REPETITION PRIMING EFFECTS IN THE RECALL AND COMPREHENSION OF AMBIGUOUS AND UNAMBIGUOUS TEXT MATERIAL

By

WILLIAM PATRICK HERNON

Bachelor of Arts
University of Missouri-Rolla
Rolla, Missouri
1970

Master of Science
Oklahoma State University
Stillwater, Oklahoma
1972

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Thesis Approved:

Robert F. Stanners
Thesis Adviser

Larry Hochhaus

Robert J. Weber

Cheryl M. Scott

Norman N. Durham
Dean of the Graduate College

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CHAPTER I

INTRODUCTION

The determination of the structure of the internal word lexicon poses one of the most basic problems in language behavior, and indeed has become a major concern of contemporary psychology. A pioneering effort in this area has been by Meyer and Schvaneveldt (1971) who were among the first to demonstrate the effects of association in what may be referred to as a semantic priming lexical decision task. In this type of task, subjects have to make a decision as to whether a string of characters is a word or nonword (lexical decision), or whether a simultaneously presented pair of items are both words, nonwords, or mixed.

Meyer and Schvaneveldt found that if a pair of items were both words, positive responses were faster if the words were associatively related (table, chair) than when they were unrelated (table, boat). These results were described as the first word acting as a priming stimulus for the recognition of the second (target) word. Subsequent research has provided two models, the logogen model (Morton, 1970) and the verification model (Becker and Killion, 1977), relevant to this effect which have indicated that semantic priming may be thought of as: a reduction in the amount of sensory information needed for identification of the target stimulus due to the presentation of a semantically related priming stimulus (Morton, 1970); or the selection of a subset of words of which the target stimulus was a member (Becker and Killion, 1977).

Logogen Model

Morton (1970) has postulated a word recognition model in which visual and auditory feature analyzers were used to derive a description of a stimulus item in terms of its acoustic and visual attributes. As sensory information was received it was resolved according to these attributes, which were in turn passively counted by an array of word (morpheme) detectors referred to as logogens. Each of these individual logogens were in turn defined by a unique set of phonological, auditory, visual, and semantic features. Once a critical count of word features for a given logogen had been reached, the word represented by the activated logogen was recognized and made available to an output buffer and the Cognitive System (a long term memory store). According to Morton, "If the word 'cat' were presented visually, the output from the visual analysis might include the attributes (three-letter word), (final ascender), (initial c), (final t), and so on. These items would be included in the set (V_{cat}) of course, so the logogen L_{cat} would automatically receive an increment for each of the attributes (presumably weighted according to some hierarchical principal)" (p. 206). It was also believed that words similar to cat (dog, cap, hat) would also have their corresponding logogens incremented, although only one word would exceed its criterion and become recognized.

The critical count for a given logogen was thought to be determined by two specific and functionally independent mechanisms, frequency and context. Each logogen had a resting threshold level determined by the frequency of usage of the word in the language. The higher the word frequency, the lower would be its resting threshold or critical count. High frequency words would then require that fewer features be activated for word recognition. Since high frequency words required activation of fewer features, the time required for recognition would be correspondingly quicker.

Contextual information, on the other had, the exact form of which had not been specified by Morton, but which may be thought of in terms of semantically related words, acted to increase the feature counts of the appropriate logogens, through the Cognitive System sending semantic attributes to the logogen system. All logogens whose semantic sets contained these attributes would also be incremented. For example, bread could serve as an adequate context, a priming stimulus, for butter, while jail house could serve as a prime for prison. A semantic context that was not appropriate for a particular logogen would leave that logogen's count unchanged. Since word frequency and context were thought to be independent systems, both the stimulus frequency of context effects were believed to be additive. That is, if word frequency were to be held constant, response latency should decrease up to some maximum value, with increases in semantic information.

Verification Model

The verification model of Becker and Killion (1977) incorporated the visual feature analysis and word detector components of Morton's (1970) logogen model, while at the same time changing the function of these components. Becker and Killion assumed that feature analysis and counting was nonspecific. That is, these initial analyses comprised a process that resulted in more than one word detector exceeding its criterion, because the feature analyzers only identified primitive features such as curves, angles, and segments. This process yielded, therefore, only a crude approximation to stimulus identification.

The functional change in this model occurred through the use of these components to construct a subset (the sensory subset) of words whose word detectors had exceeded their criterion. This subset of words was in turn used in a verification process in which a specific word (prototype) was initially selected on the basis of word frequency, with high frequency words being selected before low frequency words, and compared with the contents of the visual memory. If the prototype's relational features (information contained within the prototype which specified how the sensory features should be organized or connected) matched those found in visual memory then the word was recognized (Becker, 1976). If these relational features did not match those found in visual memory then another word was sampled from the sensory subset and compared. This process continued in an iterative manner until either a word was recognized or the sensory subset was exhausted.

Semantic context operated in the verification model by incrementing word detectors that were semantically related to the prime word. These words then comprised a semantically related subset of words on which the verification process operated. Because this semantic subset was formed before the next word was presented, the verification process was believed to begin in parallel with the presentation phase of the next word. The semantic context would allow the verification process to bypass the primitive feature analysis and start directly with the semantic subset. If a new stimulus was not related to the context word, the semantic subset would be exhaustively analyzed until processing switched to the sensory subset.

In keeping with these models of word recognition, Sternberg (1969) has proposed that the mental processes in reaction time (RT) tasks, semantic priming for example, could be thought of as a series of relatively independent stages; stimulus encoding, memory search, decision (word-nonword), and response. If two experimental variables were then believed to influence the same stage of processing, their effects should be interactive since a limited capacity processing system must switch between the two task variables. Conversely, if two variables each affect different stages of processing, their effects should be additive. Using this additive factor technique, the lexical deicsion paradigm has been applied to the following problem areas: First, the effect perceptual encoding of the stimulus words has on the semantic priming effect was assessed. Based on experiments where the target member of a priming pair was visually degraded by a random pattern of dots, it was determined that the degradation effect was smaller for an associatively related pair than for an unassociated pair. These interactive results supported the idea that the priming or semantic context effect occurred, at least in part, during an encoding stage of the visual stimuli. That is, semantic relations between word pairs facilitates the visual encoding of the target member (Meyer, Schvaneveldt, and Ruddy, 1974, 1975). In a related study, Becker and Killion (1977) replaced the random dot pattern with variations in stimulus intensity to produce a visual degradation situation. This change to stimulus intensity was made because there was evidence suggesting that the random dot pattern affected more than just the stimulus encoding stage. After varying both the associative relation between words and stimulus intensity, the conclusion, which supported the Meyer et al. studies, was that both semantic context and stimulus intensity did indeed influence the encoding stage. Secondly, in another task where a lexical decision was used, the locus of the effect of word frequency was also considered. The frequency effect was found to be localized in the memory search process and not in the encoding of the word since visual degradation, using both random dots and intensity, and word frequency factors did not interact (Stanners, Jastrzembski, and Westbrook, 1975; Becker and Killion, 1977). Finally, in a study by Schuberth and Eimas (1977) where an incomplete sentence preceeded either high or low frequency target words (The puppy chewed the bone), the presentation of these sentence contexts facilitated the classification of a congruous target word, but word frequency did not interact with congruity. According to Schuberth and Eimas, these findings support Morton's logogen model in that both contextual information and word frequency add to increase the strength of an appropriate logogen. Response time is then inversely related to the logogen's response strength.

Semantic priming has also been used to investigate the effect of ambiguous word contexts on the word lexicon by finding that when, in a series of three words (save, bank, money), the first and third words were related to the ambiguous meaning of the second word, the RT to recognize the third word would decrease. But, when the first and third words were related to a different meaning of the second word (river, bank, money), the RT to the third word was not different from a neutral control situation (fig, date, money) (Schvaneveldt, Meyer, and Becker, 1976). Schvaneveldt et al. interpreted these findings as indicating that in a relevant context, where both terminal words were related to a specific meaning of the ambiguous second word, the meanings accessed when recognizing the ambiguous second word would be restricted to those activated by the first word. Thus, in this mutually related case, recognition would be speeded for the third word because the first, second and third words would be semantically related. But, when the first word biased subjects to access a different meaning of the second word not related to the third word, the reaction time to the third word would not be decreased. Theoretically, it was thought that an appropriate word context could result in less time being needed to accumulate the number of sensory or semantic features required to recognize words with related meanings.

In a related area, another type of facilitation effect, repetition priming, was developed to investigate the priming effect resulting from making a lexical decision about the same letter string at different points in the experiment (Forbach, Stanners, and Hochhaus, 1974). For example, in this type of task the semantically related prime-target pair (bread-butter) is replaced by a repetition pair (bread-bread). This repetition priming effect has been found to be very resistant to decay, unlike semantic priming, with the facilitation effect remaining for ten minutes or more (Forbach, Stanners, and Hochhaus, 1974; Scarborough, Cortese, and Scarborough, 1977). However, the explanation for the locus of the repetition effect appears somewhat more complex. Forbach et al. (1974) found that word frequency did not interact with the priming effect. This lack of interaction could be interpreted as indicating that the priming effect was operative during some encoding stage. Contrary to this finding, Scarborough et al. (1977) found that priming interacted with word frequency. However, their interpretation was that the locus of the priming effect occurred in both the encoding stage and the memory search stage. This interpretation was reached by noting that if the lexical decision task was changed to a pronunciation task, the frequency-priming interaction was lost (supposedly the pronunciation task would only require an initial encoding and not a memory search). Yet, since there was still a good (albiet smaller) priming effect for the pronunciation task, and since priming interacted with frequency for the lexical decision task, the priming effect was thought to occur during both encoding and memory search.

Although these results seem to be somewhat less than decisive, they can both be handled in part by either Morton's (1970) logogen model or Becker and Killion's (1977) verification model. In repetition priming experiments once the initial priming word has been presented, both visual and semantic information becomes accessible and is counted by the logogens. The frequency effect occurs, either through a lower criterion for high frequency words (Morton, 1970) or through serial selection, based on frequency, from a subset of words (Becker and Killion, 1977). However, if the task is switched to a simple pronunciation situation, without semantic access since no lexical decision is made, only visual features would have been accessed. Priming may now still occur simply through a match between previously activated logogens without the benefit of semantic coding. Scarborough et al. points out that the discrepancies may have resulted from differences in the materials used. In the Forbach et al. experiment, the high frequency words were selected so that they differed in only one vowel change from the low frequency and nonword items. Although this procedure minimized orthographic differences, it may have also created some nonspecified transfer effects between the logogens for the visually similar items. The important points for the present research, is that repetition priming does involve activation of both the visual and semantic attributes of a word, and does not involve just a pattern matching sequence between identical stimuli. Furthermore, repetition priming also seems sensitive to changes in the words used within the priming task.

In the present experiment the repetition priming paradigm will be used to investigate the lexical processes involved in the comprehension and recall of text material. As applied to the problem at hand, research on comprehension and recall takes two directions, one dealing with the effects ongoing comprehension has on various recall response measures (Bransford and Johnson, 1972, 1973; Dooling and Lackman, 1971; Dooling and Mullet, 1973), and the second with the effect recall or comprehension task instructions have on the lexical analysis of text material (Aaronson and Scarborough, 1976).

Bransford et al. (1972, 1973) conducted a series of experiments in which the comprehension of an ambiguous paragraph was manipulated by presenting an appropriate thematic title or picture for the material. If a disambiguating title was presented to a subject, this presentation occurred either immediately preceeding or following the text. Their purpose was to show that not only is prior knowledge of the disambiguating title reflected in comprehension tasks, but that such knowledge is needed for any meaningful processing of the material. Potentially meaningful material was believed to remain incomprehensible when subjects did not have the required semantic information activated at the time of input. Results indicated that subjects do indeed make use of prior contextual knowledge, and that this prior knowledge facilitated recall of the text material. Specifically, subjects who understood the contextual information were able to recall more of the text material, while subjects who were presented the theme after the paragraph could recall only slightly more information than subjects who were given no thematic knowledge at all. In addition, Bransford et al. (1973) suggested that the absence of an appropriate context seemed to lead subjects to focus on the nonsemantic aspects of linguistic inputs. For example, more attention was paid to orthographic and syntactic features of sentences or words than to their semantic features. This last interpretation is also directly in line with a levels of processing approach (Craik and Lockhart, 1972) in which the disambiguating title instructions induced a deeper level of processing of the material and thereby affected the amount of information retained (Schallert, 1976).

Aaronson and Scarborough (1976), on the other hand, were interested in the immediate perceptual encoding of text information in comprehension and recall tasks, and focused on cognitive task demands as determinants of coding strategies. Sentence coding procedures were felt to be task dependent and could be characterized by the processing time required, and structural (linguistic) units involved in the sentence. That is, for recall memory tasks, coding was thought to progress serially through a sentence at first word by word, and then by phrase, and depend on the lexical items and syntactic structure. For comprehension demands, coding would be more strongly focused about main semantic points (subject, verb, object) and dependent upon deep structure and semantic information. Therefore, optimal coding for comprehension and recall was believed incompatible since comprehension operations delete or substitute lexical items, disturb word ordering, and minimized contextual retrieval cues, all of which are important to recall operations. Based on these hypotheses, it was believed that coding time for recall tasks should increase over the phrase and sentence, while coding time for comprehension tasks was thought to decrease over the phrase as linguistic predictability increased. In addition, the resultant coded representation should be dependent on the extent to which the stimulus must be comprehended or memorized. Using a subject paced task in which subjects viewed sentences one word at a time, one interesting result, particularly applicable to this study, was reported: a comprehension task demand required that more time be spent viewing semantic rather than syntactic cues while the reverse was true for a recall set.

From the preceding discussion it seems apparent that tasks that demand the recall of information influence the subject to process information both syntactically and semantically but with each word given equal weighting or attention as the processing proceeds. Comprehension tasks, on the other hand, result in the subject processing primarily semantic information with syntactic variables only being used to guide the semantic extraction of information. Once the semantic core has been processed, detailed syntactic information is dropped. The depth of comprehension can be influenced by providing a relevant thematic title.

Text Base Model

Since a repetition priming paradigm will be used, consideration must also be given to the choice of appropriate words from text materials. In the present paper, a theory for the representation of meaning proposed by Kintsch (1974, 1976) will be used as a basis for the word item selections. This theory assumes that the basic units of text meaning are propositions which consist of n-tuples of word concepts. One of these word concepts serves as a predicator while the other word concepts are the arguments, each fulfilling a unique semantic role. The predictor specified the relationship among the arguments, and the argument carries the object or intention of a given statement. These propositions are in turn, connected as an ordered sequence in a text base, or frameword, which represents the meaning of a given text. Although the arguments of a proposition are concepts rather than words, concepts shall be operationally denoted here by their corresponding English word in a manner similiar to Kintsch et al. (1975), and Kintsch and Vipond (1977). Thus the arguments of a given proposition will be selected as the items of interest for this study. Furthermore, these propositional arguments are closely tied to the semantic interpretation derived from a given text, and have already been found to be especially important for text comprehension. For example, it has been found by Kintsch et al. (1975) that text comprehension became more difficult if new arguments are constantly being introduced. In terms of the text base model this implied that when a new argument was introduced, the reader must establish in memory a concept node for that argument, but if the argument was repeated it was only necessary to connect it with an already established node. Thus, the formation of a text base was equated with the construction of a graph in which propositions that shared an argument were connected to the proposition that first introduced that argument. Any paragraph that could be analyzed into such a connected graph, was then easier to process than a paragraph that did not form such a coherent text base.

What has not been considered in detail is the influence of set or task demands on propositional arguments at the lexical level. Kintsch (1977) has suggested for instance, that the nature of the propositional network, and thereby the propositional arguments, could be differentially affected by manipulations in set or task. If, for example, manipulations of set by means of title information were made for ambiguous paragraphs, the nature of the propositional network would be completely specified if an appropriate title was given. However, in a neutral case, where no title information was specified, troubles would occur in the construction of a propositional network because it would not be obvious how topic propositions should be identified in such cases. It seems reasonable then, to expect that the words used to represent a given argument should be differentially influenced by set or task demands, since these operations have already been found to influence the amount or type of information extracted from a given text as noted before, and because the propositional argument structure can readily be tied to the semantic meaning of a given text.

Purpose of the Present Study

The important question that now arises, is what is the state of the word lexicon after reading a given text under varying task conditions? Although many current theories on the nature of the stored memory representations following reading postulate semantic units different than the word (propositions, Kintsch, 1974; conceptual dependencies, Schank, 1975, 1976; routines, Miller and Johnson-Laird, 1977), all of these higher order systems must initially be accessed through the printed or spoken word. As yet, we know little about the nature of this lexical structure and its relation to these higher order systems. The purpose of the present research then will be fourfold: First, to assess whether a repetition priming effect may be found for propositional arguments after reading a given paragraph, and what is the quantitative nature of this priming effect; second, to determine whether repetition priming of propositional arguments is sensitive to the level of understanding of the text -- the level of understanding will be manipulated by using ambiguous contexts which can be made comprehensible through the presentation of an appropriate title; third, to determine whether task instructions (recall or comprehension) will influence the repetition priming effect; and fourth, to learn if the use of title information will interact with task instructions.

CHAPTER II

METHOD

Subjects

The subjects were 48 undergraduate students in psychology. They received a small amount of extra credit toward their course grade for participation. In addition, each subject received a varying monetary reward depending on their performance on a recall test. Three subjects had to be replaced for failing to exceed a criterion of 85% correct responses for the word and nonword trials. Two other subjects had to be replaced because of equipment malfunctions.

Apparatus

Presentation of stimulus materials was via a Lear-Siegler ADM-3 cathode-ray tube (CRT) controlled by an ADS-1800E computer. This system presented the complete paragraph materials, in both upper and lower case letters, with approximately ten words per line and seven to eight lines per paragraph. With the subject seated at a distance of approximately 45 cm. from the screen, the resultant horizontal and vertical visual angles for an entire paragraph were approximately 16° 25' and 8° 6', respectively. For individual words, centered on the screen, the horizontal visual angle varied from approximately 54' to 2° 55' as word length varied from four to 13 letters. A reaction time measure (msec.) for each subject's lexical decision responses was automatically recorded by this system.

Procedure

Upon being seated before the CRT, with two buttons marked "word" and "nonword" visible, and the word "ready" on the screen, the subjects were instructed to press both buttons after which a paragraph, ambiguous in meaning, was presented on the screen for 40 seconds. This limit was based upon a preexperimental test of the time needed to read a selected paragraph during the experimental tasks. The subjects were then told to read the paragraph out loud into a microphone, under either recall or comprehension instructions, until the paragraph disappeared from the screen. These acquisition instructions emphasized that the recall subjects should attempt to read the paragraph for verbatim recall, while the comprehension subjects were instructed to attempt to understand the essential ideas of the paragraph. All subjects had to read the paragraph in a continuous fashion. That is, subjects were instructed to refrain from pauses and regressions during the reading stage. This reading stage served to "prime" the words of the paragraph, while reading out loud permitted the experimenter to note any problems or errors in reading and how much of the paragraph was read (See Flow Chart of the Procedure, Appendix A).

Following the reading of the paragraph, the subjects were required to make a series of 120 word-nonword decisions. Within this lexical decision period the subjects were presented with 15 words from the paragraph just read, these words serving as the propositional argument or Experimental Target (ET) items for the words primed by reading a paragraph. In addition, 15 repetition prime-target pairs were presented to serve as control words (Control Prime-Control Target; CP-CT) for the Experimental Target words. The control word pairs represented a standard repetition priming paradigm in which a word was primed by its identity (gems-gems). A final 15 words, for a total of 60 words, were also presented to serve as filler items (FI). During the lexical decision task, the subjects were instructed to indicate, as quickly and as accurately as possible, whether the presented item was a word or nonword. Immediate feedback, as to whether the subjects' decisions were right or wrong, was then provided via the words "correct" or "wrong" appearing on the CRT.

Upon completion of the lexical decision task, the statement "paragraph follows" appeared on the CRT after which a second paragraph was presented which the subjects also had to read out loud for comprehension, if the first paragraph was read for comprehension, or for recall if the first paragraph was read for recall. After reading this second paragraph another 120 lexical decisions were made as before. The subjects were also given, at the end of the instructions, the Title (T) of either the first or second paragraph which would make ambiguous the meaning of that paragraph, while for the other paragraph No Title (NT) was given. The presentation order of Title or No Title was counterbalanced between subjects (Appendix B).

To help insure that as much processing as possible was involved in the reading task, each subject was informed that they would be paid two cents for each correct response made on a post-experimental test (recall or comprehension). However, at the end of the experiment, all subjects were asked to recall as much as possible of the two paragraphs that they had just read to obtain comparable indices of the task instructions. Subjects were paid two cents for each idea correctly recalled. The order of recall of both paragraphs always followed the presentation order, and there was no time limit on the recall period. Before the presentation of the two experimental passages, a practice paragraph was presented followed by its own lexical decision task. The title to the practice passage was always presented. Approximately 40 minutes were required for the complete experiment, with each paragraph reading and its associated lexical decision period requiring an average of 15 minutes.

Materials

Four paragraphs (Appendix C) were selected, equated for length (77 words), consisting of two metaphorical passages and two descriptive passages adapted from the studies of Dooling and Lachman (1971), and Bransford and Johnson (1972). Each passage was considered ambiguous by these researches since the comprehension and recall of a given passage was influenced by the presentation of a title. From each passage 15 words were selected, for a total of 60 items, to serve as the prime-target stimuli. The initial selection of these items was based on a propositional analysis (Turner and Greene, 1977) of each story (Appendix D). For example, the sentence "Joe has a large nose," may be analyzed as (possess, Joe, nose) and (qualify, nose, large). Here there are three arguments, Joe, nose, and large. The complete requirements for all selected words were that: First, no ET word would appear more than once in the four paragraphs; second, all ET, CP and CT words from each paragraph would be equated on frequency (Kucera and Francis, 1967); third, the locations of the ET words within a given paragraph must be evenly distributed throughout the paragraph -- approximately 2 ET words per line of presented text were used; and fourth, the arguments of each proposition for each paragraph were selected. Based on the above criteria the mean frequency of the selected words for all four paragraphs was 39.88, with a mean frequency range for all four paragraphs from 25.93 to 57.66. The number of propositions for the four paragraphs ranged from 31 to 44 propositions per paragraph.

Besides the 60 prime-target stimuli, another 60 items were selected from Kucera and Francis (1967) English norms, matched on frequency, length, and part of speech to the prime-target stimuli. These items were selected to provide a set of filler items. Lastly, 120 nonwords were constructed by selecting an additional 120 words matched on frequency and length to the ET items with one or two vowels then changed to produce a nonword.

Design

Since all words had to serve as both ET items and as repetition priming control pairs (CP-CT) in the overall analysis of variance, so that comparisons between experimental and control items would not include differences between words, four paragraphs were used with each subject reading only two of the four paragraphs. After reading a given paragraph, the experimental (ET) lexical decision task was based on 15 words from that paragraph, with 15 word repetition pairs (CP-CT) from another paragraph that the subject did not read serving as the control items. Thus, after reading both paragraphs a given subject had seen the complete set of all prime-target items. A second subject would then read the two remaining paragraphs, with the subject pair providing the comparison between a given word primed by reading a paragraph (ET) and the same word primed in a non-paragraph situation (CP-CT).

The overall design of this experiment then, involved four factors; Prime Condition, Context, Task, and Subjects, with Prime Condition on Context being within-subjects and the Task factor between-subjects. Within the Prime Condition were the ET, CP, and CT items, while within the Context factor were Title (T) and No Title (NT), and Recall (R) versus Comprehension (C) in the Task factor. Twenty-four subjects were assigned at random to either the Recall or Comprehension tasks. Thus, the overall analysis of variance was a 3 (ET, CP, CT) X 2 (R, C) X 2 (T, NT) X subjects (Winer, 1971).

The Metaphorical (M) and Descriptive (D) distinction (Story structure, S) was included in this research by counterbalancing this factor in a Latin square with the Context (T, NT) factor. Specifically, for both the recall and comprehension task, there were two groups of 12 subjects each, one of which received the Title-Descriptive and No Title-Metaphorical factorial arrangement, while the other group received the Title-Metaphorical and No Title-Descriptive arrangement. This arrangement helped lessen the possibility of some generalized learning or interference influence between two passages depending on their similarity of structure (Bower, 1976). Consequently, a second design was applicable, pertaining directly to the analysis of the ET items, a 2 (T, NT) X 2 (R, C) X 2 (M, D) X Subjects Latin square analysis of variance.

For all of the above analyses, an additional by-items analysis of variance was also computed, in which the subjects data was collapsed across subjects onto the individual ET words. Thus, the first analysis changed to a Prime X Context X Task X Story X Words analysis of variance. These by-items analyses, in conjunction with the by-subjects analyses, were used to provide two estimates of the treatment effects; one in which subjects were considered a random effect and the second when words were considered a random effect.

CHAPTER III

RESULTS

For all of the following analyses, the latencies for each subject, for each condition, have been initially adjusted by using only those correct responses that were within two standard deviations of the unadjusted mean for each condition. Scores outside this $\pm$ 2 standard deviation band were felt to be atypical responses and attentional lapses. In addition, all subjects were able to read the paragraphs within the 40 second time limit, and no subject was able to read any paragraph more than 1.5 time, resulting in reading times varying from approximately 115 to 190 words per minute. Finally, two "F" values will be reported for each analysis of variance test. These two "F" values will always represent respectively; F_1, an analysis based on subject data collapsed over words (subjects a random effect), and F_2, an analysis based on word data collapsed over subjects (words a random effect). This technique was selected, over reporting the min F' values directly, because of a controversy surrounding the determination of an appropriated test to use when words and subjects are considered as combinations of random or fixed effects (Clark, 1973; Wike and Church, 1976; Clark, Cohen, Smith, and Keppel, 1976). By reporting both "F" values, the legitimacy of any comparison will be easy to verify since both "F" values will be present.

Priming Effects

The primary question in this research was whether a repetition priming effect may be found when the reading of paragraph materials serves as the priming stilusus. To investigate this question, the following analyses have been carried out: A four-way analysis of variance for Priming (ET, CP, CT) X Context (T, NT) X Task (R, C) X Subjects (Words) indicated (Appendices E, F) that there were significant effects for Priming, F_1 (2, 92) = 50.57, $p < .001$, F_2 (2, 236) = 61.85, $p < .001$, for the Priming by Task interaction, F_1 (1,46) = 5.27, $p < .03$, F_2 (1, 118) = 34.68, $p < .001$, and for the Context factor, F_1 (1, 46) = 6.11, $p < .02$, F_2 (1, 118) = 5.52, $p < .05$. To determine whether there was a priming effect for the experimental target (ET) items, a least significant differences (LSD) test (q = .05, 2, 138; LSD = 44 msec) was then made on pairwise comparisons (Figure 1) between control prime (CP) and ET items. In addition, to answer the question of whether there was a larger repetition priming effect during the lexical decision task when compared to priming during reading, pairwise LSD comparisons were also made between the control target (CT) and ET items within each Task level (Table I).

The results of these tests indicated that there was indeed a priming effect for the comprehension task when a title was presented since the reaction times to the ET items were significantly less than the RT's to the CP items (87 msec), while for the no-title condition there was a priming effect of 44 milliseconds between the ET and CP items. For the recall task, there was again a significant priming effect for the no-title CP-ET comparison (52 msec), but when the title

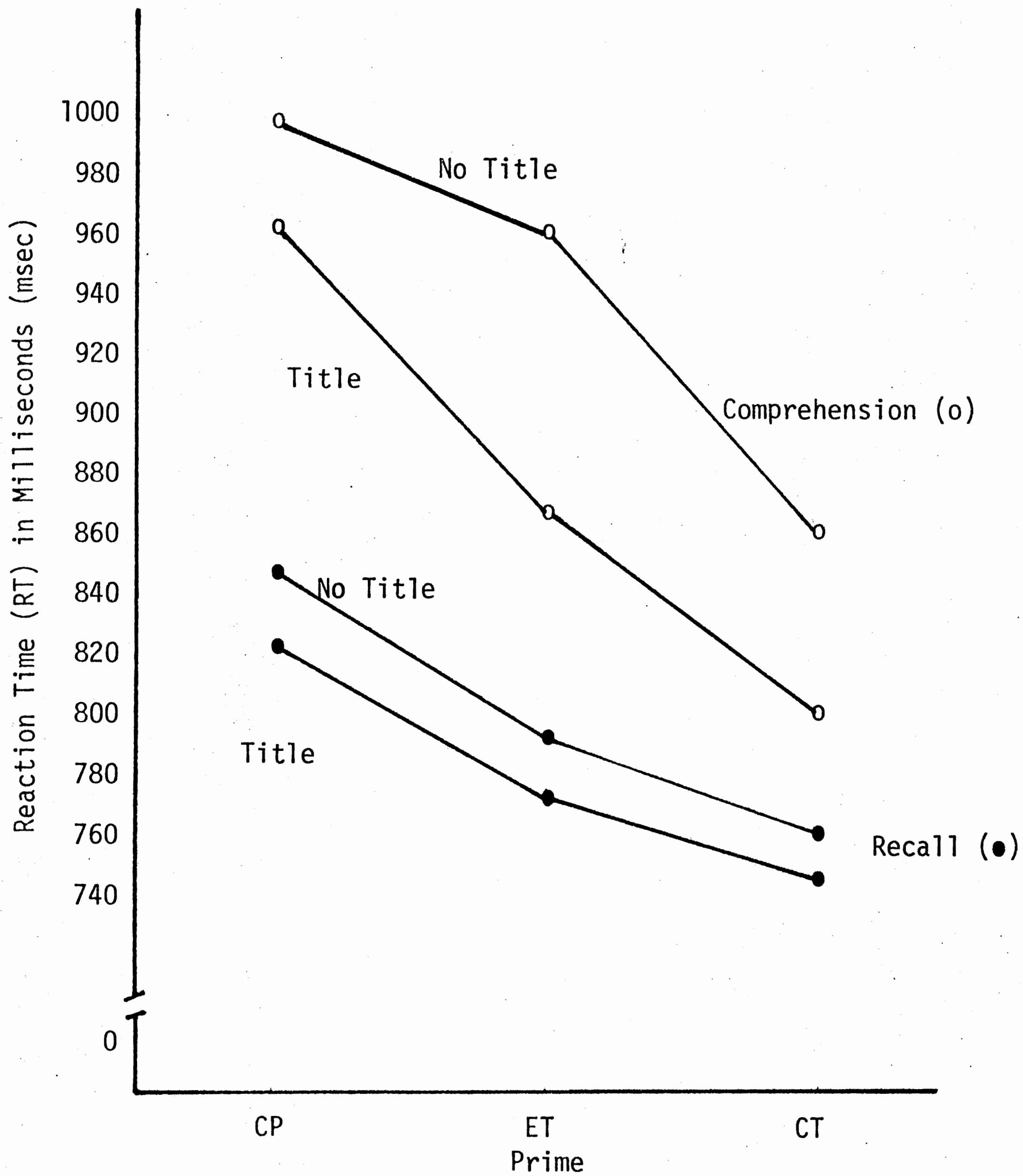

Figure 1. Task, Context, and Priming Response Latencies

was presented there was no significant difference between the ET and CP items (42 msec). Moreover, the LSD test revealed that there was no difference for either the recall title and no-title ET-CT comparisons, while there were significant differences for the comprehension title and no-title ET-CT comparisons. In addition, the CP-CT comparisons for both the comprehension title, no-title conditions, and the recall title, no-title conditions were all significant.

Thus, there appears to be three interesting results relevant to the priming task: First, it appears that the recall title CP-ET priming comparison was nonsignificant. Although the exact reason for this finding is unknown, the pattern of latency averages suggests that this particular failure of the CP-ET comparison might reasonably be a Type II error (the CP-ET difference was 42 msec, 44 msec was the LSD at the .05 level, versus a 30 msec difference for the ET-CT comparison). Second, within the comprehension task the ET items were apparently primed less than the CT items, as the CT items had significantly smaller latencies, while within the recall task the ET items were primed as much as the CT items. This result suggests that repetition priming following reading for recall is of the same order of magnitude as the priming occurring during a lexical decision task, while the repetition priming effect following reading for comprehension appears to be smaller than that occurring during the lexical decision task. And third, the Task factor appears to provide a general influence on all Priming levels (CP, ET, CT). That is, differences would not be expected between the CP conditions nor between the CT conditions for recall and comprehension, since these control items were not part of the paragraph just read. Conversely, it would be reasonable to expect the ET items to reflect the influences of task and title manipulations if such influences were present. Yet in this experiment, the CP, ET and CT items all were apparently influenced by Task manipulations, implying some form of general influence on all priming levels.

The nature of the Prime by Task interaction was investigated then, by comparing the respective CP, ET, and CT latencies between the recall and comprehension tasks, collapsed over context (Figure 2), through the use of an LSD test (q = .05, 2, 46; LSD = 105 msec). According to this text, the CP items differed, and the ET items differed, while there was no difference between the recall and comprehension tasks for the CT items. This finding leaves the Prime by Task interaction with some interpretation difficulties. For example, the interaction was small and as such may simply be an artifact of the present experiment; or perhaps this small interaction could have resulted from a reduction in the general task effect when items are repetition primed (CT items); or finally, the recall set may somehow have resulted in the CP items having smaller latencies. Yet despite these interpretation problems, there is also evidence that there was less maximum priming, the CP and CT comparison, for the recall task. That is, there appears to be a significant reduction of the recall (CP-CT) priming effect (81 msec) when compared against the comprehension (CP-CT) priming effect (135 msec) by using Scheffe's multiple comparison method, $F(3,92) = 12.75$, $p < .05$. Thus the Task factor not only resulted in shorter latencies for the recall CP and ET items, there was also a smaller priming effect for the recall control items.

To investigate the influence of the Context factor on priming, an LSD test (Q = .05, 2, 138; LSD = 58 msec) was made between the title

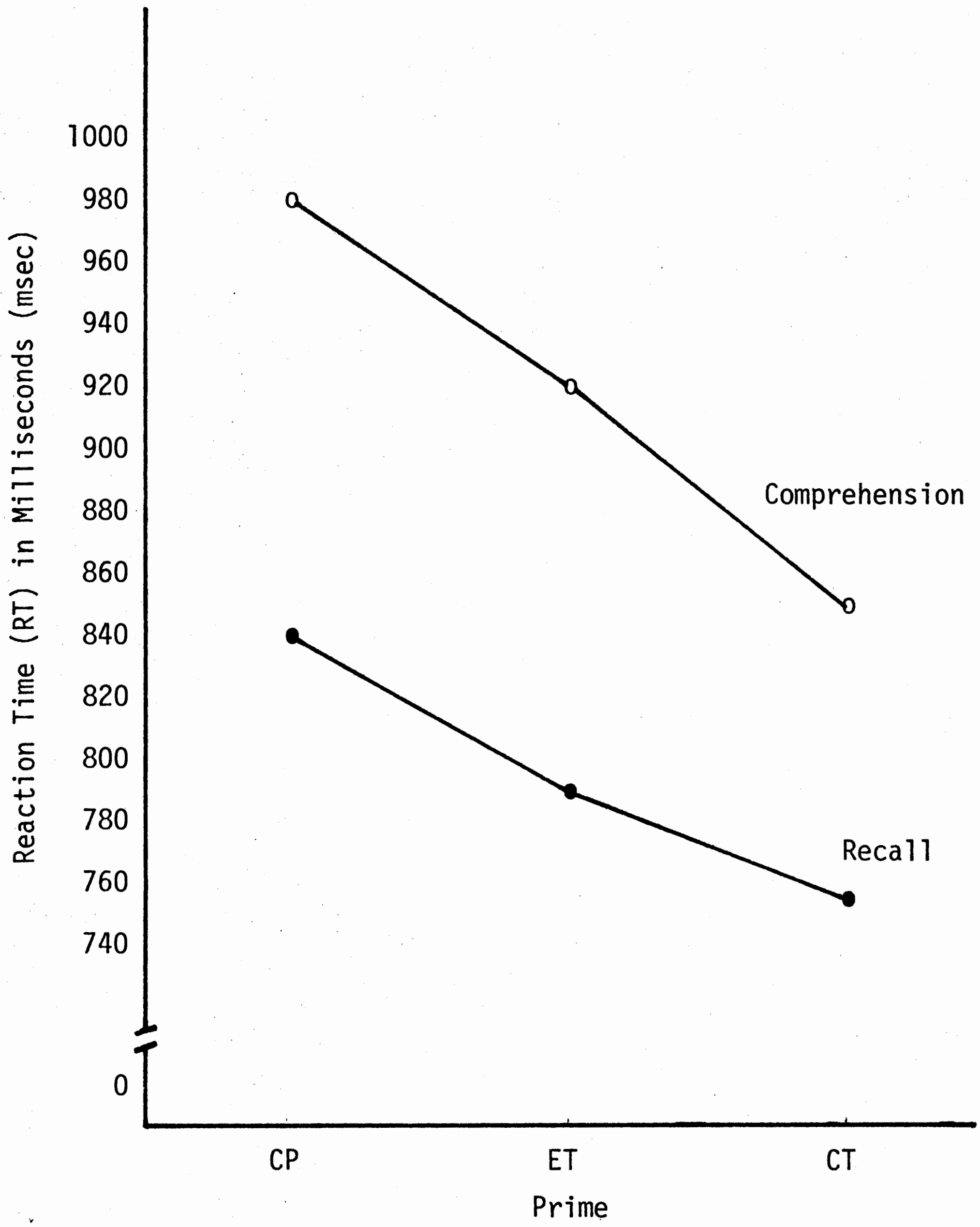

Figure 2. Prime and Task Factor Response Latencies Collapsed Over Context

and no-title conditions for the CP, ET, and CT comparisons, within the recall and comprehension tasks. Results indicated that differences between the comprehension title and no-title variations for CP and CT items were not significant (44 and 46 msec, respectively), while the ET comparison between the title and no-title manipulation was significant (87 msec). Furthermore, none of the CP, ET nor CT comparisons were significant within the recall task, with mean difference of 28, 18, and 9 milliseconds, respectively. Apparently, there was a differential ET priming effect, with the presentation of a title having no effect when reading for recall, but when a title was presented before reading a paragraph for comprehension there was a significant reduction in the latencies to the ET items. The Context influence was also specific to the ET items in that it did not influence the CP or CT items.

In summary, there was a definite priming effect for the comprehension title and no-title ET items, and the recall no-title ET items, while there was a questionable effect for the recall title ET items. Additionally, the influence of the title information was specific to the comprehension ET items. And finally, there was also evidence of a global effect for the Task instructions in which either the recall instructions produced shorter response latencies for the CP and ET items, while at the same time reducing the overall CP-CT priming effect, or the comprehension instructions produced elevated response latencies for the CP and ET items along with a larger CP-CT priming effect.

Context, Task, and Story Structure ET Effects

In order to investigate the influence of metaphorical (M) and descriptive (D) passages on ET items, a Task (R, C) X Context (T, NT) X Story (M, D) X Subjects (Words) Latin square analysis of variance (Appendices G, H) was performed. Results of the present analysis demonstrated that both the Task and Context factors were significant with F_1 (1, 44) = 6.36, $p < .05$, F_2 (1, 116) = 46.35, $p < .001$, and F_1 (1, 44) = 14.05, $p < .01$, F_2 (1, 116) = 9.98, $p < .001$, respectively. This analysis, however, also revealed that there was an interaction of Context and Task with F_1 (1, 44) = 6.24, $p < .05$, and F_2 (1, 116) = 5.38, $p < .05$. Neither the Story main effect, nor any interaction with it approached significance. As before, the Task factor revealed itself in higher latencies for the ET items for subjects who read the paragraphs for comprehension than for subjects who read for recall, whereas the Context factor resulted in shorter latencies when the corresponding title to a paragraph was presented relative to no-title being presented for the paragraph. More importantly, the lack of an interaction between the Story factor and either the Task or Context factors strengthens the previous analysis in which the Story factor was not considered. That is, if the Story factor would have interacted with other factors, a different analysis model would have been more appropriate when considering the priming effects, necessitating a consideration of paragraph words as nested within Subjects.

Recall and Comprehension Memory Scores

To be able to more objectively compare the recall scores of subjects under instructions to read the paragraphs for later recall with those subjects under instructions to read the paragraphs for comprehension, the following scoring methodology was adopted for a given subjects story summary: First, each of the four presented paragraphs was subjected to a propositional analysis (Turner and Green, 1977) to designate the template text base (Appendix) propositions; secondly, each subjects paragraph summaries were also analyzed for its propositional components; and third, the recall summary text for each subject was then matched against the template text base. For a proposition to be scored as present, it must only have appeared in some recognizable form within the subjects' paragraph summary. A strictor scoring algorithm would have resulted in a data array with too many empty cells for statistical analysis. The average number of propositional units recalled, along with the maximum possible score, are presented in Table II. Results of a Levels (T, NT) X Task (R, C) X Story (M, D) X Subjects Latin analysis of variance on the correctly recalled propositions, revealed only that the Levels factor reached significance, $F\ (1,\ 44) = 6.30$, $p < .05$ (Appendix I). However, there was also a trend in the data indicating that subjects who read the paragraphs under recall instructions performed better than those subjects who read the paragraphs under comprehension instructions, although this finding was not significant. Only in the case of supplying a title for the paragraph was there any improvement in the number of propositions recalled. This finding, however, should be viewed with some reservations because of the large number of no or few propositional units recalled. Still, it is interesting to find that the presentation of a title was effective in improving the number of propositions recalled, even though the subjects had only 40 seconds to read each paragraph and were not tested for recall until at least 15 minutes of interpolated activity (lexical decisions) had passed.

Error Analysis

A four-way analysis of variance (Prime, Task, Levels, and Subjects) was carried out on the error scores, misclassifications in the lexical decision task (Appendix J). In this analysis, the Prime factor now included the filler items (FI, CP, ET, CT) as a check on the CP errors. Since the CP items were influenced by the Task factor, it was of interest to see if the filler items would have a comparable number of errors along with testing for some form of speed-accuracy trade off in the lexical decision task. The only significant finding in the error analysis was that for the Prime factor, $F\ (3, 138) = 12.03$, $p < .001$. Multiple pairwise comparisons (Table III) based on a LSD test ($q = .05$, 2, 138; LSD = 0.31) revealed that; a comparison between the mean errors for the filler and control prime items was insignificant, the comparison for target items (ET, CT) was insignificant, and the ET item errors occurred significantly less often than the control prime and filler items. Thus, the mean number of errors for the ET items seems to indicate that a speed-accuracy trade off did not occur since there are both fewer errors and lower RT's for the ET and CT items.

The overall percentage of errors for words was 4.8% while that for nonwords was 6.1%. The overall mean number of errors for words was 5.77 while for nonwords it was 7.41, which was a significant difference, $t\ (47) = 2.53$, $p < .02$. The somewhat high percentage of errors for both words and nonwords may in part be explained by a degree of difficulty involved in reading the word-nonword dot patterns generated on the CRT. Differences between the mean number of errors for words and nonwords supports the idea that simply changing one or two vowels in a word produces many orthographically and phonemically legal nonwords which are in turn easily interpreted as words.

Finally, the latency averages for the nonwords were compared between the recall and comprehension task instructions. Here it was determined that the nonwords, encountered under the recall instructions, were responded to faster (999 msec) than the nonwords under comprehension instructions (1195 msec), $t\ (46) = 2.96$, $p < .01$. These results, which parallel the same pattern of latency averages for words, suggests that the task effect may in part be due to an overall higher response level associated with those subjects under the recall instructions.

CHAPTER IV

DISCUSSION

Given the basic repetition priming task, the present experiment provides data on the extension of this effect to situations involving the normal reading of textual materials, and the influences of various Tasks or Context operations on this effect. In line with previous research (Scarborough, Cortese and Scarborough, 1976; Forbach, Stanners and Hochhaus, 1975), the second presentation of a given word appears to result in shorter response latencies following its initial encoding during reading. However, the magnitude of this effect seems to be tied to the Task and Context information provided prior to the reading of the paragraphs. For both the comprehension title and recall no-title conditions there was a substantial priming effect, while in the comprehension no-title condition there was a smaller facilitation effect and in the recall title condition there appeared to be no priming effect at all. Therefore, to unify these results it will initially be advantageous to address the comprehension results separately before attempting to see how these findings may be combined with the recall task effects.

Comprehension Task

For the comprehension task, it appears that providing title information results in a larger priming effect for the propositional argument (ET) items than when no title information was given. As such, these results are interpretable within Morton's (1970) logogen model and Kintsch's (1974) text base propositional model. According to the text base model, an accurate propositional representation could be expected after reading an ambiguous paragraph, if provided with the orienting title, since the propositions could be uniquely specified. Here all of the propositions could be interrelated in a composite framework where the semantic interpretation given to any propositional argument would be positively determined. Now, since the basic units of the logogen model are word detectors, which are influenced by both sensory and semantic information, title or contextual information could function by simply increasing the activation level of appropriate logogens representing the words of the propositional arguments. This, in turn, would increase the probability that a faster corresponding response would occur in the lexical decision task following the reading of an unambiguous paragraph than following the reading of an ambiguous paragraph. Schallert (1976) has shown, for instance, that when using a title that could bias the meaning of a given ambiguous paragraph, the information content of the paragraph was encoded in terms of the semantic structures accessed by the context information. That is, by using paragraphs which were ambiguous in the sense that they allowed two interpretations, a strong meaning (or more frequently perceived interpretation) and a weak meaning, it was found that on a multiple-choice recognition test following reading for meaning, more strong meaning alternatives were chosen for paragraphs which had been preceded by a strong meaning title than for paragraphs which had appeared with a weak title.

Similarly, more weak meaning alternatives were chosen for paragraphs presented with weak titles. These results were believed to indicate that the stronger the context information provided, the more the subject was influenced toward activating previously stored cognitive structures. By relating these stored cognitive structures to the propositional text base and the logogen system, it appears that providing title information provides the logogen system with semantic inputs relevant to the propositional arguments (perhaps other propositional structures are influenced as well although the present experiment cannot answer that question). Consequently, the time to activate the logogen will be less when title information is provided than when no context is provided, because less sensory processing would be necessary during the lexical decision stage. Similarly, Schuberth and Eimas (1977) have found that open ended sentence contexts (the puppy chewed the _____) in a lexical decision task, lowered the response latencies for congruous words (bone) and increased the latencies for incongruous words. Here the sentence frame provided an appropriate context for the congruous word much like a title provides an appropriate semantic framework in which to interpret a series of related words.

These results also support the contention that less relevant semantic processing was engaged in for the propositional arguments, when no context was provided, because of a failure to construct a unified text base. That is, in the no-title situation, the subjects still read the entire paragraph as in the title conditions, yet now there was only a slight priming effect. Apparently without a framework in which to organize the paragraphs, there was less analysis of semantic context relevant to the propositional arguments. Consequently, less semantic information can be input to the logogens from the cognitive system, with most of the priming effect in the comprehension no-title condition possibly resulting from the activation of the visual or sensory features of the propositional arguments.

Additionally, Schvaneveldt et al. (1976) have found that a related context in a lexical decision experiment can restrict the meanings accessed in recognizing ambiguous words, while in a neutral context, alternative meanings of ambiguous words are not accessed as effectively as a single meaning of an unambiguous word. It was believed that in the neutral context situation either only one meaning was accessed or multiple meanings were accessed and they competed in some way. Likewise in the present experiment, the ambiguous paragraph no-title comprehension condition, may find the subject alternating between some level of lexical access and attempts at constructing a logical foundation or text base for the paragraph. This competition between lexical analysis and the constructing of a story text base, under a restricted reading time interval, could effectively reduce the level of processing given the propositional arguments resulting in the observed longer latencies for the no-title propositional arguments.

Recall and Comprehension Tasks

Subjects under the recall instructions, on the other hand, appear to be processing the propositional arguments in a somewhat different manner. Here only the no-title condition resulted in any priming for the propositional arguments (although as mentioned before the failure to find priming under the recall title situation might reasonably be a Type II error). Fortunately, these results are also interpretable under the logogen and text base models.

The extension of the recall data to the logogen model is direct in that the logogens for the propositional arguments are becoming fully activated, with the activation occurring regardless of the presentation of title information. That is, since the instructions to the subjects emphasized verbatim recall, this task induced a strategy of attempting to memorize each word, under the limited amount of time available, causing a complete lexical analysis of most items.

Note that this situation would apparently limit the applicability of the text base model as far as providing insight into the activation effect for propositional arguments under recall instructions. With a complete analysis occurring during the reading or study phase, the benefit of additional semantic input, provided through a unified text base, would be minimal for the recall items. This does not mean to imply that a unified text base is totally irrelevant, because it was found that title information did increase the number of propositions recalled at the end of the lexical decision task. It only appears that an organized text base does not influence the activation of (ET) propositional arguments under recall instructions. However, the text base model is important to answering the question of why there was no indicated priming for recall items when title information was presented and why the task effect resulted in smaller latencies for the recall items.

A tentative argument for these results would be one based on some form of a limited capacity attention switching mechanism coupled with both the logogen and text base models. Here the necessity of attempting to retain many words in a short term memory store or recall buffer, may interact with lexical processing. During the reading stage, the propositional arguments could be assumed as still becoming activated, but now the title information would allow more of the story to be encoded into a rehearsal buffer for later recall. As more words gain entrance into this rehearsal buffer, the active rehearsal of these words may effectively interfere with the processing of words during the lexical decision stage, especially for the recall title condition. In agreement with Morton's logogen model, activation would still occur automatically, accounting for the lower recall latencies, while less priming might be expected for the title condition, since the addition of words to the recall buffer from title information, as might be predicted from the text base model, could influence the activation of the <u>control</u> items. Specifically, the rehearsal of the paragraph materials could prevent all of the CP items from becoming fully activated since attention would be split between rehearsal and the word-nonword decisions. At the same time, a subject could be attempting to respond as quickly as possible to reduce the processing load, resulting in shorter latencies for both recall control and experimental items. Consequently, by this adjustment of the response times to the control items, the CP-ET comparison, or the comparison used to determine the degree of priming, would be affected. Thus, it may have been possible to observe the smaller recall priming effects coupled with shorter latencies. In other words, to account for the current pattern of results, it may be necessary to entertain the assumption that the Task instructions not only can influence the activation level associated with the propositional arguments during reading, but also that there might be a generalized Task influence on the control items during the lexical decision stage. In partial agreement with these speculations, it was found in a semantic priming experiment by Fischler and Goodman (1978), where the stimulus onset asynchrony (SOA) was varied, that when the subject was required to recall and orally report the prime word following the shortest SOA, the priming effect disappeared even though an immediate recall procedure was used for each lexical decision. These results were interpreted in terms of a conflict being created between attempting to remember the prime word and dealing with the target item.

During the previous discussion it was suggested that taken at face value (rather than a Type I error), the lower latencies associated with the recall items may in part be the result of an attempt to reduce the processing load during the lexical decision period, or perhaps was due to some greater initial processing. Alternatively, it also appears reasonable to suggest that operating under comprehension instructions may leave a person in a state wherein it takes considerable more time to execute lexical decisions, even for words which the person has not yet seen. Apparently a subjects processing system could be given some persisting type of effect by reading for comprehension which is detectable in a lexical decision task. This effect is then cancelled or reduced when items (CT items) are repetition primed. In addition, the differences found between the recall and comprehension nonword responses could also indicate that the generalized task effect may result from a quickening of the response system while under the recall instructions. That is, if it can be assumed that the recall instructions result in a more anxiety driven state than the comprehension instructions, then this hyperactive state may have produced the shorter latencies under the recall instructions. Unfortunately, the present results cannot lead to a definitive selection between these various explanations. Perhaps future research can unravel the relationships between Task instructions and its influences on lexical decisions.

The present results however, do appear to be in general agreement with those suggested by Aaronson and Scarborough (1976). These researchers found that comprehension and recall instructions resulted in unique encodings of lexical items during reading. In a task where sentences were read one word at a time, it was observed that the viewing time for individual words decreased with sentence length for the comprehension group but not for the recall group. However, when considering linguistic information, comprehension subjects spent more time viewing semantic than syntactic cues, while the reverse was true for recall subjects. These results were interpreted as showing that subjects under recall instructions appear to process individual words more fully than do comprehension subjects, while the comprehension subjects code less information yet attempt to focus on important content words such as the sentence subject and object. Such a position would seem to suggest that memory trace strength, or the activation level associated with the recall strategy items could be greater than the activation level associated with the corresponding comprehension strategy items, and would depend on the comprehensibility of the materials being processed. Thus, these variations in activation level could be used to predict that shorter response latencies should be associated with the recall propositional items following their greater initial processing if no context information was provided. Just such an effect was found in this experiment. The propositional argument items associated with the recall task were responded to faster, when the paragraphs were not comprehensible, than when read under comprehension instructions, but when the comprehension subjects were keyed to focus on the important content words by presentation of a title, the level of activation was similar for both recall and comprehension.

Orthographic and Semantic Analysis

These results also support a view that repetition priming involves more than just a pattern matching routine between identical stimuli. Indeed, it appears that repetition priming required the activation of both the orthographic and semantic characteristics of a word, and that stimulus repetition provides additional priming superimposed on priming due to semantic relatedness. In effect, words or at least the lexical representations, are retained within the basic units of memory for text (Hayes-Roth, 1977; Hayes-Roth and Hayes-Roth, 1977; Collins and Loftus, 1975; Morton, 1970). When these words are then processed, as in reading, this results in the storage or activation of both orthographic and semantic information relevant to a specific word, with the length of this activation interval being fairly resistant to decay and lasting as long as 24 hours (Hayes-Roth, 1977; Scarborough, Cortese, and Scarborough, 1977). The facilitiation effect observed then follows from this activation of both orthographic and semantic information. This position contrasts with those that suggest repetition priming involves primarily an orthographic matching attempt between words. For example, Collins and Quillian (1972) observed rapid RT's to stimuli like "A _canary_ is a _canary_," in which a decision (true-false) was thought to be based on pattern matching as opposed to semantic analysis. In addition, Ashcraft (1976), in an experiment where subjects viewed sentence pairs of the type "An oak has leaves--An oak has leaves," also suggested that a pattern matching process was primarily involved in the facilitation effect.

Two effects in the present experiment argue against this restrictive pattern matching account of repetition priming, and necessitates considering the present facilitation effect as composed of both orthographic and semantic components. The first result is the influence of title information on the priming of the propositional argument items, and the second is the duration of the priming effect. If pattern matching were the only component involved in repetition priming, there should have been no influence of the Levels (title presentation) condition on the propositional argument priming. Even though pronunciation does not necessitate complete lexical access, specifically semantic analysis (Scarborough, Cortese, and Scarborough, 1977; Coltheart, 1977), it does require at least a pattern matching analysis of the individual words in the paragraph for pronunciation to procede it. Hence the observed difference effects for the propositional argument words can only be attributed to semantic influences from the processing of title information plus any influences from orthographic similarity. While this explanation points to the presence of a semantic basis for repetition priming, the present data also appears to require more than just a semantic component. That is, while the orthographic component is obvious in a repetition priming situation, it maybe that the orthographic component is synergistic with the semantic component in that neither semantic nor orthographic information alone can account for the present results. If it was assumed that no orthographic information was retained following the reading stage, the facilitation effect found would have to be explained on the basis of the activation of the primed semantic units, an idea exposed in studies using the semantic priming paradigm (Meyer et al., 1975; Rubenstein, 1972). However, Meyer et al. (1972) have found, along with Loftus (1973) and Ashcraft (1976) that the semantic priming effect decays rapidly, and is almost completely lost after 30 seconds. With the lexical decision stage requiring at least 10 minutes to complete after reading the priming paragraph, a sole semantic priming explanation, or an explanation where all orthographic information is lost, becomes difficult to entertain. Thus, it appears necessary to consider the repetition priming effect as composed of both an orthographic and semantic component, or that a more powerful and longer lasting effect for repetition priming is possible based on an <u>exact</u> semantic match, as compared to semantic priming.

CHAPTER V

SUMMARY

The present experiment provided evidence that a repetition priming effect may be found when the reading of textual materials serves as the priming stimuli, and that most of this effect may be explained by appealing to Morton's logogen model and Kintsch's text base model. Moreover, this priming effect was found to be sensitive to both the task instructions given to the subjects and whether the text was capable of being understood. Specifically, the comprehension set resulted in a substantial priming effect with the title manipulation producing shorter latencies to the propositional argument words than the no-title manipulation. The recall set yielded shorter propositional argument latencies and a slightly smaller priming effect than the comprehension set, but now the title manipulation had no priming effect. Although the experiment was less than decisive in being able to completely explain the results found after the recall task instructions, these results did show that the priming technique may be a valuable aid in attempting to understand the reading process. Finally, the present experiment shows the need to design future experiments to unravel the problem of task instructions on repetition priming and the mechanisms responsible for these effects.

Even though the story structure manipulation did not result in any reliable findings, this topic should not yet be abandoned. It is still an interesting and unanswered question to see how other manipulations of story structure, and even the use of words other than those representing the propositional arguments, might influence lexical analysis as measured by priming. Such studies would be invaluable in developing more complete models of the reading process and lexical analysis.

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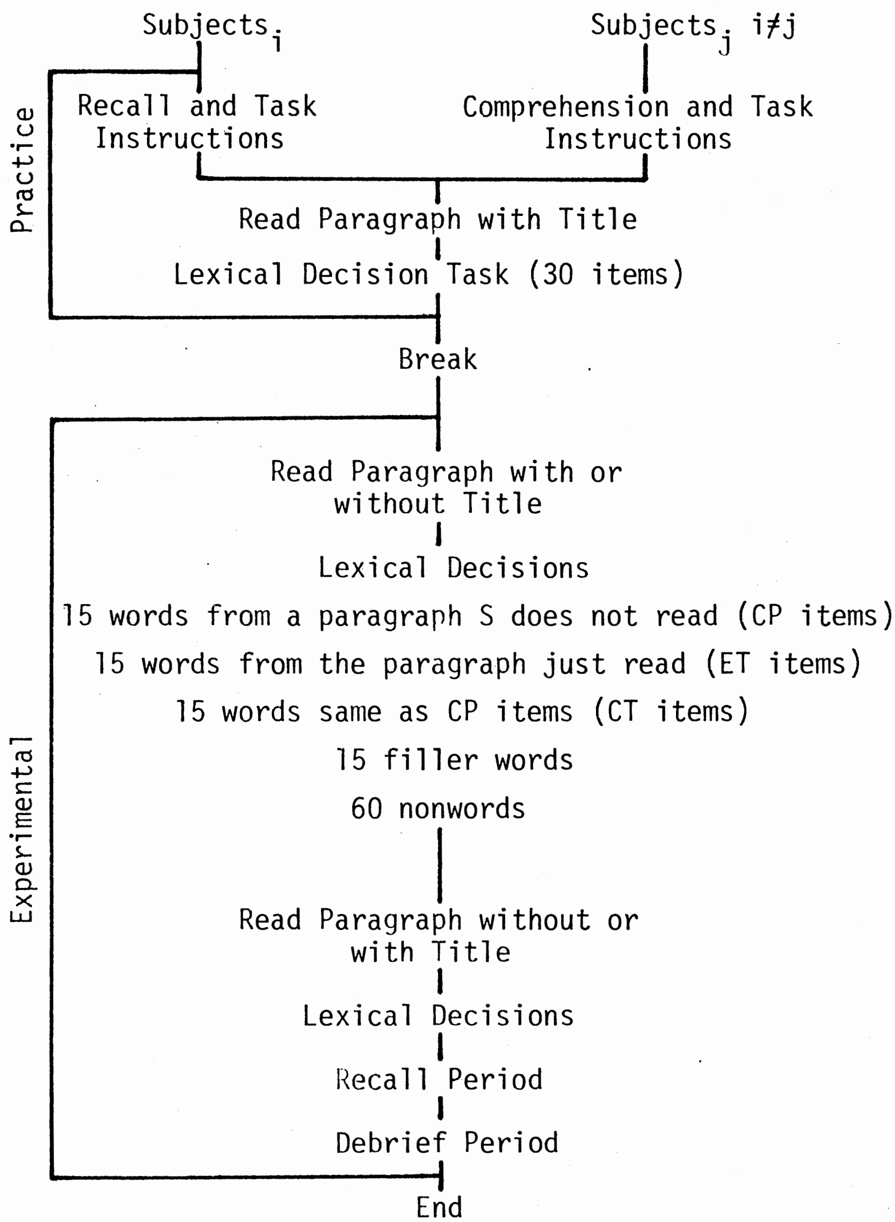
APPENDICES

APPENDIX A

FLOWCHART OF EXPERIMENTAL
PROCEDURE



APPENDIX B

PARAGRAPH AND TITLE MATERIALS

Metaphorical paragraphs:

Christopher Columbus Discovers America.

With hocked gems financing him, our hero bravely defied all scornful laughter that tried to prevent his scheme. "Your eyes deceive," he had said, "an egg, not a table, correctly typifies this unexplored planet." Now three sturdy sisters, sought proof, forging along, sometimes through calm vastness, yet more often over turbulent peaks and valleys. Days became weeks, as many doubters spread fearful rumors about the end. At last, from nowhere, welcome winged creatures appeared signifying momentous success.

The United States' First Manned Moon Landing.

Joe looked outside from cramped quarters. Numerous unknown objects moved swiftly by in vague blackness. Around his field, two brave companions worked along, manipulating buttons, while reading complex patterns. Flat familiar homeland, now actually resembled a tiny rubber ball. Everyone here and at home, knew that only lifeless things would be found among huge cold mountains, surrounding deep barren valleys. But all important papers anxiously awaited their arrival, for no man had ever made such big news.

Descriptive paragraphs:

Taking Up Jogging.

A seashore is nicer than a path. At first, it is easier to go slow than fast. You may have to try several sessions. It takes some skill, but is easy to learn. Even young participants can enjoy it. Once successful, complications are minimal. Cars seldom get too near. Rain, however, soaks in very fast. Many individuals doing the same thing can also cause problems. One needs lots of space. Without annoyances, it can be very peaceful.

Washing the Clothes.

The technique is quite ordinary. First, you arrange things into different clusters depending on their makeup. Of course, one pile may be sufficient depending on how much there is to do. The operation of the appropriate chemicals and mechanisms is self-explanatory. Recollect that it is preferable to do too few things at once than too many. After the task is concluded, one organizes the materials into different stacks again, and puts them into their appointed locations.

APPENDIX C

PROPOSITIONAL ANALYSES OF

STORY PARAGRAPHS

Christopher Columbus

1. (financing, gems, hero)*
2. (qualify; gens, hocked)
3. (defied, hero, laughter)
4. (qualify; laughter, scornful)
5. (qualify; defied, bravely)
6. (number of; laughter, all)
7. (prevent, laughter, scheme)
8. (qualify; scheme, hero's)
9. (conjunction, that; 3, 7)
10. (conjunction, with; 1, 9)
11. (deceive, eyes, you)
12. (qualify; eyes, your)
13. (typifies, egg, planet)
14. (typifies, table, planet)
15. (negate; 14)
16. (qualify; planet, unexplored)
17. (qualify; typifies, correctly)
18. (conjunction, said hero; 11, 13, 15)
19. (sought, sisters, proof)
20. (qualify; sisters, sturdy)
21. (number of; sisters, three)
22. (forging, sisters, vastness)
23. (qualify; forging, through)
24. (forging, sisters, peaks)
25. (qualify; forging, over)
26. (forging, sisters, valleys)
27. (qualify; peaks, turbulent)
28. (qualify; valleys, turbulent)
29. (conjunction, and; 24, 26)
30. (contrast, sometimes....yet more often; 22, 29)
31. (time, now; 19, 30)
32. (qualify; vastness, calm)
33. (became, days, weeks)
34. (spread, doubters, rumors)
35. (qualify; rumors, fearful)
36. (qualify; rumors, about end)
37. (number of; doubters, many)
38. (causation, as; 33, 34)

39. (appeared from, creatures, nowhere)
40. (qualify; creatures, welcome)
41. (qualify; creatures, winged)
42. (signifying, creatures, success)
43. (qualify; success, momentous)
44. (time, at last; 39, 42)

First Manned Moon Landing

1. (looked, Joe, outside)
2. (qualify; quarters, cramped)
3. (location, from; 1, 2)
4. (moved, objects, blackness)
5. (qualify; objects, numerous)
6. (qualify; objects, unknown)
7. (qualify; blackness, vague)
8. (qualify; moved, swiftly)
9. (manipulating, companions, buttons)**
10. (reading, companions, patterns)
11. (concession, while; 9, 10)
12. (qualify; patterns, complex)
13. (qualify; companions, brave)
14. (number of; companions, two)
15. (worked, companions, field)
16. (possession; field, his)
17. (location, around; 15, 11)
18. (resembled, homeland, ball)
19. (qualify; ball, tiny)
20. (qualify; ball, rubber)
21. (qualify; homeland, flat)
22. (qualify; homeland, familiar)
23. (time, now; 18)
24. (knew, everyone, here)
25. (knew, everyone, at home)
26. (conjunction, and; 24, 25)
27. (surrounding, mountains, valleys)
28. (qualify; valleys, barren)
29. (qualify; mountains, huge)
30. (qualify; mountains, cold)
31. (found, things, lifeless)
32. (qualify; found, only)
33. (location, among; 31, 27)
34. (conjunction, that; 26, 33)
35. (awaited, papers, arrival)
36. (qualify; papers, important)
37. (qualify; awaited, anxiously)
38. (made, man, news)
39. (qualify; man, no)
40. (qulaify; news, big)
41. (causality, for; 35, 38)
42. (concession, but; 34, 41)

Taking Up Jogging

1. (contrast, nicer; seashore, path)
2. (go, you, slow)
3. (go, you, fast)
4. (condition, it is better to....than; 2, 3)
5. (time, at first; 4)
6. (try, you, sessions)
7. (quantify; sessions, several)
8. (takes, it, skill)
9. (quantify; skill, some)
10. (learn, you, it)
11. (qualify; learn, easy)
12. (concession, but; 8, 11)
13. (enjoy, participants, it)
14. (qualify; participants, young)
15. (qualify; young, even)
16. (are, you, successful)
17. (are, complications, minimal)
18. (contrast, once....then; 16, 17)
19. (get, cars, near)
20. (qualify; get, seldom)
21. (qualify; near, too)
22. (soaks, you, rain)
23. (qualify; soaks, fast)
24. (qualify; fast, very)
25. (concession, however; 19, 22)
26. (doing, individuals, thing)
27. (qualify; thing, same)
28. (quantify; individuals, many)
29. (cause, you, problems)
30. (conjunction, can also; 26, 29)
31. (needs, one, space)
32. (qualify; space, lots of)
33. (can be, it, peaceful)
34. (qualify; 33, without annoyances)

Washing The Clothes

1. (isa; technique, ordinary)
2. (qualify; ordinary, quite)
3. (arrange, you, things)**
4. (depending, clusters, makeup)
5. (qualify; clusters, different)
6. (conjunction, into; 3, 4)
7. (be, pile, sufficient)
8. (qualify; be, may)
9. (number of; pile, one)
10. (depending, pile, there is to do)
11. (quantify; there is to do, how much)
12. (causation, of course; 7, 10)
13. (isa; operation, self-explanatory)
14. (reference; operation, chemicals)

15. (reference; operation, mechanisms)
16. (qualify; chemicals, appropriate)
17. (qualify; mechanisms, appropriate)
18. (do, you, things)
19. (qualify; 18, preferable)
20. (contrast; few....than many; 19, things)
21. (recollect, you, 20)**
22. (is, task, concluded)
23. (qualify; 26, after)
24. (organizes, materials, stacks)
25. (qualify; organizes, one)
26. (qualify; organizes, again)
27. (qualify; stacks, different)
28. (puts, materials, locations)
29. (qualify; locations, appointed)
30. (conjunction, and; 28, 32)
31. (conjunction, then; 27, 34)

*Underlined words are the selected propositional items.

**Initial propositional analyses incorrectly identified these propositional predicators as propositional arguments. Statistical analyses of the data without these incorrectly identified items indicated that none of the results would change.

APPENDIX D

INSTRUCTIONS TO SUBJECTS

Recall Instructions:

This is an experiment concerned with making simple judgments about verbal materials and with ordinary reading. It is not an intelligence test nor personality test of any kind and should not be interpreted as such. If you feel that at any time that you cannot fully cooperate in this experiment, please let the experimenter know. In this experiment you will be doing two simple tasks.

When the word "ready" appears on the screen in front of you, push both buttons down and then release them. Soon after pushing both buttons, a paragraph will be presented on the screen in front of you. Read this paragraph out loud as thoroughly as you can, making sure that you read each and every word so that you can recall the paragraph at least once, because at the end of the experiment you will be paid 10 cents for each 10 words that you can recall correctly. Do not skim the paragraph. However, do not try to memorize the paragraph, because it will remain on the screen for only 40 seconds. After 40 seconds, the paragraph will automatically disappear from the screen, and the word "ready" will appear again. If you complete reading the paragraph for recall before the 40 seconds are up, start reading the paragraph again at the beginning.

After the paragraph disappears from the screen, the word "ready" will appear again. When the word "ready" appears, push both buttons down, but now, hold them down. A short time after pressing both buttons, a letter string will be presented on the screen. Your task now will be to decide if the letter string in front of you is a word or nonword. If you think the item is a word, release the "word" button as quickly as you can. If you think the item is not a word, release the "nonword" button as quickly as you can. Make these word or nonword decisions as quickly and as accurately as you can. After each decision, the word "correct" or "wrong" will appear on the screen to indicate if you were right or wrong in your decision.

The word "ready" will now appear again, and you are to push both buttons down and prepare for another word-nonword decision. Continue in this manner, until the statement "paragraph follows" appears on the screen. Let up on the buttons, and prepare to read another paragraph out loud for recall for 40 seconds.

After reading the paragraph, you will have to make another series of word-nonword decisions as quickly and as accurately as you can.

Before some of the paragraphs, you will be presented with a title that will explain the meaning of the paragraph. Make every attempt to notice how the title explains the paragraph because it will make later recall much easier and profitable. For the paragraphs that do not have an explaining title, attempt to recall as much of the paragraph as you can. Remember that you have only 40 seconds to complete the reading of each paragraph.

Continue this pattern of reading paragraphs for recall, and then making a series of word-nonword decisions until the word "finish" appears on the screen. When the word "finish" appears on the screen you may come out into the other room.

Comprehension Instructions:

This is an experiment concerned with making simple judgments about verbal materials and with ordinary reading. It is not an intelligence test nor personality test of any kind and should not be interpreted as such. If you feel that at any time that you cannot fully cooperate in this experiment, please let the experimenter know. In this experiment you will be doing two simple tasks.

When the word "ready" appears on the screen in front of you, push both buttons down and then release them. Soon after pushing both buttons, a paragraph will be presented on the screen in front of you. Read this paragraph, out loud, as thoroughly as you can, making sure that you read each and every word so that you understand what the paragraph says. You must complete reading the paragraph at least once, because at the end of the experiment you will be paid 10 cents for each correct response on a comprehension test. This test will measure how well you understood the paragraph, not whether you can remember specific facts. Do not skim the paragraph. However, do not try to memorize the paragraph, because it will remain on the screen for only 40 seconds. After 40 seconds, the paragraph will automatically disappear from the screen, and the word "ready" will appear again. If you complete reading the paragraph before the 40 seconds are up, start reading the paragraph at the beginning.

After the paragraph disappears from the screen, the word "ready" will appear again. When the word "ready" appears, push both buttons down, but now, hold them down. A short time after pressing both buttons, a letter string will be presented on the screen. Your task now will be to decide if the letter string in front of you is a word or nonword. If you think the item is a word, release the "word" button as quickly as you can. If you think the item is not a word, release the "nonword" button as quickly as you can. Make these word or nonword decisions as quickly and accurately as you can. After each decision, the word "correct" or "wrong" will appear on the screen to indicate if you were right or wrong in your decision.

The word "ready" will now apper again, and you are to push both buttons down and prepare for another word-nonword decision. Continue in this manner, until the statement "paragraph follows" appears on the screen. Let up on the buttons, and prepare to read another paragraph out loud for comprehension for 40 seconds.

After reading the paragraph, you will have to make another series of word-nonword decisions as quickly and as accurately as you can.

Before some of the paragraph, you will be presented with a title that will explain the meaning of the paragraph. Make every attempt to notice how the title explains the paragraph because it will make comprehension much easier and profitable. For the paragraphs that do not have an explaining title, attempt to understand the paragraph as well as you can. Remember that you have only 40 seconds to complete the reading of each paragraph.

Continue this pattern of reading paragraphs for comprehension, and then making a series of word-nonword decisions until the word "finish" appears on the screen. When the word "finish" appears on the screen you may come out into the other room.

APPENDIX E

ANALYSIS OF VARIANCE (BY SUBJECTS) FOR THE PRIME, TASK, AND CONTEXT FACTORS

Source	df	SS	MS	F
Mean	1	243993232.000		
Task	1	1012644.000		5.27*
Error	46	8829214.000	191939.37	
Context	1	107841.250		6.11*
Context X Task	1	30813.875		1.74
Error	46	811205.625	17634.90	
Prime	2	561806.062	280903.00	50.57**
Prime X Task	2	35812.062	17906.03	3.22*
Error	92	510990.937	5554.24	
Context X Prime	2	7477.937	3738.96	<1
C X P X T	2	8736.875	4368.43	<1
Error	92	585266.375	6361.58	

*$p < .05$

**$p < .001$

APPENDIX F

ANALYSIS OF VARIANCE (BY WORDS) FOR THE PRIME, TASK, AND CONTEXT FACTORS

Source	df	SS	MS	F
Mean	1	630038528.00		
Task	1	3263656.00		34.68**
Error	118	11102113.00	94085.68	
Context	1	208859.00		5.52*
Context X Task	1	92588.00		2.44
Error	118	4464237.00	37832.51	
Prime	2	1737386.00	868693.00	61.85**
Prime X Task	2	109553.00	54776.50	3.90*
Error	236	3314390.00	14044.02	
Context X Prime	2	67767.00	33883.50	2.53
C X P X T	2	63459.00	31729.50	2.37
Error	236	3151529.00	13353.93	

*p < .05

**p < .001

APPENDIX G

LATIN SQUARE ANALYSIS OF VARIANCE (BY SUBJECTS)

FOR THE EXPERIMENTAL TARGET WORDS FOR THE

TASKS, CONTEXT, AND STORY FACTORS

Source	df	SS	MS	F
Between Subjects	47	3145814.83		
Task	1	370762.04		6.36*
Rows (CS)	1	47259.37		<1
Task X Rows	1	163680.17		2.80
Error	44	2564113.25	58275.30	
Within Subjects	48	312853.00		
Context	1	65730.66		14.05**
Story	1	5251.04		1.12
Context X Task	1	29190.38		6.24*
Story X Task	1	6868.17		1.46
Error	44	205812.75	4677.56	

*$p < .05$

**$p < .01$

APPENDIX H

LATIN SQUARE ANALYSIS OF VARIANCE (BY WORDS) FOR THE EXPERIMENTAL TARGET WORDS FOR THE TASKS, CONTEXT, AND STORY FACTORS

Source	df	SS	MS	F
Between Words	119	4145060.9		
Task	1	1024949.4		46.35**
Rows (CS)	1	91494.1		4.13*
Task X Rows	1	463760.4		20.97**
Error	116	2564857.0	22110.8	
Within Words	120	3048382.0		
Context	1	226566.1		9.98**
Story	1	37500.0		1.65
Context X Task	1	122130.8		5.38*
Story X Task	1	29748.2		1.31
Error	116	2632436.7	22693.4	

*$p < .05$

**$p < .01$

APPENDIX I

LATIN SQUARE ANALYSIS OF VARIANCE FOR PROPOSITIONS RECALLED FOR TASK, CONTEXT, AND STORY FACTORS

Source	df	SS	MS	F
Between Subjects	47	592.34		
Task	1	13.50		1.04
Rows (CS)	1	9.38		<1
Task X Rows	1	3.37		<1
Error	44	566.09	12.86	
Within Subjects	48	411.00		
Context	1	48.17		6.30*
Story	1	18.38		2.40
Context X Task	1	8.17		1.06
Story X Task	1	.04		<1
Error	44	336.25	7.64	

*$p < .05$

APPENDIX J

ANALYSIS OF VARIANCE ON SUBJECT WORD-NONWORD MISCLASSIFICATIONS FOR PRIME, TASK, AND CONTEXT FACTORS

Source	df	SS	MS	F
Mean	1	199.8136		
Task	1	1.8985		<1
Error	46	120.1612	2.6122	
Context	1	0.4400		<1
Context X Task	1	0.3150		<1
Error	46	49.1194	1.0678	
Prime	3	22.0909	7.3636	12.30**
Prime X Task	3	1.9244	0.6414	1.07
Error	138	82.6088	0.5986	
Context X Prime	3	1.7994	0.5998	<1
C X P X T	3	1.0911	0.3637	<1
Error	138	123.7337	0.8966	

**p < .001

TABLE I

SUMMARY OF REACTION TIME MEANS AND STANDARD DEVIATIONS IN MILLISECONDS FOR THE PRIME, CONTEXT, AND TASK FACTORS

	Recall		Compression	
	Title	No Title	Title	No Title
CP	830.00	857.91	964.58	1008.54
s.d.	224.08	213.41	230.07	214.07
ET	788.08	805.54	877.50	964.70
s.d.	196.93	202.03	142.28	174.02
CT	758.33	767.00	828.04	875.04
s.d.	197.48	217.28	148.04	184.46

TABLE II

SUMMARY OF TOTALS, MEANS, AND STANDARD DEVIATIONS FOR THE PROPOSITIONAL UNITS RECALLED

		Title			
		P1	P2	P3	P4
Propositions	Total	44	42	34	35
Recall	Mean	3.33	2.50	4.83	3.16
	S.D.	2.58	2.25	6.43	2.04
Comprehension	Mean	1.66	3.00	3.00	5.50
	S.D.	2.06	3.22	2.36	7.14
		No Title			
		P1	P2	P3	P4
Recall	Mean	2.00	3.00	3.66	1.83
	S.D.	1.89	1.78	4.22	2.63
Comprehension	Mean	1.00	1.66	1.00	1.50
	S.D.	1.26	2.06	1.26	1.76

TABLE III

SUMMARY OF ERROR SCORE MEANS AND STANDARD DEVIATIONS FOR THE PRIME, CONTEXT, AND TASK FACTORS

	Recall		Comprehension	
	Title	No Title	Title	No Title
FI	0.9583	1.0416	0.7083	1.2083
s.d.	0.9990	1.2328	0.6902	1.5874
CP	0.7500	0.7500	1.1250	1.0833
s.d.	0.8968	0.9440	1.6235	1.2825
ET	0.5416	0.5000	0.5416	0.7083
s.d.	0.5882	0.7801	0.9770	1.0417
CT	0.3333	0.3333	0.5416	0.4166
s.d.	0.6370	0.7019	0.8329	0.5036

VITA [2]

William Patrick Hernon

Candidate for the Degree of

Doctor of Philosophy

Thesis: REPETITION PRIMING EFFECTS IN THE RECALL AND COMPREHENSION OF AMBIGUOUS AND UNAMBIGUOUS TEXT MATERIAL

Major Field: Psychology

Biographical:

Personal Data: Born October 24, 1948, to Mr. and Mrs. Peter J. Hernon in St. Louis, Missouri; married to Mary Beth Jacks, May 24, 1978.

Education: Received the Bachelor of Arts degree in Psychology from the University of Missouri-Rolla, May, 1970; received the Master of Science in Psychology from the Oklahoma State University, May, 1972; enrolled in the Master of Science degree program in Statistics and Doctor of Philosophy degree program in Psychology at Oklahoma State University and completed requirements for the Ph.D. in July, 1979.

Professional Experience: Served as a graduate research and teaching assistant, 1970-1971; worked at the McDonnell-Douglas Corp. as a human factors engineer, 1972-1975; served as a graduate research and teaching assistant in the Psychology Department, 1976-1978; served as a graduate teaching assistant in the Statistics Department, 1978-1979; membership in the American Psychological Association, and the American Association for the Advancement of Science.