In contrast, the C_1 group differed from group E only in absence of the paragraph context. Because of these differences a preliminary analysis was performed on the two control groups to assess their comparability. A 2 (C_1 vs. C_2) x 2 (A vs. C sentences) x 2 (meaning vs. wording changes) x 2 (O_1 vs. O_2) analysis of variance on d' scores indicated a main effect for sentence type, $F(1,76) = 21.2$, $p < .01$, with concrete sentences having a higher mean d' (2.74) than abstract sentences (mean d' = 1.84). Type of sentence change was also a reliable effect, $F(1,76) = 73.7$, $p < .01$ with meaning changes being recognized with greater sensitivity (Mean d' = 2.89) than wording changes (mean d' = 1.69). In addition to the main effects, there was an interaction between sentence type and test change type, $F(1,76) = 27.5$, $p < .01$, such that the difference between meaning and wording changes was greater for concrete sentences than for abstract sentences. Two second order interactions were also noted in the analysis. Both the groups x order x test type,

$F(1,76) = 8.7$, $p < .01$, interactions were significant sources of variance.

The same analysis performed on response cutoff scores indicated that the main effect for treatment groups was not significant. However, a significant main effect of list order, $F(1,76) = 8.4$, $p < .01$, was obtained with response cutoff scores. No other results of interest to the study were obtained in analysis using cutoff scores as the dependent measure. A complete listing of all of the analyses performed are presented in Appendix B of this paper.

Effect of Paragraph Context. Since the analyses comparing groups C_1 and C_2 suggested that the two groups yielded essentially the same experimental outcomes (i.e., the group factor entered into only one second order interaction), the effect of embedding the treatment sentences in the paragraph contexts was assessed through a comparison of groups E and C_1.

The analysis included the same factors assessed in the comparison of groups C_1 and C_2. The analysis of the d' scores is of primary interest in the study. The pattern of outcomes is presented in Figure 2. There was two significant main effects in the analysis. Abstract sentences ($\bar{X} = 1.95$) produced lower d' socres than did concrete sentences ($\bar{X} = 2.53$), $F(1,76) = 11.8$, $p < .01$. Type of test also produced a significant effect with Ss responding with greater sensitivity to meaning changes ($\bar{X} = 2.92$) than to wording changes ($\bar{X} = 1.55$), $F(1,76) = 83.3$, $p < .01$. In addition to the main effects there were two significant interactions. The groups X sentence type interaction, $F(1,76) = 5.46$, $p < .05$, was reliable such that there was a greater difference between groups E and C_1 ($\bar{X} = 2.29$ and 2.76

respectively) with concrete sentences than there was with abstract sentences ($\bar{X}$ = 2.11 and 1.79, respectively). The sentence type X test type interaction was also significant, $F(1,76) = 7.27$, $p < .01$, with the difference between meaning changes and wording changes being greater for concrete sentences ($\bar{X}$ = 1.66 and 3.40), respectively) than for abstract sentences ($\bar{X}$ = 1.45 and 2.45, respectively). The critical second order interaction of groups X sentence type X test type was marginally significant, $F(1,76) = 3.47$, $p = .06$. A simple effects test for the predicted increase in sensitivity for meaning changes with abstract sentences due to embedding the sentences in the paragraph context was significant, one tailed $t(76) = 1.93$, $p < .05$. The means for the critical comparison of d' scores for meaning changes in abstract sentences for groups E and C_1 were, respectively 2.82 and 2.08.

- - - - - - - - - - - - -

Insert Figure 2 about here

- - - - - - - - - - - - -

It should be noted that the analysis using proportion of hits as a dependent variable produced the same pattern of outcomes and did yield a significant second order interaction (groups X meaning changes X sentence type), $F(1,76) = 4.66$, $p < .05$. The remaining outcomes in this analysis were essentially the same as those for the d' analysis, with one exception. Order effects contributed to one significant first order interaction (order X sentence type) and one second order interaction (order X sentence type X test type). The fact that order did not contribute to any reliable effects in the d' analysis, but did contribute to the significant order X sentence type interaction in

the cutoff value analysis suggests that the two orders of sentences produced different response biases but did not influence the sensitivity with which the Ss made their decision.

Hit Rate for Original Test Sentences and Confidence Ratings. A separate 2 (A vs. C sentences) X 2 (meaning vs. wording changes) X 3 (groups E, C_1, C_2) X 2 ($order_1$ vs. $order_2$) analysis of the hit rate for original sentences yielded a significant main effect for sentence concreteness, $F(1,114) = 27.3$, $p < .01$, with original concrete sentences ($\bar{X} = .779$) being recognized with greater accuracy than original abstract sentences ($\bar{X} = .681$). In addition, there was a significant effect for order $F(1,114) = 5.93$, $p = .01$, with O_1 original sentences being recognized with greater accuracy than O_2 original sentences. A significant groups X concreteness interaction, $F(2,114) = 9.76$, $p < .01$, was also noted with the difference between group E and the two control groups (which were almost identical) being smaller with abstract sentences than with conceret sentences.

There were several significant outcomes in the analysis of the confidence rating data but only the most pertinent ones will be reported. There were confidence rating differrences between the three types of test items (meaning, wording, original), $F(2,228) = 47$, $p < .01$. On a five point scale original items were rated with the least confidence ($\bar{X} = 3.69$) followed by wording changed items ($\bar{X} = 3.91$), and with meaning changed items being recognized with the greatest confidence ($\bar{X} = 4.17$). In addition, concrete items were rated with greater confidence than abstract items, $F(1,114) = 199.5$, $p < .01$. A somewhat surprising outcome was the lack of an effect for treatment groups, $F < 1$. The confidence of Ss did not vary systematically due to either extending the sentence presentation duration or to embedding

the sentences in the context-paragraph.

Experiment II

Since the predicted increase in detection of meaning changes in abstract sentences as a function of paragraph embedding was only marginally supported in Experiment I, we attempted to obtain a replication of the effect in a second experiment. The control group comparable to the Begg & Pavio group (C_2) was eliminated from the replication experiment because of the comparability established between the C_1 and C_2 groups in Experiment 1.

Method

Twenty undergraduate students were randomly assigned to each condition in a 2 (groups E and C_1) X 2 (List order O_1 and O_2) factorial design. The material, within-subject variables, and procedures were identical to those used in Experiment I. The only difference between the two experiments was a change of experimenters and the absence of the C_2 group from Experiment II.

Results

The analysis of d' scores was of primary interest in the experiment. In particular, attention was focused on the predicted interaction between groups, sentence type, and test type. This interaction is displayed in the second panel of Figure 2. Whereas the interaction was only marginally significant in Experiment I, the effect was much more substantial in Experiment II, $F(1,76) = 7.9$, $p < .01$. The predicted increase in detection sensitivity for meaning changes with abstract sentences as a function of paragraph embedding was assessed using a simple-effects test. Again the effect was more substantial ($t(76) = 3.7$, $p < .01$) than in the first experiment.

The remainder of the outcomes were essentially the same as those for Experiment I. This was established by combining the data from both experiments in an overall analysis with experiments as a factor in the analysis. The experiments factor did not contribute to any significant outcomes in the analysis. The ANOVA tables using d' values as a dependent variable for Experiment II and for Experiments I and II combined are reported in Appendix B.

DISCUSSION

The major purpose of the study was to examine the effect on the sentence recognition due to embedding abstract and concrete sentences in a paragraph context. Begg and Pavio (1969) have taken the strong position that concrete sentences are stored in memory primarily as images whereas abstract sentences are stored primarily as words. Several lines of evidence suggest that the Begg & Pavio results stem from inadequate comprehension of the abstract sentences (Johnson, et al., 1972).

Presumably, abstract sentences of the type used in the present study are more difficult to comprehend than concrete sentences. This likelihood might lead Ss to a strategy whereby they simply attempt to memorize the word strings when presented with abstract sentences. Our paragraph-embedding treatment was an attempt to increase the comprehension of abstract sentences and thereby increase the likelihood that changes in the meaning of the sentences would be detected.

The visual comparison presented in Figure 1 of the outcomes of our C_2 group and the Begg and Pavio (1969) study suggest one major difference in the results: i.e., the greater extent to which Ss detected meaning changes in the C_2 group at both levels of sentence

abstractness. This difference is probably due to differences in the sentences used in the two studies. Our materials were based on the sentences used in the Begg & Pavio study, but the design differences between the two studies required that changes be made and that additional sentences be generated.[3] It is probably the case that our final pool of materials consisted of sentences in which meaning changes were more easily detected than in the sentences used by Begg & Pavio. It is important to emphasize however, the very prominent interaction between sentence abstractness and test type that exists in both studies.

The comparison of the C_1 and C_2 groups in the study indicated that there were no appreciable differences between the two groups due to extending the presentation time for each sentence an additional 10 seconds (i.e., 5 vs. 15 sec.). This suggests that if comprehension is an important determinant of the ability to detect meaning changes in sentences, simply extending the time each sentence is presented has little effect on the degree to which Ss comprehend the sentences.

The null effects of extending presentation time can be contrasted with the effects due to embedding the sentences in the paragraph context (see Figure 2). The paragraph-embedding treatment had virtually no effect on responses to wording changes. However, the treatment did effect the accuracy with which Ss recognized meaning changes. Specifically, the combined results of Experiments I and II offer strong support for the conclusion that embedding the abstract sentences in paragraphs substantially improves a subject's ability to detect meaning changes in the sentences.

References

Begg, I., & Pavio, A. Concreteness and imagery in sentence meaning. Journal of Verbal Learning and Verbal Behavior, 1969, 8, 821-827.

Coombs, C. H., Dawes, R. M., & Tversky, A. Mathematical Psychology, An Elementary Introduction. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1970.

Johnson, M. K., Bransford, J. D., Nyberg, S. E., & Cleary, J. J. Comprehension factors in interpreting memory for abstract and concrete sentences. Journal of Verbal Learning and Verbal Behavior, 1972, 11, 451-454.

Pavio, A., Yuille, J. C., & Madigan, S. A. Concretness, imagery, and meaningfulness values for 925 nouns. Journal of Experimental Psychology, 1968, 76, Monograph Supplement No. 1, Part 2.

Thorndike, E. L., & Lorge, I. The teacher's workbook of 30,000 words. New York: Teachers College Press, 1944.

Footnotes

[1]This paper is based upon an M.S. thesis completed by the first author under the direction of the second.

[2]During the completion of the study the first author was supported by Office of Education grant OEG-1-71-0109(508). The final version of the paper was completed while the second author was supported by NSF Development grant GU4041. We would like to thank Gary Evans, Jerome Myers, Charles Clifton, and Jane Perlmutter for a critical reading of an early version of this paper.

[3]In the present study it was necessary to utilize more test sentences than the number used by Begg and Pavio, 1969. The primary reason for this was design differences between the two studies. In the present study, concreteness and test type were within subjects' variables, whereas these were between subjects variables in the Begg and Pavio study. Also, Begg and Pavio used "filler sets" (sentences which could only be transformed to one of the two test type sentences) which were not included in the analyses. All sentences in the present study were relevant to the analyses.

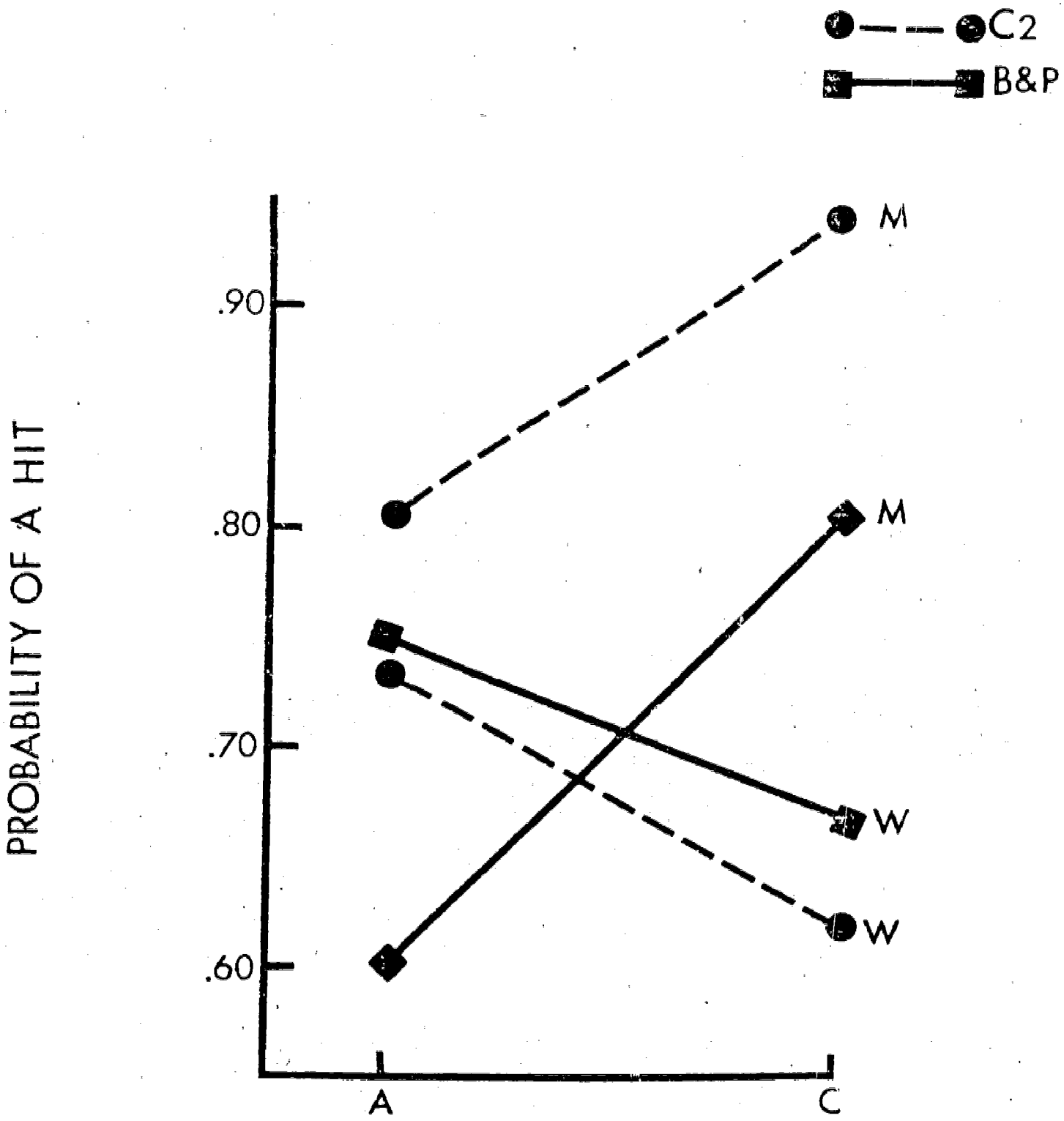

Figure 1. Comparison of P(Hit) of meaning and wording changes as a function of sentence concreteness for Begg and Pavio's data and Control$_2$.

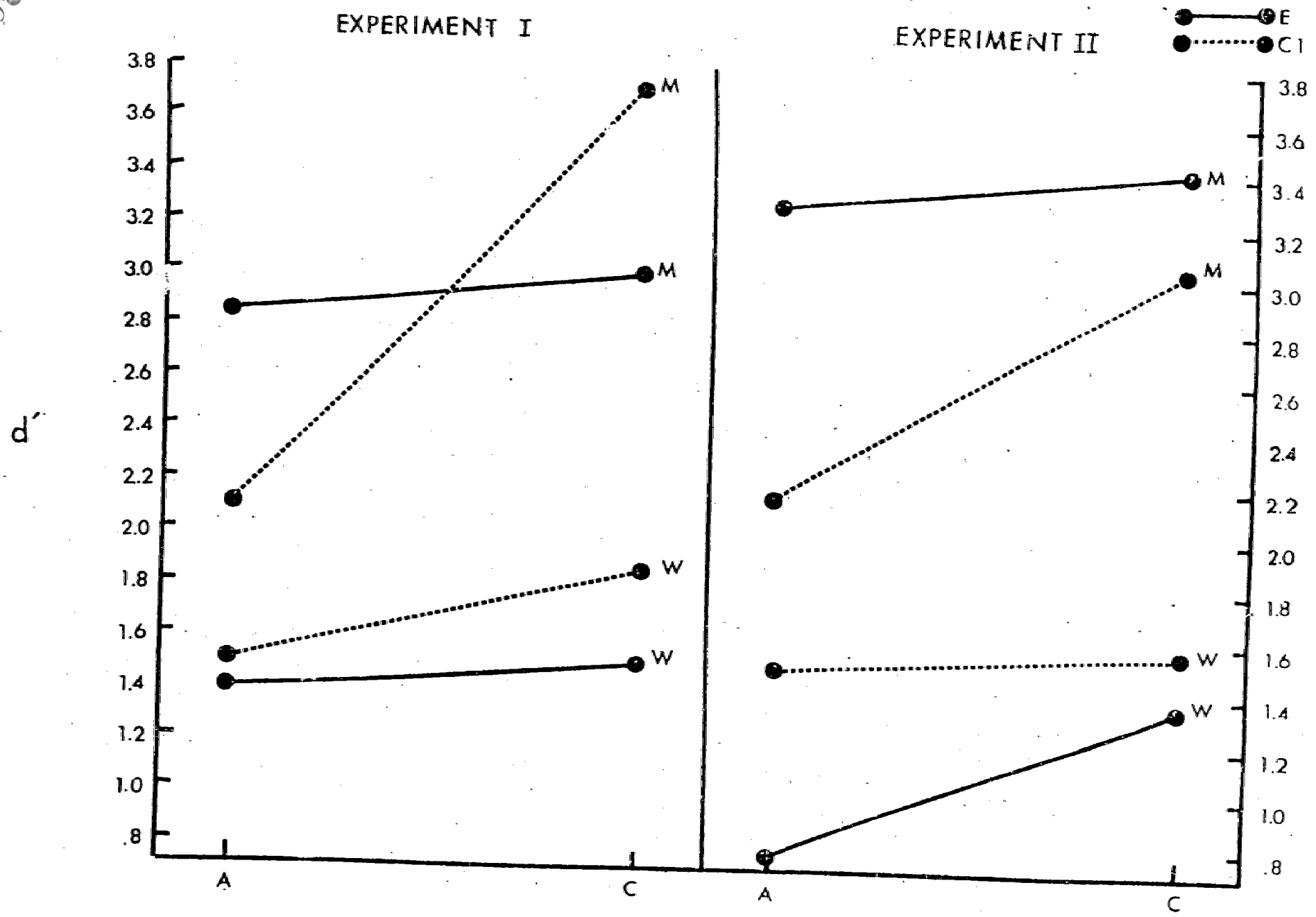

Figure 2. Comparison of d' values obtained in Experiments I and II of the present study for groups E and Control$_2$.

Appendix A

Presentation Sentences Used in the Present Study with Wording (W) and Meanings (M) Test Sentences

Abstract Sentences

1. The final reason supplied the adequate motivation.
W. The final consideration supplied the adequate motivation.
M. The final motivation supplied the adequate reason.

2. The solemn congregation encouraged an impressive service.
W. The solemn gathering encouraged an impressive service.
M. The solemn service encouraged an impressive congregation.

3. The foreign faith aroused an enduring interest.
W. The foreign belief aroused an enduring interest.
M. The foreign interest aroused an enduring faith.

4. The introductory statement promised a logical treatment.
W. The introductory assertion promised a logical greatment.
M. The introductory treatment promised a logical statement.

5. The simple mechanism reflected an outdated technology.
W. The simple machinery reflected an outdated technology.
M. The simple technology reflected an outdated mechanism.

6. The vague concern survived a renewed enthusiasm.
W. The vague opinion survived a renewed enthusiasm.
M. The vague enthusiasm survived a renewed concern

7. The complex review revealed an objective position.
W. The complex summary revealed an objective position.
M. The complex position revealed an objective review.

8. The strange situation altered the accepted conclusion.
W. The strange circumstance altered the accepted conclusion.
M. The strange conclusion altered the accepted situation.

9. The unpleasant factor caused a dismal silence.
W. The unpleasant element caused a dismal silence.
M. The unpleasant silence caused a dismal factor.

10. The complicated proof explained a limited formula.
W. The complicated calculation explained a limited formula.
M. The complicated formula explained a limited proof.

11. The original condition implied an essential balance.
W. The original provision implied an essential balance.
M. The original balance implied an essential condition.

12. The recent pact made an approved solution.
W. The recent accord made an approved solution.
M. The recent solution made an approved pact.

13. The required duty involved a standard payment.
W. The required task involved a standard payment.
M. The required payment involved a standard duty.

14. The ridiculous mistake nullifed a prior commitment.
W. The ridiculous error nullified a prior committment.
M. The ridiculous commitment nullified a prior mistake.

15. The alternative version modified an established custom.
W. The alternative copy modified an established custom.
M. The alternative custom modified an established version.

16. The actual quotation lacked a rational idea.
W. The actual expression lacked a rational idea.
M. The actual idea lacked a rational quotation.

Concrete Sentences

1. The hungry boar attacked a sleeping coyote.
W. The hungry hog attacked a sleeping coyote.
M. The hungry coyote attacked a sleeping boar.

2. The pompous monarch confronted the triumphant queen.
W. The pompous king confronted the triumphant queen.
M. The pompous queen confronted the triumphant monarch.

3. The hollow tree housed an old tomb.
W. The hollow trunk housed an old tomb.
M. The hollow tomb housed an old tree.

4. The unfamiliar helper accused a reckless prisoner.
W. The unfamiliar assistant accused a reckless prisoner.
M. The unfamiliar prisoner accused a reckless helper.

5. The carefree merchant annoyed the timid woman.
W. The carefree dealer annoyed the timid woman.
M. The carefree woman annoyed the timid merchant.

6. The white truck passed a rickety automobile.
W. The white van passed a rickety automobile.
M. The white automobile passed a rickety truck.

7. The young author cherished the homely girl.
W. The young writer cherished the homely girls.
M. The young girl cherished the homely author.

8. The crippled forger killed the tortured slave.
W. The crippled blacksmith killed the tortured slave.
M. The crippled slave killed the tortured forger.

9. The enthusiastic professor welcomed the familiar doorman.
W. The enthusiastic instructor welcomed the familiar doorman.
M. The enthusiastic doorman welcomed the familiar professor.

10. The delicate maiden watched the great dreamer.
W. The delicate damsel watched the great dreamer.
M. The delicate dreamer watched the great maiden.

11. The strong painter bullied the seedy beggar.
W. The strong artist bullied the seedy beggar.
M. The strong beggar bullied the seedy painter.

12. The overgrown stalk shaded a delicate mushroom.
W. The overgrown stem shaded a delicate mushroom.
M. The overgrown mushroom shaded a delicate stalk.

13. The polite servant introduced an intolerant doctor.
W. The polite slave introduced an intolerant doctor.
M. The polite doctor introduced an intolerant servant.

14. The smooth rock struck a heavy pot.
W. The smooth stone struck a heavy pot.
M. The smooth pot struck a heavy rock.

15. The poor scoundrel called a sluggish policeman.
W. The poor villain called a sluggish policeman.
M. The poor policeman called a sluggish scoundrel.

16. The alert laborer pursued the talkative student.
W. The alert worker pursued the talkative student.
M. The alert student pursued the talkative laborer.

Contextual Material Presented to the Experimental Treatment Group

Wild animals seldom abuse territorial boundaries except for self-defense. The need for food can explain many aggressive acts which would not otherwise occur. THE HUNGRY BOAR ATTACKED A SLEEPING COYOTE.

After much arguing, the young child could still not understand why he could not play in the mud. When his mother threatened punishment, he changed his mind. THE FINAL REASON SUPPLIED THE ADEQUATE MOTIVATION.

The king had never felt threatened by another man, not to mention a woman. The victorious queen tried to avoid him on her trip through his kingdom, but he found a way to talk to her anyway. THE POMPOUS MONARCH CONFRONTED THE TRIUMPHANT QUEEN.

The woodsman had died long ago in the middle of a severe winter. Because the ground was too hard to bury him, his body was placed inside a huge rotted tree. THE HOLLOW TREE HOUSED AN OLD TOMB.

The minister had always had a difficult time attracting the town's people to church. The night of the assasinated governor's funeral was an exception. THE SOLEMN CONGREGATION ENCOURAGED AN IMPRESSIVE SERVICE.

The foreign-exchange student from India spoke at an attentive high school assembly Wednesday. Much of her talk revealed the fact that Buddhism was a major guiding force in her life. THE FOREIGN FAITH AROUSED AN ENDURING INTEREST.

Because the convict frequently broke tools which he borrowed from the prison shop, he often was blamed for others' mistakes. A new prison aid found that using the man as a scape-goat for his own short-sightedness was often profitable. THE UNFAMILIAR HELPER ACCUSED A RECKLESS PRISONER.

The president was anxious to study the committee's review of the welfare program. They had outlined their proposal to him that morning. THE INTRODUCTORY STATEMENT PROMISED A LOGICAL TREATMENT.

The first job of the Peach Corp engineer was to replace the horse-driven well pump with a small electric pump. The old type pump was too slow and was holding up irrigation of the field. THE SIMPLE MECHANISM REFLECTED AN OUTDATED TECHNOLOGY.

The jolly man was selling fruit at the market at the booth usually occupied by the butcher. He only laughed when one quiet but obviously disoriented shopper scurried around in front of him. THE CAREFREE MERCHANT ANNOYED THE TIMID WOMAN.

For months no one really took a stand on how they felt about environmental legislation. When a sanitary land-fill area was planned for the outskirts of the city, everyone was up in arms. THE VAGUE CONCERN SURVIVED A RENEWED ENTHUSIASM.

Driving along the turnpike is particularly trying when you are stuck behind a slow car. A truck was anxious for a chance to pull into the passing lane. THE WHITE TRUCK PASSED A RICKETY AUTOMOBILE

The jury tried to express their feelings without showing signs of emotional involvement in the case. After a one hour oration, they stated their decision. THE COMPLEX REVIEW REVEALED AN OBJECTIVE POSITION.

The gentleman was noted for the compassion he revealed in his novels. That is why no one doubted that he would marry the poor maiden whom he loved. THE YOUNG AUTHOR CHERISED-THE HOMELY GIRL.

After weeks of debate, the equal-rights committee voted unanamously in favor of a female president. Unexpectedly, the only eligible female was hospitalized as a result of a serious accident. THE STRANGE SITUATION ALTERED THE ACCEPTED CONCLUSION.

The brawny man could not run and had only his strength to defend himself with. The mad servant had not seen the anvil in his hand. THE CRIPPLED FORGER KILLED THE TORTURED SLAVE.

The excited ski team was suddenly quited by the news that one of their team-mates had fallen during the slalom race. This disaster would ruin any chance of a gold medal for the team. THE UNPLEASANT FACTOR CAUSED A DISMAL SILENCE.

The couple was anxious to revisit the people they had met the previous summer in London. When they pulled up to their favorite restaurant, the friendly face they had remembered was there to greet them. THE ENTHUSIASTIC PROFESSOR WELCOMED THE FAMILIAR DOORMAN.

The statistics class was convinced that they were wasting their time going through such a long proof. The formula they were deriving would not even be very useful to any of them. THE COMPLICATED PROOF EXPLAINED A LIMITED FORMULA.

Any changes that were attempted in the factory threw the whole system off. The old routine, with all of its faults, still ran smoother than any innovation plan. THE ORIGINAL CONDITION IMPLIED AN ESSENTIAL BALANCE.

The young girl was infatuated by her friend who gazed idly toward the sky. She sat silently by him and hesitated to disturb him. THE DELICATE MAIDEN WATCHED THE GREAT DREAMER.

The United States agreed to offer financial assistance to Turkey if in turn Turkey would discourage exportation of Morphine to the U. S. The U. S. did not want Morphine smuggled into this country and Turkey needed financial aid. THE RECENT PACT MADE AN APPROVED SOLUTION.

The noted master was insensitive in his treatment of others. When a helpless derelict stumbled into him and asked for money, the villager was annoyed. THE STRONG PAINTER BULLIED THE SEEDY BEGGAR.

Forest mushrooms flourish in areas which receive a moderate amount of sun light. Some underbrush which grows faster than the mushrooms stifles the growth of muchrooms. THE OVERGROWN STALK SHADED A DELICATE MUSHROOM.

The butler did not look forward to presenting the doctor to the host. Although guests were often abrupt with him, the butler performed his job admirably. THE POLITE SERVANT INTRODUCED AN INTOLERANT DOCTOR.

The importation laws required that jewelry being shipped over the border be accounted for according to its weight. All jewelry, regardless of its worth was considered on the basis of the same criterion. THE REQUIRED DUTY INVOLVED A STANDARD PAYMENT.

The teacher had promised the class a field trip as a reward for their attendance. He remembered too late that he had neglected to reserve a bus, and therefore had to cancle the trip. THE RIDICULOUS MISTAKE NULLIFIED A PRIOR COMMITMENT.

The child was not aware of the value of the utensils he had pulled out of the kitchen cabinet. He threw a homemade paperweight toward the cabinet. THE SMOOTH ROCK STRUCK A HEAVY POT.

The old man knew that he was considered to be a rather shady character and never thought that he would have to rely on civil authority for protection. One night the fellow lost his way in the city and helplessly sought assistance. THE POOR SCOUNDREL CALLED A SLUGGISH POLICEMAN.

The woman on the committee refused to pass the bill until a phrase pertaining to woman's rights was included in it. The committee had never heard such a demand, but was forced to reword the bill. THE ALTERNATIVE VERSION MODIFIED AN ESTABLISHED CUSTOM.

The union member was curious as to the views of college students on the Vietnam war. He was thrilled when he overheard a co-ed avidly discussing the topic with a friend. THE ALERT LABORER PURSUED THE TALKATIVE STUDENT.

It was popular for people to quote Mark Twain in regards to his statement on old age. As would be expected of the humorous writer, his comments on old age reflected a make-believe senility on his own part. THE ACTUAL QUOTATION LACKED A RATIONAL IDEA.

Appendix B

Analyses of variance tables and table of means for study.

Table 1

Analysis of Variance and Table of Means for P(Hit) Data for Groups E, C_1 & C_2

Source of Variance	df	MS	F
G Groups)	2	.0396	.68
O (Order)	1	.4380	8.10**
C (Concreteness)	1	.1333	2.70
T (Test Type)	1	5.1047	118.71**
GO	2	.1005	1.86
GC	2	.0145	.30
OC	1	.7521	15.26**
GT	2	.0297	.69
OT	1	.0880	2.05
CT	1	.8333	24.22**
S (GO)	114	.0541	
GOC	2	.0005	.01
GOT	2	.1911	4.44*
GCT	2	.1286	3.74*
OCT	1	.5333	15.50**
SC (GO)	114	.0493	
ST (GO)	114	.0430	
GOCT	2	.0536	1.558
SCT (GO)	114	.0344	

*Significant at .05α level
**Significant at .01α level

Table of Means

		E		C_1		C_2	
		O_1	O_2	O_1	O_2	O_1	O_2
A	Wording Charge	.700	.625	.763	.625	.713	.750
	Meaning Charge	.913	.850	.725	.825	.788	.813
C	Wording Charge	.613	.750	.550	.725	.425	.813
	Meaning Charge	.913	.963	.888	.975	.938	.938

Table 2

Analysis of Variance and Table of Means for

d' Data for Groups E, C_1 and C_2

Source of Variance	df	MS	F
G (Groups)	2	.4575	<1.00
O (Order)	1	.0459	<1.00
C (Concreteness)	1	52.1704	19.53**
T (Test Type)	1	207.0050	131.43**
GO	2	2.4941	<1.00
GC	2	6.9790	2.61
OC	1	10.8535	4.06*
GT	2	1.3879	<1.00
OT	1	1.2078	<1.00
CT	1	30.0040	21.71**
S (GO)	114	2.6620	
GOC	2	1.2928	<1.00
GOT	2	6.4728	4.11*
GCT	2	4.7410	3.43*
OCT	1	13.1420	9.51**
SC (GO)	114	2.6713	
ST (GO)	114	1.5750	
GOCT	2	.7424	<1.0
SCT (GO)	114	1.3823	

*Significant at .05 α level
**Significant at .01 α level

Table of Means

		E		C_1		C_2	
		O_1	O_2	O_1	O_2	O_1	O_2
A	Wording Charge	1.605	1.197	1.721	1.262	2.016	1.347
	Meaning Charge	2.921	2.713	1.703	2.462	2.465	1.763
C	Wording Charge	1.209	1.740	1.632	2.069	1.084	2.371
	Meaning Charge	3.175	3.056	3.450	3.900	4.034	3.370

Table 3

Analysis of Variance and Table of Means for P(Hit) Data for Groups E and C_1

Source of Variance	df	MS	F
G (Groups)	1	.0781	1.48
O (Order)	1	.0945	1.80
C (Concreteness)	1	.1531	3.50
T (Test Type)	1	3.6125	76.05**
GO	1	.0383	<1.00
GC	1	.0031	<1.00
OC	1	.4883	11.17**
GT	1	.0500	1.05
OT	1	.0070	<1.00
CT	1	.3125	8.18**
S (GO)	76	.0526	
GOC	1	.0008	<1.00
GOT	1	.0633	1.33
GCT	1	.1531	4.01**
OCT	1	.2258	5.91*
SC (GO)	76	.0437	
ST (GO)	76	.0475	
GOCT	1	.0633	1.56
SCT (GO)	76	.0382	

*Significant at .05α level
**Significant at .01α level

Table of Means

		E		C_1	
		O_1	O_2	O_1	O_2
A	Wording Charge	.700	.625	.763	.625
	Meaning Charge	.913	.850	.725	.825
C	Wording Charge	.613	.750	.550	.725
	Meaning Charge	.913	.963	.888	.975

Table 4

Analysis of Variance and Table of Means for

d' Data for Groups E and C_1

Source of Variance	df	MS	F
G (Groups)	1	.4249	<1.00
O (Order)	1	1.2090	<1.00
C (Concreteness)	1	26.9648	11.80**
T (Test Type)	1	149.7481	83.32**
GO	1	2.4240	<1.00
GC	1	12.4682	5.46*
OC	1	3.2629	1.43
GT	1	2.0505	1.19
OT	1	0.7635	<1.00
CT	1	10.6394	7.27**
S (GO)	76	2.6356	
GOC	1	0.2436	<1.00
GOT	1	3.5349	2.04
GCT	1	5.0851	3.47
OCT	1	5.2667	3.60
SC (GO)	76	2.2845	
ST (GO)	76	1.7349	
GOCT	1	0.1581	<1.00
SCT (GO)	76	1.4638	

*Significant at .05 α level
**Significant at .01 α level

Table of Means

		E		C_1	
		O_1	O_2	O_1	O_2
A	Wording Charge	1.605	1.197	1.721	1.262
	Meaning Charge	2.921	2.713	1.703	2.462
C	Wording Charge	1.209	1.740	1.632	2.069
	Meaning Charge	3.175	3.056	3.450	3.900

Table 5

Analysis of Variance and Table of Means for P(Hit) Data for Groups C_1 and C_2

Source of Variance	df	MS	F
G (Groups)	1	.0125	<1.00
O (Order)	1	.5695	10.83**
C (Concreteness)	1	.0781	1.3971
T (Test Type)	1	2.9070	68.40**
GO	1	.0633	1.20
GC	1	.0281	<1.00
OC	1	.4883	8.74**
GT	1	.0008	<1.00
OT	1	.0781	1.84
CT	1	1.0695	33.84**
S (GO)	76	.0526	
GOC	1	.0008	<1.00
GOT	1	.3781	8.98**
GCT	1	.0070	<1.00
OCT	1	.6125	19.38**
SC (GO)	76	.0559	
ST (GO)	76	.0425	
GOCT	1	.0031	<1.00
SCT (GO)	76	.0316	

*Significant at .05 α level
**Significant at .01 α level

Table of Means

		C_1		C_2	
		O_1	O_2	O_1	O_2
A	Wording Charge	.763	.625	.713	.750
	Meaning Charge	.725	.825	.788	.813
C	Wording Charge	.550	.975	.938	.938
	Meaning Charge	.888	.975	.938	.938

Table 6

Analysis of Variance and Table of Means for

d' Data for Groups C_1 and C_2

Source of Variance	df	MS	F
G (Groups)	1	.0786	<1.00
O (Order)	1	.2413	<1.00
C (Concreteness)	1	64.2459	21.16**
T (Test Type)	1	116.3296	73.72**
GO	1	4.6883	1.72
GC	1	.5019	<1.00
OC	1	8.3228	2.74
GT	1	.0003	<1.00
OT	1	.7104	<1.00
CT	1	38.5052	27.49**
S (GO)	76	2.7299	
GOC	1	2.4716	<1.00
GOT	1	12.9368	8.20**
GCT	1	..4739	<1.00
OCT	1	12.1887	8.70**
SC (GO)	76	3.0356	
ST (GO)	76	1.5780	
GOCT	1	.6380	<1.00
SCT (GO)	76	1.4008	

*Significant at .05 α level
**Significant at .01α level

Table of Means

		C_1		C_2	
		O_1	O_2	O_1	O_2
A	Wording Charge	1.721	1.262	2.016	1.347
	Meaning Charge	1.703	2.462	2.465	1.763
C	Wording Charge	1.632	2.069	1.084	2.371
	Meaning Charge	3.450	3.900	4.034	3.370

Table 7

Analysis of Variance and Table of Means for

d' Data for Groups E and C_1

Experiment II

Source of Variance	df	MS	F
G (Groups)	1	1.5331	.48
O (Order)	1	2.2313	.67
C (Concreteness)	1	15.0568	4.61*
T (Test Type)	1	227.1970	69.81**
GO	1	15.3374	4.59*
GC	1	0.1757	.05
OC	1	19.8358	6.08*
GT	1	28.5814	21.91**
OT	1	1.8536	1.42
CT	1	0.6339	.63
S (GO)	76	3.3380	
GOC	1	14.8803	4.56*
GOT	1	0.6987	.53
GCT	1	7.9157	7.85**
OCT	1	4.5886	4.55*
SC (GO)	76	3.2644	
ST (GO)	76	1.3043	
GOCT	1	1.2902	1.28
SCT (GO)	76	1.0089	

*Significant at .05 α level
**Significant at .01 α level

Table of Means

		E		C_1	
		O_1	O_2	O_1	O_2
A	Wording Charge	1.27	.30	1.77	1.25
	Meaning Charge	3.48	3.11	2.59	1.80
C	Wording Charge	1.45	1.34	.81	2.37
	Meaning Charge	3.94	2.97	2.66	3.50

Table 8

Analysis of Variance

d' Data for Groups E and C_1

Across Experiments I and II

Source of Variance	df	MS	F
D (Exp. I or II)	1	0.8933	.30
G (Groups)	1	0.1719	.06
O (Order)	1	0.0777	.00
C (Concreteness)	1	41.1603	14.84**
T (Test Type)	1	372.9240	245.41**
DG	1	1.7861	.60
DO	1	3.3626	1.13
GO	1	14.9781	5.02*
DC	1	0.8613	.31
GC	1	7.8022	2.81
OC	1	19.5944	7.06**
DT	1	4.0211	2.65
GT	1	22.9856	15.13**
OT	1	0.1189	.08
CT	1	8.2337	6.66**
DGO	1	2.7834	.93
DGC	1	4.8417	1.75
DOC	1	3.5043	1.26
GOC	1	5.6580	2.04
DGT	1	7.6523	5.04*
DOT	1	2.4983	1.64
GOT	1	0.5452	.36
DCT	1	3.0396	2.46
GCT	1	12.8448	10.39**
OCT	1	9.8436	7.96**
S (DGO)	152	2.9868	
DGOC	1	9.4658	3.41
DGOT	1	3.6884	2.43
DGCT	1	0.1559	.13
DOCT	1	0.0117	.01
GOCT	1	0.2726	.22
SC (DGO)	152	2.7745	
ST (DGO	152	1.5196	
DGOCT	1	1.1756	.95
SCT (DGO)	152	1.2364	

PREVIOUS REPORTS FROM THE COGNITIVE PROCESSES LABORATORY

70-1 Jerome L. Myers. Sequential choice behavior. June, 1970.

70-2 Patricia A. Butler. The role of information in choice behavior. April, 1970.

70-3 James I. Chumbley. A duoprocess theory of concept learning. June, 1970.

70-4 Charles Clifton, Jr., and Karl D. Gutschera. Evidence for hierarchical search processes in a recognition memory task. November, 1970.

71-1 Donna Cruse, and Charles Clifton, Jr. Recoding strategies and the retrieval of information from memory. April, 1971.

71-2 Jerome L. Myers and David H. Ellis. Memory and binary prediction. December, 1971.

72-1 Jerome L. Myers, Kathy Pezdek, and Douglas Coulson. Effects of prose organization upon free recall. April, 1972.

72-2 Gary W. Evans. The relationship between interpersonal distance and human behavior. June, 1972.