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A MULTIVARIATE ANALYSIS OF THE EFFECTS OF IMPOSED PROCESSING STRATEGIES ON THE COMPREHENSION AND RECALL OF TEXT.

The Ohio State University Ph.D. 1981

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A MULTIVARIATE ANALYSIS OF THE
EFFECTS OF IMPOSED PROCESSING STRATEGIES
ON THE COMPREHENSION AND RECALL OF TEXT

DISSertation

Presented in Partial Fulfillment of the
Requirements for the Degree Doctor of Philosophy
in the Graduate School of The Ohio State University

By

Jerry James Lewis, BS.Ed., M.ED.

*   *   *

THE OHIO STATE UNIVERSITY

1981

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I thank Therthenia W. Lewis, my wife, for her love and support during the time that it has taken me to complete my doctoral program. I would also like to thank Professor Victor M. Rentel and the members of my Graduate Reading Committee for their support and advice.
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CHAPTER I
THE PROBLEM

Background of the Problem

The extent to which informational content and related world-knowledge, and the extent to which text structures influence the comprehension and recall of text are unsettled issues in cognitive science. Theorists who argue for knowledge-based processes emphasize the manner in which prior knowledge influences comprehension and recall. These theorists view processing activities as being principally controlled by the reader's prior knowledge (Fredericksen, 1977). Theorists who argue for text-based processes emphasize the influence of intrapassage structural relations on comprehension and recall. These theorists view the reader's processing activities as being principally controlled by the structure of the text (Fredericksen, 1977).

Because of these unsettled issues, more research is needed so that additional data identifying factors which influence comprehension and recall can be contributed to the development of an adequate theory about how and what people learn from text.

Significance of the Problem

The National Assessment of Educational Progress (NAEP) reported in the spring of 1977 that 13 percent of those 17-year-olds tested
were unable to comprehend simple materials as street signs, store coupons, telephone directories, or driver's license tests (Bishop, 1978). Another NAEP report (Mellon, 1975) indicated that students in all age groups, including young adults, have trouble comprehending difficult materials. Many of these students could not answer questions dealing with major and minor idea sequences - nor could they recognize the development of key concepts.

The severity of this problem is highlighted by the fact that nearly one million students a year quit school because of reading problems (Spencer, 1973). Average high school dropouts are two grade levels behind in their reading when they quit school. In fact, Marksheffel (1969) reported that thirty to forty percent of the students enrolled in a single high school may be unable to comprehend their assigned textbooks.

Reading textbooks is also a problem for college students. A study conducted by Santa and Burstyn (1978) indicates that college textbooks are becoming more difficult to read at a time when college students are showing a decline in reading skills. Verbal scores, for instance, on the Scholastic Aptitude Test (SAT) which reflect reading comprehension as well as word usage, grammar, reasoning, and other aspects of verbal ability declined - among college freshmen - 49 points (on a 200 to 800 scale) between 1963 and 1977 (Bishop, 1978; Copperman, 1978).

Researchers and educators share the nation's concern about these reading problems. They are assessing the extent of the problems and devising ways to attack them directly - from basic research into the processes of learning to read, to evaluation of instructional programs,
to examining teaching practices, to devising instructional programs that promise to be more effective (Bishop, 1978).

**Statement of the Problem**

Teachers at all grade levels need an adequate theory that will enable them to develop within their students the ability to efficiently acquire information from reading texts. For instance, even though all students are eventually required to read textbooks, most of them are not taught to read textbooks as systematically as they are taught to read stories (Herber, 1970). To make effective classroom use of textbooks, teachers must not only be cognizant of the skills and experiences that their students need in order to comprehend the vocabulary, concepts, and ideas found in textbooks; but, they also must be aware of the role that text structures play in comprehension.

However, a major handicap in developing appropriate strategies and materials is the lack of an adequate theory of how and what people learn from text (Meyer, 1977c). The study reported here is representative of the research to determine how people learn from text. In future phases of research on comprehension and recall, data will be collected on greater numbers of students at all grade levels and analyzed in an attempt to come up with descriptions of a variety of comprehension styles people use and descriptions of methods which can strengthen or improve these styles. The ultimate aim of this type of research is a new more comprehensive understanding of the ways people learn to read.
Rationale

The study investigated the extent to which two schema-oriented models of text processing adequately account for how readers comprehend and recall text. In general, two types of schema-oriented approaches can be identified (Glenn, 1980). The first emphasizes the informational content of text and its relationship to individuals' knowledge of related real-world situations. The second emphasizes schemata that define the structure of text rather than its informational content.

Two specific models were investigated in the present study: Meyer's (1975a,b) text-based processing model and Spiro's (1977, 1980) knowledge-based processing model. Meyer's model emphasizes text structures and their influence on comprehension and recall; while Spiro's model emphasizes the interaction between text content and pre-existing world knowledge.

To account for how readers select information to be stored in memory, Meyer (1975a,b) and Spiro (1977) propose two distinctly different processing models. Meyer's model argues for a structure strategy. Processing activities hypothesized for this strategy place primary emphasis on a search for interrelationships among chunks of complex propositions.

Readers employing this strategy are hypothesized to approach text looking for patterns which tie together the propositions contained in text; in addition, they search for the author's primary thesis which will provide the content to be bound by these patterns or schemata. Then, they search for relationships among this primary thesis and
supporting details (Meyer et al., 1980).

Once the primary thesis or central organization of the information, as represented by the top level of the content structure, has been identified; readers rehearse and subsequently store in long-term memory that information most centrally connected to the primary thesis (i.e., supporting details). Peripherally related information is rehearsed less in short-term memory and the information that is processed for long-term storage tends to be particular clusters of content (Meyer, 1975a,b).

In contrast, Spiro (1977) proposes a knowledge-based processing model. A basic tenet of his theory is that information from text interacts with pre-existing cognitive structures, and that this interaction can range from near total differentiation of new information from pre-existing cognitive structures to total subordination of new information to pre-existing cognitive structures.

To explain the range and possible consequences of the interaction that can occur between the information in text and pre-existing cognitive structures, Spiro (1977) makes a distinction between two types of cognitive interaction. According to him, interaction with prior knowledge may occur solely to facilitate an internally consistent semantic representation of text or it may occur because the text structures are subordinate in function to exogenous factors. In the first case, he refers to text as having high integrity. In the second, he refers to text as having low integrity. The function of comprehension in the first case is solely to understand text as an independent entity. In
the second, the function of text is to update old knowledge.

Additionally, Spiro (1977) argues that recall for each type of text will be different. When asked to recall high integrity text, readers will try to maintain the structure of the text. Spiro argues that this strategy may be very common among readers in memory experiments where the material is typically not of any general usefulness, and the goal is to try to remember accurately as much information as possible.

On the other hand, low integrity text will result in inaccurate recall of text. Low integrity text contains, for readers, information that is uninteresting or redundant. However, a lot of the information is also new to readers. Therefore, readers will focus on new information when reading to update old knowledge. This being the case, intra-passage structural relations would become subordinate to the pattern of relations in the pre-existing knowledge structure being updated. Thus, Spiro argues, there would be no reason to expect the recall of low integrity information to be in total agreement with the original text because the new information will have been assimilated into pre-existing cognitive structures and the modification of these previous cognitive structures may be altered as a result of the assimilation.

In summary, Meyer (1975b) proposes a text-based processing model that suggests readers select, rehearse, and subsequently store in long-term memory top level information and their related details. Whereas, Spiro (1977) proposes a knowledge-based processing model that suggests readers, in normal reading situations, select and store only that information which is important to them.
The general purpose of this study was to ascertain the extent to which each model adequately accounts for how people comprehend and recall text. Specifically, the study attempted to determine what type of text structures subjects processed for long term storage as a result of the type of processing instructions they received prior to reading a passage. Previous results reported by Meyer (1975a,b) indicate that readers tend to process and store in memory the underlying top structures of top level information. However, her results might have been obtained because her subjects received explicit instructions telling them to read their passages in a manner that would enable them to recall everything they had read.

Research conducted by McConkie, Rayner, and Wilson (1973), McConkie and Meyer (1974) and McConkie and Rayner (1974) indicate that subjects' processing strategies can be manipulated by administering different types of processing instructions to subjects prior to their reading passages. Hence, it is possible that Meyer's subjects were induced to rely on the authors' textual schemata to aid their comprehension and recall only because of the specific processing instructions they received. Therefore, her results may not have been indicative of how readers process text in normal reading situations.

Additionally, Spiro (1977) has made a similar argument against Meyer's model. He argues that in normal reading situations readers do not necessarily tend to concentrate on any particular text structure since readers normally read to update old knowledge - not to memorize passages.
To assess in the present study the influence that different processing instructions had on the type of text structures subjects processed, free recall tasks were used to measure what subjects stored in memory after reading their passages. Each subject read one of two passages. These passages will be discussed fully in the "Materials" section of Chapter III.

Two experimental variables were of interest in the study: 1) instructions and 2) passages. The instructions variable consisted of two levels (Text-based Processing Instructions versus Knowledge-based Processing Instructions). The text-based processing instructions told subjects to read for the purpose of remembering everything they had read. The knowledge-based instructions told subjects not to read for the purpose of remembering everything that they had read. Instead, they were told to read for the purpose of identifying the author's implicit meaning. Hence, the text-based processing instructions were designed to control subjects processing strategies by inducing them to rely more on the authors' textual schemata than on their own world knowledge to aid their comprehension and recall. Whereas, the knowledge-based processing instructions were designed to control subjects' processing strategies by inducing them to rely more on their own world knowledge than on the authors' textual schemata to aid their comprehension and recall.

Since research (e.g., Thorndyke, 1977) indicated that the content and structure of passages can influence comprehension and recall, a passages factor also was included in the study. The "passages"
independent variable was included only to control for passage effects. This variable had two levels: 1) the AS passage level and 2) the CP passage level. The AS passage dealt with the treatment of adult and child schizophrenics. The CP passage dealt with the wide variety of colors among parakeets.

Free recall protocols were subjected to a version of Meyer's (1975a,b) text analysis procedure. Meyer's procedure was used because the experimenter was primarily interested in determining whether or not subjects had recalled two specific types of text structures: rhetorical propositions and lexical propositions. Meyer's procedure allowed the experimenter to identify these structures both in the original passages subjects read and then in the subjects' free recall protocols. Thus, her procedure provided the means for determining whether or not subjects had stored a particular structure in memory.

Rhetorical propositions were of interest because a central issue for the Spiro and Meyer processing models was whether or not subjects tend to store in memory particular text structures. Meyer's model argues that they do; especially the superordinate rhetorical propositions (i.e., top level structures). Whereas, Spiro argues that readers in normal situations do not necessarily tend to store any particular text structure.

Superordinate rhetorical propositions give text their overall structure (Grimes, 1972; Meyer, 1975a,b). The AS passage was organized by a superordinate rhetorical proposition which consisted of a
rhetorical predicate called response with two equally weighted arguments, problem and solution. Meyer's model suggested that subjects would tend to select and store this response rhetorical proposition in memory; whereas, Spiro's model suggested that subjects would not necessarily store it. To test their opposing arguments, subjects' recall of this structure in their free recall protocols was investigated.

The CP passage contained a superordinate rhetorical proposition, that included a rhetorical predicate called covariance which indicates a causal relation between an argument serving as an antecedent and one serving as a consequent. Subjects' recall of this covariance rhetorical proposition also was investigated.

With regard to lexical propositions, they were equally important because little research had been done to assess the influence that various processing instructions have on the comprehension and recall of these structures. Lexical propositions are important in memory research because they provide a means for analyzing text into units and also because they suggest a way in which information may be stored in memory. According to Meyer (1975a,b), these propositions are the underlying structures of low level ideas and consist of lexical predicates and arguments which are related by specific role relations. These role relations comprise a set of universal concepts which identify certain judgments that human beings are capable of making about events that are going on around them - judgments about such matters as who did it, who it happened to, and what got changed. (Anderson and Bower, 1973).
Since superordinate rhetorical propositions and lexical propositions are the abstract underlying structures of ideas contained in text, the study investigated the effect that the different processing instructions had on the comprehension and recall of the surface structure forms of these propositions. Hence, the effect that the instructions had on subjects' comprehension and recall of top level structures and role relationship units was investigated. Top level structures were defined as the surface structure form of the superordinate rhetorical proposition of a passage as represented in the content structure of that passage. Role relationship units were defined as the surface structure forms of lexical propositions as represented in the content structure of that passage.

If Meyer's model were correct, subjects' recall of top level structures and role relationship units would be equivalent. In other words, type of processing instructions would have no significant effect on subjects' recall performance.

Equivalent recall performance was expected because Meyer argues that readers tend to select for long term storage top level information but not low level information. If so, one would expect the knowledge-based and text-based processing instructions subjects to be equivalent in their recall of top level structures since both groups would be equally inclined to store top level information. Additionally, one would also expect the two groups to be equivalent in their recall of role relationship units since there would be no reason to expect one group to store more low level information than the other group.
because, according to Meyer's model, neither group would tend to store this type of information.

On the other hand, if the type of processing instructions subjects received prior to reading influenced how they processed their passages; then, differences in the recall of top level structures and role relationship units were expected. Such differences would support Spiro's model.

If Spiro's model were correct, the following results were expected. First, if the text-based processing instructions were effective, they would induce subjects to treat their passages as high integrity text. Hence, subjects who received these instructions would attempt to select for long term storage as much information as possible. This information would include both top level and low level information.

However, since there is a limitation on the amount of information that people can store, the text-based processing instructions subjects would reduce their passages to their macrostructures (Van Dijk and Kintsch, 1978) which would include the superordinate rhetorical proposition. Hence, for text-based processing instructions, subjects would tend to have better retention of top level structures than of role relationship units since they would tend to delete from the content structures of their passages lexical propositions but not superordinate rhetorical propositions.

Second, if the knowledge-based processing instructions were effective, they would induce subjects to treat their passages as low integrity text. Hence, subjects who received knowledge-based processing
instructions would, according to Spiro, read to update old knowledge. In doing so, these subjects would treat top level information as functional information. For these subjects, top level information would be redundant information which merely strengthened pre-existing schemata.

Rather than concentrate on redundant information, knowledge-based instructions subjects would seek new updating knowledge from low level information. Hence, the knowledge-based processing instructions subjects would be less likely to delete lexical propositions from the content structures of their passages and more likely to delete subordinate rhetorical propositions. Therefore, they would tend to have better recall of role relationship units than of top level structures.

Clearly, if the two types of processing instructions were equally effective, subjects' recall of top level structures and role relationship units would differ. First, text-based processing instructions subjects' recall of top level structures would be superior to the recall of knowledge-based instructions subjects since the knowledge-based instructions would treat top level information as functional information; whereas, for the text-based processing instructions subjects, the top level information would have been the most important information. Second, knowledge-based processing instructions subjects' recall of role relationship units would be superior to the recall of the text-based processing instructions subjects since knowledge-based processing subjects would treat low level information as the most important information; whereas, for the text-based processing instructions subjects, low level information would have been the least important information.
Research Questions and Related Null Hypotheses

The three research questions, and the related null hypotheses developed from the rationale were as follows:

Research Question 1: Independent of the effect of the passage variable, do the levels of the instructions variable \textit{Text-based Processing Instructions (TBI) versus Knowledge-based Processing Instructions (KBI)} lead to equal subject performance?

The related null hypothesis was: Subjects in the TBI level will not score significantly higher on the two dependent variables than subjects in the KBI level.

Research Question 2: Independent of the effect of the instructions variable, do the levels of the passage variable \textit{the "Anti-S-proteins for Schizophrenics" (AS) passage versus the "Color of Parakeets" (CP) passage} lead to equal subject performance?

The related null hypothesis was: Subjects in the AS passage level will not score significantly higher on the two dependent variables than subjects in the CP passage level.

Research Question 3: Do the differences among the levels of the instructions variable remain constant as they cross from one level to another level of the passages variable?
The related null hypothesis was: The difference between the levels of the instructions and passages variables on the two dependent variables will not differ significantly. The two variables will not interact.

Definition of Terms

1. **Anti-rehearsal task.** Maintenance rehearsal is a term used to define the process of keeping information accessible in primary memory without increasing its accessibility to free recall from secondary memory. For the purpose of this study, an anti-rehearsal task was an interpolated task given to subjects to perform between the time that they completed their reading of an experimental passage and before their initial free recall of that passage. Within the context of this study, the anti-rehearsal task was called the anti-rehearsal verbal reasoning task, and it is described more fully in Chapter III.

2. **Content structure.** A content structure is an ordered list of propositions and represents the semantic structure of a unit of text (See Appendix B for partial copies of content structures used for experimental passages).

3. **Knowledge-based processing instructions.** Knowledge-based processing instructions instruct subjects to read a passage in a manner which will allow them to infer the author's implicit meaning.

4. **Proposition.** A proposition is the underlying semantic representation of a simple sentence (Marshall and Glock, 1978).

5. **Role relations.** Role relations (Grimes, 1975; Meyer, 1975a) are labels used to classify the underlying relationships between the
content words (e.g., nouns, verbs) that are contained in a passage.

6. **Text.** A text is a semantic unit which is encoded in sentences. Text relates as a whole to the environment in which it is placed. In any text, every sentence except the first exhibits some form of cohesion with a preceding sentence. Hence, the expression of semantic unity of text lies in the cohesion among the sentences of which it is composed. Within the context of this study, "text" will refer to materials similar to written classroom instructional materials (e.g., textbooks).

7. **Text-based processing instructions.** Text-based processing instructions instruct subjects to read a passage in a manner which will allow them to remember exactly what they have read.

8. **Top level structures.** Top level structures refer to the labeled relationships that exist among the content words which appear in the top level of the content structure of a passage. These top level structures are the surface structure forms of superordinate rhetorical propositions and show how subordinate ideas are related together in the content structure of a passage (Meyer, 1975a). (See Appendix B for examples of the content structures for the passages used in this study).

**Limitations**

1. The subjects in this study were incoming college freshmen from predominantly white middle class and upper class families. They were enrolled at a small liberal arts college. As such, the results
represent the comprehension and recall performance only of this population performing under the stated conditions.

2. Data from several students had to be discarded after the experiments were completed. Data for several students were discarded because 1) it was discovered that transfer students had mistakenly participated in the experiment, 2) several students arrived at the test area after the experiment had begun, and a special mark was placed on their experimental booklets to indicate that their booklets would be eliminated from further analysis, 3) it was discovered that several students had defective experimental booklets and failed to inform the experimenter or the student assistants, and 4) several students failed to follow the proper instructions. To remedy this situation, all non-usable booklets were removed from each of the experimental subgroups. This procedure left one of the subgroups with forty usable experimental booklets. Consequently, only forty booklets for each subgroup were randomly selected to be coded.

3. The study was designed to investigate the extent to which the comprehension and recall of text are knowledge-based and the extent to which they are text-based. In order to infer the extent to which either of these two phenomena influence the comprehension, several assumptions were made. These assumptions were previously identified by Marshall and Glock (1978). The assumptions were 1) Memory is structured, 2) Memorial structure is similar to the semantic structure of language, and 3) The semantic structure of a recall is similar to the memorial structure (Marshall and Glock, 1979).
CHAPTER II

REVIEW OF THE LITERATURE

The Effects of Text Structure on Comprehension and Memory

Every type of text has a structure. Stories have a particularly clear structure. Several researchers (e.g., Mandler and Johnson, 1977; Rumelhart, 1975; Thorndyke, 1977) argue for similar effects of story structure on comprehension and memory.

Mandler and Johnson constructed a story schema or grammar which, they argue, denotes a set of expectations about the internal structure of stories which serve to facilitate both encoding and retrieval. Their grammar is designed to represent the structure of simple stories which are defined by the fact that they have a single protagonist in each episode. Their grammar consists of rewrite roles and transformational rules which can be used to parse simple stories into their constituent units (e.g., states events, and episodes) or they can be used to generate stories.

With regard to the effect that the grammar has on memory, they argue for instance, that causally connected episodes are better recalled than temporally connected episodes. Additionally, they argue that stories with a higher degree of structure are better
recalled in more accurate temporal order than less structured stories.

Rumelhart (1975) also has constructed a story grammar. In fact, the Mandler and Johnson grammar is based on his story structure. However, Mandler and Johnson argue that their grammar permits the analysis of a broader range of stories than Rumelhart's grammar. Basically, Rumelhart's grammar posits two sets of rewrite rules: syntactic rules and semantic interpretation rules. Syntactic rules indicate how sentences can be decomposed; whereas, the semantic interpretation rules indicate how the parts of the decomposed sentences are related.

Essentially, Rumelhart views the underlying structure of a story as a psychological whole. This psychological whole consists of settings, events, actions, and the reader's response to the story. Rumelhart argues that people use this psychological whole to reconstruct the story by filling in whatever is needed in order to make the story complete.

One aspect of Rumelhart's grammar which distinguishes it from Mandler and Johnson's grammar is his emphasis on single protagonist stories. According to his grammar, a story consists of an episode in a particular setting. An episode consists of an event plus a reaction. Unlike Mandler and Johnson's grammar, Rumelhart's grammar places little emphasis on multiple protagonist stories or on multiple episodic stories.

Thorndyke (1977) reported data which indicates that both story structure and content affect memory. His data indicates that recall
probability of individual propositions is a function of the hierarchical level of the proposition (he defines a proposition as a clause or sentence). He also argues that people attempt to use narrative prototypes (internal representations) to encode stories structurally as a mechanism for recall.

Other researchers also have investigated the effect of text on comprehension and memory. However, they were not actually concerned with the underlying structure of the text. For example, Blumenthal and Robbins (1977) used text to investigate the release from proactive inhibition phenomenon. Surprisingly, their findings suggest that possible structural similarity among the passages presented to their subjects caused a build-up of proactive inhibition resulting in poor recall of the passages that they read. The results were surprising because their passages seem to have had structural characteristics that produced the same proactive inhibition effect that words related semantically have been known to do.

Aulls (1975) also investigated the effect of text on recall. He manipulated the structure and meaningfulness of the paragraphs presented to his sixth grade subjects. His findings indicate that both structural properties and meaningfulness have a significant joint-effect on literal recall.

This review will now turn to studies dealing with the representation of knowledge in the human memory system.
Representation of Knowledge in The Human Memory System

Theories about representation attempt to explain both how concepts expressed in natural language are represented and how sensory, experiential, emotional, and cognitive aspects of information are represented (Norman, 1976). The question of how to represent theoretically the knowledge that a person has is one of the most fundamental problems confronting cognitive psychologists (Anderson and Bower, 1973).

For example, theorists like Fredericksen (1977a) and Chafe (1977a,b) have opposing views about what constitutes the basic structure of human knowledge. Fredericksen (1977a) argues for a structure that is propositional in nature; whereas Chafe (1977a,b), although he acknowledges the existence of propositions, argues that knowledge is not necessarily stored propositionally.

Chafe's (1977a,b) basic argument is that knowledge becomes propositionalized when it becomes necessary to verbalize that knowledge. Chafe, however, acknowledges that propositions and the case grammar are important to verbalization (i.e., the production and understanding of written and oral text).

Chafe (1977) argues that the representation of knowledge has an internal structure which is to some extent analogically related to the structure of its corresponding external structure. He also argues that this basic form of storage may consist of individuated events and objects which are not connected in a propositional network until a need to verbalize them make propositional decisions necessary.

Chafe's (1977) schematic view of representation is supported by Bobrow
and Norman (1975) and Rumelhart and Ortony (1977) who argue that schemata are the basic constituents of human knowledge.

Schemata is a rather vague term and it is necessary for any researcher arguing for a schematic representational format to define what he or she means by "schema" or "schemata." For instance, Gagne (1977) states that a schema is not a single word or fact, but rather a complex organization having many tentacles of contact with surrounding or associated stored entities. Chafe (1977) argues that a schema is a pattern by which a larger chunk is broken down into smaller chunks, and that schemata are available at various levels in the sense that a chunk with a higher level schema may itself be broken down into smaller chunks at a lower level. Rumelhart and Ortony (1977) argue that schemata are abstract symbolic representations of knowledge which can be expressed in language and used to understand language - but are not necessarily linguistic. Spiro's (1977) "state of schema" model describes schemata as representations of a subset of information that can contain - among other things - specific details from stories, general impressions, general types of events that have occurred in prototypical situations, and rules for inferential reconstruction.

In contrast to schematic models of representation are the propositional models. Three representative propositional models are the Anderson and Bower (1973) Human Associative Memory (HAM) model, the Kintsch (1974, 1975) model and the Norman and Rumelhart (1975) model. The basic unit of representation in each of these models is the proposition.
Kintsch (1974) argues that the basic units of representation are propositions which are n-tuples of word concepts, one of which serves as a predicator, and the remaining ones as arguments with each fulfilling a unique semantic role. Anderson and Bower (1973) also argue that the basic unit of knowledge in HAM is the proposition which corresponds to a complete conceptualization. According to them, this conceptualization can take the form of an assertion or statement. Norman and Rumelhart (1975) make a similar claim. Their model suggests that humans retain knowledge in the form of specific statements about the conceptual information in the information that is stored (Norman, 1976).

These propositional models are also representative of what Norman (1976) refers to as one of the most popular formats being studied by cognitive scientists - the semantic network. Fredericksen (1975c) states that a semantic network consists of networks of semantic tokens or concepts connected by relational units. According to him semantic networks are graphic representations of the interrelations among propositions.

Other models of semantic networks exist which differ in the types of concepts which are connected into networks and in the types of elementary semantic relations which connect concepts into higher order semantic units (Fredericksen, 1975c). For example, Collins and Quillian (1972) posit a model that is hierarchical in nature. In their model, concepts are organized into superordinate and subordinate properties. Superordinate properties are transitive relations which enable concepts to form chains where each concept has a more general concept as its
superordinate. Although Norman (1976) describes this model as a list model rather than a semantic network model, it is apparent the model is similar to other models in that it has the same notion of an underlying set of relations which represent knowledge in memory.

The next section reviews studies dealing with how the human memory system processes text.

**Text Processing in the Human Memory System**

There are two alternative conceptions of how the human memory system processes text. The two concepts are the interpretive conception and the constructive conception (Fredericksen, 1975b).

Anderson and Bower (1973) are representative of the interpretive conception of text processing. They posit that an automatic parsing of the text input takes place which results in a semantic interpretation of linguistic input. The linguistic parser accepts a sentence and presumably delivers as output a set of atomistic propositions related in specified ways. Interpretive models of text processing are often suggested by researchers who work with single sentences and who have borrowed from the computational and transformational traditions of linguistics (Fredericksen, 1975b).

In opposition to the interpretive view is the constructive view. Bransford, Barclay, and Franks (1972) are most often associated with the constructive conception of text processing. Their seminal study in sentence comprehension indicates that the creation of a semantic interpretation is the joint function of input information and prior knowledge.
The constructive conception of text processing argues that comprehension involves using prior knowledge, intentions, context, and task demands in combination with input structure to control text processing (Fredericksen, 1975b). In contrast to the interpretive concept of text processing, the constructive concept does not suggest that each input sentence is semantically processed in its entirety. Instead, it is argued that input sentences are selectively processed together with contextual information and stored knowledge to generate a semantic interpretation which fits the input data (Bransford, Barclay, and Franks, 1972; Fredericksen, 1975b; Eysenck, 1977).

Even though the Bransford, Barclay and Franks (1972) study indicates that human beings create semantic interpretations of input sentence, their original study did not indicate whether the integration of past and present information took place during comprehension, during subsequent storage, or at the time of retrieval (Eysenck, 1977). A subsequent study by Bransford and Johnson (1972) indicated that the integration of past knowledge with present input occurs during initial comprehension. Fredericksen (1975b) reported data supporting this argument.

The classic research in the tradition of the constructive concept was first performed by Bartlett (1932). Bartlett argued that the central meaning of a passage is stored in schematic form with subsequent recall being achieved by a process of reconstruction from the underlying schema (Eysenck, 1977). Bartlett had subjects attempt to memorize a passage from a story entitled "The War of the Ghosts." He found many
errors beside simple omissions of details. His subjects tended to change, distort, and even import new materials into their reproductions (Anderson and Bower, 1973). Bartlett argued that the recall was distorted because the passage had been assimilated into the subjects' knowledge and belief structure (Bartlett, 1932; Anderson and Bower, 1973; Eysenck, 1977).

Since Bartlett first reported his findings, however, several researchers have attempted but failed to replicate his initial results (Eysenck, 1977; Spiro, 1977). This failure to replicate Bartlett's finding has led several researchers to believe that Bartlett's subjects deliberately made confabulations in order to smooth out the retelling of the story (Anderson and Bower, 1973; Spiro, 1977).

Eysenck (1977) argues that confabulations might have occurred because of the kind of story that Bartlett used in his study. Mandler and Johnson (1977) describe the story as being ill-formed without any obvious causal connections or rational order.

Spiro (1977) cites several studies which attempted to replicate Bartlett's findings. He states that, because of this failure to replicate Bartlett's findings, some researchers have concluded that the recall process is abstractive rather than reconstructive. In other words, recall is a matter of passive retrieval of stored memory traces. This abstractive trace retrieval theory claims that the to-be-remembered information has a particular identity immune from the assimilative effects of other knowledge and other subsequently encountered relevant information.
This view is in direct opposition to the reconstruction hypothesis. The reconstruction hypothesis claims that human beings reconstruct information upon recall by utilizing underlying representations of stored knowledge to fill in the gaps when attempting to recall stored information; whereas, the abstract-trace retrieval theory claims that any to-be-recalled information is virtually untouched by previously stored relevant information.

Many researchers support the reconstruction hypotheses. Clark and Clark (1977) state that remembering is a reconstructive process. People recall or recognize a sentence by retrieving bits and pieces of what is stored in memory, and then utilizing these bits and pieces to reconstruct what could plausibly be the original information. Rumelhart and Ortony (1977) also state that people use fragments of the copies of original instantiated schemata to reconstruct original interpretations and thereby remember the input data.

Researchers also have studied how people process longer units of text. According to Van Dijk (1977), in order for people to store information from complex text (e.g., text such as novels), the amount of information presented to the reader must be reduced to the macrostructures of the text. This reduction of information is referred to as semantic information reduction (Van Dijk, 1977).

During semantic information reduction, information is deleted or integrated. That is, a certain number of propositions may be replaced by one (macro-) proposition subsuming the more detailed information at a more global level of representation. Thus, sequences of propositions can form semantic units relative to the level(s) of the macro-propositions
(Van Dijk, 1977).

Both Van Dijk (1977) and Kintsch et. al. (1977) agree that what is stored in memory is at least the macro-structures of the text, especially a story text. Furthermore, Van Dijk (1977) states that a reader or a hearer is unable to retrievably store all the individual propositions from longer texts; hence, he argues, there is a threshold beyond which a language user hearing or listening to long text cannot store all the semantic information of the text as a set or sequence of propositions.

Yet, in spite of these constraints on processing long text, a reader or listener still knows what the longer text is about and can establish coherent relations with previous parts of it (Van Dijk, 1977). These relations must be based on information which can easily be stored and which is necessary and sufficient for the interpretation of the rest of the text (Van Dijk, 1977).

Therefore, Van Dijk (1977) and Kintsch et. al. (1977) argue that macro-structures play an important role both in the recall and comprehension of complex text. Reducing information to macro-structures involves operations which maintain the semantic core of a passage by constructing, during input, a macro-proposition representing the most important information of the passage (Van Dijk, 1977). Kintsch et. al. (1977) also argue that in order to comprehend long stories information must be reduced to macro-structures, and that these macro-structures provide the reader with a schema which helps guide the reader's comprehension of the story.
Van Dijk (1977) argues that comprehension occurs because the macro-structures provide the necessary presuppositions for the interpretation of subsequent sentences and sequences. Additionally, these structures aid in recalling detailed information through inference. That is, even though individual propositions are not stored from complex information, inferences based upon stored macro-structures aid in the retrieval of detailed information that has been subsumed by the macro-structures.

Results cited by Kintsch et. al. (1977) indicate that the formation of macro-structures is an integral part of the comprehension process and occurs during reading and not during recall. Subjects in his study read 1,400 word stories and wrote 60 to 80 word summaries. Reading time was either unrestricted or limited, and the stories were either presented in their natural order or with their paragraphs scrambled. Although, subjects took longer to read the scrambled stories, they produced the same kind of summaries whether the stories were scrambled or in their natural order. Judges were able to differentiate summaries based on less well structured stories that had been scrambled than they were able to differentiate well structured stories that had been scrambled. The overall results from this study suggest that macro-structures are formed during the comprehension process and that these macro-structures permit subjects to comprehend scrambled stories by reorganizing them.

In a separate but related study Van Dijk (1977) reports results indicating that macro-structures aid the comprehension of complex
information as well as the recall of detailed information subsumed by the macro-propositions. According to Van Dijk, subjects, when recalling a story, produce recall protocols which mainly contain macro-propositions. He also reports that in immediate recall more detailed information is still connected with this macro-structure, but after several weeks the detailed information deteriorates, leaving only macro-structures or fragments of macro-structures in subsequent reproductions made by the subjects.

The Kintsch et. al. (1977) and Van Dijk (1977) studies suggest that macro-structures are formed during comprehension and that these structures enable the reader or listener to interpret sentences and subsequent sequences while the information is being presented to them. Furthermore, Kintsch et. al.'s (1977) theory of story comprehension indicate that macro-structures facilitate the organizing of a story when a comprehender knows how a particular type of text is usually organized. That is, comprehension involves the construction of macro-structures which represent the meaning of the story; and when a comprehender is familiar with the structure of a particular type of text, his knowledge about the nature of that type of text helps him to organize the macro-structures of a particular passage or story.

In summary, the Van Dijk (1977) and Kintsch et. al. (1972) studies indicate that when people are presented with complex text, they reduce the information to macro-structures, and that this construction of macro-structures occur during the comprehension process and not at the time of recall.
However, responses such as those reported by Kintsch et al. (1977) and Van Dijk (1977) are subject to two different interpretations. Fredericksen (1975a) indicates that such responses could result from processes occurring during acquisition, or they could reflect processes occurring during recall. That is, when subjects are asked to reconstruct the content of discourse to which they have been exposed, their recalls often contain information which has been paraphrased, reduced, overgeneralized, elaborated, or inferred. Fredericksen (1975a) argues that on the one hand, these responses may reflect gaps in a subject's memory structure and that subjects attempt during recall to fill in these gaps, or on the other hand, that these responses reflect underlying processes fundamental to acquisition.

To determine whether such responses are due to processes occurring during the acquisition of information or to processes occurring during recall, Fredericksen (1975a) conducted a study in which he examined the effects of repeated exposures to a text on the relative frequencies of different classes of conceptual and relational information in subjects' recalls. He argued that if these responses are reflective of an acquisition process; then, once semantic information is acquired it becomes an integral part of a subject's memory structure; therefore, inferred or overgeneralized semantic information will not decrease even when subjects have been exposed to a text several times. On the other hand, if these responses are reflective of a recall process; then, inferred and overgeneralized semantic information will decrease over trials because subjects would be adding previously omitted information.
Fredericksen (1975a) exposed his subjects to a tape recorded passage four times. His subjects recalled the passage after each of the presentations. Results from the study indicate that inferred and overgeneralized semantic information that appear in recall responses are reflective of an acquisition process. That is, the inferred and overgeneralized responses did not decrease over repeated trials. Thus, it appears that once these structures became a part of the memory system, they were retained over repeated exposures. Since subjects did not decrease the inferred or overgeneralized semantic information, Fredericksen (1975a) argues that these responses indicate that a selective process occurs when subjects are presented with text. This selective processing aids in the acquisition of information because there is a limitation on the amount of information that human memory can process.

Fredericksen's (1975a) findings support both Van Dijk (1977) and Kintsch (1977). His findings indicate that when subjects are presented with a long passage they reduce the information to overgeneralized and inferred concepts when they are first exposed to the passage.

Perhaps, the conclusion to be drawn from Fredericksen's (1975a) study and other studies cited in this review of the literature is that different forms of representational formats are needed for different purposes. Glucksberg and Danks (1975) argue that, depending on the kind of information involved and the characteristics of the task, people apparently use many representational formats: verbatim, various
linguistic structures, abstract conceptual structures, and imagery to code or store information.
CHAPTER III

METHOD

Subjects
A total of 160 students served as subjects in the study. They were incoming college freshmen enrolled at a small midwestern liberal arts college. The data collected for the experiments were gathered as part of their freshman orientation activities. For their participation these subjects received no reward and were not told that they were participating in an experiment.

These subjects were predominantly white and from middle and upper class families. Their mean age was approximately eighteen years. There were 63 males and 97 females.

Design

Two independent variables and two dependent variables were investigated in the study. Thus, data were subjected to a two-way multivariate analysis of variance.

The two experimental variables of interest were 1) instructions and 2) passages. The instructions variable consisted of two levels (Text-based Processing Instructions versus Knowledge-based Processing Instructions). The text-based processing instructions told subjects to read for the purpose of remembering everything they had read. The
knowledge-based instructions told subjects not to read for the purpose of remembering everything that they had read. Instead, they were told to read for the purpose of identifying the author's implicit meaning. Hence, the text-based processing instructions were designed to control subjects' processing strategies by inducing them to rely more on the authors' textual schemata than on their own world knowledge to aid their comprehension and recall. Whereas, the knowledge-based processing instructions were designed to control subjects' processing strategies by inducing them to rely more on their own world knowledge than on the authors' textual schemata to aid their comprehension and recall.

The passages variable consisted of two levels: the AS passage versus the CP passage. This variable was included only to control for passage effects. Hence, the primary variable of interest was the instructions variable.

One-hundred and sixty subjects read and responded (free recall) to one of two experimental passages: the AS or the CP passage. The presentation of the passages was counterbalanced.

Eighty subjects were randomly assigned to read the AS passage. Forty of these subjects were randomly assigned to the text-based processing instructions level and 40 were randomly assigned to the knowledge-based processing instructions level.

Eighty subjects also were randomly assigned to read the CP passage. Forty of these subjects were randomly assigned to the text-based processing instructions level and 40 were randomly assigned to the knowledge-based processing instructions level.
Dependent Variables

Two dependent variables were of interest in this study. Each will be discussed in the remainder of this section.

Role Relationship Units. Role relationship units are the surface structure forms of lexical propositions as represented in the content structures of particular passages. For example, in the sentence ROGER RODE THE HORSE, there are two lexical propositions. The first lexical proposition is represented by an agent role relationship unit. This unit is composed of the following. RODE is the lexical predicate. RODE is related to its argument ROGER by an agent role relation since ROGER performed the action in the sentence. The second lexical proposition is represented by a patient role relationship unit. This unit is composed of the following. RODE is the lexical predicate. RODE is related to its second argument HORSE by a patient role relation since HORSE is the thing acted upon in the sentence.

Role relationship units were important in this study because by identifying the role relationship units contained in subjects' free recall protocols, the experimenter was able to identify which lexical propositions subjects stored in memory.

In order to identify lexical propositions in subjects' free recall protocols, each protocol was matched against the content structure of the passage upon which the protocol was based. Subjects were given credit for having recalled a particular lexical proposition if they included the actual content words (or paraphrases) of the surface structure role relationship unit representing that lexical proposition.
Top Level Structure. Top level structures are the surface structure forms of the superordinate rhetorical propositions as represented in the content structures of particular passages. Top level structures were important in this study because, with the use of the content structure of a particular passage, the experimenter by analyzing the subjects' free recall protocol could identify the superordinate rhetorical proposition contained in a particular passage and then determine whether or not subjects had stored that proposition in memory.

Subjects read two passages in this study. The superordinate covariance rhetorical proposition in the "The Color of Parakeets" (CP) passage was the underlying structure of the idea that a WIDE VARIETY IN THE COLOR OF PARAKEETS RESULTED FROM CAREFUL BREEDING OF COLOR MUTANT OFF-SPRINGS (Meyer, 1975a,b). The top level structure of this rhetorical proposition, as represented in the content structure is shown below:

```
RESULTED FROM, covariance, consequent
- WIDE VARIETY
- RESULTED FROM, covariance, antecedent
  BRED
```

The above example of the top level structure indicates that the WIDE VARIETY IN COLORS OF PARAKEETS is the consequent of the covariance rhetorical proposition; whereas, BREEDING OF COLOR MUTANT OFFSPRINGS is the antecedent.

The second passage subjects read was the "Anti-S-proteins for Schizophrenics" (AS) passage. The superordinate response rhetorical
proposition represents the idea that several problems: NEED TO CHANGE ABNORMAL BEHAVIOR OF ADULT SCHIZOPHRENICS, need to IMPROVE ADULT SCHIZOPHRENIC'S ABILITY TO PROCESS INFORMATION, and the TREATMENT OF CHILDREN WITH SCHIZOPHRENIA are problems which can be solved with the use of ANTI-S-PROTEINS (Meyer, 1975a,b). The top level structure of the superordinate rhetorical proposition, as represented in the content structure is shown below:

```
response
  problem
  collection
    NEED TO CHANGE BEHAVIOR OF ADULT SCHIZOPHRENICS
    IMPROVE ADULT SCHIZOPHRENIC'S ABILITY TO PROCESS INFORMATION
    TREATMENT OF CHILDREN WITH SCHIZOPHRENIA
  solution
    ANTI-S-PROTEIN
```

The above example indicated that the NEED TO CHANGE BEHAVIOR OF ADULT SCHIZOPHRENICS, IMPROVE ADULT SCHIZOPHRENICS ABILITY TO PROCESS INFORMATION, and TREATMENT OF CHILDREN WITH SCHIZOPHRENIA are the problems for the response rhetorical predicate. The term "collection" indicates that there is more than one problem discussed in the passage. ANTI-S-PROTEINS is the solution for the response rhetorical predicate.

In order to identify the superordinate rhetorical propositions in subjects' free recall protocols, each protocol was matched against the content structure upon which the protocol was based. Subjects
were given credit for having recalled a superordinate rhetorical proposition (or part of it) if they included the actual content words (or paraphrases) of the surface structure top level structure representing that proposition.

**Scoring Procedure**

**Description of Content Structure.** Meyer's procedure analyzing written text yields hierarchically arranged tree structures. The nodes in these tree structures contain content words from the passage, and the lines among the nodes show spatially how the content is organized. Additionally, labels are used in the tree structure to explicitly state and classify the role relations between content words.

This hierarchically arranged tree structure of a passage's informational content is referred to as the content structure. The content structure represents the underlying structure of the informational content of a passage. The content structure of a passage shows how ideas in the passage are subordinate to other ideas. It also specifies the relationship among ideas in a passage by indicating which ideas are located at the top levels and which ideas are located at the bottom levels of the structure (Meyer, 1975a,b). Ideas at the top-levels of the content structure have many ideas beneath them and related to them in a direct downward path in the structure. These top-level ideas dominate their subordinate ideas; whereas, the lower level ideas describe or give more information about the ideas above them in the content structure.
The ideas at these various levels in the content structure are content words and phrases from the passage. Role relations are represented by such labels as agents, patients, instrumental, etc., and are always directly under certain types of content words which dominate them in the content structure. These special content words are the lexical predicates which appear as verbs and their adjuncts in the passage (See Appendix B).

Role Relationship Units. Meyer's (1975a,b) system of expressing role relations was used to help identify role relationship units. Her system was used because her list of role relations was small but inclusive of the role relations typically identified by such linguists as Fillmore (1968, 1972) and Grimes (1975). The list includes the following role relations:

(1) Agent: Names the instigator of an action
(2) Instrument: An inanimate object used by the agent to perform an act
(3) Force: A causal relation devoid of responsibility
(4) Vehicle: Something that conveys a patient or moves along with it
(5) Patient: The who or what that is directly affected by an action or what is in a particular state
(6) Benefactive: Someone or something on whom an action has a secondary effect, good or bad
(7) Latter: Where the patient is headed or where it ends up

(8) Former: Where the patient begins a motion

(9) Range: Path or area traversed, a static location, or limitation of a process to a specified field or object

Since role relations exist only within role relationship units in a content structure, and since each role relationship unit in a content structure contains only one role relation; role relations were used as an index to indicate where corresponding role relationship units are located in a content structure. Since there were 34 role relations in the AS passage, there were also 34 role relationship units. With regard to the CP passage, there were 54 role relations; and hence, 54 role relationship units. (Those role relation categories identified in the content structures of both passages but not used in the study were eliminated because there were fewer than two of them in the content structures.)

The content structure of each passage subjects recalled was used as templates against which subjects' free recall protocols were matched. When a role relationship unit was discovered in a subject's protocol, the unit was labeled (e.g., agent, patient, etc.) and the number of the line in which the role relation appeared in the content structure was written next to the labeled role relationship unit in the subject's free recall protocol (See Appendix D for an example of a scored protocol).
A point was assigned for each role relationship unit identified in a subject's free recall protocol. Once subjects received a point for recalling a particular role relationship unit, they could not receive another point for recalling the same role relationship unit in another part of their free recall protocol.

The role relationship unit score was determined by deriving the mean proportion of total role relationship units subjects recalled. The study did not attempt to determine the effect that processing instructions had on the recall of particular role relationship units since the purpose of the study was to ascertain what effect, in general, the independent variables had on the recall of lexical propositions as represented by role relationship units.

**Top Level Structure.** The top level structure score was determined by deriving the mean proportion of top level structures subjects recalled. For each passage recalled there was only one top level structure. Each top level structure had two parts. The top level structure for the AS passage was the *response* rhetorical proposition which consisted of two parts: problem and solution. The top level structure for the CP passage was the *covariance* rhetorical proposition. The two parts for this rhetorical proposition was the antecedent and consequent.

One point was assigned to each part of the top level structure recalled from each passage. The highest possible number of points was two. No subjects received additional points for repeating top level structures in other parts of their free recall protocols.
A ceiling effect was expected for this score. Meyer's (1975a, b) model argues that readers tend to select superordinate rhetorical propositions for long term storage. If so, subjects in the present study were expected to have high equivalent recall scores for the top level structure variable.

To insure accuracy in coding, every tenth free recall protocol was reassessed to determine whether or not coding procedures were consistent. If the tenth protocol indicated that coding had been inconsistent, the previous nine protocols were reexamined and errors were corrected. On an average, there were two miscoded propositions per free recall protocol.

Since there were 160 free recall protocols which contained an average of ten coded propositions, there were 1600 propositions coded. Of the 1600 propositions coded, 320 were miscoded and corrected. Therefore, the coding procedure resulted in an accuracy rate of 80%.

Transformation of Scores

An arcsine transformation was performed on the top level structure and role relationship units scores. This transformation was used because the original observations for each subject were reported as proportions. Since the original scores were reported as proportions, there was a relationship between cell means and cell variances. The arcsine transformation made variances approximately equal independent of their means (Kirk, 1968).
Materials

Experimental Passages. There were two experimental passages used in the experiment. One passage was titled "Color of Parakeets (CP passage). This passage was 541 words in length and dealt with the wide variety of colors that exist among parakeets. The other passage was titled "Anti-S-proteins for Schizophrenics" (AS passage). This passage was 538 words in length and dealt with the treatment of schizophrenia among adults and children.

Both passages had different content structures. The total number of role relationship units in the CP passage was 54. The total number of role relationship units in the AS passage was 34. Finally the top level structure in the AS passage was the problem-solution response rhetorical proposition. In the CP passage the top level structure was the antecedent-consequent covariance rhetorical proposition (see Appendix A for examples of these passages).

Both passages were subjected to a Bormuth cloze readability formula computation. The computation indicated that a subject had to be reading at 10.4 reading level in order to comprehend the AS passage, and at the 9.7 reading level in order to comprehend the CP passage. Since the majority of subjects were from predominantly middle and upper class families and whose verbal S.A.T. scores ranged from 420 to 720, subjects were expected to have little difficulty in reading either passage.

Experimental Booklets. Experimental booklets were randomly distributed among the subjects. The booklets contained all the
materials used in the experiment. The materials included (1) a set of typed standard general instructions explaining the nature of the task (although they were actually participating in an experiment, the subjects were led to believe that they were being administered diagnostic reading comprehension tests), (2) a set of processing instructions: either the knowledge-based or text-based instructions, (3) one anti-rehearsal verbal reasoning test sheet (see Appendix C for examples of the verbal reasoning test sheet), (4) one experimental passage, and (5) several sheets of writing paper. For all booklets, processing instructions and experimental passages were counterbalanced (see Appendix C for an example of an experimental booklet).

**Tape and Tape Recorder.** Standard general instructions explaining the nature of the task, directions telling subjects when to start and when to stop reading their passages, directions telling subjects when to start and when to stop taking the anti-rehearsal verbal reasoning test, and directions telling subjects when to start and when to stop writing their free recall protocols were tape recorded in advance and then played to the subjects during the course of the experiment. The taped directions provided a means for controlling the time allowed for each part of the experiment.

The experiment was designed so that each subject had three minutes to read each passage. The amount of time allowed for reading each passage was determined by using Carver's (1973) standard word length control procedure. Computations from this procedure indicated that subjects had to be exposed to each passage for a minimum of three minutes to insure that each passage could be read by subjects
at the rate of 185 words per minute. Research cited by Sticht (1976) indicated that the average college reader reads silently at the rate of 185 to 195 words per minute. Thus, the subjects were given three minutes to read at the minimum rate of 185 words per minute.

Additionally, the Carver procedure indicated that subjects needed approximately 60 seconds to read the processing instructions. Thus, an additional minute was utilized to give subjects ample time to read their processing instructions.

Finally, in addition to the four minutes given to subjects for reading their passages and the accompanying instructions, subjects were given a total of three minutes to complete the anti-rehearsal verbal reasoning task, and a total of fifteen minutes to write each of their free recall protocols.

The Three-Minute Anti-Rehearsal Verbal Reasoning Task. There was a three minute delay between the time that the subjects finished reading a passage and the time they began their free recall of that passage. An anti-rehearsal task was used to fill each three minute delay to prevent subjects from maintaining in short-term memory any information obtained from reading a passage. This was done in an attempt to insure that subjects' free recall protocols reflected information that was recalled from long term rather than information rehearsed in short term memory.

The anti-rehearsal task was a modification of Baddeley's (1968) written verbal reasoning test (see Appendix C for example found in experimental booklet). The subjects read each test item and responded
to each item by placing a check mark in the appropriate true or false column. While the subjects performed this task, they could not rehearse any of the information acquired from their reading of the previous passage. Thus, any information recalled from a passage in their free recall protocols would reflect what was stored in long term memory rather than in short term memory.

**Procedure.** During the summer months, all incoming freshmen received through the mail an agenda which listed the various orientation activities in which the freshmen were to participate during freshman orientation week. Listed among the activities was a reading comprehension test session. Consequently, all incoming freshmen expected to take a reading comprehension test on the day designated on the agenda.

However, on the day of the test, they were administered only one actual test, the Davis Reading Test which assesses the comprehension and reading rate level of college freshmen. The second test that was administered was actually an experiment. Thus the students (the subjects) did not know that they were participating in an experiment. The Davis Reading Test took forty minutes to administer and the experiment took approximately thirty minutes to administer.

The experiment was conducted in the afternoon. All subjects participated at the same time and in the same test area. As the subjects entered the test area, they were instructed by five student assistants to take a seat anywhere within the test area.

After all the subjects were seated, the student assistants and the experimenter distributed among the subjects copies of the Davis
Reading Test. The subjects were told not to begin the test until after they heard the taped instructions which would be played over the public address system. After all subjects received their copies of the Davis Reading Test, a student assistant began the tape which contained standard general instructions for the experiment and the other directions that the subjects were to follow throughout the experiment. The tape played throughout both the Davis Reading Test and the experiment. It was not stopped until the end of the experimental sessions. At the end of 40 minutes, the subjects were told to stop the Davis Reading Test. There was a three minute gap between the end of the Davis Reading Test and the beginning of the experiment. During those three minutes, the student assistants collected the Davis Reading Test and randomly distributed the experimental booklets.

The experimental booklets had been randomly stacked on a table in the test area prior to the beginning of the experimental session by the experimenter. Each student assistant picked up several stacks of booklets and distributed them among the subjects during the three minute gap. All subjects remained in their seats during this time and were told not to begin until after they heard the instructions telling them to do so. The experimenter did not participate in the distribution of the booklets, and the five student assistants did not know that an experiment was being conducted.

At the end of the three minute gap, the subjects heard the beginning of the taped standard general instructions which explained the nature of the experiment. While listening to the tape, the
subjects were instructed to read the same standard general instructions in their booklets.

After listening to these instructions, the subjects were then instructed to turn the page and read the contents of the next page. Subjects read either the text-based processing instructions or the knowledge-based processing instructions and then began reading either the AS or the CP passage.

When signaled, subjects stopped reading their passages. They were then directed to turn to the next page and read its contents. All subjects read the directions for performing the anti-rehearsal task. While subjects read the directions, they also listened to the directions as they were read aloud. After reading and listening to the directions, subjects participated in the three minute anti-rehearsal task.

At the end of three minutes, subjects were told to stop and were then instructed to turn the page and read the contents of the next page. On that page, subjects were instructed to write (free recall) everything that they could remember from the passage (either the AS or the CP passage) that they had read. All subjects were given fifteen minutes to write their free recall protocols.

At the end of fifteen minutes, all subjects were told to stop writing. The subjects were told to leave their booklets on their desks and to leave quietly from the test area. As the subjects departed, the student assistants and the experimenter collected the booklets. After the booklets were collected, the experimenter thanked
the student assistants for their assistance and the experimental session was officially ended.
CHAPTER IV

RESULTS

The primary purpose of this study was to assess the effects of two independent variables: processing instructions and passages, on the comprehension and recall of two dependent variables: role relationship units and top level structures. Raw scores were converted to proportions. To ensure homogeneity of cell variance, an arcsine transformation for the two dependent variables was used.

A two-way multivariate analysis of variance (MANOVA) was used to analyze the transformed data. Significant multivariate effects were followed-up by univariate analyses of variance (ANOVA's) and discriminant function analyses. For the discriminant function analyses, both standardized discriminant function weights and structure coefficients were interpreted because of the relative instability of standardized discriminant function weights. Structure coefficients indicate the correlation between the discriminant function and the original dependent variables. Thus, they presented a more stable index of the extent to which a variable discriminated between groups.

The research questions, related null hypotheses, and the findings of the multivariate analysis of variance and the univariate analysis of variance and discriminant function analysis follow-up tests are presented in the remainder of this chapter.
The means and standard deviations for the Processing Instructions groups (i.e., Text-based and Knowledge-based) and the respective passages levels to which they were assigned are given in Table 1. The within cells correlation between the top level structure and role relationship dependent variables was .16.

Table 1

Means and Standard Deviations by Level of Instructions and Passages for Two Dependent Variables: Role Relationship Units and Top Level Structure

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Ro Rel Units</th>
<th>TLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text-based Instructions (AS)</td>
<td>40</td>
<td>.138</td>
<td>1.466</td>
</tr>
<tr>
<td>M</td>
<td></td>
<td>.082</td>
<td>.379</td>
</tr>
<tr>
<td>SD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge-based Instructions (AS)</td>
<td>40</td>
<td>.187</td>
<td>1.246</td>
</tr>
<tr>
<td>M</td>
<td></td>
<td>.089</td>
<td>.547</td>
</tr>
<tr>
<td>SD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Text-based Instructions (CP)</td>
<td>40</td>
<td>.247</td>
<td>1.374</td>
</tr>
<tr>
<td>M</td>
<td></td>
<td>.078</td>
<td>.526</td>
</tr>
<tr>
<td>SD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge-based Instructions (CP)</td>
<td>40</td>
<td>.233</td>
<td>1.217</td>
</tr>
<tr>
<td>M</td>
<td></td>
<td>.067</td>
<td>.632</td>
</tr>
<tr>
<td>SD</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 presents the overall results of the two-way multivariate analysis of variance. There were significant multivariate effects for the instructions variable $F(2, 155) = 4.12, p < .02$; the passages variable $F(2, 155) = 20.30, p < .001$; and the instructions and passages interaction $F(2, 155) = 3.42, p < .04$. 
Table 2

Summary of the Multivariate Analysis of Variance on the Two Dependent Variables by Level of Instructions and Passages

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>df</th>
<th>dfHYP</th>
<th>dfERR</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructions (A)</td>
<td>1</td>
<td>2.00</td>
<td>155.00</td>
<td>4.12</td>
<td>.018</td>
</tr>
<tr>
<td>Passages (B)</td>
<td>1</td>
<td>2.00</td>
<td>155.00</td>
<td>20.30</td>
<td>.001</td>
</tr>
<tr>
<td>Instructions X Passage (AB)</td>
<td>1</td>
<td>2.00</td>
<td>155.00</td>
<td>3.42</td>
<td>.035</td>
</tr>
<tr>
<td>Error (S/AB)</td>
<td>156</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>159</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3 presents the results of the univariate analysis of variance and discriminant function analysis follow-up tests for the significant multivariate interaction effect. Taken together, these follow-up techniques indicate that the role relationship units variable was the better discriminator for the instructions and passages variables interaction. An inspection of the univariate Fs shows that subjects differed significantly on this variable (p < .01). Likewise, the standardized discriminant function weight (-.991) and the structure coefficient (-.944) show a high contribution for the role relationship unit variable to the discrimination among the groups. Whereas, for the top level structure variable, the standardized discriminant function weight (.376) and the structure coefficient (.240) indicate that this variable contributed negligibly to the discrimination.
Table 3

Discriminant Analysis and Univariate Anova's on the Use of Text Structures in Recall for the Instructions and Passages Interaction

<table>
<thead>
<tr>
<th>Text Structures Category</th>
<th>Standardized Discriminant Structure Analysis Weights</th>
<th>Univariate F Tests (1, 156)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Role Relationship Units</td>
<td>-.991</td>
<td>-.944</td>
<td>6.250</td>
</tr>
<tr>
<td>2. Top Level Structure</td>
<td>.376</td>
<td>.240</td>
<td>.143</td>
</tr>
</tbody>
</table>

A graphic display of this interaction is presented in figures 1 and 2. Figure 1 presents a plot of the cell means as a function of the instructions variable which was the variable of primary interest in the study. An inspection of the graph indicates the interaction was disordinal. The plot of the cell means indicates that for the AS passage subjects in the knowledge-based instructions level had a cell mean of .187 and subjects in the text-based instructions level had a cell mean of .138. Whereas, for the CP passage subjects in the text-based level had a cell mean of .247 and subjects in the knowledge-based level had a cell mean of .233. (These cell means and their standard deviations were presented in Table 1).
Tukey's HSD Procedure was used to determine whether or not the differences between the cell means were significant. The minimum significant difference needed was .044. Thus, the difference between subjects who received knowledge-based instructions prior to reading the AS passage (.137) and subjects who received text-based instructions prior to reading the same passage (.138) was significant. Whereas, the difference between the knowledge-based instructions subjects (.247) and text-based instructions subjects (.233) for the CP passage was not significant.

The present finding indicated that for at least one passage, the AS passage, the knowledge-based instructions subjects recalled a higher proportion of role relationship units than did the text-based instructions subjects. Hence, this finding provided support for the hypothesis that knowledge-based processing instructions would induce subjects to
select for long term storage more low level information than would the
text-based processing instructions.

Figure 2 presents a plot of the cell means as a function of the
passages variable. When graphed in this manner, the interaction was
ordinal and indicated that the significant multivariate effect for
the passages variable could be interpreted independent of the interaction
effect.

![Figure 2](image)

**FIGURE 2.** Mean proportion interaction scores on the role relationship units variable obtained by subjects in the CP and AS passages groups for the KBI and TBI levels. TBI = Text-based Instructions level. KBI = Knowledge-based Instructions level.

Table 4 presents the results of the univariate analysis of variance
and discriminant function analysis follow-up tests for the significant
multivariate passages effect. Taken together, these follow-up techniques
indicate that the role relationship units variable was the better
discriminator for passage differences. An inspection of the univariate
Fs shows that subjects differed significantly on this variable ($p < .001$). Likewise, the standardized discriminant function weight (-.997) and the structure coefficient (-.964) show a high contribution for the role relationship units variable to the discrimination between the two passages groups. Whereas, for the top level structure variable, the standardized discriminant function weight (.297) and the structure coefficient (.176) indicate that this variable contributed negligibly to the discrimination.

Table 4

<table>
<thead>
<tr>
<th>Text Structures Category</th>
<th>Standardized Discriminant Analysis Weights</th>
<th>Structure Coefficients</th>
<th>Univariate F Tests (1,156)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Role Relationship Units</td>
<td>-.997</td>
<td>-.964</td>
<td>37.792</td>
<td>.001</td>
</tr>
<tr>
<td>2. Top Level Structure</td>
<td>.297</td>
<td>.176</td>
<td>.515</td>
<td>.474</td>
</tr>
</tbody>
</table>

Table 5 presents for the passages contrast the mean proportion scores for the role relationship units and top level structure dependent variables. The table shows that for the role relationship units variable, subjects in the CP level recalled a higher proportion of role relationship units (.240) than subjects in the AS level (.162).
Table 5

Mean Performance Scores by Level of Passages for Two Dependent Variables: Role Relationship Units and Top Level Structure

<table>
<thead>
<tr>
<th>Passages</th>
<th>Role Relationship Units</th>
<th>Top Level Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS</td>
<td>.162</td>
<td>1.356</td>
</tr>
<tr>
<td>CP</td>
<td>.240</td>
<td>1.296</td>
</tr>
</tbody>
</table>

Table 6 presents the results of the univariate analysis of variance and discriminant function analysis follow-up tests for the significant multivariate instructions effect. Taken together, these follow-up techniques indicate that the top level structure variable was the better discriminator for the instructions differences. An inspection of the univariate Fs shows that subjects differed significantly on this variable \( p < .02 \). Likewise, the standardized discriminant function weight (.863) and the structure coefficient (.830) show a high contribution for the top level structure variable to the discrimination between the two instructions groups. Whereas, for the role relationship units variable, the standardized discriminant function weight (-.606) and the structure coefficient (-.520) indicate that this variable made a lower contribution to the discrimination.
Table 6

Discriminant Analysis and Univariate Anova's on the Use of Text Structures in Recall for Instructions Effect

<table>
<thead>
<tr>
<th>Text Structures Category</th>
<th>Standardized Discriminant Analysis Weights</th>
<th>Structure Coefficients</th>
<th>Univariate F Test (1,156)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Role Relationship Units</td>
<td>-.606</td>
<td>-.520</td>
<td>1.950</td>
<td>.165</td>
</tr>
<tr>
<td>2. Top Level Structure</td>
<td>.863</td>
<td>.830</td>
<td>5.092</td>
<td>.02</td>
</tr>
</tbody>
</table>

Table 7 presents for the instructions contrast the mean proportion scores for the role relationship units and top level structure dependent variables. The table shows that for the top level structure variable, subjects in the TBI level recalled a higher proportion (1.420) than subjects in the KBI level (1.233).
Table 7
Mean Performance Scores by Level of Instructions for Two Dependent Variables: Role Relationship Units and Top Level Structure

<table>
<thead>
<tr>
<th>Instructions</th>
<th>Role Relationship Units</th>
<th>Top Level Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge-based</td>
<td>.210</td>
<td>1.233</td>
</tr>
<tr>
<td>Text-based</td>
<td>.192</td>
<td>1.420</td>
</tr>
</tbody>
</table>

In summary, the following results were obtained from the two-way multivariate analysis of variance and follow-up tests. First, there was a significant instructions and passages interaction effect ($p < .04$). Subjects differed significantly on the role relationship units variable ($p < .01$). Apparently for the AS passage, the knowledge-based instructions subjects recalled a higher proportion of role relationship units than did the text-based instructions subjects. There was no significant effect for the CP passage.

Second, there was a significant instructions effect ($p < .02$). Subjects differed significantly on the top level structure dependent variable ($p < .02$). Text-based instructions subjects recalled a higher proportion of top level structures than did the knowledge-based instructions subjects.
Third, there was a significant effect for the passages contrast ($p<.001$). Subjects differed significantly on the role relationship units variable ($p<.001$). Subjects who read the CP passage recalled a higher proportion of role relationship units than did the subjects who read the AS passage.

As a consequence of these results, the null hypothesis for each effect was rejected. The implications of these results for the Spiro and Meyer models will be discussed in the next chapter.
CHAPTER V
DISCUSSION and RECOMMENDATIONS

Discussion

The purpose of this study was to ascertain the extent to which two schema-oriented models of text processing adequately account for how readers comprehend and recall text. Two specific models were investigated: Meyer's (1975a,b) text-based processing model and Spiro's (1977) knowledge-based processing model.

The substantive hypothesis based on Meyer's model was that text-based and knowledge-based instructions subjects would be equivalent in their recall of top level structures because, according to her model, readers tend to select top level information for long term storage. Whereas, subjects would be equivalent in their recall of role relationship units because, according to her model, readers are less likely to select low level information for long term storage. Since neither of the instructions group would tend to select low level information, neither group was expected to recall a higher proportion of role relationship units than the other group.

In contrast, the substantive hypothesis based on Spiro's model was that subjects would not be equivalent in their recall of role relationship units or top level structures. It was argued that if Spiro's model were correct, the type of instructions subjects received
would have an effect on their recall of text structures. First, the knowledge-based instructions would induce subjects to update old knowledge. Hence, they would tend to select low level information for long term storage rather than top level information because, for them, low level information would contain new information; whereas, top level information would be redundant information. Second, text-based instructions would induce subjects to read for full recall. Hence, subjects in their recalls would preserve the integrity of their passages. In doing so, they would rely on the authors' textual schemata to guide their comprehension and recall. Relying on the authors' textual schemata would result in subjects having better retention of top level structures because, even though they were instructed to read for the purpose of recall, they would be unable to store in memory all that they had read because of the length of the passages. Hence, they would reduce the passages to their macrostructures (c.f., Van Dijk, 1977; Kintsch, 1977). Since top level structures are superordinate macrostructures, the text-based instructions subjects, after reducing their passages, were expected to have stored these superordinate structures in memory.

Additionally, text-based instructions subjects were expected to delete lower level structures from the content structures of their passages since these lower level structures would not be as important to them as the macrostructures. Thus, text-based instructions subjects were expected to have better recall of top level structures than of the lower level role relationship units. Whereas, the opposite
result was expected for the knowledge-based instructions subjects. Hence the two groups would differ in their recall of role relationship units and top level structures.

Results from the present study supported the hypothesis based on Spiro's model. First, there was a significant interaction effect for the instructions and passages contrast. The contrast indicated that for the AS passage, knowledge-based instructions subjects recalled a higher proportion of role relationship units than did the text-based instructions subjects. Apparently, the knowledge-based processing instructions induced subjects to treat the AS passage as low integrity text; whereas, the text-based processing instructions induced subjects to treat the passage as high integrity text. Hence, the knowledge-based instructions subjects were induced to select more low level information for long term storage than were the text-based instructions subjects. Therefore, the knowledge-based instructions subjects were able to recall a higher proportion of role relationship units than were the text-based instructions subjects.

With regard to the CP passage, it appears that the instructions variable had no significant effect on subjects' comprehension and recall. One possible explanation based on subjects' extra-experimental knowledge can account for this result. For example, in Thorndyke's (1977) study, his findings indicated that his subjects recalled more information from the Old Farmer story than from the Circle Island story. He argued that subjects who read the Old Farmer story recalled more information because that story was more concrete than the Circle
Island story. In the Old Farmer story the characters consisted of a farmer and familiar farm animals whose actions were stereotypical of their normal behavior. Whereas, in the Circle Island story the characters were less familiar and less obviously suggested by the context and setting of the story. Thus, subjects who read the Circle Island story had less extra-experimental knowledge to aid their comprehension and recall than subjects who read the Old Farmer story. Subsequent results from an experiment reported by Thorndyke in his 1977 study supported his argument and he concluded that content affected recall independent of structural organization.

A similar argument can be offered to explain why subjects who received knowledge-based processing instructions prior to reading the AS passage recalled a higher proportion of role relationship units than did subjects who received the text-based processing instructions; and to explain why there was no significant main effect for the instructions variable for the CP passage. One possible explanation is that the informational content of the CP passage was more concrete and possibly more familiar than the informational content of the AS passage. The CP passage discussed the wide variety of colors among parakeets and dealt with concepts such as feathers, genetics, mutations, mutants, greens, blues, and others. Whereas, the AS passage discussed the treatment of adult and child schizophrenics and dealt with concepts such as schizophrenia, amino acids, proteins, alpha-two-globulins, dimethyl tyramine, and others. Thus, subjects may have been more familiar with concepts discussed in the CP passage since their knowledge and
awareness of such concepts as parakeets and colors may have been more common to their everyday experience than such concepts as amino acids and schizophrenia. Therefore, subjects who read the CP passage may have had sufficient extra-experimental knowledge to aid their comprehension and recall than subjects who read the AS passage. Support for this argument was found in the significant passages contrast which indicated that subjects who read the CP passage recalled a higher proportion of role relationship units than subjects who read the AS passage. This finding suggests that subjects who read the CP passage recalled more information than subjects who read the AS passage.

Although the results of the passages contrast provided support for the argument that subjects may have recalled more role relationship units from the CP passage because they were more familiar with its content, this support must be considered tentative at best since informational content and structural organization were confounded. Hence, it was impossible to assess to what extent informational content actually affected recall. Such an assessment will have to be made in a future experiment.

However, subjects more familiar with the content of the CP passage were less likely to read for the purpose of updating old knowledge because there would have been relatively little new information to add to their store of knowledge. Hence, the knowledge-based instructions would not have effectively induced subjects to treat the CP passage as low integrity text. Instead, they, like the text-based instructions subjects, treated the passage as high integrity
text. Therefore, both groups were equivalent in their recall of top level structures and role relationship units because of the information reduction process which resulted in both groups deleting low level lexical propositions but not the top level rhetorical proposition.

On the other hand, if subjects were less familiar with the content of the AS passage, they were more likely to update old knowledge because their store of knowledge for this passage would have been insufficient. Hence, the knowledge-based processing instructions would have induced subjects to treat the AS passage as low integrity text and they would have selected low level information for long term storage. Therefore, they would have had better retention of role relationship units; whereas, the text-based instructions subjects would have had better retention of top level structures. Support for this argument, of course, was found in the significant instructions and passages interaction for the AS passage on the role relationship units variable.

The second major finding which supported Spiro's model was the significant main effect for the instructions variable. Text-based instructions subjects recalled a higher proportion of top level structures than did the knowledge-based instructions subjects. This finding supported the hypothesis that knowledge-based instructions subjects would be induced to treat top level information as functional or redundant information. Hence, they were less likely to select top level information for long term storage than were the text-based instructions subjects. Therefore, the text-based instructions subjects
were expected to have better retention of top level structures than the knowledge-based instructions subjects.

Three mechanisms could have accounted for the results of the instructions contrast. They were the selective attention hypothesis, the retrieval hypothesis, and the response criterion hypothesis.

The selective attention hypothesis claims that information high in the content structure is selected for extra attention and processing at the time it is read. This processing leads to a higher probability of encoding than when the information is low in the content structure (Britton and Meyer, 1980).

The retrieval hypothesis has three different views: a structural retrieval hypothesis, a cue availability hypothesis, and a retrieval selective attention hypothesis. Each of these views claims, to one extent or another, that the effect of the organization of text on memory occurs at the time of retrieval; with the result that information high in the content structure is more accessible than the low information and thus more likely to be retrieved.

The response criterion hypothesis specifies that the effect occurs when subjects are writing, in their own words, all the information they can remember from the text. This hypothesis assumes that subjects establish response criteria based on the perceived importance of the information. Information above that criterion is regarded as relevant enough to be included in the free-recall protocol; whereas, information below the criterion is regarded as not relevant enough to be recorded. Since information low in the content structure is regarded as less
relevant, it is less likely to appear in the protocol (Britton and Meyer, 1980).

Although each of these hypotheses offered possible explanations for why the subjects in the text-based and the knowledge-based instructions groups were equivalent in their recall of role relationship units, neither of them adequately explained why the two groups differed in their recall of top level structures. Since each hypothesis implied that top level information was equally accessible for subjects in both groups, the hypotheses could not explain why the text-based instructions group's recall of top level structures was superior.

Although the three mechanisms did not adequately explain the difference in the recall of top level structures between the two groups, the response criterion hypothesis suggested an alternate explanation. First, let us consider why the response criterion hypothesis did not explain the results. The response criterion hypothesis suggested that subjects in the present experiment would have stored the same information during their initial reading of the passage; but, at recall, they would have differed in the amount of information they tended to record in their free recall protocols. Subjects who used a high response criterion would have recorded only information that they perceived to be most relevant to both themselves and the experimenter. Subjects who used a low response criterion would have recorded both relevant and irrelevant information since they would have wanted to store as much information as possible.

Whether or not subjects used a high response criterion or a low response criterion would have been the function of the particular free
recall instructions subjects received after reading their passages. If subjects had been told only to record the important information, they would have used a high response criterion. Whereas, if they had been told to record everything they could remember, they would have used a low response criterion.

Since subjects in both groups received, at recall, the same free recall instructions telling them to write down everything they could remember from the passage, the response criterion hypothesis suggested that there should have been no difference in recall. That is, if at the time of the initial reading of their passages, both groups selected the same top level information; then, according to the response criterion hypothesis, that information should have been equally accessible to both groups at recall.

The fact that there was a difference between the two groups in their recall of top level structures suggested that the difference did not occur when subjects were writing their free recall protocols. Instead, it appeared that the difference occurred during the initial reading of the passages. This suggested that the difference was the function of a selection process. Hence, subjects appeared to have used a selection criterion rather than a response criterion. Unlike the response criterion, the selection criterion hypothesis assumes that subjects did not necessarily select the same information for long term storage. Instead, the hypothesis assumes that what subjects selected for storage was dependent upon their purposes for reading.

The hypothesis assumes that subjects used one of two selection criteria. One was a low selection criterion which meant that subjects
encoded both top level information and low level information. Their purpose for reading was to preserve the integrity of their passages. The other criterion was a high selection criterion which meant subjects encoded only information which updated old knowledge. Their purpose for reading was to select only new information for long term storage.

Clearly, the selection criterion hypothesis offered a suitable explanation for the recall performance of the text-based and knowledge-based instructions subjects. Apparently, the text-based instructions group were induced to treat their passages as high integrity text because they had been instructed to read for full recall. Thus, they used a low selection criterion; selecting both top level and low level information for long term storage which resulted in their having better retention of top level structures - but poorer retention of role relationship units.

On the other hand, the knowledge-based instructions subjects were induced to treat their passages as low integrity text because they had been instructed to read for meaning. Thus, they used a high selection criterion; selecting only information which updated old knowledge. Therefore, they selected a higher proportion of low level information for long term storage than did the text-based instructions subjects which resulted in the knowledge-based instructions subjects having better retention of role relationship units - but poorer retention of top level structures.

In summary, the results of the present study supported Spiro's knowledge-based processing model. Spiro's model predicts that type
of processing instructions affect subjects' comprehension and recall such that subjects reading to update old knowledge were less likely to rely on the author's textual schema; and, thus, more likely to add new role relationship units (low level information) to memory. This prediction was supported by the findings of this study; whereas, predictions based on Meyer's model were not supported. Hence, it was concluded that Spiro's model accounts more efficiently for how readers comprehend and recall text. Apparently, readers do not necessarily select top level information for long term storage. Instead, it appears that readers select only information which updates old knowledge unless they are explicitly instructed to read for the purpose of recall.

Recommendations

The purpose of this section is to discuss four recommendations for future research dealing with text processing. Particular emphasis will be given to the first recommendation because it proposes a study which suggests how the present study can be extended to investigate factors affecting inferential processing.

Recommendation 1.

In the present study, processing instructions influenced the recall of superordinate rhetorical propositions and lexical propositions. These propositions were explicit propositions. That is, these propositions were explicitly stated in the content structures of the passages. The first recommendation, then, is that researchers investigate the
extent to which the Meyer (1975a, b) and Spiro (1977) processing
models adequately account for how readers process implicit propositions;
with particular emphasis on how different processing instructions
affect inferential processing. The rationale and predicted results
for the proposed study will be discussed in the next three sections:

1. The Distinction between Propositional and Pragmatic Inferences:

Inference is another term for implicit proposition. Inferences can
be differentiated into two classes: propositional inferences (which
are similar to Harris and Monaco's (1978) logical inferences) and
pragmatic inferences (Hildyard and Olson, 1978). Propositional inferences
are necessary implications of explicit propositions contained in text.
They are logically valid and can be derived from the formal structure
of the explicit statements.

On the other hand, pragmatic inferences are not logically valid.
They do not follow necessarily from the explicit propositions per se
(Hildyard and Olson, 1978). Pragmatic inferences can be subdivided
into two categories: enabling inferences and elaborating inferences
(Hildyard and Olson, 1978). Enabling inferences are critical to the
comprehension of text. They are essential to the coherence of the
statements. However, they are drawn not as a result of explicit
propositions, but rather are based both upon the reader's knowledge
of the structure of various types of text (e.g., stories, jokes,
conversations, exposition, etc.) and upon the reader's world knowledge.

Elaborating inferences also are based on implicit world knowledge;
however, they are not critical for the comprehension of text. They
are not essential and serve to embellish given information (Hildyard and Olson, 1978).

Although enabling inferences and elaborating inferences are grouped under the superordinate pragmatic inferences category, Hildyard and Olson (1978) argue that enabling inferences can actually be classed along with the propositional inferences because of Grice's (1975) Cooperative Principle. Grice argues that this principle must exist between the writer and reader if the reader is to comprehend the text.

Since enabling inferences are critical to comprehending and must be drawn to make statements in text coherent, they are similar to propositional inferences in that they must be drawn in order for adequate comprehension to occur. Propositional inferences are necessary by virtue of the explicit propositions; whereas, enabling inferences are necessary by virtue of the structure of the text as a whole. Hence, in the remainder of this proposed study the term propositional inferences will refer to both propositional and enabling inferences; whereas, pragmatic inferences will refer to non-essential, non-critical elaborating inferences.

2. **Two Rival Views about the Importance of Syntactic Structures in Determining Whether or not Inferences Will be Processed:**

There are two rival views about the role syntactic structures play in determining whether or not inferences will be processed. In one view, syntactic structures are thought to play a very important part; especially in processing pragmatic inferences.

Although comprehension is seen as an interaction between syntactic
structures and the reader's world knowledge, this view also suggests that there is a deterministic relation between syntactic structures and the end product of comprehending text. Emphasis is placed on syntactic structures rather than on the general nature of the processor (Keenan; 1978). For example, proponents of this view like Harris and Monaco (1978) argue that, although syntactic structures are not a sufficient condition for determining when inferences will be made, they do suggest inferences to the reader.

In contrast, an alternate view claims that what permits inferences is the world knowledge states (i.e., schemata) activated by concepts contained in the input. Proponents of this view like Keenan (1978) argue that there is really nothing about syntactic structures that permit inferences; especially pragmatic inferences. For instance, Keenan argues:

It should be noted that part of the problem in discussing the psychology of implication is that implication is a relation between sentences. So when we speak of "X" implying (either logically or pragmatically) "Y", the variables X and Y range over sentences. When considering the psychological side of implication, we must speak of inference. "X" infers (logically or pragmatically) "Y" specifies a relation between a knower and his knowledge. The distinction is important because "X" implies "Y" does not entail "X" infers "Y"...
To say that "X" implies "Y" does not entail "X" infers "Y" is to say that the structure of the sentence is not a sufficient condition for determining when inferences will be processed. (p. 25)

The above example indicates that Keenan (1978) thinks that any deterministic relation that holds between sentences does not necessarily hold between readers and sentences. Instead, she argues that there exists a body of knowledge associated with each concept in memory. The body of that knowledge, or some subset of it, is activated whenever the concept is processed in a meaningful way. Inferences simply fill in the open slots in the knowledge frame. The likelihood of making an inference is determined by the centrality of the open variables to the knowledge frame; where the knowledge frame has been invoked by some concept and qualified by a context.

3. The Relationship between the Meyer and Spiro Models and the Two Rival Views: With regard to inferential processing, the text-based processing model (Walker and Meyer, 1980) argues that the probability of processing implicit propositions (inferences) does not rely solely upon the processor's ability to integrate information. The model argues that a relationship exists between the content structure of the text and the probability of integrating textual information (drawing inferences).

The model argues further that since ideas high in the content structure are more accessible for storage and recall, they are also more susceptible to simultaneous activation (and integration via the
processing of inferences) than low level ideas. For example, the model argues that two propositions which occur low in the content structure of separate information sources are less susceptible to integration because comprehension of the latter proposition is not predicated on integrating it with the former proposition. Recognizing that a relationship exists between two propositions in separate episodes would be less critical to comprehension than integrating consecutively presented high level propositions (main ideas).

The emphasis that Meyer's text-based processing model (Walker and Meyer, 1980) places on the idea that the probability of inferences being processed is dependent on an author's textual schema led to the conclusion that Meyer's model reflects Harris and Monaco's view about the importance of syntactic structures in drawing inferences.

In contrast, it was concluded that Spiro's (1977) knowledge-based processing model reflects Keenan's (1978) view. A basic tenet of his model is that information from text interacts with pre-existing cognitive structures, and that this interaction can range from near total differentiation of new information from pre-existing cognitive structures to total subordination to the pre-existing cognitive structures. If total subordination to pre-existing cognitive structures occurs, current schematic states at recall will differ from the pre-assimilation states at the time of comprehension. Hence, past schematic states must be inferred from the current states. Depending on the nature of the change in the schematic states, the personal rules of inferential reconstruction will lead to accurate recall or inaccurate
recall; the inaccuracy resulting from faulty inferences based on schematic states at recall.

These faulty inferences are similar to the pragmatic inferences described earlier. Only, Spiro refers to them as reconstructive errors. These faulty inferences usually consist of distortions of interelement relations, adding relations not specified in the original passage, or importations of information which explicitly supersede concepts stated in the original text.

Spiro's arguments strongly suggest that in normal reading situations the important factor determining whether or not inferences will be processed is the extent to which the reader's world knowledge interacts with the input and the extent to which the interaction results in modification of the pre-existing world knowledge. Unlike Meyer's model, Spiro's model places more emphasis on the processor than on the author's textual schema.

Since Meyer's processing model (Walker and Meyer, 1980a) argues that an author's textual schema affects the probability of inferences being made, her model seems to suggest that subjects who are induced to use an author's textual schema will generate a higher proportion of propositional inferences than subjects who are induced not to do so.

On the other hand, since Spiro's processing model argues that schema-activation and subsequent schema-modification are the primary factors determining whether pragmatic inferences will be made, his model seems to suggest that subjects who are induced to rely on their world knowledge more than on an author's textual schema will generate
a higher proportion of pragmatic inferences.

To test these ideas, the proposed study would manipulate subjects' processing activities during reading by presenting subjects with different types of processing instructions. One type of instructions would be text-based processing instructions which would induce subjects to rely on an author's textual schema to aid their comprehension and recall and to assure that they would generate a higher proportion of propositional inferences than would subjects who received different instructions. The second type of instructions would be knowledge-based processing instructions which would induce subjects to rely on their own world knowledge rather than on the author's textual schema to assure that they would generate a higher proportion of pragmatic inferences than would the text-based instructions subjects. Finally, a condition would be included in the study in which subjects are presented with no processing instructions. This condition would be contrasted with the other two conditions to determine what effects, if any, the absence of specific processing instructions had on subjects' inferential processing.

If the predictions based on the Meyer and Spiro processing models are correct, then, the following can be expected: 1) text-based processing instructions subjects will generate a higher proportion of propositional inferences than knowledge-based processing instructions subjects, 2) knowledge-based processing instructions subjects will generate a higher proportion of pragmatic inferences than the text-based processing instructions subjects, and 3) with regard to the no processing
instructions subjects, if Meyer's processing model is correct about subjects' use of textual schema, both the knowledge-based processing instructions subjects and the text-based processing instructions subjects will be equivalent with the no processing instructions subjects in their recall of propositional and pragmatic inferences since all three groups supposedly will have relied on the same intrapassage structural relations to generate inferences. On the other hand, if Spiro's model is correct, the three groups will not be equivalent in their recall of propositional or pragmatic inferences since the type and amount of inferences subjects generated would vary with each subject's store of world knowledge, as it relates to the information they are reading.

Recommendation 2.

Further research is needed to assess how particular textual schemata and informational content of text affect comprehension and recall. Thorndyke (1977), for example, showed that recall of a second story was facilitated by first reading and recalling a story with the same structural representation. Hence, he concluded that proactive facilitation occurs when subjects read two passages which have the same underlying structure.

Thorndyke's (1977) work also indicates the influence that informational content might have on comprehension and recall. Such an influence might have occurred in the present study. For example, results from the present study were not consistent across both the "Anti-S-proteins for Schizophrenics" and "Color of Parakeets" passages. However, since the textual schema and informational content of both
passages were confounded, it was not possible to determine their individual influence on subjects' performance.

One way to assess their individual influence would be to hold textual schemata constant while allowing informational content to vary among passages subjects read. This would help researchers to determine the effect informational content has on comprehension and recall. The same could be done to assess the influence of textual schemata. That is, informational content among passages could be held constant while allowing textual schemata to vary.

Recommendation 3.

A third recommendation is that further research be done to determine what underlies uni-directional biases in text processing styles. There are substantial differences between individuals in their patterns of resource allocation to text-based and knowledge-based processes (Spiro, 1979). For skilled readers, there are tendencies for an individual to employ more processes (text-based or knowledge-based) when characteristics of the situation permit substituting one process for another without affecting ultimate performance. Less able readers, however, are likely to overrely on one process or the other, producing detrimental effects on comprehension (Spiro, 1979).

The problem for future research will be to identify factors causing overreliance on a particular process. Poor readers, for example, might have a text-based bias because they lack relevant background knowledge. If so, these readers would lack the schemata
needed to engage in knowledge-based processing. On the other hand, relevant schemata might be stored, but may not be activated during reading activities. If lack of activation is a problem, future research can be conducted to determine those factors which impede the activation of relevant schemata.

Recommendation 4.

Finally, further research needs to be done to determine how classroom teachers can help their students learn to use a variety of processing strategies when reading. Research indicates that when given appropriate classroom instruction, readers can learn to recognize and use authors' textual schemata (Meyer, 1979). For example, one study examined the effects of teaching ninth graders to recognize commonly found rhetorical structures on their ability to identify and use these structures in their own free recall protocols and on the amount of information recalled. Direct instruction led to significantly increased identification and use of the top-level structure of passages and better retention of information (Meyer, 1979).

Such research demonstrates the potential use that can be made of findings produced by research on text processing. For example, the findings from the present study can be helpful to classroom teachers. If, as Meyer (1978, 1980) argues, one of the differences between good and poor readers is the inability of poor readers to recognize an author's textual schema, then, one way to attack this problem may be through classroom use of assignments that include
instructions similar to those used in the present study. By using these types of assignments teachers may be able to induce poor readers into eventually recognizing and utilizing textual schemata as part of their normal reading activities.

Another problem that may be attacked is the poor reader's misconception about reading. Some poor readers think that knowledge-based processing is not an appropriate activity in reading. Often these readers are laborious effortful decoders (Spiro, 1979).

One way to attack this problem may be through the use of assignments which include instructions similar to the knowledge-based processing instructions used in the present study. Such assignments can be used to induce poor readers with a text-based bias to relate what is read to prior knowledge.

However, it should be noted that poor readers who have a knowledge-based bias (e.g., readers who are laborious decoders may rely on knowledge-based processes to avoid the decoding task) would not benefit from such assignments. Hence, their problem would require a different teaching strategy. Spiro (1979), for example, suggests that instruction may have to be determined by the cause of overreliance of a particular process rather than on its manifestation.

In summary, four recommendations were discussed in this section. The first presented a proposed study to investigate the effect that processing instructions have on inferential processing. The second recommended future research to investigate the particular individual effects that specific textual schemata and specific informational
content have on the comprehension and recall text. The third recommended future research to determine what underlies uni-directional biases in text processing. Finally, the fourth recommended that further research be done to determine how teachers can help their students learn to use a variety of processing strategies when reading.
APPENDIX A

COPIES OF EXPERIMENTAL PASSAGES

USED IN THE STUDY
Anti-s-proteins for Schizophrenics

The need to change the abnormal behavior of adult schizophrenics along with improving their ability to process information is taking form as one of the major psychological and psychiatric problems that mental health workers must resolve in the near future. The American Psychiatric Association has proclaimed that mental health workers must modify adult schizophrenics' abnormal behavior by the end of this century. This action would benefit the largest single proportion of hospitalized mental patients, two million schizophrenics. As for improving adult schizophrenics' ability to process information, it is hoped that these schizophrenics, who are usually not older than thirty years of age at initial hospitalization, will learn to pick out the relevant stimuli of a task, use the structure in materials, and use efficient learning strategies. It will take inhibition by adult schizophrenics in order for them to increase their use of relevant stimuli of a task, structure of materials and efficient learning strategies. Inhibition is produced by the ability to prevent the intrusion of responses that are not appropriate to the stimulus situation; that is, the ability to maintain a set. Unfortunately, inhibition tends to be defective in schizophrenics.

A related problem of equal magnitude is the treatment of children in the nation's mental hospitals with schizophrenia. They need to be treated for their lack of responsiveness, their unusual body movements and their inability to differentiate between self and others. The
schizophrenic child has made an identification and fusion of himself with his mother, but he is unable to cope with the painful knowledge that he and his mother are separate entities. He is not like the autistic child that never becomes close to his mother after birth. Successful treatment of childhood schizophrenics would considerably reduce the total number of hospitalized mental patients from the ranks of patients classified as schizophrenic.

The anti-s-protein, an enzyme, holds great promise as the solution to these problems. Anti-s-proteins keep normal people sane. They are completely missing in the brains of adult and childhood schizophrenics, and this lack causes them to be mentally disturbed until the time when anti-s-proteins can be given to them. Proper doses could allow schizophrenics to function normally and return to society. It is in the light of these considerations that Dr. Gottlieb, Dr. Frohman, and Dr. Domino have mounted a concerted effort to develop the procedures whereby it will be possible to cure the nation's schizophrenics by 1978.

S-proteins are potent, unstable proteins called alpha-two-globulin. Anti-s-proteins control the production of the cork-screw shaped s-proteins. Cork-screw shaped s-proteins are abnormal proteins and are the only type of s-protein found in schizophrenics, while the s-proteins of normals are nearly all shaped like an accordion or a coil or string. The anti-s-proteins control the s-proteins by shutting off their production and preventing them from becoming abnormal. The anti-s-proteins could lessen the schizophrenic's confusion due to
lack of the production of abnormal s-proteins, and dramatically curtail the schizophrenic's delusional state. Anti-s-proteins, the s standing for schizophrenic or stress, could stop the schizophrenic's hallucinogenic factory in his brain. This delusion factory over-produces an essential amino acid for human metabolism, tryptophan, and DMT, dimethyl tyrtamine. Thus, its use would result in a reduction in abnormalities in schizophrenics. It would reduce their abnormal behavior and information processing deficit. It would eliminate their unrealistic fears and attention to irrelevant stimuli.

It has been mentioned that anti-s-proteins keep normal people from thinking and behaving bizarrely. The effect of anti-s-proteins on a normal person calms him down after a crisis. It reduces the person's mental activities and alertness to a normal state. After a crisis anti-s-proteins inhibit a person's extreme sensitivity to all auditory stimuli and all visual stimuli. This is its effect on a person with normal amounts of anti-s-proteins.
COLOR OF PARAKEETS

Parakeets or budgerigars are vividly colored birds that add exotic color to their owners' homes. Many breeders of parakeets have studied the nature and development of the colors in parakeets. The richness of color of parakeets' feathers results from the physical structure of the barbs in the feathers as well as the nature and distribution of pigments in the feathers' barbs. Barbs are the branches of the main shaft of a feather. Various genetic factors in parakeets can affect the color of the feathers in one of three ways. First, they can alter the structure of the cells composing the feather's barbs. Second, genetic factors can reduce the amount of one of the barb's pigments or completely prevent a pigment from being formed. Third, certain genes can alter the distribution of pigment in feather's barbs. These factors which exert influences on the color of parakeets are of interest to parakeet breeders who strive to produce new colors of parakeets.

The wide variety in color of parakeets that are available on the market today resulted from careful breeding of the color mutant offspring of light-green-bodies and yellow-faced parakeets. The light green body and yellow face color combination is the color of parakeets in their natural habitat, Australia. The first living parakeets were brought to Europe from Australia by John Gould, a naturalist, in 1840. The first color mutation appeared in 1872 in Belgium; these birds were completely yellow. The most popular color of parakeets in the
United States is sky-blue. These birds have sky-blue bodies and white faces; this color mutation occurred in 1878 in Europe. There are over 66 different colors of parakeets listed by the Color and Technical Committee of the Budgerigar Society. In addition to the original light green-bodied and yellow-faced birds, colors of parakeets include varying shades of violets, blues, grays, greens, yellows, whites and multi-colored variations.

Without the effort of patient and skillful parakeet breeders and the spontaneous and unexpected natural mutation of genes in parakeets, these many different colors of parakeets would not exist. The wild Australian flocks of light green colored parakeets with yellow heads testify that without the assistance of breeders, color mutants died out. Parakeets with visible color mutations are rarely if ever found in nature due to several factors. First, the mutations are often recessive and do not manifest themselves outwardly. In the case of the recessive mutation in nature there is no breeder at work to breed related birds suspected of recessive mutations, and wild birds rarely breed with close relatives. Consequently, the mutation never becomes visible. In the cases of parakeets with dominant or semi-dominant mutation or with two recessive mutant genes, these rare colored birds die out. Yellow is the rare color of parakeet reported to be seen in wild Australian flocks. Yellow parakeets, as well as parakeets with other rare colors, tend to be very conspicuous to their natural enemies, and thus are preyed on more easily than the green parakeets whose color provides better camouflage. The final reason for the lack
of rare colored parakeets in nature is that mutants in all species are usually weaker, smaller and harder to rear than established varieties. In captivity the mutant is given special care by the breeder, and future breeding may genetically link the mutation with other genes which counteract the mutation's bad points and enhance its good points.

Breeders have developed this wide variety in color of parakeets through nurturing and perfecting mutant birds, combining existing color genes by interbreeding different colored birds, and by planning breeding to induce crossovers of color genes in order to produce a new color from recombined genes. The work of parakeet breeders over the last century is clearly evident in the beautifully colored parakeets of nearly all hues that are available on the market today.
APPENDIX B

PARTIAL COPIES OF THE CONTENT STRUCTURES USED

FOR EACH PASSAGE IN THE STUDY
CONTENT STRUCTURE OF THE SCHIZOPHRENIA HIGH PASSAGE

titled Anti-s-proteins for Schizophrenics

1. response
2. problem
3. collection
4. NEED TO CHANGE ABNORMAL BEHAVIOR OF ADULT SCHIZOPHRENICS
5. specific
6. MUST MODIFY (0, 4)
7. agent
8. MENTAL HEALTH WORKERS
9. patient
10. ADULT SCHIZOPHRENIC'S ABNORMAL BEHAVIOR
11. benefactive
12. IS LARGEST SINGLE PROPORTION OF HOSPITALIZED MENTAL PATIENTS
13. patient
14. TWO MILLION SCHIZOPHRENICS
15. setting time
16. BY THE END OF THIS CENTURY
17. PROCLAIMED
18. agent
19. AMERICAN PSYCHIATRIC ASSOCIATION
20. IMPROVE ADULT SCHIZOPHRENICS ABILITY TO PROCESS INFORMATION
21. specific
22. INCREASE USE
23. agent
24. ADULT SCHIZOPHRENICS
25. attribution
26. USUALLY NOT OLDER THAN 30 AT INITIAL HOSPITALIZATION
27. patient
28. collection
29. RELEVANT STIMULI OF A TASK
30. STRUCTURE IN MATERIALS
31. EFFICIENT LEARNING STRATEGIES
32. latter
33. collection
34. PICKING OUT RELEVANT STIMULI OF A TASK
35. USE THE STRUCTURE IN MATERIALS
36. USING EFFICIENT LEARNING STRATEGIES
37. instrument
38. INHIBITION
39. attribution
40. TENDS TO BE DEFECTIVE IN SCHIZOPHRENICS
41. PRODUCED
42. force
43. ABILITY TO PREVENT INTRUSION OF RESPONSES THAT ARE NOT APPROPRIATE TO THE STIMULUS SITUATION
44. specific
45. LABILITY TO MAINTAIN A SET
TREATMENT OF CHILDREN WITH SCHIZOPHRENIA

setting, location

NATION'S MENTAL HOSPITALS

specific
CONTENT STRUCTURE OF THE PARAKEET HIGH PASSAGE

entitled Color of Parakeets

1. RESULTED FROM, covariance, consequent
2. WIDE VARIETY IN COLOR OF PARAKEETS (6)
3. attribution
4. ARE VIVIDLY COLORED BIRDS
5. patient
6. PARAKEETS
7. equivalent
8. BUDGERIGARS
9. latter
10. ADD EXOTIC COLOR
11. range
12. LOWER'S HOME
13. BEAUTIFULLY COLORED BIRDS
14. AVAILABLE
15. range
16. MARKET
17. setting time
18. TODAY
19. specific
20. LISTED
21. patient
22. OVER 66 DIFFERENT COLORS
23. agent
24. COLOR AND TECHNICAL COMMITTEE
25. constituency identification
26. BUDGERIGAR SOCIETY
27. INCLUDE
28. range
29. COLOR OF PARAKEETS
30. patient
31. collection
32. LIGHT GREEN-BODIES AND YELLOW-FACED BIRD
33. attribution
34. ORIGINAL (COLOR)
35. collection
36. attribution
37. VARYING SHADES
38. VIOLETS
39. BLUES
40. GRAYS
41. GREENS
42. YELLOWS
43. WHITES
44. MULTI-COLORED VARIATIONS
RESULTED FROM, covariance, antecedent
BRED (2, 5)

manner
CAREFULLY
agent
PARAKEET BREEDERS

attribution
APPENDIX C
COPY OF AN EXPERIMENTAL BOOKLET
USED IN THE STUDY
Name ____________________________
  Last  First  Middle

Sex:  Male_______  Female_______

Age:  Years_______  Months_______

Social Security Number________________________

Class:  Freshperson____  Sophomore____  Junior____  Senior____

Place of Birth:  City__________________________  State_________

Date______________________________

General Directions

The purpose of this test is to assess your skills in the following: 1) your ability to remember and comprehend college level reading materials, 2) your ability to perform verbal reasoning tasks, 3) your ability to follow instructions, 4) your normal rate of reading, and 5) your writing skills.

This is a 55-minute test with six parts. The directions for each part are printed at the beginning of the part. When you are told to begin, turn this page and read the directions for the first part.

At the end of the test, you will hear the words "Stop. This ends the test." When this occurs, please close your test booklet. Do not leave the room until you have returned your test booklet to the examiner.

You may begin.
PART I

Directions for Reading the Passage

After you finish reading these directions, you are to turn to the next page and begin reading the passage. While reading the passage, you are to read with only one purpose in mind: **to remember exactly what you've read.** Try to remember as much of the passage as you possibly can. Eventually, you will be asked to write everything that you remember about the passage.

Read the passage at your normal rate until you are told to stop reading. If you complete reading the passage before you are told to stop, you are **to go back to the beginning of the passage and read it again.** You are to read in this manner until you are told to stop reading.

When you are told to stop reading, circle the last word that you read in the passage and then at the end of the passage, write in the blank provided the number of times that you were able to read the passage at your normal rate (e.g., 1, 2, or 3 times).
COLOR OF PARAKEETS

Parakeets or budgerigars are vividly colored birds that add exotic color to their owners' homes. Many breeders of parakeets have studied the nature and development of the colors in parakeets. The richness of color of parakeets' feathers results from the physical structure of the barbs in the feathers as well as the nature and distribution of pigments in the feathers' barbs. Barbs are the branches of the main shaft of a feather. Various genetic factors in parakeets can affect the color of the feathers in one of three ways. First, they can alter the structure of the cells composing the feather's barbs. Second, genetic factors can reduce the amount of one of the barb's pigments or completely prevent a pigment from being formed. Third, certain genes can alter the distribution of pigment in feather's barbs. These factors which exert influences on the color of parakeets are of interest to parakeet breeders who strive to produce new colors of parakeets.

The wide variety in color of parakeets that are available on the market today resulted from careful breeding of the color mutant offspring of light-green-bodies and yellow-faced parakeets. The light green body and yellow face color combination is the color of parakeets in their natural habitat, Australia. The first living parakeets were brought to Europe from Australia by John Gould, a naturalist, in 1840. The first color mutation appeared in 1872 in Belgium; these birds were completely yellow. The most popular color of parakeets in the
United States is sky-blue. These birds have sky-blue bodies and white faces; this color mutation occurred in 1878 in Europe. There are over 66 different colors of parakeets listed by the Color and Technical Committee of the Budgerigar Society. In addition to the original light green-bodies and yellow-faced birds, colors of parakeets include varying shades of violets, blues, grays, greens, yellows, whites and multi-colored variations.

Without the effort of patient and skillful parakeet breeders and the spontaneous and unexpected natural mutation of genes in parakeets, these many different colors of parakeets would not exist. The wild Australian flocks of light green colored parakeets with yellow heads testify that without the assistance of breeders, color mutants died out. Parakeets with visible color mutations are rarely if ever found in nature due to several factors. First, the mutations are often recessive and do not manifest themselves outwardly. In the case of the recessive mutation in nature there is no breeder at work to breed related birds suspected of recessive mutations, and wild birds rarely breed with close relatives. Consequently, the mutation never becomes visible. In the cases of parakeets with dominant or semi-dominant mutation or with two recessive mutant genes, these rare colored birds die out. Yellow is the rare color of parakeet reported to be seen in wild Australian flocks. Yellow parakeets, as well as parakeets with other rare colors, tend to be very conspicuous to their natural enemies, and thus are preyed on more easily than the green parakeets whose color provides better camouflage. The final reason for the lack
of rare colored parakeets in nature is that mutants in all species are usually weaker, smaller and harder to rear than established varieties. In captivity the mutant is given special care by the breeder, and future breeding may genetically link the mutation with other genes which counteract the mutations bad points and enhance its good points.

Breeders have developed this wide variety in color of parakeets through nurturing and perfecting mutant birds, combining existing color genes by interbreeding different colored birds, and by planning breeding to induce crossovers of color genes in order to produce a new color from recombined genes. The work of parakeet breeders over the last century is clearly evident in the beautifully colored parakeets of nearly all hues that are available on the market today.
Directions for Performing Verbal Reasoning Test

In the following test there are a number of short sentences each followed by a pair of letters (AB or BA). The sentences claim to describe the order of the two letters, i.e., to say which comes first. They can do this in several ways. Thus the order AB can be correctly described by saying either (1) A precedes B, or (2) B follows A, or (3) B does not follow A, or (4) A does not follow B. All of these are correct when applied to AB but are incorrect when applied to the other pair, BA.

Your job is to read each sentence and to decide whether it is a true or false description of the letter pair which follows it. If you think that the sentence describes the letter pair correctly, put a check in the first column (labelled "True"). If you think the sentence does not give a true description of the letter order, put a check in the second ("False") column.

This is illustrated in examples 1 and 2 below.

<table>
<thead>
<tr>
<th>Examples</th>
<th>True</th>
<th>False</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A follows B - BA</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>2. B precedes A - AB</td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

When you start the main test, work as quickly as you can without making mistakes. Start with sentence 1 and work systematically through sentence 64 leaving no blank spaces. You will be given 3 minutes to perform this task. Now, begin.

VERBAL REASONING TEST A

<table>
<thead>
<tr>
<th>Sentence</th>
<th>True</th>
<th>False</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A follows B - BA</td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>2. B precedes A - AB</td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>3. A is followed by B - AB</td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>4. B is not followed by A - BA</td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>5. B is preceded by A - BA</td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>6. A does not precede B - BA</td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>7. B follows A - BA</td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>8. A precedes B - BA</td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>9. B is followed by A - AB</td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>10. A is not followed by B - BA</td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>Test A Continued</strong></td>
<td><strong>True</strong></td>
<td><strong>False</strong></td>
</tr>
<tr>
<td>11.</td>
<td>A is preceded by B</td>
<td>BA</td>
</tr>
<tr>
<td>12.</td>
<td>B does not precede A</td>
<td>BA</td>
</tr>
<tr>
<td>13.</td>
<td>A does not precede B</td>
<td>BA</td>
</tr>
<tr>
<td>14.</td>
<td>B is preceded by A</td>
<td>BA</td>
</tr>
<tr>
<td>15.</td>
<td>B is not followed by A</td>
<td>AB</td>
</tr>
<tr>
<td>16.</td>
<td>A is not followed by B</td>
<td>BA</td>
</tr>
<tr>
<td>17.</td>
<td>B is followed by A</td>
<td>BA</td>
</tr>
<tr>
<td>18.</td>
<td>B precedes A</td>
<td>AB</td>
</tr>
<tr>
<td>19.</td>
<td>A follows B</td>
<td>BA</td>
</tr>
<tr>
<td>20.</td>
<td>B follows A</td>
<td>BA</td>
</tr>
<tr>
<td>21.</td>
<td>A precedes B</td>
<td>AB</td>
</tr>
<tr>
<td>22.</td>
<td>A is followed by B</td>
<td>BA</td>
</tr>
<tr>
<td>23.</td>
<td>B is not followed by A</td>
<td>AB</td>
</tr>
<tr>
<td>24.</td>
<td>A is not followed by B</td>
<td>AB</td>
</tr>
<tr>
<td>25.</td>
<td>B is preceded by A</td>
<td>BA</td>
</tr>
<tr>
<td>26.</td>
<td>A is not preceded by B</td>
<td>BA</td>
</tr>
<tr>
<td>27.</td>
<td>A does not precede B</td>
<td>BA</td>
</tr>
<tr>
<td>28.</td>
<td>B does not precede A</td>
<td>AB</td>
</tr>
<tr>
<td>29.</td>
<td>A precedes B</td>
<td>AB</td>
</tr>
<tr>
<td>30.</td>
<td>B does not follow A</td>
<td>BA</td>
</tr>
<tr>
<td>31.</td>
<td>B does not follow A</td>
<td>AB</td>
</tr>
<tr>
<td>32.</td>
<td>A is followed by B</td>
<td>AB</td>
</tr>
<tr>
<td>33.</td>
<td>A is not followed by B</td>
<td>BA</td>
</tr>
<tr>
<td>34.</td>
<td>A is not preceded by B</td>
<td>BA</td>
</tr>
<tr>
<td>35.</td>
<td>B is preceded by A</td>
<td>AB</td>
</tr>
<tr>
<td>36.</td>
<td>B precedes A</td>
<td>BA</td>
</tr>
<tr>
<td>37.</td>
<td>B does not follow A</td>
<td>BA</td>
</tr>
<tr>
<td>38.</td>
<td>A does follow B</td>
<td>BA</td>
</tr>
<tr>
<td>39.</td>
<td>B precedes A</td>
<td>AB</td>
</tr>
<tr>
<td>40.</td>
<td>A does not follow B</td>
<td>AB</td>
</tr>
<tr>
<td>41.</td>
<td>B does not precede A</td>
<td>BA</td>
</tr>
<tr>
<td>42.</td>
<td>B follows A</td>
<td>BA</td>
</tr>
<tr>
<td>43.</td>
<td>A follows B</td>
<td>BA</td>
</tr>
<tr>
<td></td>
<td>Test A continued</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>-----------------</td>
<td>---</td>
</tr>
<tr>
<td>44.</td>
<td>A is followed by B - BA</td>
<td></td>
</tr>
<tr>
<td>45.</td>
<td>A does not precede B - AB</td>
<td></td>
</tr>
<tr>
<td>46.</td>
<td>B is preceded by A - AB</td>
<td></td>
</tr>
<tr>
<td>47.</td>
<td>A does not follow B - BA</td>
<td></td>
</tr>
<tr>
<td>48.</td>
<td>B precedes A - BA</td>
<td></td>
</tr>
<tr>
<td>49.</td>
<td>A does not precede B - AB</td>
<td></td>
</tr>
<tr>
<td>50.</td>
<td>A does precede B - BA</td>
<td></td>
</tr>
<tr>
<td>51.</td>
<td>A does not follow B - BA</td>
<td></td>
</tr>
<tr>
<td>52.</td>
<td>B follows A - AB</td>
<td></td>
</tr>
<tr>
<td>53.</td>
<td>A precedes B - BA</td>
<td></td>
</tr>
<tr>
<td>54.</td>
<td>A is followed by B - BA</td>
<td></td>
</tr>
<tr>
<td>55.</td>
<td>B is preceded by A - BA</td>
<td></td>
</tr>
<tr>
<td>56.</td>
<td>A does not follow B - AB</td>
<td></td>
</tr>
<tr>
<td>57.</td>
<td>A is followed by B - BA</td>
<td></td>
</tr>
<tr>
<td>58.</td>
<td>B is followed by A - AB</td>
<td></td>
</tr>
<tr>
<td>59.</td>
<td>A does not precede B - AB</td>
<td></td>
</tr>
<tr>
<td>60.</td>
<td>B does not follow A - BA</td>
<td></td>
</tr>
<tr>
<td>61.</td>
<td>A is followed by B - AB</td>
<td></td>
</tr>
<tr>
<td>62.</td>
<td>B does not precede A - BA</td>
<td></td>
</tr>
<tr>
<td>63.</td>
<td>A follows B - AB</td>
<td></td>
</tr>
<tr>
<td>64.</td>
<td>A is not followed by B - AB</td>
<td></td>
</tr>
</tbody>
</table>

Stop. Do not turn the page until you are told to do so.
PART III

Directions for Writing

On the following sheets of writing paper, do the following: beginning with the first sheet of writing paper, write everything you remember from the passage. Write only in sentence form. If you remember a word but forget how it related to the words in the passage; then, write something similar to the following: "I remember the word 'sky' but I can't remember how it relates to the other words in the passage." Do not reread the passage.

Please write neatly. Your writing will be evaluated on the organization and compositional skill your paper shows. You will have fifteen (15) minutes to write.
Directions for Reading the Passage

After you finish reading these directions, you are to turn to the next page and begin reading the passage. While reading the passage, you are to read with only one purpose in mind: to be able to explain what you think the author meant. Therefore, you must read in a manner that allows you to comprehend the thought that lies beneath the words. Do not try to memorize the passage. Eventually, you will be asked to write about the passage.

Read the passage at your normal rate until you are told to stop reading. If you complete reading the passage before you are told to stop, you are to go back to the beginning of the passage and read it again. You are to read in this manner until you are told to stop reading. When you are told to stop reading, circle the last word that you read in the passage and then at the end of the passage write in the blank provided the number of times you were able to read the passage at your normal rate (e.g., 1, 2, or 3 times).
Anti-s-proteins for Schizophrenics

The need to change the abnormal behavior of adult schizophrenics along with improving their ability to process information is taking form as one of the major psychological and psychiatric problems that mental health workers must resolve in the near future. The American Psychiatric Association has proclaimed that mental health workers must modify adult schizophrenics' abnormal behavior by the end of this century. This action would benefit the largest single proportion of hospitalized mental patients, two million schizophrenics. As for improving adult schizophrenics' ability to process information, it is hoped that these schizophrenics, who are usually not older than thirty years of age at initial hospitalization, will learn to pick out the relevant stimuli of a task, use the structure in materials, and use efficient learning strategies. It will take inhibition by adult schizophrenics in order for them to increase their use of relevant stimuli of a task, structure of materials and efficient learning strategies. Inhibition is produced by the ability to prevent the intrusion of responses that are not appropriate to the stimulus situation; that is, the ability to maintain a set. Unfortunately, inhibition tends to be defective in schizophrenics.

A related problem of equal magnitude is the treatment of children in the nation's mental hospitals with schizophrenia. They need to be treated for their lack of responsiveness, their unusual body movements and their inability to differentiate between self and others. The
schizophrenic child has made an identification and fusion of himself with his mother, but he is unable to cope with the painful knowledge that he and his mother are separate entities. He is not like the autistic child that never becomes close to his mother after birth. Successful treatment of childhood schizophrenics would considerably reduce the total number of hospitalized mental patients from the ranks of patients classified as schizophrenic.

The anti-s-protein, an enzyme, holds great promise as the solution to these problems. Anti-s-proteins keep normal people sane. They are completely missing in the brains of adult and childhood schizophrenics, and this lack causes them to be mentally disturbed until the time when anti-s-proteins can be given to them. Proper doses could allow schizophrenics to function normally and return to society. It is in the light of these considerations that Dr. Gottlieb, Dr. Frohman, and Dr. Domino have mounted a concerted effort to develop the procedures whereby it will be possible to cure the nation's schizophrenics by 1978.

S-proteins are potent, unstable proteins called alpha-two-globulin. Anti-s-proteins control the production of the cork-screw shaped s-proteins. Cork-screw shaped s-proteins are abnormal proteins and are the only type of s-protein found in schizophrenics, while the s-proteins of normals are nearly all shaped like an accordion or a coil or string. The anti-s-proteins control the s-proteins by shutting off their production and preventing them from becoming abnormal. The anti-s-proteins could lessen the schizophrenic's confusion due to
lack of the production of abnormal s-proteins, and dramatically curtail the schizophrenic's delusional state. Anti-s-proteins, the s standing for schizophrenic or stress, could stop the schizophrenic's hallucinogenic factory in his brain. This delusion factory over-produces an essential amino acid for human metabolism, tryptophan, and DMT, dimethyl tryptamine. Thus, its use would result in a reduction in abnormalities in schizophrenics. It would reduce their abnormal behavior and information processing deficit. It would eliminate their unrealistic fears and attention to irrelevant stimuli.

It has been mentioned that anti-s-proteins keep normal people from thinking and behaving bizarrely. The effect of anit-s-proteins on a normal person calms him down after a crisis. It reduces the person's mental activities and alertness to a normal state. After a crisis anti-s-proteins inhibit a person's extreme sensitivity to all adultory stimuli and all visual stimuli. This is its effects on a person with normal amounts of anti-s-proteins.

Number of times you read the passage___
APPENDIX D

SAMPLES OF SCORED FREE

RECALL PROTOCOL
Schizophrenia is a problem in adults which needs to be treated. The victims of schizophrenia comprise a great portion of hospital patients today. The solution to this problem must deal with creating inhibition in the patients. When the inhibition is absent, the patient will react in an irrelevant manner to the stimuli given to him.

Schizophrenia is also a big problem among children. The schizophrenic child confuses his identity with others. He cannot conceive that he and his mother who have been so often together are separate. This is unlike the autistic child who does not interact with the mother at all.

Three doctors are researching the problem of creating an inhibition and feel that the resolution will come before 1980. The solution is to add an anti s-particle (s standing for schizophrenic or strain) to the body of the patient. This anti s will inhibit the s particle, the defective enzyme in schizophrenics. The defective particle is corkscrew in shape as opposed to an accordion or spring shaped normal particle. The anti s, in inhibiting the s will allow the patient to react correctly and specifically to therapy. Doctors are hopeful with this treatment especially as most schizophrenic patients are under 30 years old.
Sample Two

Canaries or Budgerigars are brightly colored birds that add decor to many homes. Research into the reasons for various colorings has followed interest. The reason for the feather pigmentation is in the barbs of the feather. Barbs arranged in different positions affect the coloring of the bird as does a difference in the genetic make up of the barb. These can change coloration or inhibit it.

The original coloring of parakeets, which came from Australia, is green on the body with a yellow face. Several mutations have occurred, though, and now one of the most popular colors in the U.S.A. is the all blue parakeet. Some birds in England showed up all yellow, completely green or in lighter shades of these colors.

Without the great pains taken by avid breeders, however, all parakeets would still be green and yellow. Reasons for this very.

Genes of these different colors - blue, or solid yellow or green - are recessive and in breeding are usually lost. In rare occasions when two birds with recessive genes produce offspring with the recessive trait, the offspring are generally weaker. The defects causing weakness and inability to survive are in some cases, because of mutations. Exemplified are the rare yellow canaries in Australia which have never become common.

Thus the great variety of color has come as a result of breeders selecting perfect mutant specimens to breed. Thus the wide variety continues to brighten pet owners' homes.
APPENDIX E

SAMPLE OF RECORD SHEET

FOR SCORED FREE RECALL PROTOCOLS
READING AND WRITING ASSESSMENT SCORE SHEET FOR TEST NUMBER 3

Problem = 1
Solution = \frac{1}{2}
Antecedent = 0
Consequent = \frac{1}{1}

Name Doe, Jane E.

Last First Middle

Sex: Male _____ Female x

Age: Years 18 Months 2

Social Security Number 000-00-0000

Class: Freshperson X Sophomore_____ Junior____ Senior____

Place of Birth: City Detroit_____ State Michigan_____

Date September 13th

Part III

1. Agent = 1
2. Instrument = 0
3. Force = 1
4. Benefactor = 0
5. Latter = 2
6. 
7. 
8. Inference = 2
9. Elaboration = 1
10.
11.
12.

Part VI

1. Agent = 1
2. Instrument = 0
3. Patient = 2
4. Former = 2
5. Latter = 0
6. Range = 1
7. 
8. Inference = 0
9. Elaboration = 0
10.
11.
12.
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