

THE UNIVERSITY OF ALBERTA

AN INVESTIGATION INTO THE RELATIONSHIP BETWEEN STRUCTURAL
AMBIGUITY AND READING COMPREHENSION

by



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ABSTRACT

Although an understanding of the ways in which syntactic structures convey information is essential for comprehension, there are at present no adequate means of measuring the child's linguistic competence as it relates to his reading comprehension of syntactic structures. A basic contention of this study was that the structurally ambiguous sentence might provide such a measure as the ability to identify structural ambiguity seems to imply the ability to understand the two possible syntactic relationships in the ambiguous structure. The purpose of the study was to explore the relationship between the ability of grade five students to identify ambiguity in structurally ambiguous sentences of written English and their reading comprehension ability.

Identification of ambiguity was defined as the ability to correctly classify paraphrased meanings of a structurally ambiguous or unambiguous sentence as giving a meaning of that sentence and was measured by the Sentence Interpretation Test constructed by the investigator. This test contained sentences with surface structure ambiguity, sentences with underlying structure ambiguity, and unambiguous sentences. Scores for literal and inferential reading comprehension ability were obtained by administration of the Stanford Diagnostic Reading Test, Level II, Reading Comprehension subtest. Both tests were administered in May, 1972 to sixty grade five students who were native speakers of English, of average reading ability, and of average or above I.Q.. Each student's I.Q. and chronological age were obtained from the cumulative school record cards. An interview

was then conducted with eight students from the sample to further explore the feasibility of using the structurally ambiguous sentence as a means of measuring children's understanding of syntactic structures.

Pearson product-moment correlations and analysis of variance were used to analyse the data. Mean scores on ambiguous sentences were extremely low, especially on sentences with underlying structure ambiguity, suggesting that grade five students have not generally acquired the ability to identify ambiguity. However, reading comprehension ability was significantly related to identification of ambiguity with the most consistent relationship existing between inferential comprehension ability and the ability to identify surface structure ambiguity. Significant differences were found between high and low readers within the sample and between boys and girls on the Sentence Interpretation Test scores, with girls scoring consistently higher. I.Q. appears to be an important factor in identification of ambiguity.

Unambiguous sentences were found to be easier than structurally ambiguous sentences, and sentences with surface structure ambiguity were easier than sentences with underlying structure ambiguity.

The interview data suggested that the ability to recognize ambiguity i.e. the ability to orally describe the two meanings of a structurally ambiguous sentence, was also not generally acquired by grade five students. The interview also provided further evidence that the structurally ambiguous sentence could be used as a vehicle to measure the child's understanding of syntactic structures.

It was suggested that a program of instruction be implemented to facilitate students' understanding of structural relationships and that further research be conducted to determine the relationship between identification of ambiguity and reading comprehension ability in a more heterogeneous sample at different grade levels.

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CHAPTER I

INTRODUCTION

The ability to read has been described by Huey (1908) as "the most remarkable specific performance that civilization has learned in all its history (p. 6)." Civilization has increasingly depended on its schools to foster the abilities needed to carry out this "performance" and thus a great deal of responsibility rests on the teacher to ensure that the pupils in his care develop these abilities to the fullest extent to which they are capable. However, because of the many impositions on his time, the teacher must rely largely on researchers to find the most effective ways of conveying the information needed to master the reading process.

Researchers are generally agreed with Wiener and Cromer (1967) that reading is a two-stage process involving first identification and then comprehension, although not all are agreed on the relationship of the two parts. The first stage, identification, has received far more attention than the second, perhaps because comprehension is such a complex procedure. As a result the teacher has received little concrete guidance to aid his teaching of the comprehension aspect of the reading process. What research there has been on children's comprehension of written language has been hampered by the very complexity of this process for the workings of the mind are not overtly apparent. Simons (1970) recognizes this problem when he states:

Consequently, the instructional procedures and materials used when teaching children to comprehend what they read are based upon the intuitions and accumulated experience of reading specialists, not on research evidence (p. 1).

For this situation to be remedied researchers need to concentrate on the reading comprehension process with the express purpose of identifying particular factors that not only make this process more understandable but also can be used to develop meaningful teaching strategies.

I. THE PROBLEM

According to Bormuth (1970) "an inescapable fact of instruction is the necessity of using test-like tasks (p. 349)." He goes on to say:

Without these test-like tasks, there is no way to ascertain what, if anything, is being learned or even if the student is doing anything at all relevant to the instructor's intentions (p. 350).

As a prerequisite for any test it is necessary to be able to identify what is to be tested but, as mentioned previously, in the area of reading comprehension instruction few aspects of the process are sufficiently definable to be tested with any precision. One aspect that has, however, recently received some considerable attention is the syntactic structuring of written language for research has shown that reading comprehension is partly dependent on the syntactic structures of the language that is read. Yet attempts to measure the child's understanding of the syntactic structures of written language are notably lacking and those attempts that have been made were

generally inconclusive. The problem has largely been to find a vehicle upon which to construct such a measure for in the reading situation understanding of syntactic structures implies understanding of the ways in which these structures convey information. This vehicle must be composed of written language, it must minimize the vocabulary knowledge aspects of reading, and it must be capable of reflecting the developmental nature of the ability to understand syntactic structures. Fortunately, some recent work in language ability and psycholinguistics has suggested such a vehicle - the structurally ambiguous sentence.

The structurally ambiguous sentence in written form is the identical orthographic representation which has resulted from transformations of two different sentences at an underlying structure level. For example, the sentence, Flying planes may be dangerous, is structurally ambiguous because this orthographic form has resulted from transformations applied to at least two different sentences at an underlying structure level, corresponding to "is dangerous" and "are dangerous". The ability to recognize that a sentence such as this is ambiguous or to identify the ambiguity from the interpretations given would seem to imply an ability to understand the two possible syntactic relationships in the sentence.

Moreover, the ability to recognize ambiguity in language has become a canonical example in the linguistic and psycholinguistic literature of a characteristic of a mature user of language. Research by Kessel (1970) and Jurgens (1971), however, has indicated that children seem to acquire this ability in developmental stages. Finally,

the difficulty of the vocabulary in the sentence containing the ambiguity may be altered to correspond to different levels of vocabulary knowledge without altering the syntactic relationships in the sentence.

For these reasons it was considered by the investigator that structurally ambiguous sentences might well constitute a viable means of measuring a child's understanding of syntactic structures.

The purpose of this study is, therefore, to attempt to determine the relationship between the reading comprehension ability of children in grade five and their ability to identify ambiguity in structurally ambiguous sentences of written English. If a significant relationship does exist then it may be possible to measure the developmental sequence of a child's linguistic competence as it relates to his reading comprehension of syntactic structures by the use of a test of his ability to identify ambiguity. To shed further light on this possibility is a secondary purpose of the study to be conducted by means of an interview with certain students in the sample.

II. DEFINITION OF TERMS

For the purposes of this study, the following terms will be associated with that meaning given in the definitions below.

Written Language is the graphic representation of the English language as it appears in handwriting or print.

Ambiguity exists when any stimulus pattern is capable of two or more distinct interpretations. Ambiguities with more than two interpretations will not be used in this study.

Structural Ambiguity exists when an orthographic form has two distinct phrase markers associated with it in the surface structure.

Surface Structure Ambiguity is traditionally defined as involving the possibility of two distinct groupings of adjacent words. For example, in the sentence She spoke to the boy with a smile, the prepositional phrase with a smile could function as an adjectival or an adverbial modifier. For the purposes of this study, surface structure ambiguity will be defined as an instance of structural ambiguity in which the ambiguous structure is characteristic of the ambiguous structures found in sentences traditionally classified as containing surface structure ambiguity and as identified by MacKay and Bever (1967) and Jurgens (1971). These structures are described in Chapter III, Section II.

Underlying Structure Ambiguity is traditionally defined as involving a change in the logical relations between words rather than a change in the apparent grouping of words. For example, in the sentence The choice of the students was announced, the noun phrase the choice of the students is seen as originating in either of two underlying structures: either the students chose someone (or something) or someone chose the students. In either case the grouping of the words in the surface structure (without labelled bracketing) remains invariant. For the purposes of this study, underlying structure ambiguity will be defined as an instance of structural ambiguity in which the

ambiguous structure is characteristic of the ambiguous structures found in sentences traditionally classified as containing underlying structure ambiguity and as identified by MacKay and Bever (1967) and Jurgens (1971). These structures are described in Chapter III, Section II.

Identification of Ambiguity is the ability to determine whether a sentence is in fact structurally ambiguous by correctly classifying paraphrased meanings of a structurally ambiguous or unambiguous sentence as giving a meaning of that sentence (as in the Sentence Interpretation Test).

Recognition of Ambiguity is the ability to orally describe the two meanings of a structurally ambiguous sentence.

Reading Comprehension Ability will refer to the child's score on the Stanford Diagnostic Reading Test, Level II, Reading Comprehension subtest. This ability can be divided into literal comprehension ability and inferential comprehension ability on the basis of this test score.

Literal Reading Comprehension Ability is the ability to understand information that is contained explicitly in the material read and in this study will refer to the score on those items in the Stanford Diagnostic Reading Test, Level II, Reading Comprehension subtest which the authors of this test claim to measure literal comprehension ability.

Inferential Reading Comprehension Ability is the ability to understand information that is contained implicitly in the material read

and in this study will refer to the score on those items in the Stanford Diagnostic Reading Test, Level II, Reading Comprehension subtest which the authors of this test claim to measure inferential comprehension ability.

III. HYPOTHESES

From the findings of research studies and in view of what the investigator proposes to do in this study, the following research and null hypotheses have been formulated:

Research Hypothesis I

Students in grade five who have developed a greater ability to identify ambiguity will also be better able to comprehend what they read.

Null Hypothesis I

There is no significant relationship between scores on a test of reading comprehension (Stanford Diagnostic Reading Test, Level II, Reading Comprehension subtest) and scores on a test of identification of ambiguity (Sentence Interpretation Test).

Research Hypothesis II

I.Q. will have a notable effect on the relationship between the ability of grade five students to identify ambiguity and their ability to comprehend what they read.

Null Hypothesis II

There is no significant relationship between scores on a test of reading comprehension (Stanford Diagnostic Reading Test, Level II,

Reading Comprehension subtest) and scores on a test of identification of ambiguity (Sentence Interpretation Test) when I.Q. is partialled out.

Research Hypothesis III

High readers will be better able to identify ambiguity than will low readers.

Null Hypothesis III

There is no significant difference between high and low readers on their scores on the Sentence Interpretation Test.

Research Hypothesis IV

The I.Q. and the chronological age of a student will determine in part his ability to identify ambiguity.

Null Hypothesis IV There is no significant relationship between the scores on the Sentence Interpretation Test and

- (a) I.Q.
- (b) chronological age

Research Hypothesis V

Girls will be better able to identify ambiguity than will boys.

Null Hypothesis V

There is no significant difference between boys and girls on their scores on the Sentence Interpretation Test.

Research Hypothesis VI

Students will score higher on unambiguous sentences than they will on sentences with structural ambiguity, and will score higher on sentences with surface structure ambiguity than they will on sentences

with underlying structure ambiguity.

Null Hypothesis VI

There is no significant difference among scores on unambiguous sentences, sentences with surface structure ambiguity, and sentences with underlying structure ambiguity.

The null hypotheses will be considered rejected when the probability of the results occurring by chance is .05 or less.

IV. ASSUMPTIONS

1. It is assumed that the I.Q. scores taken from each student's cumulative school record card are in fact indicative of his intelligence.
2. It is assumed that each student's performance on the tests used in this study is indicative of his ability on those factors that these tests purport to measure.

V. LIMITATIONS

The generalizability of the findings of this study are limited in accordance with the following considerations:

1. The population from which the sample was chosen was limited to grade five students in three schools of the Edmonton R.C. Separate School District No. 7.
2. Only students whose scores on the school-administered Gates-McGinitie Reading Test fell between one standard deviation either side of the local mean for this test were selected for study.

3. Only students who were of average or above intelligence were selected for study.
4. The number of students who were selected for interview was limited to eight.

VI. SIGNIFICANCE OF THE STUDY

The need for a more specific analysis of the reading comprehension process has been mentioned in the introduction to this chapter and will be discussed further in Chapter II. Hopefully, a study of the student's ability to identify ambiguity will provide more information on one aspect of reading comprehension, the ability to understand the ways in which syntactic structures convey information. This aspect has received some attention in previous research but as yet the teacher does not have a means of measuring the student's ability to understand syntactic structures. The main purpose of this study is to determine if a significant relationship exists between reading comprehension ability and the ability to identify ambiguity in structurally ambiguous sentences of written English. Underlying this purpose is the contention that to identify ambiguity requires the ability to understand the two possible syntactic relationships in the structure containing the ambiguity. If a significant relationship does exist then it is hoped that the Sentence Interpretation Test, constructed to measure the ability to identify ambiguity, may provide the basis for a measure of the child's linguistic competence as it relates to his reading comprehension of syntactic structures. Such a measure would complement already established measures of aspects of reading comprehension in

aiding the teacher and the reading clinician to determine reading comprehension ability more accurately. It would help in providing a more precise analysis of a particular child's needs, particularly in understanding language structures, and would thus facilitate the grouping of children for instructional purposes and a more accurate definition of difficulties encountered by individual students.

VII. OVERVIEW OF THE INVESTIGATION

This study consists of two separate but related phases. Firstly an attempt to discover the relationship between the ability of students to identify ambiguity and their reading comprehension ability and, secondly, an interview designed to shed more light on the value of using the structurally ambiguous sentence as the basis for a possible measure of the child's linguistic competence as it relates to his reading comprehension of syntactic structures.

In Chapter II the writer will sketch the theoretical framework under which this study was conducted and review the empirical research pertinent to the problem. Chapter III will contain the experimental design of the study with descriptions of the sample, the experimental and standardized tests used, the format of the individual interviews, the pilot study, and the collection and methods of analysing the data. The results of the test data will be analysed and explained in Chapter IV and the findings of the interview will be presented and discussed in Chapter V. The final chapter will contain the summary, conclusions and implications.

CHAPTER II

REVIEW OF LITERATURE

In this chapter a brief rationale will be presented for considering the language of print as a basis for developing an understanding of the reading comprehension process. The effect of the syntactic element in written language upon reading comprehension will then be discussed, along with attempts at measuring a child's awareness of grammatical structure. Finally, the theory of transformational-generative grammar with regard to one aspect of this syntactic element, structural ambiguity, will then be outlined, and empirical evidence concerning the individual's ability to recognize, perceive or identify ambiguity will be considered as a basis for using structurally ambiguous sentences for a possible measure of a child's linguistic competence as it relates to his reading comprehension of the syntactic structures of written language.

Reading Comprehension: A Basis for Re-evaluation

As Thorndike pointed out in 1917, reading comprehension is ". . . a very complex procedure (p. 323)", and over the last fifty years many attempts have been made to analyse the components of the reading comprehension process. However, our knowledge of the process remains scanty, despite these research attempts. Bormuth (1969) states:

Nearly all this research and virtually all the instruction are based upon a conception of comprehension which is faulty and so subjective and nebulous that it is more misleading than helpful (p. 48).

This is a strong indictment but is supported by other recent writers in the field of reading. Goodman (1970), for example, pleads for a more scientific approach to the whole spectrum of reading:

As scientific understanding develops in any field of study, pre-existing, naive, common sense notions must give way. Such outmoded beliefs clutter the literature dealing with the process of reading (p. 259).

The reason for the lack of significant insights into the way that individuals process meaning seems to lie largely in the fact that a complex mental process is involved in reading comprehension and takes place with little or no overt behaviour being produced. Jenkinson (1968) states that one of the reasons for the lack of research into reading comprehension as compared to that into word identification "lies in the nature of the complexity of this activity, for its performance is usually less overt and much has to be examined indirectly by inference (p. 1)". Because of this very basic limitation, it is not surprising that researchers have been unable to provide the teacher with a description of the reading comprehension process that would enable him to develop meaningful teaching techniques and practice exercises.

However, although the mental processes are not directly observable, the input to them often is. Indeed, it is likely that the only aspect of reading comprehension that all reading specialists would agree upon is that it cannot take place unless there is something to be

read. In the vast majority of cases this means language in print and although this is a very basic contention, it is probably the best place to begin an analysis of the reading comprehension process. Written language can be observed directly and does not depend on inference, the same data can be immediately available to all concerned, it is amenable to systematic analysis, and linguists have provided a competence theory about the nature of language on which to base an analysis. If Goodman (1968) is right in his contention that "reading is the receptive phase of written communication (p. 15)", then reading comprehension must be a response to written language. Language is a system which in a variety of forms conveys semantic information and thus it is necessary for the reader to know how the system works before he can extract the information from the language in which it is encoded. Although it must be admitted that reading comprehension involves a process that cannot as yet be defined, it can be stated that this process operates on definable features of language. Indeed, Goodman (1972) has recently stated that "it is essential for educators to view reading as a receptive language process and readers as users of language (p. 506)", and he goes on to say:

Instruction will be successful to the extent that it capitalizes on children's language learning ability and their existing language competence (p. 508).

Thus it would seem desirable to carefully analyze and extend research on the definable aspects of the input to the mental process involved in reading comprehension in order to be able to analyse the process itself with any hope of success. This must involve a

consideration of specific aspects of language in print in light of an individual's understanding of those aspects. One such aspect, the syntactic structure of written language, will now be considered.

The Syntactic Element in Written
Language and its Effect Upon
Reading Comprehension

Wiener and Cromer (1967) state that "language can include not only meaning but also those subjects typically dealt with by linguists (patterns, grammars, sequences, meaningful units, and so on) (p. 638)". Indeed, as Goodman (1963) suggests, without structure language would be meaningless:

Most words have lexical (or dictionary) meaning. However, it is the devices which signal the structural meaning that make communication intelligible. The meaning of an utterance is not the sum of the lexical meanings of the words in it (p. 291).

Structure as an important variable in written language was first given emphasis in readability studies. Vogel and Washburne (1928) were probably the first to consider syntactic complexity as an important variable in the level of readability of written material when they took into account number of prepositions and number of simple sentences as two of four criteria in their Winnetka formula. Gradually these concepts were refined and extended. Gray and Leary (1935) included the number of first-, second-, and third-person pronouns, average sentence length and number of prepositional phrases, although Lorge (1944) claimed that only the last two of these factors were important. Average sentence length as an important aspect of readability was again emphasized by Dale and Chall (1948) and confirmed by Spache (1953). In 1953,

Taylor published the Cloze procedure, and since that time this has been the predominant method of measuring readability in research in reading. By virtue of its very nature (i.e., the systematic deletion of every nth word), the Cloze allows syntactic structure to function implicitly, as it normally does in the reading situation.

The advent of the theory of transformational-generative grammar sparked renewed interest into the particular grammatical structures that affect readability. Yngve (1960), for example, developed an analysis of the number of grammatical facts a reader must temporarily hold in his memory as he reads a particular sentence. The more grammatical facts there are, then the less likely is the reader to comprehend the sentence. This aspect provoked research by Bormuth (1967) and by Coleman and Aquino (1967). They measured the number of words occurring between a word or phrase and the word or phrase it modifies, on the theory that the longer the time a grammatical fact is held in memory, the more likely it is that it will be forgotten, and indeed they found a high and significant correlation between this feature and passage difficulty.

The transformations that operate on phrase-structures have also been considered recently in readability research. Coleman (1964) found that the proportion of words that were derived by nominalizing verbs and adjectives had correlations of $-.76$ and $-.57$ respectively with passage difficulty, and Bormuth (1966) developed an inventory of what he considered to be all the transformations found in English and studied the effect of each transformation on difficulty.

Thus research into the readability of written language has continually placed great emphasis on syntactic structure as one of the main variables in determining the ease or difficulty of a particular passage.

Apart from readability studies, research in the 1940's and 1950's into the relationship between syntactic structure and reading comprehension, drew the general conclusion that short, simple sentences were easier to comprehend than complex, longer sentences. Within the framework of structural linguistics, and by use of the Cloze technique, Coleman (1962) analyzed the reading comprehension difficulty of a number of passages and gave added support to this conclusion. He also noted the increased difficulty of comprehending clauses as opposed to sentences, and the difficulty of the connectives "but", "for", "or", etc., as opposed to "and".

Connectives were the basis of Robertson's (1966) study. She used a modified transformational-generative grammar "to investigate the understanding in reading which children aged eight to twelve studying in grades four to six, have of connectives (p. 4)." She maintained that ideas may be embedded or conjoined but that the association between the ideas is partially contained in the connectives that join them, and indeed she found a significant relationship between the understanding a child has of connectives and his reading achievement.

In terms of the embeddedness of elements within the structural framework of a sentence, Cossitt's (1966) analysis of social studies textbooks revealed the predominance of prenominal adjectives which

she claimed were more deeply embedded than other structures. However, she did not test for reading comprehension difficulty, and this was left to Fagan (1969). He found that adjectives were by far the commonest embedded structure in basal readers but yet were among the easiest in terms of reading comprehension difficulty. Indeed, Fagan's study represents the most thorough analysis to date of the relationship between sentence structure and reading comprehension. Claiming that "in order for children to understand what they read, they must be able to analyse the written language structures by which information, ideas and concepts are conveyed (p. iii)", he investigated the relationship between reading comprehension and the number and types of sentence transformations in basal reading material. The subjects, who were given "cloze" tests on variously prepared passages, were children in grades four, five, and six. In the framework of a transformational-generative grammar, embedding and deletion transformations were found to correlate with a difficult sentence or passage, while conjoining transformations were relatively easy, and the difficulty of simple transformations seemed to hinder comprehension more than their presence. In all, sentence difficulty was found to be more dependent on the presence and difficulty of transformations than was the difficulty of the passage. The reason for this was suggested by Fagan as lying in the greater redundancy inherent in units larger than the sentence, a factor which may also account in part for Coleman's (1962) finding that clauses were more difficult to comprehend than sentences.

The effect of syntactic structure on reading comprehension

was considered in a different light by Ruddell (1963). He analysed the structure of children's oral language in grade four and used these structures in written passages. He found that the reading comprehension of these children was significantly higher on passages using high-frequency patterns of their oral language than on passages using low-frequency and more elaborated constructions. Tatham (1970) confirmed Ruddell's findings with grade four students and also found that the difference in reading comprehension scores on these two types of passages was even greater for grade two students.

The role of syntax in reading comprehension has received added emphasis from a recent study by Denner (1970). He reported a study of representational and syntactic competence of problem readers (first, and third to fifth grade), normal readers (first grade), and Headstart preschoolers. He found that problem readers and those expected to be problem readers performed as well as those reading normally on enactive, pictograph and logograph tasks, but demonstrated little syntactic competence by obtaining very low scores on a synthesis task. He suggested that the finding demonstrates that poor readers consider sentence meaning as the project of individual word meanings, while normal readers appreciate that words derive their meanings from the contextual environment. What the problem readers seem to lack, he states, even as late as the fifth grade "is an appreciation of written language and the rules that govern the relationship of words to words (syntax) independent of their relevance and reference to external reality (p. 887)."

Research involving mature adult readers has also provided evidence for the important role played by syntactic structure in the

comprehensibility of language. Forster and Ryder (1971) studied the effects of syntactic complexity on the relative difficulty of visually perceiving rapidly presented word sequences in anomolous, bizarre, and normal semantic conditions. The sample consisted of forty undergraduate students, and the conclusion reached was that the effect of syntactic structure on perception is independent of the effects of semantics. Forster and Ryder state that this result suggests that full semantic processing must be delayed until the syntactic structure of the sentence has been established.

Thus it would appear that the syntactic structure of written language does have a considerable effect on reading comprehension. In light of this it would seem desirable to develop a means of measuring a child's ability to understand the ways in which structures convey meaning and, indeed, some few attempts to provide such a measure have been made. In 1941 Gibbons studied the child's ability to manipulate disarranged parts of a sentence into a coherent whole and the relationship of this ability to reading comprehension. She concluded that "the ability to understand sentences depends somewhat upon the ability to see relationships between the parts of a sentence (p. 46)". It is open to question whether this reflects a process compatible with reading comprehension and, in general, studies of awareness of grammatical structure in the reading situation have shown inconclusive findings. Strom (1956), for example, sought to discover if a knowledge of grammar improved reading ability by studying the relationship between the ability to read materials of an informative nature and the ability to

analyse the syntax and grammar of the sentences read. She found little if any relationship between these factors. O'Donnell (1962) also came up with low statistical correlations between the level of reading comprehension of his subjects and their awareness of structure. For O'Donnell, awareness involved matching sentences in which similar relationships occurred as defined by structural linguistics (subject-predicate, predicate verb-complement, etc.) and he concluded that the relationship of this awareness to reading comprehension ability was not significant enough to warrant teaching grammatical structure as a major means of developing reading comprehension.

In view of the evidence to support the inclusion of sentence structure as a factor in reading comprehension, researchers have recently become dissatisfied with the results of these studies, and have expressed the need to find a suitable measure of this factor. Bormuth (1970), noting the heavy dependence of education on the student's ability to comprehend the language in his instructional materials, states:

Unfortunately, the testing procedures in current use are unable to provide the information necessary for determining how well students are able to understand the syntactic structures by which language signals information (p. 349).

Two studies, both in 1970, were conducted to help remedy this situation, the first by Bormuth and the second by Simons. Both were concerned with defining and measuring reading comprehension in terms of particular aspects of written language rather than in terms of vaguely defined skills and abilities.

Using sixty grade four students, Bormuth tested their ability

to comprehend twenty-five common sentence structure elements, fourteen types of anaphoric structures, and sixteen types of intersentence structures. For the purposes of the study he defined a comprehension skill as "the ability to respond correctly to a question beginning with the letters 'wh' which deletes one of the immediate constituents of a syntactic structure", arguing that for an instructional theory of comprehension this definition is quite reasonable as Wh-questions are among the most common classroom devices for testing comprehension. Two sentences containing a particular structure were composed and both were embedded in paragraphs. Then four types of questions were constructed to test the structure in question. The results showed that "large proportions of the students were unable to demonstrate a comprehension of the most basic syntactic structures by which information is signalled in language (pp. 354-5)." His use of the word "demonstrate" is indicative of a fact that he stresses throughout the study, namely that he was not seeking to construct a theory of the process involved in the comprehension of syntactic structures, but was concerned with constructing a theory for the teaching and measurement of comprehension.

Simons (1970) was concerned with the other aspect, the psychological processes involved in reading comprehension, claiming that "knowledge of these processes can then provide a basis for instruction (pp. 1-2)". His review of the major approaches to reading comprehension led him to the conclusion that research should be based on available linguistic competence theory, claiming that "without this competence theory the research has been reduced to almost 'random fact

gathering' (p. 31)." Therefore he took what is probably the most important concept of the transformational grammarians, deep structure, and attempted to show its relevance to reading comprehension by looking at the relationship between children's skill at recovering the deep structure of sentences and their reading comprehension ability. He claimed that to understand a sentence the reader must understand the underlying structural relationships, i.e., the logical subject and the logical object of the sentence. In fact, he found that the children's scores on his Deep Structure Recovery Test had "a substantial and significant correlation" with the "cloze" test scores and with the scores on a standardized reading test, and that the ability to recover deep structure was the most important factor in the reading comprehension of the eighty-seven grade five students whom he tested when compared to I.Q., word knowledge, and word recognition skill.

It was Simons' hope that his study of children's ability to recover deep structure "could lead to the development of tests to identify students with deficiencies in this skill (p. 104)" and although neither of the two studies outlined above purport to have developed tests to measure the child's understanding of syntactic structures, both have highlighted the need for such a measure and have provided a great deal of empirical evidence upon which to build such a measure.

Thus there is considerable theoretical and empirical evidence upon which to base the claim that the syntactic structuring of written language has a major effect on the reading comprehension of that

language. Although research into this area is as yet at an early stage and a large number of questions remain to be asked, various aspects of structure have been identified as contributing to the ease or difficulty of readability, and attempts to measure the child's reading comprehension ability in terms of various aspects of the structure of language have been made. The most fruitful studies have used the competence theory of transformational-generative grammar as a framework of reference and it would seem that this same theory provides the best available means of analysing the input material to the reading comprehension process.

In the remainder of this chapter, the theory of transformational-generative grammar as it relates to the basic concept of this study, structural ambiguity, will be outlined and empirical evidence will be offered to support the use of this concept as a means of measuring the child's linguistic competence as it relates to his reading comprehension of the syntactic structuring of written language.

Transformational-Generative Grammar and Ambiguity

That a grammar must account for the ambiguity of certain strings was formulated as a basic adequacy criterion of grammars when Chomsky discussed the relationship of constructional homonymity and ambiguity in the original form of the theory of transformational-generative grammar in Syntactic Structures in 1957. He suggested that a transformational grammar can be written, and indeed must be written, so that if the grammar assigns two different derivational structures to a phoneme

sequence, then that phoneme sequence is ambiguous:

In general, we say that we have a case of con-
structional homonymity when a given phoneme sequence
is analyzed in more than one way on some level. This
suggests a criterion of adequacy for grammars (pp. 85-6).

Since that time, this concept has been applied to grapheme sequences and the adequacy criterion has been repeatedly stated by transformational grammarians, becoming a canonical example of the superiority of transformational grammar to structuralism or descriptive linguistics. Jacobs and Rosenbaum (1968) discussed "the ability to perceive ambiguity in a grammatical string (p. 7)" as one of four basic skills that characterize the native speaker of English.

MacKay and Bever (1967) suggested that transformational grammar defines three levels at which ambiguity in sentences can occur - the lexical, the surface structure, and the underlying structure levels. As this forms an important concept in this study, they will be quoted in detail:

The meanings and sounds of individual words are represented at the lexical level. A sentence is lexically ambiguous if a word or sequence of words has two distinct meanings and no differences at the other grammatical levels. For instance, the sentence The soldiers like the port is lexically ambiguous since the lexical item "port" can mean either "wine" or "harbor."

The manner in which words can be grouped into phrases is represented in the surface structure of sentences. Ambiguity at the surface structure level involves the possibility of two distinct groupings of adjacent words. Consider the sentence Small boys and girls are frightened easily. If the word "small" is grouped with "boys and girls" then both the boys and the girls are small. But if "small" is grouped only with "boys" then only the boys are small.

The underlying structural level of sentences represents the essential "logical" relations between words and phrases. For instance, the logical relation between "police" and

"drinking" is quite different in these two sentences:
The mayor will ask the police to forbid drinking.
The mayor will ask the police to cease drinking.
 Ambiguities at the underlying structure level involve neither a change in meaning of individual words, as in lexical ambiguity, nor a change in the apparent grouping of words, as in surface structure ambiguities, but only a change in the logical relations between words. For example, consider the sentence The mayor will ask the police to stop drinking. In this sentence are the police doing the drinking, or is somebody else? This sentence is ambiguous at the underlying structure level since only the logical relations between police and drinking is altered in the two interpretations (p. 193).

Prideaux (1972) has recently argued that the two types of structural ambiguity, surface and underlying, described by Mackay and Bever are, in fact, the same and that "structural ambiguities are resolvable at the level of the surface structure (p. 1)." Using the embedded clause of the sentence used by Mackay and Bever as representative of underlying structure ambiguity, Prideaux demonstrates its disambiguation at the level of surface structure by means of labelled bracketings thus:

- a. ((the police) ((stopped) (drinking)))
 S NP VP V NP VP S
- b. ((the police) ((stopped) (drinking))) (p. 5).
 S NP VP V V VP S

He also examined tests of passivization, clefting, pseudoclefting and questioning to secure the bracketings proposed above, and concluded that Mackay and Bever's claim that certain structural ambiguities are only resolvable at an underlying structural level fails "first because such resolution is represented syntactically at the surface, and secondly, because the 'logical relationships' claimed for a level of deep structure are inadequate (p. 10)."

It is beyond the scope of this present study to comment on the

relative merits of either position presented here, except to state that hopefully some empirical evidence will be forthcoming from the study which may aid the linguists in their analysis of the problem. However, it appears obvious that transformational grammarians consider ambiguity to be an important aspect of their grammatical theory, and as this theory is designed to represent the competence of the native speaker of a language then ambiguity must also be considered an important aspect of this competence.

Despite the seeming importance of ambiguity as an aspect of language, there has been little systematic research into the individual's ability to recognize when a phoneme or grapheme sequence is ambiguous or his ability to identify the ambiguity within such an ambiguous sequence. Research that has been conducted has largely concerned itself with adult subjects. Mackay and Bever (1967) used twenty undergraduate students to study "some of the factors influencing the ease of perception of the two interpretations of various kinds of ambiguous sentences (p. 193)." The "various kinds" of ambiguity consisted of lexical, surface, underlying, and multiple (i.e., combinations of the preceding three types). The subjects were told that the sentences were ambiguous and were asked to find the two meanings. Each sentence was written on a card and controlled in length to eight (plus or minus one) words. The processing time, from the moment each sentence was presented to the moment that the subjects indicated that they had identified both meanings by responding "yes", was measured and the median perception time for the three types of ambiguity was calculated.

A significant difference at the .01 level was found for the perception time between the three types, with lexical ambiguities discovered faster than surface structure ambiguities, which in turn were discovered faster than underlying structure ambiguities. The perception time for sentences with multiple ambiguities was consistently higher than for singly ambiguous sentences, even when the subject noticed only one of the ambiguities.

This hierarchical arrangement of types of ambiguity was confirmed in a second study by Mackay (1966), again with undergraduate students. These subjects were asked to orally complete written sentence fragments, half of which contained ambiguities of the four types mentioned above and rest of which were unambiguous. An attempt was made to maintain the same level of structural complexity between the ambiguous and the unambiguous sentence fragments by constructing the unambiguous sentences by "making the smallest change possible in the ambiguous sentence to approximate one of the two meanings selected at random (p. 428)." Measurement of the completion time showed that all types of ambiguous fragments took longer to complete than did the unambiguous ones, even though none of the subjects reported being aware of the ambiguities. Moreover, Mackay concluded that "structural complexity was the prime determinant of neither the time to discover ambiguity nor the time to complete ambiguous sentences (p. 433)."

Other evidence about the individual's processing of ambiguous sentences is scanty. Foss, Bever, and Silver (1968) identified the "expected" meanings of ambiguous sentences and then used a latency

measure to distinguish between the speed of response to "expected" versus "unexpected" meanings of ambiguous sentences. They concluded that "the results support a model of normal sentence comprehension which states that subjects typically assign only one immediate interpretation to an ambiguous sentence. Only if that interpretation is found to be incorrect does the subject reinterpret the sentence (p. 306)."

Carey, Mehler, and Bever (1970) again used adult subjects to assess the influence of an expected syntactic structure on the perception time for ambiguous sentences. Causing the subjects to expect a certain syntactic pattern led them to assign that same pattern to an ambiguous sentence to the extent that at times they were completely unaware of the other sense of the sentence. Consequently, processing times for ambiguous sentences did not differ from those for unambiguous sentences.

Foss (1970) used a phoneme-monitoring task to measure the relative difficulty of processing ambiguous sentences. The subjects were instructed to push a button whenever they heard a word beginning with the phoneme /b/ and some of the subjects were also asked to report whether or not the sentence was ambiguous. His results showed that response time was significantly longer when the phoneme occurred in ambiguous sentences, provided that the subject was aware of the ambiguity.

Only two studies have been found that consider the child's understanding of sentential ambiguity. The first, by Kessel (1970) focused on the comprehension of certain linguistic constructions by children in kindergarten and grades one, two, three and five. One such

construction was the ambiguous sentence. His basic aim was "to establish at what age children reveal a capacity to detect ambiguities and whether that age differs according to ambiguity type (p. 21)." Kessel selected twelve ambiguous sentences (four with lexical, four with surface, and four with underlying structure ambiguity) from those provided by MacKay (1966). Each sentence was read twice to ten subjects at each grade level with different intonation patterns used whenever required by the alternate meanings. As each sentence was read, the subject was shown a set of four drawings, two of which were correct and two incorrect for each sentence, and was asked to select the picture or pictures that illustrated the meaning or meanings of the sentence. He found that the lexical ambiguities that he used were easily interpreted by most of the six-year-olds but that the structural ambiguities were not interpreted with the same degree of correctness by any of the subjects other than the twelve-year-olds. The greatest gains in detection of surface structure ambiguity occurred between grades three and five, whereas the greatest gains in the detection of underlying structure ambiguity showed up between grades two and three. Kessel recognized a number of limitations of this study: the fact that he used only four sentences of each type; the fact that the sentences used had to be "picturable"; the fact that the difficulty of a particular lexical ambiguity is specific to the lexical item contained therein. To these may be added the fact that no attempt was made to equalize the structural complexity of the sentences across ambiguity types; that one of the twelve sentences contained a multiple ambiguity and that the pictures

suffered from a lack of artistry which may well have complicated the child's comprehension of them.

The second study, by Jurgens (1971), sought "to shed some light on the subject of the developmental sequence of receptive linguistic competence through a study of the recognition of ambiguity in sentences by students in grades seven, nine, and eleven (p. 3)." She argued that,

. . . if ambiguity is indigenous to, and not deviant from, the linguistic system, and if the processes by which ambiguities arise can be shown to operate in a systematic way, then obversely, the processes by which an individual perceives sentences containing ambiguities at different syntactic levels should likewise be expected to vary in a systematic fashion (p. 2).

Some confusion in terminology is evident for although Jurgens uses the terms "recognition" and "perception" of ambiguity, she does not define the former and defines the latter as "the ability to recognize two interpretations of an ambiguous sentence when both the ambiguous sentence and the interpretations were presented in written form (p. 7)."

The test constructed by Jurgens to measure this ability was composed of sixty lead sentences divided equally among unambiguous, lexical ambiguity, surface ambiguity, and underlying ambiguity, as defined by MacKay and Bever (1967) and also with two interpretative sentences for each lead sentence. The lead sentences were controlled for length (eight, plus or minus one, words) and for syntactic complexity, although the analysis of syntactic structures occurring in the sentences did not take into account whether or not the ambiguity was

located in the particular structure identified.

Each subject was directed to read the lead sentence aloud, read the interpretative sentences silently and state whether one or both of the interpretative sentences gave a possible interpretation of the lead sentence. A perception time score and a right-wrong score was recorded for each test item. An analysis of perception time scores revealed the order of difficulty, from easiest to most difficult, as being: lexical ambiguity, unambiguous, underlying ambiguity and surface ambiguity. Jurgens suggests that this difference from the ordering reported by MacKay (1966) and MacKay and Bever (1967) may have resulted from the subjects having to re-read the lead sentence in light of the possible interpretations and that surface ambiguity "in which the ambiguity depended on two possible groupings of the surface structure" is thus likely to take longer to interpret.

In terms of the number of correct responses, no significant differences were found for surface ambiguity among the grade levels and the differences between scores on underlying ambiguity only reached significance at the .05 level in a comparison of grade seven with grades nine and eleven. Scores on sentences with lexical ambiguity also only reached significance when a comparison was made between grade seven and grades nine and eleven, and students at all grades obtained almost identical scores for unambiguous sentences. However, Jurgens concludes:

The data for correct-response scores quite readily suggest that maturation of the ability to perceive ambiguity at different linguistic levels may follow a distinct developmental pattern. In contrast with the

evidence offered by Kessel, ability to perceive surface ambiguity seems to develop earlier than the ability to detect underlying ambiguity (pp. 70-71).

She also points out, as did Kessel, that the ability to perceive lexical ambiguity cannot be considered along the same developmental continuum as the ability to perceive structural ambiguity because of the differences inherent in the different lexical items displaying the ambiguity.

Jurgens also studied the relationship of perception time and correct response scores to five language-related measures, among them being I.Q., reading rate, and reading comprehension. I.Q. scores were taken from the cumulative school record, although different tests had been administered at different times to the students, and Parts 1 and 3 of the Diagnostic Reading Test, Survey Section, Form C, were used to provide the reading scores. For all grade levels, I.Q. emerged as the best predictor of perception time scores but did not correlate with correct-response scores except at the grade eleven level. Reading rate showed a significant, negative correlation with perception time for grade eleven only, and reading comprehension correlated significantly with perception time for grades seven and eleven, and with correct-response scores at grade eleven only. However, as Jurgens states, "these data can only be interpreted with caution (p. 72)."

Thus there appears to be some evidence that comprehension of at least structurally ambiguous sentences may shed some light on the comprehension process and seems to reflect a developmental process in children. That this developmental process is tied to an understanding

of the grammatical structure of sentences appears evident from the fact that to perceive the ambiguity in structurally ambiguous sentences, the individual must be able to perceive two separate syntactical groupings in one grapheme sequence. It thus seems that the structurally ambiguous sentence may well be used as the basis of a measure of the child's linguistic competence as it relates to his reading comprehension of the syntactic structures of written language.

Finally, it must be noted that all the research mentioned here on comprehension of ambiguity has dealt with the sentence in isolation. However, ambiguous sentences occur not only in isolation but are to be found in all reading matter. Halliday (1965) would claim that accomplished readers are not normally aware of this ambiguity, suggesting as a possible reason for this that:

We are not aware of it [ambiguity] because all of the necessary factors which enable us to resolve these ambiguities are built into the context - the social situation or the surrounding language or both (p. 17).

Context is obviously important for the resolution of ambiguity, but Menyuk (1971) states that context alone is not sufficient:

Although context is used to disambiguate the ambiguous sentence, the listener must have available both syntactic information (subject-object relationships in structures) and semantic information (all the dictionary meanings of a lexical item and the logical relationships of these items) to carry out the required interpretation. If this information is not available, then regardless of context the sentence will not communicate the meaning intended by the speaker (p. 164).

Although Menyuk is here referring to communication between speaker and listener, it may well be that in the reading situation, where context is of necessity more limited, syntactic and semantic

structuring of sentences, as one aspect of the reading comprehension process, have been generally inconclusive. However, the need for such a measure has been established and some recent studies in the framework of transformational-generative grammar have provided some empirical evidence upon which to build such a measure.

5. Transformational-generative grammarians, although generally undecided on the classification of types of structural ambiguity, quote the ability to perceive ambiguity in a grammatical string as a basic characteristic of a native speaker of English.

6. Studies of adults' understanding of ambiguity have provided evidence that surface structure ambiguity and underlying structure ambiguity differ in kind in terms of comprehensibility.

7. Studies of children's understanding of ambiguity, although very few in number, have suggested that therein may lie a developmental process and that further studies may shed some light on the comprehension process as a whole.

8. Although context may be the main aid to the resolution of ambiguity, syntactic information may be necessary for students in the acquisition stage of reading to resolve structurally ambiguous sentences.

CHAPTER III

THE EXPERIMENTAL DESIGN

The purpose of this chapter is to describe the sample selected for this study, the experimental and standardized tests used, the format of the individual interviews, the pilot study, and the collection and analysis of data.

I. THE SAMPLE

The test population for this study consisted of five grade five classes in three schools assigned to the investigator by the Edmonton R.C. Separate School Board. The total enrollment in these schools for grade five was 145. The schools were in various parts of the City of Edmonton.

As it was considered necessary to limit the sample to sixty grade five students (thirty boys and thirty girls) who were native speakers of English, displayed average reading ability, and whose scores on the tests given would not be affected by a low intelligence quotient, the cumulative school record card for each student was consulted for information on the following criteria:

(a) Language

The theory of transformational-generative grammar upon which this study is based is a theory of the linguistic competence of the native speaker of English. Thus, the sample was limited only to those

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(a) Language

The theory of transformational-generative grammar upon which this study is based is a theory of the linguistic competence of the native speaker of English. Thus, the sample was limited only to those

students whose parents were both native speakers of English.

(b) Reading Ability

The purpose of the Sentence Interpretation Test used in this study was to measure a child's ability to identify the meanings of structurally ambiguous sentences written in English. Although the vocabulary level of this test was carefully controlled, it was felt necessary to obtain a further safeguard against vocabulary and word identification factors affecting the scores on this test by limiting the sample only to those students who displayed average reading ability. All students had taken the Gates-McGinitie Reading Test, Survey D, Form 1M, in January, 1972, and local norms and standard deviations for this test had been established by the Edmonton R. C. Separate School Board. For grade five students the mean grade level was 5.8 and the standard deviation was 1.7 grades. Thus, only those students whose grade level on this test fell between 4.1 and 7.5 were selected.

(c) Intelligence Quotient

As it was also felt necessary to limit the sample to those students whose scores on the tests given would not be affected by a low I.Q., information was also obtained from the cumulative school record cards on the I.Q. displayed by the students. All students had taken the Lorge-Thorndike Intelligence Test, Form A, in June, 1971. The standard deviation for this test is sixteen I.Q. points and thus any student whose I.Q. was recorded as being below 84 was not included in the sample. The I.Q.'s for the final sample ranged from 84 to 125, the mean for the group being 102.3, and the standard deviation being 10.2.

(d) Grade Level

Grade five students were chosen for the sample as by this grade level the students have normally received some formal instruction in reading comprehension and word identification difficulties do not generally constitute a hindrance to their comprehension of written language. Moreover, Kessel (1970) found that the greatest increase in the ability to detect ambiguity occurred between grades four and six and Fagan (1969) found a dramatic increase in students' ability to understand the syntactic structures found in basal readers between grades four and five that did not occur so markedly between grades five and six.

(e) Sex

Sex differences in reading achievement have been observed and measured by many researchers (Carroll, 1960; Balow, 1963; Weintraub, 1966; Fagan, 1969). Although there is a lack of consensus evident from the research, it was considered important to record the sex of the students in the sample and to balance the number of boys and girls in order to shed further light on this problem.

(f) Chronological Age

Although chronological age was not used as a limiting criterion for selection of the sample, each student's age in months was recorded from the cumulative record cards as the basis for certain statistical correlations. The age in months for the final sample ranged from 122 to 145 and the mean age was 130.8 months.

The resultant sample consisted of sixty-three students, thirty-

two of whom were girls and thirty-one boys. As the sample size had been previously determined to be sixty and as it was felt necessary to equate the numbers of each sex in the sample for a comparison between the performance of the sexes, two girls and one boy were deleted at random, leaving a final selected sample of sixty students equally divided between the sexes. A summary of the continuous variables characterizing the sample is contained in Table I.

TABLE I
SUMMARY OF CONTINUOUS VARIABLES
CHARACTERIZING THE SAMPLE

Variable	Mean	Standard Deviation	Range	
			Lowest	Highest
<u>Gates-McGinitie Reading Test Grade Level</u>	5.8	1.7	4.1	7.5
I.Q.	102.3	10.2	84	125
Chronological Age (months)	130.8	5.6	122	145

II. TESTING INSTRUMENTS

1. Sentence Interpretation Test

The Sentence Interpretation Test, (SIT), used in this study to measure the ability of children to identify the meanings of structurally ambiguous or unambiguous sentences of written English, was constructed by the investigator. It consisted of forty lead sentences: ten with

surface structure ambiguity, ten with underlying structure ambiguity, and twenty which were unambiguous. For each of these lead sentences three interpretative sentences were constructed, one, two, or all three of which gave a meaning of the lead sentence. An example of a complete test item is given in Figure 1.

	<u>GIVES</u> <u>A MEANING</u>	<u>DOES NOT</u> <u>GIVE A MEANING</u>
<u>BOYS LIKE ICE CREAM BETTER THAN GIRLS.</u>		
(a) It is ice cream that boys like better than they like girls.	_____	_____
(b) Boys like ice cream better than girls like boys.	_____	_____
(c) Boys like ice cream better than girls like ice cream.	_____	_____

Fig. 1. Sample SIT Item

Sentences with lexical ambiguity were not included in the test because of the findings by Kessel (1970), later confirmed by Jurgens (1971), that the perception of lexical ambiguity is highly dependent on the actual lexical item containing the ambiguity and thus depends largely on the vocabulary knowledge of the individual, and for this reason cannot be considered on the same developmental continuum as the ability to perceive structural ambiguity.

Construction of the Lead
Sentences for the SIT

The construction of the lead sentences for the SIT was based upon an analysis of the syntactic structures that occurred in the

structurally ambiguous sentences used by MacKay (1966), MacKay and Bever (1967), and Jurgens (1971). This analysis revealed that the types of syntactic structures in which the ambiguity was located differed absolutely between those sentences classified as containing surface structure ambiguity and those classified as containing underlying structure ambiguity. To the extent that these researchers did not make provision for these types of structure to occur equally in all types of sentences included in their tests, it was felt that their conclusions about the effect of structural complexity on the perception of ambiguity were invalid.

Five main structures for both types of structurally ambiguous sentences were identified. These were as follows:

(a) Surface Structure Ambiguities

1. Adjective + Noun + Noun - where the element Noun + Noun may be interpreted as a compound noun, in which case the Adjective modifies the second Noun in the compound noun, or where both Nouns are distinct, in which case the Adjective modifies the first Noun. e.g., He was an American art expert.

2. Adverb/Adjective - where one word which may function as either an Adverb or an Adjective may be interpreted alternately. e.g., The blue dress particularly interested her.

3. Prepositional Phrase - where the Prepositional Phrase may be interpreted as modifying either a preceding noun or a preceding verb. e.g., He painted the picture on the patio.

4. Adjective + Noun₁ + and + Noun₂ - where the Adjective may

As a basis for constructing the lead sentences, those structures characteristic of surface structure ambiguity were randomly paired with those characteristic of underlying structure ambiguity. These pairings are shown in Figure 2.

<u>Pairing</u>	<u>Structure Characteristic of Surface Structure Ambiguity</u>	<u>Structure Characteristic of Underlying Structure Ambiguity</u>
1.	Adj + N + N	Infinitive
2.	Adv/Adj	Ving + N
3.	Prep Phrase	Genitive
4.	Adj + N ₁ + and + N ₂	Infinitive + V ing
5.	N ₁ + N ₂	Comparative Deletion

Fig. 2. Pairings of Structures for Construction of the SIT

Forty lead sentences were then constructed such that there were eight lots of five sentences each. Two of the eight lots were surface structure ambiguities, two were underlying structure ambiguities, and four were unambiguous. These were designated as Types 1 to 8 according to the nature of the structures that they contained. The construction of these types is described in detail below using Pairing 1. (Fig. 2) as the basis for example.

The five Type 1 sentences (surface structure ambiguities) were constructed so that each sentence in this Type contained one of the structure pairings shown in Fig. 2. In this Type the structure characteristic of surface structure ambiguity was used ambiguously

and the structure characteristic of underlying structure ambiguity was used unambiguously. For example, the sentence He went to fetch the red crayon box in which the structure Adj + N + N is ambiguous but the infinitive structure is unambiguous.

Type 2 sentences (underlying structure ambiguities) were likewise constructed so that each sentence contained one of the structure pairings. However, this Type differed in that the ambiguity resided in that structure characteristic of underlying structure ambiguity and the structure characteristic of surface structure ambiguity was used unambiguously. For example, the sentence The young science teacher is the one to ask, in which the the infinitive structure is ambiguous but the Adj + N + N structure is used unambiguously.

Type 3 and Type 4 sentences (unambiguous) were constructed to balance Type 1 and Type 2 sentences respectively in terms of syntactic complexity. That is, each one of the sentences in Type 3 was constructed to contain exactly the same structures as each one of the sentences in Type 1, and likewise each one of the sentences in Type 4 was constructed to contain exactly the same structures as each one of the sentences in Type 2. These Types differed from Types 1 and 2 only in that all structures were used unambiguously.

For example, Type 3 sentence He wanted to find the front door key (compare Type 1 He went to fetch the red crayon box), and Type 4 sentence The white race horse was the first to finish (compare Type 2 The young science teacher is the one to ask).

Thus, Types 1, 2, 3 and 4 all contained the same basic syntactic

structures.

Type 5 sentences (surface structure ambiguities) were constructed so that each sentence in this type contained an ambiguous usage of one of the five structures characteristic of surface structure ambiguity. However, these sentences did not contain the paired structure shown in Figure 2, and no control was placed upon the structure of the remainder of each sentence except that it be unambiguous. For example, the sentence A black bear trap was sold to the hunter contains the Adj + N + N structure which is used ambiguously (compare Type 1 He went to fetch the red crayon box) but as has been indicated, the sentences of Type 5 did not contain the pairing structure of Type 1. In this case, therefore, the infinitive structure of Type 1 was not repeated in Type 5.

Type 6 sentences (underlying structure ambiguities) were constructed in the same way as Type 5 sentences except that they contained an ambiguous usage of one of the five structures characteristic of underlying structure ambiguity rather than of surface structure ambiguity. For example, the sentence The hunter was too far away to see (compare Type 2 The young science teacher is the one to ask).

Type 7 sentences (unambiguous) were constructed to contain identical structures to those used in Type 5 sentences except that all structures were used unambiguously. The syntactic interpretation used for the structure characteristic of surface structure ambiguity was the alternate of that used when constructing Type 3 sentences. For example, the sentence A new wrist watch was given to the winner (compare Type 5

A black bear trap was sold to the hunter).

Type 8 sentences (unambiguous) were constructed to contain identical structures to those used in Type 6 sentences, again with the exception that all structures were used unambiguously. Likewise, the syntactic interpretation used for the structure characteristic of underlying structure ambiguity was the alternate of that used when constructing Type 4 sentences. For example, the sentence The box was too high up to reach (compare Type 6 The hunter was too far away to see).

A summary of the basic structural design of these eight types of sentences and the SIT item numbers corresponding to each type are contained in Figure 3.

<u>Sentence Type</u>	<u>Sentence Structure Design</u>	<u>Test Item No.s</u>
1	surface structure ambiguity + unambiguous structure characteristic of underlying structure ambiguity	10,26,27,33,37
2	underlying structure ambiguity + unambiguous structure characteristic of surface structure ambiguity	4,16,18,39,40
3	unambiguous instances of these structures occurring in Type 1 sentences	3,6,11,21,35
4	unambiguous instances of these structures occurring in Type 2 sentences	5,7,15,25,30
5	surface structure ambiguity + optional structure	9,13,17,19,20
6	underlying structure ambiguity + optional structure	1,2,22,28,31
7	unambiguous instances of those structures occurring in Type 5 sentences	8,12,23,32,38
8	unambiguous instances of those structures occurring in Type 6 sentences	14,24,29,34,36

Fig. 3. Sentence Types in the SIT

Other considerations that affected the construction of these lead sentences were sentence length, vocabulary, grammatical and semantic acceptability, and the consistency with which these sentences could be classified as ambiguous or unambiguous by mature native speakers of English.

- a. Sentence Length - In view of the importance attached to sentence length in studies of the readability of written language, it was considered necessary to maintain a consistent sentence length for each lead sentence. Thus the precedent of MacKay and Bever (1967) was followed in limiting each sentence to eight words (plus or minus one).
- b. Vocabulary - In order that the vocabulary used in the sentences constructed could be considered as within the reading vocabulary of grade five students, only words listed in Carroll's (1971) Word Frequency Book as occurring in the reading material of grade four students or below were used.
- c. Grammatical and Semantic Acceptability and Consistency of Classification - a panel composed of twenty graduate students and faculty members was asked to classify each of the lead sentences as ambiguous or unambiguous and to comment on the grammatical and semantic acceptability of these sentences. Any ambiguous sentence that was not classified as such by at least fifteen of the panel and any unambiguous sentence that was classified as ambiguous by any one member of the panel were revised or replaced. Revised and replacement sentences were again submitted for judgement until the investigator was reasonably certain that the lead sentences adequately fitted the category assigned to them

and were grammatically and semantically acceptable.

Construction of the Interpretative
Sentences for the SIT

Three other sentences were then constructed for each lead sentence such that either one, two, or all three of these sentences gave a paraphrased meaning of the lead sentence. For all ambiguous lead sentences, two of the three sentences gave a meaning, representing both interpretations of the ambiguity. To avoid any overt pattern to the number of correct responses for each item, this number was varied for the unambiguous sentences. Thus, for the unambiguous lead sentences constructed to parallel the syntactic complexity of those lead sentences containing surface structure ambiguity, four were randomly assigned to have only one of the three interpretative sentences give a meaning, four more were assigned to have all three of the interpretative sentences give a meaning, and the remaining two were assigned to have two of the three interpretative sentences give a meaning. The same procedure was followed for the unambiguous sentences constructed to parallel the syntactic complexity of those lead sentences containing underlying structure ambiguity. Each of these interpretative sentences was constructed such that the least possible change was made in the wording of the lead sentence to represent the required meaning. In no instance were any content words introduced into the interpretative sentences that did not occur in the lead sentence.

The ordering of the interpretative sentences was randomized for each lead sentence and the lead sentences themselves were ran-

domized with the exception that no two pairings of the same type, as represented in Figure 2, were permitted to immediately follow one another. This precaution was taken as it was felt that two sentences of similar structure occurring together might influence the interpretation of each other.

Instructions for the SIT

The instructions for the test contained one example of an item with surface structure ambiguity, one of an item with underlying structure ambiguity and one that was unambiguous. The students were instructed to read each lead sentence carefully, read the interpretative sentences and indicate which of the latter gave a meaning of the lead sentence by placing a check (✓) by each interpretative sentence under a column headed "GIVES A MEANING" or under a column headed "DOES NOT GIVE A MEANING".

The complete test with its instructions is contained in Appendix A.

Validity of the SIT

Helmstadter (1970) states that "in the original writing of items, face validity is about all there is to rely upon (p. 298)."

Face validity for the SIT as a measure of the ability to identify the meanings of structurally ambiguous or unambiguous sentences of written English is claimed on the basis of the following considerations:

1. That structurally ambiguous sentences differ from unambiguous

deep structures and thus the meanings of that lead sentence. Simons (1970) has provided ample evidence that the recovery of deep structure is necessary to determine whether or not sentences are paraphrases of one another. If this is the case, and the theory of transformational generative grammar would again support this contention, then the use of paraphrases of the lead sentences to measure the students' ability to identify the meanings of the lead sentences would seem to be valid.

5. That vocabulary was carefully controlled, and that readers of average ability were selected for the sample, would indicate that the lexical items used in the test were well within the range of comprehensibility of average grade five students, and thus the test was not measuring the variables of word recognition and word identification that are associated with reading comprehension. This was borne out by the pilot study and interviews conducted with certain students in the sample after they had taken the test.

6. That the sentences were grammatically and semantically acceptable was adjudged by a panel of mature, educated, native speakers of English and again borne out by the pilot study and interviews.

Reliability of the SIT

On the basis of data collected on sixty grade five students, the reliability of the SIT was calculated by using the technique of split-half reliability. The items were so divided that each half of the test contained equal numbers of sentences that were unambiguous, that contained surface structure ambiguity, and that contained underlying structure ambiguity. The resultant correlation of .722 was

corrected by the Spearman-Brown prophecy formula to determine the reliability of the entire test. The reliability of the SIT is .839.

2. Stanford Diagnostic Reading Test

To assess the reading comprehension achievement of the students in the sample, Test 1 (Reading Comprehension) of the Stanford Diagnostic Reading Test (SDRT), Level 11, Form X was administered. The decision to use this particular standardized test was based on the following considerations:

1. The SDRT, normed in the United States, has received a favorable review in O. K. Buros The Seventh Mental Measurements Yearbook.
2. Level 11 of the SDRT is designed for use from the middle of grade four to the middle of grade eight and thus was deemed suitable for readers of average ability at the grade five level.
3. According to the SDRT Manual, reading comprehension "appears to be composed of two subskills at the reading level covered by SDRT Level II; these two subskills are variously referred to as literal or inferential, factual and interpretative, or explicit and implicit comprehension." As these two subskills are scored separately it was felt that this test provided a more accurate analysis of reading comprehension ability than other available standardized tests.
4. These skills are tested on a wide variety of subject-matter material, including science, social studies, health, etc..
5. The corrected split-half reliability coefficient for the sub-test of reading comprehension at the grade five level was reported by the authors as being .87.

5. Content, construct, and concurrent validity are claimed for the test by its authors, largely on the basis of item analysis and correlations between SDRT subtests and the Stanford Achievement Test.

III. THE INTERVIEW

One of the purposes of this study was to conduct a structured interview with certain students in the sample in order to further explore students' understanding of structurally ambiguous sentences and to examine more closely aspects of the validity of the SIT. All interviews were conducted individually by the investigator and student responses were recorded in writing as it was felt that a tape-recorder might inhibit the responses of some students.

Selection of the Students for Interview

It was decided to select eight students who reflected extremes of performance on both the SIT and the SDRT Reading Comprehension subtest. The selection of these students was made, following an analysis of the test data, according to the following criteria:

1. Those students whose score on the SDRT Reading Comprehension subtest placed them in the top quartile, and whose score on the SIT placed them above the mean were listed. From these students the boy and the girl whose scores reflected the highest levels of performance on both tests were selected for interview. These two students thus represented high scores on both tests.
2. Those students whose score on the SDRT Reading Comprehension

subtest placed them in the top quartile and whose score on the SIT placed them below the mean were listed. The boy and the girl whose scores reflected the greatest extremes of performance in both tests were then selected for interview. These two students thus represented a high score on the reading comprehension test and a low score on the SIT.

3. Those students whose score on the SDRT Reading Comprehension subtest placed them in the bottom quartile and whose score on the SIT placed them below the mean were listed. From these students the boy and the girl whose scores reflected the lowest levels of performance on both tests were selected for interview. These two students thus represented low scores on both tests.

4. Those students whose score on the SDRT Reading Comprehension subtest placed them in the bottom quartile and whose score on the SIT placed them above the mean were listed. In this case the two girls whose scores reflected the greatest extremes of performance on both tests were selected for interview as no boy was found who met the criteria. These two students thus represented a low score on the reading comprehension test and a high score on the SIT.

Content of Interview

The interview consisted of three parts:

1. The test of identification used in this study, the SIT, involves the student in classifying interpretative sentences as giving or not giving a meaning of a structurally ambiguous or unambiguous lead sentence. However, it was considered important to further

explore students' understanding of structurally ambiguous sentences by testing their ability to recognize ambiguity. Recognition of ambiguity was defined for this study as the ability to orally describe the two meanings of a structurally ambiguous sentence, and thus differs from identification mainly in the fact that interpretative sentences are not available to aid the student in this task.

The test of recognition of ambiguity was constructed to minimize the external clues to the meanings of an ambiguous sentence such that this simulated as nearly as possible the normal reading situation.

Twenty sentences (five with surface structure ambiguity, five with underlying structure ambiguity, and ten that were unambiguous) were constructed according to the design outlined in Figure 3 (p. 47) such that there were five of sentence Type 1., five of Type 2., five of Type 3., and five of Type 4. All sentences were limited to eight words (plus or minus one) and were subject to the same vocabulary controls as were the sentences in the SIT. The sentences were randomly ordered and typed individually on cards for presentation to the students. Each card was presented individually to the student with the request that he read it silently and "explain the meaning of the sentence in your own words." Following the student's response, the question was then asked, "Could this sentence have any other meaning?"

The sentences constructed for this test are contained in Appendix C.

2. To shed some light on the strategies used by different students to determine which interpretative sentences gave or did not give a

meaning of the lead sentences on the SIT, and to determine some reasons for students' incorrect classification of the interpretative sentences in certain instances, the second part of the interview was devoted to a retesting of the students on certain test items. For each student six items were selected from the SIT that that student had answered incorrectly by assigning one of the paraphrases to the wrong classification. Two of these sentences displayed surface structure ambiguity, two underlying structure ambiguity and two were unambiguous. The two sentences of each type that had the lowest item difficulty index on an item analysis of the SIT and that the individual student had answered incorrectly were selected for the retesting. Sentences with a difficulty index as low as possible were selected because it seemed less likely that the student's original incorrect response could then be attributed to an artifact of the test item itself and also because it is more surprising that these sentences should have been answered incorrectly when they had proved comparatively easy to the rest of the sample.

These sentences were retyped for presentation to the students in the same format as was used for the total SIT. The SIT instructions were repeated to the student who was then asked to complete the six items. Following this a comparison of the responses on the retest and the original test on these items was made in the presence of the student who was then encouraged to comment on any differences in these responses and to describe the process by which each item was answered.

The SIT items used for retesting each student are listed in Appendix D.

3. This section of the interview was included in order to explore the effect of context upon students' ability to identify the meanings of structurally ambiguous sentences. For this purpose the sentence with surface structure ambiguity and the sentence with underlying structure ambiguity that had the highest index of item difficulty on an item analysis of the SIT were selected. Each sentence was placed in the context of two separate paragraphs such that this context pointed to only one interpretation of the ambiguous sentence. These paragraphs were typed separately on cards with the sentence containing the ambiguity underlined. Below each paragraph the three interpretative sentences used with the ambiguous sentence in each paragraph on the SIT were typed.

The students were asked to read the paragraph silently and to determine, for each of the interpretative sentences, which could give a meaning of the underlined sentence as it occurred in the paragraph and which could not give a meaning. Students were encouraged to comment on the reasons for their answers.

These paragraphs are contained in Appendix E.

IV. PILOT STUDY

A pilot study was conducted in April, 1972, with a class of grade five students in an elementary school of the Edmonton R.C. Separate School System. Its purposes were to shed some light on the content validity of the SIT, to determine a suitable form of instructions for administration of this test, and to discover the amount of time needed by the students to complete the test.

Twenty-one students completed the test in times ranging from seventeen minutes to twenty-nine minutes. A discussion with the students revealed no difficulties with word knowledge or with the grammatical or semantic acceptability of the sentences, although some students reported that they found some of the items amusing. All students were unanimously agreed that the test was "easy".

The experience of the pilot study led to a restructuring of the instructions for administration and an item analysis of the sentences led to minor revisions in twelve of the lead sentences. It was also apparent that the students could more accurately identify unambiguous sentences than ambiguous sentences (77.9 per cent correct responses as opposed to 29.7 per cent correct responses) and that surface structure ambiguity was more readily identified than underlying structure ambiguity (37.6 per cent correct responses as opposed to 21.9 per cent correct responses). The teacher's perceptions of each student as having high, average, or low reading ability were also secured and seemed to correlate with the scores on the SIT, thus lending support to the positive relationship between reading comprehension achievement and the ability to identify ambiguity as hypothesized by the investigator. The data from the pilot study are summarized in Table II.

V. COLLECTION OF THE DATA

Information on the chronological age, I.Q., reading ability, and native language of a sample of grade five students attending three Edmonton R.C. Separate Schools was collected by the investigator

TABLE II
 MEAN SCORES ON THE SIT FOR STUDENTS IN THE PILOT STUDY

Variable	Possible Score	Mean Scores			
		Total Readers	High Readers	Average Readers	Low Readers
Total <u>SIT</u>	40	21.5	24.8	19.8	16.2
Unambiguous Sentences	20	15.6	17.2	14.7	13.0
Surface Structure Ambiguities	10	3.8	4.7	3.3	2.2
Underlying Structure Ambiguities	10	2.2	2.9	1.9	1.0

from the cumulative school record cards at the beginning of May, 1972.

The test data were collected from this sample in a period of three days in May, 1972, and all testing was conducted by the investigator. The students were tested in three groups, one group at each school, and administration of the SIT was immediately followed by administration of the SDRT Reading Comprehension subtest. The instructions for both tests were read orally by the investigator to the students and any additional explanation needed was provided. All scoring was done by the investigator. For both tests, the procedure was the same in that the student received one point for each test item answered correctly and zero for each item answered incorrectly.

Following analysis of these data, eight students were selected for interview as described earlier. These interviews took place a fortnight after the collection of the test data.

VI. DATA ANALYSIS

The data were analysed according to the following statistical procedures:

(1) Pearson Product-Moment Correlation

This procedure was applied to determine if a linear relationship existed:

- (a) between all variables for the total sample
- (b) between all variables for the total sample when I.Q. was partialled out
- (c) between all variables for boys only

- (d) between all variables for girls only
- (e) between all variables for high readers
- (f) between all variables for low readers
- (g) between the scores on the two halves of the SIT as determined for calculation of that test's split-half reliability

(2) Two-Way Analysis of Variance

This analysis was used to test the significance of variation over the five variables associated with the SIT when the students were divided into four groups. The groups set up for this purpose were by sex and by classification of the students as high or low readers on the basis of their total reading comprehension score.

(3) One-Way Analysis of Variance with Repeated Measures

This analysis was used to determine whether there was a significant difference in the variation of students' performance on sentences in the SIT when these sentences were grouped into:

- (a) those that were unambiguous, those with surface structure ambiguity, and those with underlying structure ambiguity
- (b) those corresponding to Sentence Types 1, 2, 3 and 4 as outlined in Figure 3 (p. 47).

(4) Item Analysis

This analysis was used to determine the item difficulty index and biserial correlation of the items on the SIT.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF TEST DATA

In this chapter the following aspects of the test data obtained in this study will be examined:

- I. Performance on the Sentence Interpretation Test (SIT).
- II. Performance on the Standard Diagnostic Reading Test - reading comprehension subtest.
- III. Relationship between the SIT variables and reading comprehension variables.
- IV. Relationship between the SIT variables and reading comprehension variables when I.Q. is partialled out.
- V. Differences between high and low readers on the SIT.
- VI. Relationship among performance on the SIT, reading comprehension achievement, and related variables
 1. I.Q.
 2. Sex
 3. Chronological Age
- VII. Differences among the scores on sentences with surface structure ambiguity, sentences with underlying structure ambiguity and unambiguous sentences.
- VIII. Differences among scores on sentences Types 1, 2, 3 and 4.

I. PERFORMANCE ON THE SENTENCE INTERPRETATION TEST

Scores on the SIT constitute a measure of students' ability to identify the meaning or meanings of structurally ambiguous or unambiguous sentences of written English by correctly classifying paraphrases of those meanings. The results of this test are shown in Table III in terms of possible score, mean score and standard deviation

for the total test and sub-sections of it.

TABLE III
MEANS AND STANDARD DEVIATIONS
FOR THE SIT

<u>SIT</u> Scores	Possible Score	Mean Score	Standard Deviation
Total Test	40	17.78	5.84
Unambiguous Sentences	20	11.97	3.57
Ambiguous Sentences	20	5.85	3.29
Surface Structure Ambiguities	10	3.48	2.00
Underlying Structure Ambiguities	10	2.37	1.80

Total Test. On the total SIT the scores ranged from 7 to 32 with a mean score of 17.78, and a standard deviation on this score of 5.84. This relatively low score would indicate that the ability that the test is designed to measure has not been adequately acquired by average readers at the grade five level.

Unambiguous Sentences. The scores on those sentences that were unambiguous ranged from 6 to 19 out of a possible 20 with a mean score of 11.97. This mean score accounts for approximately 67% of the mean score on the total test indicating that the students in the sample could correctly answer those test items containing unambiguous lead sentences with more consistency than they could the remainder of the test items which contained ambiguous lead sentences. However, the mean correct score for unambiguous sentences is lower than the results of the pilot study led the investigator to

expect. It may be that the students in the pilot study were generally at a higher level of reading ability, but it does seem that many grade five students have considerable difficulty in identifying the meaning of sentences even though these sentences are unambiguous. Many of the syntactic structures used in the construction of these sentences were the same as those used by Bormuth (1970) in his study of grade four students' understanding of syntactic structures. He found that many students were unable to demonstrate an understanding of these structures and the same seems to be true of grade five students.

Ambiguous Sentences. The scores on those twenty test items that contained structurally ambiguous lead sentences ranged from 0 to 15 with a mean score of 5.85. This would indicate that the ability to identify structurally ambiguous sentences is far from acquired by the grade five level.

Surface Structure Ambiguities. Ten of the twenty ambiguous sentences in the SIT contained structures with surface structure ambiguity. The scores on these ten sentences ranged from 0 to 8 with a mean of 3.48, representing approximately 60% of the mean score for the total number of ambiguous sentences.

Underlying Structure Ambiguities. The remaining ten ambiguous sentences contained structures with underlying structure ambiguity and the scores on this type of sentence ranged from 0 to 7 with a mean score of 2.37. This would suggest that the meanings of sentences containing underlying structure ambiguity are more difficult to identify

than those of sentences containing surface structure ambiguity.

Thus, although the students exhibited some success in classifying the interpretative sentences of unambiguous lead sentences, structurally ambiguous sentences posed more difficulties. That structurally ambiguous sentences proved more difficult than unambiguous lead sentences is in accord with the findings of MacKay (1966) and Jurgens (1971) and was hypothesized by the investigator. Moreover, the fact that sentences with underlying structure ambiguity proved more difficult than those with surface structure ambiguity is again in accord with the findings of MacKay (1966) as well as with the findings of MacKay and Bever (1967), Kessel (1970) and Jurgens' (1970) analysis of correct response scores.

The low mean scores on all aspects of the SIT would seem to suggest the need for more intensive teaching of the ways in which syntactic structures convey information.

II. PERFORMANCE ON THE STANFORD DIAGNOSTIC READING TEST - READING COMPREHENSION SUBTEST

Scores on the SDRT reading comprehension subtest were used as a measure of the literal and inferential reading comprehension ability of the students in the sample. Table IV shows the possible score, mean score and standard deviation for this subtest in total and for each of its two facets.

TABLE IV

MEANS AND STANDARD DEVIATIONS FOR THE
SDRT READING COMPREHENSION SUBTEST

<u>SDRT</u> Reading Comprehension Subtest	Possible Score	Mean Score	Standard Deviation
Total score	60	33.32	6.56
Literal comprehension score	30	18.10	3.63
Inferential comprehension score	30	15.22	3.83

Total score. Total scores on the subtest of reading comprehension ranged from 20 to 50 with a mean score of 33.32. According to the Manual for Administering and Interpreting this test, this mean score represents a grade equivalent of 5.0, whereas the students in the sample were at an actual grade placement level of 5.8 at the time of testing.

Despite this discrepancy it is felt that the students in the sample were readers of average ability with respect to the population as they were selected on the basis of local norms for the Gates-McGinitie Reading Test whereas the SDRT was normed on students in the United States of America. The standard deviation of 6.56 indicates that, assuming a normal curve, 68% of the sample scored between the grade 4.2 and grade 5.8 level as interpreted by the SDRT Manual, and the total range of scores indicates an achievement range of from grade 3.3 to grade 9.0.

Literal comprehension score. Scores on those thirty items in the SDRT reading comprehension subtest that the authors of this test claim to measure literal comprehension ability ranged from 9 to 26 with a mean score of 18.10. The extremes of this range are interpreted in the SDRT Manual as reflecting scores at the second and eighty-sixth percentile ranks for students placed between the grade 5.5 and grade 6.5 levels.

Inferential comprehension score. Scores on the thirty items designed to measure inferential comprehension ability ranged from 7 to 25 with a mean score of 15.22. The extremes of this range are interpreted in the SDRT Manual as reflecting scores at the second and ninetieth percentile ranks for students placed between the grade 5.5 and grade 6.5 levels.

Thus there appears to be little difference between the literal and inferential comprehension abilities of the students in the sample. The range of scores was greater than expected for readers who were selected as of average ability but this can be partly accounted for in that the SDRT is designed as a diagnostic test and as such highlights minor differences in performance.

III. RELATIONSHIP BETWEEN THE SIT VARIABLES AND READING COMPREHENSION VARIABLES

The Pearson product-moment correlation was used to indicate the probabilities and significance levels of the relationships between each of the continuous variables measured by the SIT and each in turn

of the continuous variables measured by the SDRT reading comprehension subtest. As all variables were measured on the interval level and the relationship between the characteristics was assumed to be linear this was deemed to be a suitable method of analysis. These relationships are presented in Table V.

TABLE V
COEFFICIENTS OF CORRELATION BETWEEN THE SIT SCORES
AND READING COMPREHENSION SCORES

<u>SIT</u> scores	Literal Comprehension	Inferential Comprehension	Total Comprehension
Total <u>SIT</u>	.349**	.503**	.486**
Unambiguous sentences	.412**	.469**	.501**
Ambiguous sentences	.171	.380**	.317*
Surface Structure Ambiguities	.232	.405**	.365**
Underlying Structure Ambiguities	.056	.245	.174

** p < .01 when r > .325
* p < .05 when r > .250 for df = 59

This analysis revealed that all correlations were positive and that the majority reached significance at or above the .01 level. Total comprehension correlated significantly with all of the SIT scores with the exception of underlying structure ambiguities, and of the two aspects of total comprehension, inferential comprehension showed a greater number of significant relationships to the SIT scores than did literal comprehension. Indeed, inferential comprehension correlated significantly at the .01 level with all of the SIT scores, again with the exception of underlying structure ambiguities which only approached significance at the .05 level ($p = .059$), and the highest correlation coefficient found (.503) was that between inferential comprehension and the total SIT score. Literal comprehension showed a correlation significant at the .01 level with the total SIT score and with unambiguous sentences but not with the ambiguous sentences in total or in either of their types. The total SIT scores correlated significantly at the .01 level with all comprehension scores as did the scores on the unambiguous sentences. Of the scores on ambiguous sentences those on surface structure ambiguities showed a significant relationship to inferential comprehension and total comprehension, while those scores on underlying structure ambiguities did not correlate significantly with any measure of reading comprehension.

These results provide evidence that there is a significant, positive relationship between the ability to identify the meaning of unambiguous sentences and reading comprehension ability, both literal and inferential. That this should be so, and that the mean score on the twenty unambiguous sentences (11.97) was lower than expected,

stresses more emphatically the need for teaching upper elementary students the ways in which syntactic structures convey information.

The relationship between the ability to identify ambiguity and reading comprehension ability also shows a significant, positive relationship. If the assumption is true that this identification ability as measured by the SIT represents the child's understanding of syntactic structures then this finding lends support to the contention outlined in Chapter II that the understanding of syntactic structures is an important element in reading comprehension. The failure of underlying structure ambiguities to show a significant relationship with any reading comprehension score may be partly accounted for in that the mean score for this type of sentence was extremely low (2.37) and thus left room for little variation. Underlying structure ambiguities are not easily resolved by regrouping the words in the terminal string and thus contain more subtle meanings than do surface structure ambiguities. Likewise, inferential comprehension involves understanding of more subtle relationships than does literal comprehension, and thus it is noteworthy that the relationship between underlying structure ambiguities and inferential comprehension did approach significance at the .05 level ($p = 0.59$).

Overall, a larger number of significant relationships and higher correlation coefficients were found for inferential comprehension than for literal comprehension. It may be, therefore, that instruction in those aspects of language measured by the SIT will help to improve the inferential comprehension ability of grade five students.

IV. RELATIONSHIP BETWEEN THE SIT VARIABLES AND READING
COMPREHENSION VARIABLES WHEN I.Q. IS PARTIALLED OUT

Researchers in the area of language development and in the area of reading ability have suggested that a positive relationship exists for both of these factors with I.Q.. Thus it was considered important to assess the effect of I.Q. on the relationship between the SIT scores and reading comprehension scores. Correlation coefficients were used to examine the relationship between these variables when I.Q. was partialled out. Table VI gives these correlation coefficients and the probability of their occurrence by chance.

TABLE VI

COEFFICIENTS OF CORRELATION BETWEEN THE SIT SCORES AND READING
COMPREHENSION SCORES WHEN I.Q. IS PARTIALLED OUT

<u>SIT</u> scores	Literal Comprehension	Inferential Comprehension	Total Comprehension
Total <u>SIT</u>	.181	.384**	.336**
Unambiguous Sentences	.252*	.335**	.346**
Ambiguous Sentences	.049	.297*	.209
Surface Structure Ambiguities	.096	.307*	.242
Underlying Structure Ambiguities	-.013	.202	.115

** p < .01 when r > .325
* p < .05 when r > .250 for df = 59

This analysis revealed that correlations remained positive with the exception of that between underlying structure ambiguities and literal comprehension which was negative but which was so close to .0 (-.013) that for practical purposes may be considered as showing no relationship in either direction.

The effect of partialling out I.Q. was to reduce the correlation coefficient in all cases. Of the two aspects of comprehension measured, this was most noticeable for literal comprehension. The relationship between literal comprehension and the total SIT, which was previously significant at the .01 level, failed to reach significance, and that between literal comprehension and unambiguous sentences dropped from the .01 level to the .05 level of significance. For inferential comprehension, on the other hand, all previously significant relationships remained significant, although the level of significance for the relationships between inferential comprehension and both ambiguous sentences in total and surface structure ambiguities dropped from .01 to .05.

It is likely that the effect on literal comprehension of partialling out I.Q. played a large part in causing the correlation coefficients involving total comprehension to drop. This was most noticeable for the relationship of this variable with ambiguous sentences and with surface structure ambiguities, both of which failed to reach their previous levels of significance (i.e. .05 and .01 respectively).

Thus it seems that inferential comprehension ability may be more directly related to that aspect of linguistic competence measured

by the SIT than is literal comprehension ability. Also, in view of the fact that those relationships involving literal and total comprehension ability are more heavily dependent on I.Q., there is additional evidence on which to claim the need for more precise measurements of reading comprehension ability. This is especially important for diagnostic purposes as without the measurement of specific factors that are involved in reading comprehension ability, it will be impossible to judge the influence of other variables, such as I.Q., on the global scores made available by tests that claim to measure reading comprehension ability in total.

It is also apparent that I.Q. is an important factor in the ability measured by the SIT, as all correlation coefficients dropped. This was most apparent for the total SIT scores and for unambiguous sentences and surface structure ambiguities. Again, the value of isolating specific factors in a total test is apparent in order to determine the influence of other contributing variables.

V. DIFFERENCES BETWEEN HIGH AND LOW READERS ON THE SIT

The relationship between performance on the SIT and reading comprehension ability was further analysed by dividing the students tested into high and low readers on the basis of their scores on the SDRT Reading Comprehension subtest. The students were divided on the basis of the median score of total comprehension and a two-way analysis of variance, with sex as the second factor, was performed to determine any differences between high and low readers on each of five

variables measured by the SIT. Table VII presents a summary of this analysis but it must be kept in mind in interpreting this analysis that the readers were chosen from within an average range of ability and thus any differences between those classified as high or low readers are likely to be magnified with a more heterogeneous reading group.

TABLE VII
SUMMARY OF ANALYSIS OF VARIANCE BETWEEN HIGH
AND LOW READERS ON THE SIT

<u>SIT</u> scores	Sum of Squares	Mean Square	df	F
Total <u>SIT</u>	284.656	284.656	1	10.318**
Unambiguous Sentences	140.251	140.251	1	14.506**
Ambiguous Sentences	25.198	25.198	1	2.379
Surface Structure Ambiguities	16.267	16.267	1	4.538*
Underlying Structure Ambiguities	2.572	2.572	1	0.755

** p < .01 when F > 7.12
* p < .05 when F > 4.02 for 1 and 55 df

The analysis revealed a difference between high and low readers in the sample that reached significance at the .01 level for the total SIT and for unambiguous sentences. A difference significant at the .05 level was found for surface structure ambiguities but no significant difference was found for underlying structure ambiguities or for the ambiguous sentences in total.

Thus high and low readers do differ on linguistic competence as measured by the total SIT although this difference may largely be due to the difference on unambiguous sentences. That a significant difference was not found on the ambiguous sentences in total may be due to the very low means and thus lack of variation on underlying structure ambiguity, for a significant difference was found for surface structure ambiguities. The mean score for high readers on underlying structure ambiguities was 2.63 and for low readers was 2.15, suggesting a very slight difference in favour of high readers, but as mentioned previously, it seems likely that the ability to identify the meanings of this type of sentence demands a higher level of linguistic competence as measured by the SIT than grade five students have acquired.

Finally, it is noteworthy that no significant interaction effects were found between high/low readers and sex, suggesting that any differences found on the analysis were independent of the other dimension.

VI. RELATIONSHIP AMONG PERFORMANCE ON THE SIT, READING COMPREHENSION ACHIEVEMENT, AND RELATED VARIABLES

The contribution of the selected variables, I.Q., sex, and

chronological age, to the SIT scores and scores on the SDRT reading comprehension subtest are each discussed in this section.

1. I.Q. - A comparison of the correlation coefficients between the SIT scores and reading comprehension scores before and after I.Q. was partialled out led to the conclusion that I.Q. is an important factor in the abilities measured by these tests (Chapter IV, Section IV). The correlation coefficient of I.Q. with the reading comprehension scores is reported in Table VIII.

TABLE VIII
COEFFICIENTS OF CORRELATION BETWEEN I.Q. AND
READING COMPREHENSION SCORES

Contributing Variable	Literal Comprehension	Inferential Comprehension	Total Comprehension
I.Q.	.445**	.420**	.491**

** p < .01 when r > .325 for df = 59

This analysis gives added support to this finding in that I.Q. correlated at the .01 level of significance with the total comprehension score and with both of its facets independently.

The correlation of I.Q. with the scores on the SIT are reported in Table IX.

TABLE IX
COEFFICIENTS OF CORRELATION BETWEEN I.Q. AND
THE SIT SCORES

Contributing Variable	Total <u>SIT</u>	Unambiguous Sentences	Ambiguous Sentences	Surface Structure Ambiguities	Underlying Structure Ambiguities
I.Q.	.461**	.482**	.290*	.340**	.152

** p < .01 when r > .325
* p < .05 when r > .250 for df = 59

Table IX gives evidence of the high positive relationship between I.Q. and the total SIT scores, the scores for unambiguous sentences and the scores for surface structure ambiguities, all of which were significant at the .01 level. The relationship between I.Q. and the ambiguous sentences in total was also significant but at the .05 level. Only between I.Q. and underlying structure ambiguities was no significant relationship found at the desired level of confidence. As mentioned previously, this may be due in part to the comparatively low mean score and standard deviation found for this type of sentence in this sample. However, this analysis does suggest that the ability to identify the meanings of underlying structure ambiguities is less dependent on I.Q. than the ability to identify the meanings of other types of sentences in the SIT.

Thus there is further evidence to support the initial finding that I.Q. is an important contributing variable to the abilities measured by the SIT, although, as with relationships between any tests involving the ability to read printed language, part of the relationship between I.Q. and the SIT scores may be due to common factors of test format.

2. Sex - The second dimension of the two-way analysis of variance mentioned previously was a sex factor, and this was included to determine if there was a significant difference between boys and girls on their scores on the SIT. The mean scores and a summary of this analysis are presented in Table X.

TABLE X
MEANS AND SUMMARY OF ANALYSIS OF VARIANCE BETWEEN
BOYS AND GIRLS ON THE SIT

<u>SIT</u> scores	Means		Sums of Squares	Mean Squares	df	F
	Girls	Boys				
Total <u>SIT</u>	19.50	16.07	133.52	133.52	1	4.84*
Unambiguous sentences	12.93	11.00	39.72	39.72	1	4.11*
Ambiguous sentences	6.60	5.10	27.59	27.59	1	2.60
Surface Structure Ambiguities	4.07	2.90	14.50	14.50	1	4.06*
Underlying Structure Ambiguities	2.53	2.20	2.09	2.09	1	0.61

* $p < .05$ when $F > 4.02$ for 1 and 55 df.

On all aspects of the SIT the mean score for the girls was higher than that for the boys and a difference significant at the .05 level between these means was found on the total SIT, on unambiguous sentences, and on surface structure ambiguities. Hopkins (1970), in a review of studies that considered sex differences in language and reading ability, noted that these studies showed that girls tend to perform better on tests of both of these abilities. The data analysed in this study would tend to support this conclusion. Furthermore, as mentioned in connection with the analysis of the difference between high and low readers, no significant interaction effects were found between high/low readers and sex. This would suggest that the

difference found between boys and girls is a true difference, independent of the other dimension.

Further aspects of this difference were presented by a comparison of the correlation coefficients for boys and girls between the SIT scores and reading comprehension scores. This information is presented in Table XI.

TABLE XI
COMPARISON OF COEFFICIENTS OF CORRELATION BETWEEN THE SIT
SCORES AND READING COMPREHENSION SCORES FOR BOYS
AND GIRLS

<u>SIT</u> scores	Literal Comprehension		Inferential Comprehension		Total Comprehension	
	Girls	Boys	Girls	Boys	Girls	Boys
Total <u>SIT</u>	.412*	.280	.589**	.462**	.561**	.431*
Unambiguous Sentences	.449**	.374*	.595**	.374*	.585**	.432*
Ambiguous Sentences	.217	.100	.366*	.423*	.328	.307
Surface Structure Ambiguities	.117	.343	.374*	.482**	.278	.478**
Underlying Structure Ambiguities	.291	-.175	.285	.210	.321	.027

** p < .01 when r > .449

* p < .05 when r > .349 for df = 29

The comparison reveals a higher positive relationship between the total SIT scores and all measures of reading comprehension for girls than for boys. The same is true of unambiguous sentences and reading comprehension in that the relationship between these scores reached significance at the .01 level for girls but only at the .05 level for boys. Conversely, the relationship between surface structure ambiguities and scores of inferential comprehension and total comprehension reached significance at the .01 level for boys, whereas for girls the only significance level reached concerning surface structure ambiguities was at the .05 level with inferential comprehension. Underlying structure ambiguities showed a higher relationship with reading comprehension measures for girls than for boys but in all cases these relationships failed to reach significance at the .05 level.

Thus with the exception of scores on surface structure ambiguities, the relationship between the SIT scores and reading comprehension scores was consistently higher for girls than for boys, providing further evidence of a sex difference on the abilities measured.

3. Chronological Age - Although only students who were placed in grade five at the time of testing were selected for the sample, it was found that the chronological ages of these students ranged over approximately two years, from 122 to 145 months. The correlation coefficients of chronological age with scores on the SIT are presented in Table XII.

TABLE XII
 COEFFICIENTS OF CORRELATION BETWEEN CHRONOLOGICAL
 AGE AND THE SIT SCORES

Contributing Variable	Total <u>SIT</u>	Unambiguous Sentences	Ambiguous Sentences	Surface Structure Ambiguities	Underlying Structure Ambiguities
Chronological Age	-.128	-.07	-.225	-.138	.025

p < .05 when r > .250 for df = 59

All correlations with the exception of chronological age and underlying structure ambiguities were negative and did not reach statistical significance. The same negative and non-significant correlations were also found between chronological age and reading comprehension scores (Table XIII). The lack of significance may well be due to the fact that only grade five students were tested but the negative relationship is difficult to explain. This is especially true in light of the fact that girls scored consistently higher than boys and the mean age of the girls (131.3 months) was higher than that of the boys (130.3 months), although the difference between the two is minimal. It would appear, however, that chronological age is not an important contributing variable in the abilities measured by these tests for this particular sample.

TABLE XIII
COEFFICIENTS OF CORRELATION BETWEEN CHRONOLOGICAL AGE
AND READING COMPREHENSION SCORES

Contributing Variable	Literal Comprehension	Inferential Comprehension	Total Comprehension
Chronological Age	-.051	-.110	-.093
$p < .05$ when $r > .250$ for $df = 59$			

VII. DIFFERENCES AMONG THE SCORES ON SENTENCES WITH
SURFACE STRUCTURE AMBIGUITY, SENTENCES WITH
UNDERLYING STRUCTURE AMBIGUITY, AND
UNAMBIGUOUS SENTENCES

Research has indicated a difference between an individual's understanding of structurally ambiguous and unambiguous sentences. Moreover, two main types of structurally ambiguous sentences have been identified, corresponding to those classified by Mackay and Bever (1967) as containing surface structure ambiguity and those containing underlying structure ambiguity. Thus a one-way analysis of variance was performed to determine if there were significant differences in scores on those lead sentences in the SIT that contained surface structure ambiguity (i.e. Types 1 and 5, Figure 3), those that contained underlying structure ambiguity (i.e. Types 2 and 6, Figure 3), and those that were unambiguous (i.e. Types 3, 4, 7 and 8, Figure 3). For this purpose, each individual's score on these three groups of sentences was entered

as a percentage to balance the effect of having more sentences, and thus the likelihood of a higher total score, of the unambiguous Types.

A summary of this analysis is presented in Table XIV.

TABLE XIV
SUMMARY OF ANALYSIS OF VARIANCE ON SIT SCORES FOR
SENTENCES WITH SURFACE STRUCTURE AMBIGUITY,
SENTENCES WITH UNDERLYING STRUCTURE
AMBIGUITY AND UNAMBIGUOUS SENTENCES

Test	<u>Sums of Squares</u>		<u>Mean Squares</u>		<u>df</u>		F
	Between	Within	Between	Within	Between	Within	
<u>SIT</u>	402.923	649.641	6.829	5.414	59	120	99.135**

** p < .01 when F > 4.75

The fact that the analysis revealed a difference at the .01 level of significance prompted a further analysis to determine where this difference lay. The mean percentage of correct responses for each of the three groups of sentences in the SIT (Table XV) were compared by a Scheffé multiple comparison test. (Table XVI)

TABLE XV

MEAN PERCENTAGE OF CORRECT RESPONSES FOR SENTENCES WITH SURFACE STRUCTURE AMBIGUITY, SENTENCES WITH UNDERLYING STRUCTURE AMBIGUITY, AND UNAMBIGUOUS SENTENCES

	Surface Structure Ambiguity	Underlying Structure Ambiguity	Unambiguous
Mean Percentage Correct	35.00	23.33	59.43

TABLE XVI

SCHEFFE MULTIPLE COMPARISON OF MEANS FOR SENTENCES WITH SURFACE
STRUCTURE AMBIGUITY, SENTENCES WITH UNDERLYING STRUCTURE
AMBIGUITY AND UNAMBIGUOUS SENTENCES

	Surface Structure Ambiguity 1.	Underlying Structure Ambiguity 2.	Unambiguous 3.
1.	--	.01	.01
2.		--	.01
3.			--

As suggested in Section I of this chapter and as is apparent from Table XV, lead sentences that were unambiguous were responded to correctly more often than sentences with structural ambiguity. Of these structurally ambiguous sentences those with surface structure ambiguity were responded to correctly more often than sentences with underlying structure ambiguity.

The fact that the differences on the scores for these three types of sentences were all significant at the .01 level (Table XVI) indicates that the abilities measured by these sentences also differ. To record a correct response to those items on the SIT containing unambiguous lead sentences seems to require a different skill, or perhaps a different level of the same skill, than for those items with surface structure ambiguity or for those with underlying structure

ambiguity. Indeed, the same seems to be true of the difference between scores on those items containing surface structure ambiguity and those containing underlying structure ambiguity. If different abilities, or different levels of the same ability, are required, then this may account in part for the differences in the relationships between scores on the SIT and scores on the reading comprehension test.

VIII. DIFFERENCES AMONG SCORES ON SENTENCE TYPES ONE, TWO, THREE AND FOUR

Since it was considered that the syntactic structure of the sentences rather than the presence or absence of structural ambiguity might result in differences in the identification ability measured, this factor was, therefore, controlled for.

Twenty of the lead sentences on the SIT were constructed to contain two structures each, one of which was characteristic of surface structure ambiguity and the other of which was characteristic of underlying structure ambiguity. These sentences each fell into one of four Types shown in Figure 3 as Types 1, 2, 3, or 4. Type 1 sentences contained a surface structure ambiguity, Type 2 sentences contained an underlying structure ambiguity, and Type 3 and Type 4 sentences paralleled Type 1 and Type 2 sentences respectively in terms of syntactic complexity with the exception that both Types were unambiguous.

A one-way analysis of variance test was performed to determine whether a significant difference existed among these Types and a

summary of this analysis is given in Table XVII.

TABLE XVII
SUMMARY OF ANALYSIS OF VARIANCE AMONG SENTENCE
TYPES 1, 2, 3 AND 4

<u>SIT</u>	<u>Sums of Squares</u>		<u>Mean Squares</u>		<u>df</u>		F
	Between	Within	Between	Within	Between	Within	
Types 1, 2, 3, 4	123.73	251.00	2.10	1.39	59	180	35.87**

** p < .01 when F > 3.88

As this analysis showed there is to be a difference significant at the .01 level, among sentence Types 1, 2, 3 and 4, the mean scores for each of these sentence Types (Table XVIII) were compared by the Scheffé test to determine where this difference lay (Table XIX).

TABLE XVIII
MEANS FOR SENTENCE TYPES 1, 2, 3 and 4

	Type 1	Type 2	Type 3	Type 4
Mean Score	1.83	1.38	2.83	2.82

TABLE XIX
SCHEFFE MULTIPLE COMPARISON OF MEANS FOR SENTENCE
TYPES 1, 2, 3 AND 4

	Type 1	Type 2	Type 3	Type 4
Type 1	--	ns	.01	.01
Type 2		--	.01	.01
Type 3			--	ns
Type 4				--

Table XIX shows that sentences with surface structure ambiguity (Type 1) obtained significantly different scores than their unambiguous counterparts (Type 3). In the construction of both Types the syntactic structures used were identical and the major difference between the two Types was that one was ambiguous whereas the other was unambiguous. The same is true of those sentences with underlying structure ambiguity (Type 2) and their unambiguous counterparts (Type 4).

Thus, on the basis of these data, it appears that the syntactic structures used in the construction of these sentences did not cause the differences among the scores on the sentence Types but rather that the presence or absence of structural ambiguity was the deciding factor. This is in accord with the finding of Mackay (1966) that structural complexity is not an important factor in the perception of ambiguity.

No significant difference was found between the scores on sentences with surface structure ambiguity (Type 1) and those with underlying structure ambiguity (Type 2). It is difficult to draw any conclusion from this finding because of the extremely low mean scores on both Types (1.83 and 1.38 respectively) and because only five sentences of each Type were included in the SIT. The analysis of variance between all ten sentences with surface structure ambiguity (Types 1 and 5) and all ten with underlying structure ambiguity (Types 2 and 6) did in fact show a difference significant at the .01 level (Table XVI). Thus these data offer no conclusive evidence to determine the importance of syntactic structure in effecting a difference on the scores on identification of surface structure

ambiguities and underlying structure ambiguities.

IX. SUMMARY OF FINDINGS

The findings resulting from the interpretation of the test data are summarized as follows:

1. Scores on the SIT would indicate that grade five students have not attained a mature level of ability in classifying paraphrases of ambiguous and unambiguous sentences.
2. Sentences that were unambiguous were answered correctly more often than sentences with structural ambiguity, and sentences with surface structure ambiguity were answered correctly more often than those with underlying structure ambiguity.
3. A significant, positive relationship exists between the ability to identify the meaning(s) of both ambiguous and unambiguous sentences and reading comprehension ability. This relationship is more consistently significant when scores on inferential reading comprehension only are involved.
4. The effect of partialling out I.Q. was to reduce the correlation coefficient in all cases, suggesting that I.Q. is an important factor in those abilities tested. This was most apparent for those relationships involving literal comprehension.
5. High and low readers in the sample differed significantly on their scores on the total SIT.
6. I.Q. correlated significantly with reading comprehension scores and with the SIT scores.

7. Girls scored consistently higher than boys on all aspects of the SIT and the correlation coefficient between these scores and reading comprehension scores was also consistently higher for girls with the exception of these correlations involving surface structure ambiguity.
8. Chronological age did not correlate significantly with the SIT scores or with the reading comprehension scores.
9. Significant differences were found among the scores on those sentences that were unambiguous, those with surface structure ambiguity, and those with underlying structure ambiguity.
10. The syntactic structure of the lead sentences did not appear to be a factor in scores on the SIT, but rather the presence or absence of structural ambiguity seemed to cause differences among these scores.

CHAPTER V

ANALYSIS AND INTERPRETATION OF INTERVIEW DATA

An oft repeated criticism of research in education is that tests constructed by the researchers are little used outside of the immediate research situation. The SIT was constructed out of a proposal by the investigator that structurally ambiguous sentences could be used to measure a student's understanding of the syntactic structures of written language that convey information. If the SIT is to be useful beyond the present situation then certain questions must be asked of the concept that underlies it and of the test itself that purports to embody that concept. For this purpose an interview was conducted with certain students in the sample who were selected to represent extremes of performance on the reading comprehension test and the SIT. The structuring of this interview and the selection of the students are described in Chapter III and a summary of the data applicable to each student is contained in Table XX.

The questions to which this interview was intended to suggest answers are as follows:

1. Does a repeat attempt at answering certain items on the SIT which were previously answered incorrectly result in different responses to these items?
2. Are students able to recognize structural ambiguity?
3. Do the explanations given by students in the test of recognition of ambiguity differ among students?

TABLE XX
SUMMARY OF DATA ON STUDENTS SELECTED FOR INTERVIEW

Student	Sex	Age (Months)	I.Q.	<u>Comprehension</u>		<u>SIT</u>	
				Total Score	Rating	Total Score	Rating
A	Girl	126	120	42	High	32	High
B	Boy	127	118	45	High	29	High
C	Girl	130	121	43	High	15	Low
D	Boy	123	104	42	High	10	Low
E	Girl	128	100	20	Low	9	Low
F	Boy	128	97	20	Low	12	Low
G	Girl	133	101	27	Low	21	High
H	Girl*	129	97	27	Low	22	High

* No boy was found who met the criteria in this case for inclusion in the interview sample.

4. What effect does written language context have on the student's understanding of certain structurally ambiguous sentences?
 5. Do students' observations on the SIT affect the claims made for the face validity of this test?
 6. What factors may affect the administrative procedures for the SIT?
-
1. Does a repeat attempt at answering certain items on the SIT which were previously answered incorrectly result in different responses to these items?

Six items (two with surface structure ambiguity, two with underlying structure ambiguity, and two that were unambiguous) which had been originally answered incorrectly by each individual selected for interview were chosen from the SIT. Only items in which one of the interpretative sentences had been classified wrongly were selected as this would seem to indicate that at least one of the meanings of the ambiguous sentence had been previously identified. These items were retyped and presented to the student for completion with the original test instructions given. The results of this partial retest are presented in Table XXI.

TABLE XXI

NATURE OF THE RESPONSES OF ALL SUBJECTS INTERVIEWED
ON A RETEST OF SIX SIT ITEMS

Nature of Structural Ambiguity	Same Incorrect Response	Different Incorrect Response	Correct Response	Total
Surface Structure	9	1	6	16
Underlying Structure	9	2	5	16
Unambiguous	0	3	13	16
Total	18	6	24	48

These results showed that half of the total forty-eight items which were previously answered incorrectly by the students were answered correctly on the retest. Thirteen of these twenty-four correct responses were on sentences that were unambiguous, six were on sentences with surface structure ambiguity, and five on sentences with underlying structure ambiguity. Based on observation of each individual's attempts at these items and on comments by the students interviewed, it is suggested by the investigator that the reason for this lies mainly in two factors. Firstly, individual administration of the test allowed for the establishment of rapport with the students, and secondly, this individual contact offered the chance to explain the test examples in detail to any who were not fully aware of the two meanings of the ambiguous sentences in the examples.

Eighty-one per cent of the responses to the unambiguous sentences were correct on the retest, offering further evidence that this type of test item contains less difficulty for the students than the type containing structural ambiguity. Those items with structural ambiguity drew forth the same incorrect response in fifty-six per cent of the instances, a different incorrect response in only nine per cent of the instances, and a correct response in the remaining thirty-five per cent. The increase from the original testing in the number of correct responses may well be due to the factors noted above. However, the large percentage of same incorrect responses on ambiguous sentences would suggest that these sentences have a preferred meaning for most students. This meaning is not the same for all students as different interpretative sentences were chosen by different students as giving a meaning of the lead sentence. However, it is suggested by the investigator that the strength of this preferred meaning prohibits some students from identifying the other meaning of the sentence despite the aid of the interpretative sentences. This may well be characteristic of students at the grade five level and may account in part for the comparatively low scores obtained on the ambiguous items in the SIT. Perhaps the ability to identify ambiguity is similar to the ability to perceive ambiguity as defined by Jurgens (1971) in that it "may develop rather dramatically during the junior high school years (p. 3)."

Finally, although there were six correct responses to sentences containing surface structure ambiguity and five to those containing underlying structure ambiguity, there is insufficient evidence from this retest to make further claims about a difference in

responses between these two types of sentences.

2. Are students able to recognize structural ambiguity?

Recognition of ambiguity is defined for this study as the ability to orally describe the two meanings of a structurally ambiguous sentence. In the SIT students were required to identify the meanings of sentences by classifying the interpretative sentences as giving a meaning of the lead sentence or as not giving a meaning. In the normal reading situation interpretative sentences are not available to assist the reader with ambiguous sentences and thus, in consideration of this fact, the students selected for interview were tested on their ability to recognize ambiguity in written sentences of English. The construction of this test is described in Chapter III, Section III and basically it consisted of twenty sentences (five with surface structure ambiguity, five with underlying structure ambiguity, and ten that were unambiguous) which the student read individually and then explained to the investigator.

The results of this test are presented in Table XXII for the ambiguous sentences only, as the unambiguous sentences were included in the test mainly as distractors to avoid the fact that every sentence would have two meanings.

TABLE XXII

INDIVIDUAL SCORES ON AMBIGUOUS SENTENCES IN THE TEST
OF RECOGNITION OF AMBIGUITY

Student	Surface Structure Ambiguities		Underlying Structure Ambiguities	
	Possible Score	Actual Score	Possible Score	Actual Score
A	5	0	5	2
B	5	2	5	3
C	5	2	5	1
D	5	0	5	0
E	5	1	5	1
F	5	0	5	0
G	5	0	5	1
H	5	0	5	0
Total	40	5	40	8

These data suggest that the students interviewed were rarely able to recognize the ambiguity in structurally ambiguous sentences. One subject only (B) managed to average fifty per cent correct responses, although those students who were rated as High on the reading comprehension test (A, B, C, D) obtained more correct responses (10) than did those students (E, F, G, H) rated as Low (3). It is suggested, therefore, that the ability to recognize structural ambiguity in sentences has not generally been acquired by these grade five students. However, there is some evidence to suggest that a

positive relationship exists between this ability and reading comprehension ability, and may well warrant the classroom teacher discussing and explaining occurrences of structural ambiguity in the reading material of his students.

3. Do the explanations given by students in the test of recognition of ambiguity differ among students?

In the test of recognition of ambiguity the students were asked to explain the meaning or meanings of the sentences presented to them in the hope that their comments would shed some light on their understanding of these sentences. These sentences are contained in Appendix C. Although the investigator made every effort to be as objective as possible, conclusions drawn must of necessity be subjective.

Of interest was the observation that those students who scored highly on the SIT (A, B, G, H) differed from those who had a low score (C, D, E, F) in explaining the meanings of the structurally ambiguous sentences in the test of recognition of ambiguity. All four of the latter either attempted to provide a contextual situation to explain a meaning or else said nothing apart from statements such as "It's got one meaning," or "Well, it just means what it says" and repeated the sentence. The four high scorers on the SIT, however, all attempted to manipulate the grouping of the words in the sentence, to invert the order, or to explain a meaning by means of a paraphrase of the sentence, which in itself seems to suggest a comparatively well developed ability to understand the syntactic structures of sentences.

This difference is all the more remarkable in that the scores between these two groups on recognition of ambiguity differed only slightly in favour of those who scored highly on the SIT. It would thus seem that the SIT is a better indicator of a student's understanding of syntactic structures than is the test of recognition used in the interview.

If this is the case, and if the understanding of syntactic structures is an important aspect of reading comprehension ability, then the question is raised of why two of the students who were rated as high scorers on the SIT were rated low on the SDRT reading comprehension subtest. This question provoked further analysis of the data on these two students. It was then found that on the Gates-McGinitie Reading Test, the scores on which were used as a criterion in selecting the sample, these two students had performed far better than on the SDRT. One student (G) had been rated at the grade 6.5 level, and the other (H) had been rated at the grade 6.9 level, whereas the local mean grade level for this test was 5.8.

There is no apparent reason why such a discrepancy on these test scores should have occurred, but it was suggested by the teachers of these two students that the Gates-McGinitie Reading Test score better reflects the performance of both students in the classroom than does the SDRT score. Thus the SDRT reading comprehension subtest score may well have underestimated the ability of these two students and this finding may partially explain why they were better able to verbalize their responses to the test of recognition of ambiguity.

Of further interest are the semantic considerations offered by

some students as reasons for certain sentences having particular meanings. For example, one student (A), having noted the structural ambiguity in the sentence Peter's mother looked at the girl with the telescope, then discounted the interpretation that the mother looked through the telescope at the girl as improbable because "a telescope is to look at the universe with." Another student (H) commented that "old" could possibly modify "men" only and not "women" in the sentence Old men and women like to go visiting but that this was unlikely because "it's only old people who like to go visiting" and thus "old" must also modify "women".

Only a few such semantic considerations were noted by the investigator and this is not surprising in light of the fact that the student had first to recognize the ambiguity and then be reasonably loquacious in explaining the meanings. It may be that other instances occurred in which the ambiguity was recognized but one meaning was then rejected as being semantically improbable. This would only become apparent if the student happened to explain its occurrence. This has implications for the SIT which will be discussed in answer to Question 6 of this chapter.

4. What effect does written language context have on the student's understanding of certain structurally ambiguous sentences?

Structurally ambiguous sentences were used in this study as a possible means of measuring the child's ability to understand the syntactic structures of written language. No claim is made that this represents the normal reading situation in total and nor was this

intended for, although Huey (1908) states that "language begins with the sentence and this is the unit of language everywhere (p. 123)", rarely is the child required to comprehend a sentence that is completely without context. However, it has been noticed by the investigator in a search for structurally ambiguous sentences that sentences of this type do in fact occur in basal readers, subject-matter textbooks, and children's literature, as well as in newspapers and as the basis for many jokes. Thus an attempt was made to assess the effect of context on the students' reading comprehension of two structurally ambiguous sentences. For this purpose the lead sentence with surface structure ambiguity and that with underlying structure ambiguity that obtained the highest item difficulty rating in the SIT were set into four paragraphs such that the context led to one interpretation of each sentence being preferred in each paragraph. The same interpretative sentences as used for those items on the SIT were used to question the students' understanding of the ambiguous sentences in context.

No obvious pattern emerged from the responses to these sentences in context, although it is interesting to note that all but two of the students (F, G) showed some misunderstanding of the meaning of the ambiguous sentence in at least one paragraph. This resulted in seven instances of the student assigning a wrong meaning to the sentence and five instances of the student maintaining that the sentence could have two meanings despite the semantic constraints of the context. Although any conclusions drawn are severely limited by the fact that only two sentences were used in context, that only eight students were tested, and that these students had been previously exposed to the concept of

structural ambiguity in sentences, it would appear that Menyuk (1971) is correct in her claim that context alone will not disambiguate an ambiguous sentence. This may be especially true of grade five students who are still in the acquisition stage of reading ability and may not be fully aware of contextual constraints to meaning.

5. Do students' observations on the SIT affect the claims made for the face validity of this test?

Following the retest of the eight students on six items from the SIT, the students were encouraged to comment on their responses to these items and on the test in general. None of the students reported any difficulties with the vocabulary used in the test or in understanding at least one meaning of all sentences used. When both meanings of an ambiguous lead sentence were not identified by a student in the retest, these meanings were then explained. All students agreed that these meanings were acceptable as interpretations of the lead sentence with the exception of one lead sentence. This sentence, He went to fetch the red crayon box, could only mean "It was the red box for crayons that he went to fetch" to one student (B), as he claimed that for "red" to modify "crayon", a comma was needed after "crayon". One instance of lexical ambiguity was also noted by one student (C) in one of the interpretative sentences. "For" in the phrase "a small engine for a boat" was interpreted by this student as "in exchange for" rather than as the intended meaning of "suited for".

With these possible exceptions, the students' comments seem to raise no problems in maintaining the claims made for the face validity

of the SIT in Chapter III, Section III.

6. What factors may affect the administrative procedures for the SIT?

The directions to the student and the mode of administration of any test should facilitate the optimum possible performance of the student. Clarity and explicitness, therefore, should characterize the administration of the test, and this can only be obtained by a process of trial and error with the students for whom the test is intended. One of the purposes of the interview with certain students in the sample was to discover any factors that might have implications for the administration of the SIT. The factors that became apparent are discussed in this section.

Firstly, the large increase in the number of correct responses reported previously for the retest on selected SIT items seems to suggest that individual administration of the SIT is preferable to group testing. Indeed, many of the students interviewed commented that they probably answered the SIT items with more accuracy on the retest because they were able to concentrate more when working by themselves than when working in company with the rest of the class. There are many other factors that may have accounted for the increase in correct responses but, as mentioned previously, individual testing allows for the establishment of rapport with the student and facilitates clarification of the test instructions in general and the examples in particular. In retrospect it is felt by the investigator that the examples given in the instructions need to be more carefully explained to the students. This became apparent in administering the retest on the selected SIT

items. Also, the fact that a sentence can have two meanings is probably a new concept to many grade five students and every effort needs to be made to ensure that this concept is understood and accepted by the students, especially in a group testing situation.

A further consideration is that, as mentioned in answer to Question 3 of this chapter, semantic considerations may force certain students to reject one of the meanings of an ambiguous sentence despite the fact that both meanings have been identified. To avoid this situation affecting the scores on the SIT it would seem desirable to include an instruction to the effect that, no matter how semantically bizarre a particular interpretation seems, if an interpretative sentence conveys this meaning, then it should be classified as giving a meaning of the lead sentence. One of the examples could be used to illustrate this situation.

In general, the directions to the student in the SIT seemed to cause no problems of interpretation. There were no requests for a reexplanation of these directions when the SIT was originally administered and none of the students interviewed seemed at all uncertain of the procedure to follow in responding to the SIT items.

Summary

The data from this interview suggest that grade five students are only able to recognize ambiguity with very limited success. High readers, however, tend to do better on recognition of ambiguity, as they did on identification of ambiguity (SIT). From the oral explanations given by the students of the meanings of the sentences, it

seems that high scorers on the SIT are better able to understand the ways in which syntactic structures convey information. Claims for the face validity of the SIT are upheld, with the possible exception of the directions for the student, and it is claimed that individual administration of this test is preferable to group administration.

CHAPTER VI

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

A summary of the purpose and design of the study will be presented in this chapter together with a summary of the findings and conclusions. Educational implications and suggestions for further research will also be presented.

I. SUMMARY

In view of the importance of the ability to understand the ways in which the syntactic structures of written language convey information, the investigator attempted in this study to find a basis upon which to measure this ability. It was suggested that the structurally ambiguous sentence might constitute a suitable vehicle for this measure and thus the purpose of the study was to determine the relationship that was believed to exist between the ability to identify ambiguity and reading comprehension ability.

To achieve this purpose the Sentence Interpretation Test (SIT) was constructed by the investigator to measure the student's ability to identify the meanings of ambiguous and unambiguous sentences by means of paraphrases of the meanings of those sentences. Reading comprehension ability, both literal and inferential, was assessed by means of the Stanford Diagnostic Reading Test, Level II, Reading Comprehension subtest.

A sample of sixty grade five students who were all native speakers of English, of average reading ability, and of average or above

I.Q. were tested in May, 1972. All testing and scoring was conducted by the investigator. A structured interview was then conducted with eight students who were selected from the sample to represent extremes of performance on the tests administered. This interview was designed to provide further information on the feasibility of using structurally ambiguous sentences as the basis for measuring the linguistic competence of children as it relates to their reading comprehension of syntactic structures.

Pearson product-moment correlations were used to determine the relationships between the scores on the tests and the relationships between the ability to identify ambiguity and the selected contributing variables of I.Q., and chronological age. Analysis of variance was used to determine the differences between boys and girls and high and low readers on the ability to identify ambiguity, and to determine the differences between certain types of structurally ambiguous and unambiguous sentences.

II. FINDINGS AND CONCLUSIONS ON TEST DATA

The null hypotheses stated in Chapter I are restated below and data for and against the statement of each hypothesis is explained.

Null Hypotheses

Null Hypothesis I

There is no significant relationship between scores on a test of reading comprehension (Stanford Diagnostic Reading Test, Level II,

Reading Comprehension subtest) and scores on a test of identification of ambiguity (Sentence Interpretation Test).

The SDRT provided a score for literal and a score for inferential reading comprehension ability, and the SIT provided scores on unambiguous sentences, sentences with surface structure ambiguity, and sentences with underlying structure ambiguity. Analysis of the data revealed that a significant relationship existed between all of these variables with the exception of those involving underlying structure ambiguity, and those between literal comprehension and both surface structure ambiguities and ambiguous sentences in total. It was suggested that no significant relationships were found involving underlying structure ambiguities as the mean scores on these sentences were so low and thus left room for little variation. It was also found that a larger number of significant relationships and higher correlation coefficients occurred for inferential comprehension and thus it was suggested that the abilities measured by the SIT may be more related to inferential comprehension.

Thus this hypothesis is rejected for all measures of comprehension in so far as they are related to the total SIT and to the identification of unambiguous sentences. It is also rejected for the relationships involving inferential and total reading comprehension ability and the identification of surface structure ambiguities and total ambiguous sentences. A significant relationship does in fact exist between these variables.

The hypothesis is not rejected for the relationship between

literal comprehension ability and the ability to identify surface structure ambiguities and total ambiguous sentences nor is it rejected for the relationship between any measure of comprehension and the identification of underlying structure ambiguity.

Null Hypothesis II

There is no significant relationship between scores on a test of reading comprehension (Stanford Diagnostic Reading Test, Level II, Reading Comprehension subtest) and scores on a test of identification of ambiguity (Sentence Interpretation Test) when I.Q. is partialled out.

The correlation coefficients between the variables measured by both tests were reduced in all cases when I.Q. was partialled out. However, those relationships involving inferential comprehension that were previously significant all remained so. Literal comprehension remained significantly related to unambiguous sentences and total comprehension remained significantly related to unambiguous sentences and to the total SIT. All other relationships were not significant.

Therefore, this hypothesis is rejected for the relationship between total comprehension and both the total SIT and identification of unambiguous sentences. It is rejected for the relationship between inferential comprehension and all measures provided by the SIT with the exception of identification of underlying structure ambiguities and it is also rejected for the relationship between literal comprehension and identification of unambiguous sentences. A significant relationship does exist between these variables when I.Q. is partialled

out.

The hypothesis is not rejected for the relationships between all measures of comprehension and identification of underlying structure ambiguities. It is not rejected for the relationships between literal comprehension and the total SIT, identification of surface structure ambiguities and identification of ambiguous sentences in total, nor is it rejected for the relationships between total comprehension and both surface structure ambiguities and ambiguous sentences in total.

Null Hypothesis III

There is no significant difference between high and low readers on their scores on the Sentence Interpretation Test.

A two-way analysis of variance was used to determine whether a significant difference existed between high and low readers on the variables measured by the SIT, the second dimension of this analysis being a sex factor. Significant differences were found on the total SIT, on unambiguous sentences and on surface structure ambiguities. As no significant interaction effects were found it was suggested that these differences were independent of the second dimension. Moreover, as the high and low readers were selected from within a sample of students of average reading ability, it was suggested that these differences might be more pronounced in a more heterogeneous group. No significant differences were found on underlying structure ambiguities or on ambiguous sentences in total.

This hypothesis is, therefore, rejected for scores on unambiguous sentences, surface structure ambiguities, and the total SIT.

A significant difference does exist between high and low readers on these variables.

The hypothesis is not rejected for scores on underlying structure ambiguities and ambiguous sentences in total.

Null Hypothesis IV

There is no significant relationship between the scores on the Sentence Interpretation Test and

(a) I.Q.

(b) Chronological Age

A correlation of I.Q. with the scores on each of the variables measured by the SIT showed that significant positive relationships existed with all but scores on underlying structure ambiguity.

Thus, Hypothesis IV(a) is rejected for the relationship between I.Q. and unambiguous sentences, total ambiguous sentences, surface structure ambiguities, and the total SIT. The relationship between I.Q. and each of these variables is significant. Hypothesis IV(a) is not rejected for the relationship between I.Q. and underlying structure ambiguities.

A correlation of chronological age with the scores on each of the variables measured by the SIT showed a negative relationship in all instances except in that with underlying structure ambiguities which was positive. No apparent reason existed for the negative relationships. None of the relationships were statistically significant ($p > .05$) and it was suggested that this was largely due to the fact that only students at one grade level were tested.

Thus, Hypothesis IV(b) is not rejected.

Null Hypothesis V

There is no significance difference between boys and girls on their scores on the Sentence Interpretation Test.

The second dimension of the two-way analysis of variance mentioned in connection with Hypothesis III was a sex factor included to determine if any significant differences existed between boys and girls on those variables measured by the SIT. This analysis revealed significant differences on the total SIT, on unambiguous sentences, and on surface structure ambiguities. No significant differences were found on underlying structure ambiguities and total ambiguous sentences.

Thus this hypothesis is rejected for the difference between boys and girls on scores on the total SIT, unambiguous sentences and surface structure ambiguities, but is not rejected for the difference on scores on underlying structure ambiguities and total ambiguous sentences.

Further light was shed on these differences by a comparison of the correlation coefficients for boys between the SIT scores and reading comprehension scores with those for girls. This comparison revealed that with the exception of scores on surface structure ambiguity, the relationships were consistently higher for girls than for boys.

Null Hypothesis VI

There is no significant difference among scores on unambiguous sentences, sentences with surface structure ambiguity,

and sentences with underlying structure ambiguity.

A one-way analysis of variance was performed to determine whether significant differences existed among these three groups of sentences. This analysis showed a significant difference and thus a Scheffé multiple comparison of means was conducted to determine where this difference lay. Significant differences were found among all three groups of sentences with scores on unambiguous sentences being higher than scores on structurally ambiguous sentences and scores on sentences with surface structure ambiguity being higher than scores on sentences with underlying structure ambiguity. Further evidence of the difficulty of structurally ambiguous sentences when compared to unambiguous sentences was presented by an analysis of variance on the scores on those sentences that contained identical syntactic structures. This analysis revealed significant differences between surface structure ambiguities and their unambiguous syntactic counterparts and between underlying structure ambiguities and their unambiguous syntactic counterparts.

Hypothesis VI is, therefore, rejected, as significant differences do exist among the scores on unambiguous sentences, sentences with surface structure ambiguity and sentences with underlying structure ambiguity.

Summary and Conclusions

All hypotheses were rejected wholly or in part with the exception of Hypothesis IV(b). This hypothesis which stated that there was no relationship between chronological age and scores on the SIT

could not be rejected on the basis of the findings of this study.

Reading comprehension ability was significantly related to the ability to identify ambiguity although the most consistent relationship existed between inferential reading comprehension ability and the ability to identify surface structure ambiguity. No significant relationships were found involving underlying structure ambiguity, possibly because the mean scores on these sentences were so low.

Significant differences were found between high and low readers within the sample and between boys and girls on the SIT scores, with girls scoring consistently higher. I.Q. appeared to be an important factor in the ability to identify ambiguity.

Finally, unambiguous sentences were found to be easier than structurally ambiguous sentences, and sentences with surface structure ambiguity were easier than sentences with underlying structure ambiguity.

III. FINDINGS AND CONCLUSIONS ON INTERVIEW DATA

An interview was conducted with certain students in the sample in order to suggest answers to certain questions involving students' understanding of structurally ambiguous sentences and the validity of the SIT. These questions are restated below and the main findings for each question are summarized.

1. Does a repeat attempt at answering certain items on the SIT which were previously answered incorrectly result in different responses

to these items?

Half of the items presented were answered correctly on the retest and it was suggested that this resulted largely from individual administration of the test. A larger number of correct responses to unambiguous sentences than to ambiguous sentences provided further evidence of the comparative ease of identifying unambiguous sentences. Also, a large percentage of same incorrect responses on ambiguous sentences suggested that these sentences have a preferred meaning for most students and that the ability to identify ambiguity is not generally acquired by grade five students.

2. Are students able to recognize structural ambiguity?

The students interviewed did not display any consistent ability to recognize structural ambiguity although it was suggested that high readers were more advanced in this ability than were low readers.

3. Do the explanations given by students in the test of recognition of ambiguity differ among students?

The explanations offered by students who scored highly on the SIT seemed to reflect a more fully developed ability to understand the ways in which syntactic structures convey information than did the explanations of low scorers. It was also suggested that semantic considerations in certain sentences affected some students' ability to identify the ambiguity in these sentences.

4. What effect does written language context have on the student's understanding of certain structurally ambiguous sentences?

As the majority of the students interviewed showed some inability to identify a structurally ambiguous sentence in light of its context, it was suggested that, for grade five students at least, context alone may not disambiguate an ambiguous sentence.

5. Do students' observations on the SIT affect the claims made for the face validity of this test?

None of the students interviewed reported any difficulty with the vocabulary used in the SIT and with the possible exception of two sentences in the test no observations were made that affected the claims made for face validity.

6. What factors may affect the administrative procedures for the SIT?

It was suggested that individual administration may be preferable to group administration of this test, and that the examples given in the instructions need to be more carefully explained. It was also suggested that it be made apparent in the instructions that semantic bizarreness is not a criterion for an interpretative sentence not giving a meaning of a structurally ambiguous lead sentence.

IV. IMPLICATIONS FOR EDUCATION

The findings of this study suggest a number of implications for the reading program and for those who are concerned with the teaching

of reading. Some of these implications are stated below.

1. Results of this study have suggested that grade five students do not generally exhibit the ability to understand the ways in which syntactic structures convey information. Thus reading comprehension ability and particularly inferential comprehension ability may well be improved by incorporating the teaching of language structures into the program for upper elementary school children. It must be pointed out, however, that the current practice of teaching the names of parts of speech would not seem to achieve the required results. The students need to understand how the structuring of sentences affects the relationship of one word or phrase to another. The teaching of a linguistic metalanguage, while perhaps important for a more advanced study of language, does not provide this understanding.

It is suggested that the students be encouraged to restructure sentences in such a way that the meaning does not change. Minimal changes may be made to the structure of sentences so that the meaning does change and the causes of this change can be discussed and analysed. Structurally ambiguous sentences in isolation may be used to illustrate the importance of understanding structural relationships and should provide the basis for worthwhile discussions on the effect of structure on meaning.

In view of the fact that girls achieved at a higher level on the SIT than did boys, it would seem that boys are more in need of such teaching. Also, as high readers performed better than low, teaching of the ways in which written language is structured may help low readers to achieve at their full potential.

2. As transformational generative grammar appears to be the best description of language that is presently available, this theory may be the most effective way of teaching language structure. Phrase markers may be used to illustrate the two possible structurings of structurally ambiguous sentences; teaching of the concept of deep structure may facilitate the students' understanding of paraphrase and teaching of some basic transformational rules may help to develop an understanding of the way in which two different meanings can be represented in the same orthographic form.

Of prime importance is to convey the concept that the structures of language are flexible, viable phenomena that operate according to certain rules and that can be manipulated to convey meaning in various ways. Transformational generative grammar seems to treat language in such a way.

3. This study showed that grade five students are no more able to recognize ambiguity than they are to identify it by means of paraphrases. It has also been noticed by the investigator that structurally ambiguous sentences occur in all types of reading matter. It thus becomes important for the teacher to be aware of such occurrences and to explain them to the students to avoid any misunderstanding on their part of the meaning of the material in which these sentences occur. This would seem to be especially important in light of the finding that context alone may not disambiguate an ambiguous sentence. The ability to understand contextual restraints on meaning may be developed by using ambiguous sentences in context and teaching the ways in which the context affects the interpretation

assigned to the ambiguous sentence.

4. In light of the fact that a significant relationship exists between reading comprehension ability and the ability to identify ambiguity, a test of this latter ability, such as the SIT, may well be used to measure the linguistic competence of upper elementary school students as it relates to their reading comprehension of syntactic structures. Such a test could be used for grouping students for instruction in those aspects of language mentioned above and may be also used for clinical assessment of reading difficulty. It is essential to pinpoint the causes of an individual's difficulty in reading so that tutoring can be planned and executed with the utmost proficiency. A measure of the individual's ability to understand the ways in which syntactic structures convey information would aid this assessment.

5. Finally, it is presumed that the teacher is able to carry out the suggestions made above. This may not necessarily be the case. Methods courses on the teaching of reading should place greater emphasis on the importance of written language in reading comprehension. Practice with exercises similar to those mentioned above and discussion of the value of such exercises could form an integral part of such courses. Moreover, in view of the ever-increasing knowledge of language supplied by linguists, teachers should be encouraged to take linguistic courses as part of their teacher education program. Finally it is suggested that the findings of research be made more available to established teachers by such means as the distribution of summaries of research studies to schools in the local systems and by the conducting of in-service programs by the researcher in the area from which he drew

his sample for study.

V. SUGGESTIONS FOR FURTHER RESEARCH

The findings and conclusions from this study produced the following suggestions for further research:

The sample tested in this study was composed of sixty average readers at the grade five level, and it was found that these students were not generally able to identify ambiguity with any consistency. It would thus seem desirable to test students at higher grade levels to determine whether grade level is related to the ability to identify ambiguity. A further consideration is to determine whether this ability is developmental and thus a longitudinal study of certain students would be valuable. Moreover, as certain differences were found between high and low readers despite the fact that only average readers were tested, a study of the ability to identify ambiguity in a more heterogeneous group may provide more conclusive evidence for the importance of understanding syntactic structures in reading comprehension.

Only students who were native speakers of English were included in the sample. Do those students for whom English is a second language display the same ability to identify ambiguity?

Recognition of ambiguity was tested for only eight students. This ability warrants further study with a larger number of students at different grade levels and a careful comparison between this ability and identification of ambiguity could be made to determine the differences and similarities of the two.

The findings of this study with regard to students' identification of structurally ambiguous sentences in context are extremely limited but suggest the need for a more detailed study. In connection with this a search could be made to determine the incidence and types of ambiguity in basal readers and childrens' reading material and the students' ability to identify or recognize these instances of ambiguity.

The implication that a program of instruction be implemented to facilitate the student's understanding of syntactic structures in written language suggests that research is needed to investigate the efficacy of such a program in achieving this understanding.

Finally, the differences between sentences with surface structure ambiguity and those with underlying structure ambiguity need to be determined in light of the fact that students display different levels of ability in identifying the meanings of these types of sentences. Is the fact that students tested in this study found surface structure ambiguities easier to identify than underlying structure ambiguities true of students at higher grade levels and of students who display a higher reading comprehension ability?

VI. CONCLUDING STATEMENT

This study has found that the ability to identify ambiguity is significantly related to reading comprehension ability and that this relationship is most consistent for identification of surface structure ambiguity and inferential reading comprehension ability. High readers and girls were better able to identify ambiguity than were low

readers and boys but generally it was found that this ability is not well developed among students at the grade five level.

Further research needs to be conducted to determine the relationship between these variables for students at different grade levels and of different reading ability, but in view of the findings of this study it seems that the structurally ambiguous sentence may well be used as a vehicle to measure the student's linguistic competence as it relates to his reading comprehension of syntactic structures. Also, provision should be made for instruction in these structures so that students may be better equipped to analyze the various linguistic patterns and thus be better able to comprehend written language.

Such instruction and the suggested means of measuring the effect of this instruction may be incorporated into a systematic program for the teaching of reading comprehension skills based upon current knowledge of the language of print.

BIBLIOGRAPHY

- Balow, I. H. Sex differences in first grade reading. Elementary English, 1963, 40, 303-306, 320.
- Bormuth, J. R. et al. Children's comprehension of between- and within-sentence syntactic structures. Journal of Educational Psychology, 1970, 61, (5), 349-357.
- Bormuth, J. R. Implications of cloze procedure for the evaluation of instructional programs. Los Angeles: University of California, Center for the Study of Evaluation of Instructional Programs, Occasional Report, No. 3, 1967.
- Bormuth, J. R. An operational definition of comprehension instruction. In K. S. Goodman and J. F. Fleming (eds.) Psycholinguistics and the teaching of reading. Newark, Delaware: International Reading Association, 1969.
- Bormuth, J. R. Readability: a new approach. Reading Research Quarterly, 1966, 1, (3), 79-132.
- Carey, P. W., J. Mehler, and T. G. Bever. Judging the veracity of ambiguous sentences. Journal of Verbal Learning and Verbal Behavior, 1970, 9, 243-254.
- Carroll, J. B. Language development. In C. W. Harris (ed.) Encyclopedia of Educational Research. New York: The MacMillan Company, 1960, 744-752.
- Carroll, J. B. et al. Word frequency book. New York: American Heritage Publishing Co. Inc., 1971.
- Chomsky, N. Syntactic structures. The Hague: Mouton & Co., 1957.
- Coleman, E. B. Improving comprehensibility by shortening sentences. Journal of Applied Psychology, 1962, 44, 131-134.
- Coleman, E. B. The comprehensibility of several grammatical transformations. Journal of Applied Psychology, 1964, 48, 186-190.
- Cossitt, T. G. A linguistic analysis of social studies texts. Unpublished master's thesis, University of Alberta, 1966.
- Dale, E. and J. Chall. A formula for predicting readability. Educational Research Bulletin, 1948, 27, 11-20.
- Denner, B. Representational and syntactic competences of problem readers. Child Development, 1970, 41, (3), 881-887.
- Fagan, W. T. An investigation into the relationship between reading

- difficulties and the number and types of sentence transformations. Unpublished doctoral dissertation, University of Alberta, 1969.
- Forster, K. I. and L. A. Ryder. Perceiving the structure and meaning of sentences. Journal of Verbal Learning and Verbal Behavior, 1971, 10, 107-115.
- Foss, D. J. Some effects of ambiguity upon sentence comprehension. Journal of Verbal Learning and Verbal Behavior, 1970, 9, 699-706.
- Foss, D. J., T. G. Bever and M. Silver. The comprehension and verification of ambiguous sentences. Perception and Psychophysics, 1968, 4, 304-306.
- Gibbons, H. D. Reading and sentence elements. Elementary English Review, 1941, 18, 42-46.
- Goodman, K. S. A communication theory of the reading curriculum. Elementary English, 1963, 40, 290-398.
- Goodman, K. S. (ed.) The psycholinguistic nature of the reading process. Detroit: Wayne State University Press, 1968.
- Goodman, K. S. Reading: a psycholinguistic guessing game. In H. Singer and R. B. Ruddell (eds.) Theoretical models and processes of reading. Newark, Delaware: International Reading Association, 1970, 259-272.
- Goodman, K. S. Reading: the key is in children's language. The Reading Teacher, 1972, 25, (6), 505-508.
- Gray, W. S. and B. E. Leary. What makes a book readable. Chicago: University of Chicago Press, 1935.
- Halliday, M. A. K. Speech and situation. In Some aspects of oracy. National Association of Teachers of English Bulletin, 1965, 2, 14-17.
- Helmstadter, G. C. Research concepts in human behavior. New York: Appleton-Century-Crofts, 1970.
- Hopkins, D. M. A study of the relationship between level of linguistic competence and reading achievement. Unpublished master's thesis, University of Alberta, 1970.
- Huey, E. B. The psychology and pedagogy of reading. New York: The MacMillan Company, 1908.
- Jacobs, R. A. and P. S. Rosenbaum. English transformational grammar. Waltham, Massachusetts: Blaisdell Publishing Company, 1968.

- Jenkinson, M. D. Basic elements of reading comprehension. Paper presented at the Second World Congress on Reading, Copenhagen, 1968.
- Jurgens, J. M. Perception of lexical and structural ambiguity by junior and senior high school students. Unpublished doctoral dissertation, George Peabody College, 1971.
- Kessel, F. S. The role of syntax in children's comprehension from ages six to twelve. Monograph of the society for research in child development, 1970, 35, (6), Serial No. 139.
- Lorge, I. Predicting readability. Teachers College Record, 1944, 45, 404-419.
- MacKay, D. G. To end ambiguous sentences. Perception and Psychophysics, 1966, 1, 426-436.
- MacKay, D. G. and T. G. Bever. In search of ambiguity. Perception and Psychophysics, 1967, 2, 193-200.
- Menyuk, P. The acquisition and development of language. Englewood Cliffs, N. J.: Prentice Hall, 1971.
- O'Donnell, R. Awareness of grammatical structure and reading comprehension. High School Journal, 1962, 45, 184-188.
- Prideaux, G. D. Surface structure resolution of structural ambiguity. Paper presented to the Annual Meeting of the Alberta Linguistic Association, Banff, Alberta, 1972.
- Robertson, J. E. An investigation of pupil understanding of connectives in reading. Unpublished doctoral dissertation, University of Alberta, 1966.
- Ruddell, R. B. An investigation of the effect of the similarity of oral and written patterns of language structure on reading comprehension. Unpublished doctoral dissertation, Indiana University, 1963.
- Simons, H. D. Linguistic skills and reading comprehension. U. S. Department of Health, Education, and Welfare, Office of Education Bureau of Research, Final Report, Project No. 9-A-078, 1970.
- Spache, G. D. A new readability formula for primary grade reading materials. Elementary School Journal, 1953, 53, 410-413.
- Strom, J. M. Does knowledge of grammar improve reading? English Journal, 1956, 44, 129-133.

- Tatham, S. M. Reading comprehension of materials written with select oral language patterns: a study at grades two and four. Reading Research Quarterly, 1970, 5, (3), 427-451.
- Taylor, W. L. Cloze procedure: a new tool for measuring readability. Journalism Quarterly, 1953, 30, 415-433.
- Thorndike, E. L. Reading as reasoning: a study of mistakes in paragraph reading. Journal of Educational Psychology, 1917, 8, 323-332.
- Vogel, M. and C. W. Washburne. An objective method of determining grade placement of children's reading material. Elementary School Journal, 1928, 26, 373-381.
- Wardhaugh, R. Reading: a linguistic perspective. New York: Harcourt Brace and World, Inc., 1969.
- Weintraub, S. Sex differences in reading achievement. The Reading Teacher, 1966, 20, 155-165.
- Wiener, M. and W. Cromer. Reading and reading difficulty: a conceptual analysis. Harvard Educational Review, 1967, 37, 620-643.
- Yngve, V. H. A model and hypothesis for language structure. Proceedings of the American Philosophical Society, 1960, 104, 444-466.

APPENDIX A

SENTENCE INTERPRETATION TEST

SENTENCE INTERPRETATION TEST

Name _____ Date of Birth _____
School _____ Grade _____

Instructions:

Normally, the sentences that you read have only one meaning, but sometimes can have more than one meaning. This test is designed to see how well you can understand the meaning of meanings of a sentence. In each question a lead sentence is typed in capital letters and underlined. Below this sentence are three more sentences labelled a), b), and c). These sentences may give one or more meanings of the lead sentence. Take each one in turn, compare it to the lead sentence, and decide whether it does give a meaning of the lead sentence or does not give a meaning. For each one that does, put a tick under the column marked GIVES A MEANING, and for each one that doesn't, put a tick under the column marked DOES NOT GIVE A MEANING. Look at these examples:

	<u>GIVES A MEANING</u>	<u>DOES NOT GIVE A MEANING</u>
Ex. 1: <u>HE KNEW THAT BURNING PAPER COULD BE DANGEROUS.</u>		
a) He knew that burning could be dangerous to paper.	_____	_____✓
b) He knew that paper which was burning could be dangerous.	_____✓	_____
c) He knew that it could be dangerous to burn paper.	_____✓	_____
Ex. 2: <u>THE ANGRY CAT WAS CHASING THE DOG.</u>		
a) The angry dog was being chased		

	<u>GIVES</u> <u>A MEANING</u>	<u>DOES NOT</u> <u>GIVE A MEANING</u>
by the cat.	_____	<u>✓</u>
b) The dog was chasing the angry cat.	_____	<u>✓</u>
c) It was the angry cat that was chasing the dog.	<u>✓</u>	_____

Ex. 3: SAM PAINTED THE PICTURE IN THE KITCHEN.

a) The picture that Sam painted was in the kitchen.	_____	_____
b) What Sam painted was the picture of the kitchen.	_____	_____
c) It was in the kitchen that Sam painted the picture.	_____	_____

The lead sentence in Ex. 3 could have two meanings - either that the picture was in the kitchen, or that Sam did the painting in the kitchen. It does not mean that Sam painted the picture of the kitchen. Thus you should have put a tick by a) and c) under GIVES A MEANING, and a tick by b) under DOES NOT GIVE A MEANING.

Remember that in the test sometimes only one, sometimes two, and sometimes all three sentences will give a meaning for the lead sentence. You will have as much time as you need to finish.

	<u>GIVES</u> <u>A MEANING</u>	<u>DOES NOT</u> <u>GIVE A MEANING</u>
1. <u>THE HUNTER WAS TOO FAR AWAY TO SEE.</u>		
a) The hunter was too far away to be seen.	_____	_____
b) The hunter was too far away from something to see it.	_____	_____
c) The hunter who was seen was too far away.	_____	_____

GIVES
A MEANING

DOES NOT
GIVE A MEANING

2. THE CHOICE OF THE STUDENTS SURPRISED THE PARENTS.

- a) What surprised the parents was the students who were chosen. _____
- b) It was the choice made by the parents that surprised the students. _____
- c) The choice made by the students surprised the parents. _____

3. HE WANTED TO FIND THE FRONT DOOR KEY.

- a) It was the front door key that he wanted to find. _____
- b) He wanted to find the front door for the key. _____
- c) He wanted to find the key for the front door. _____

4. ONLY THOSE LADIES WHO LIKED GROWING FLOWERS CAME.

- a) Only those ladies who were like growing flowers came. _____
- b) Only those ladies came who liked flowers that are growing. _____
- c) It was only those ladies who liked to grow flowers that came. _____

5. THE TIGER'S ROAR WAS HEARD DURING THE NIGHT.

- a) It was heard that the tiger had roared during the night. _____
- b) During the roar of the night the tiger was heard. _____
- c) The roar of the tiger was heard during the night. _____

6. YOUNG BILLY AND DAD LIKE TO GO FISHING.

- a) What young Billy likes is for Dad to go fishing. _____
- b) Dad likes young Billy to go fishing. _____
- c) It is young Billy and Dad who like to go fishing. _____

	<u>GIVES</u> <u>A MEANING</u>	<u>DOES NOT</u> <u>GIVE A MEANING</u>
7. <u>ONLY THOSE BOYS WHO WANTED WRITING PAPER STAYED.</u>		
a) Only those boys who wanted to write a paper stayed.	_____	_____
b) It was only those boys who wanted paper for writing that stayed.	_____	_____
c) Only those boys stayed who wanted paper that was for writing.	_____	_____
8. <u>SOME STORES SELL NEW TOYS AND NEW BOOKS.</u>		
a) New toys and new books are sold by some stores.	_____	_____
b) Some stores sell new books and new toys.	_____	_____
c) It is new toys and new books that some stores sell.	_____	_____
9. <u>A SMALL BOAT ENGINE WAS SOLD TO THE CAPTAIN.</u>		
a) To the captain was sold an engine for a small boat.	_____	_____
b) A small engine for a boat was sold to the captain.	_____	_____
c) A small boat and an engine were sold to the captain.	_____	_____
10. <u>HE THREW HER DOG BISCUITS RATHER THAN CANDIES.</u>		
a) It was dog biscuits that he threw her rather than candies.	_____	_____
b) He threw candies to her rather than dog biscuits.	_____	_____
c) He threw biscuits rather than candies to her dog.	_____	_____
11. <u>THE VISITING NURSE ASKED HOW THE OLD MAN WAS.</u>		
a) The nurse who was visiting asked how old the man was.	_____	_____
b) The visiting nurse was asked how the old man was.	_____	_____
c) The visiting nurse asked how the man who was old was.	_____	_____

	<u>GIVES</u> <u>A MEANING</u>	<u>DOES NOT</u> <u>GIVE A MEANING</u>
12. <u>IT FELL TO THE GROUND WITH A CRASH.</u>		
a) It was with a crash that it fell to the ground.	_____	_____
b) It crashed and then it fell to the ground.	_____	_____
c) It fell with a crash to the ground.	_____	_____
13. <u>HE TOLD HER BABY STORIES IN THE EVENING.</u>		
a) Baby stories were what he told her in the evening.	_____	_____
b) She told him baby stories in the evening.	_____	_____
c) In the evening he told stories to her baby.	_____	_____
14. <u>THE BOX WAS TOO HIGH UP TO REACH.</u>		
a) Someone was too high up to reach the box.	_____	_____
b) The box was too high up to be reached.	_____	_____
c) The box that was reached was too high up.	_____	_____
15. <u>MOM LIKES SEA FOOD BETTER THAN MEAT.</u>		
a) Meat is what Mom likes better than sea food.	_____	_____
b) It is meat that Mom likes better than she likes sea food.	_____	_____
c) Mom likes sea food better than she likes meat.	_____	_____
16. <u>THE YOUNG SCIENCE STUDENT IS THE ONE TO ASK.</u>		
a) The young science student is the one who should do the asking.	_____	_____
b) The young science student was the one who asked.	_____	_____
c) The one who should be asked is the young science student.	_____	_____

	<u>GIVES</u> <u>A MEANING</u>	<u>DOES NOT</u> <u>GIVE A MEANING</u>
17. <u>SHE SPOKE TO THE BOY WITH A SMILE.</u>		
a) She smiled and then she spoke to the boy.	_____	_____
b) The boy with a smile was the one to whom she spoke.	_____	_____
c) She was smiling when she spoke to the boy.	_____	_____
18. <u>THE NEW TEACHER AND TOM WANTED TO START SKATING.</u>		
a) It was skating that the new teacher and Tom wanted to start.	_____	_____
b) The new teacher and Tom were going to skate and they wanted to start.	_____	_____
c) The new teacher wanted Tom to start the skating.	_____	_____
19. <u>MOST PEOPLE WEAR CLEAN SOCKS AND SHOES.</u>		
a) Most people wear shoes and clean socks.	_____	_____
b) Most people wear socks and clean shoes.	_____	_____
c) It is clean socks and clean shoes that most people wear.	_____	_____
20. <u>HER BEST FRIEND HAD LEFT EARLY TONIGHT.</u>		
a) Tonight her friend had best leave early.	_____	_____
b) Early tonight was when her best friend had left.	_____	_____
c) Tonight her best friend had left early.	_____	_____
21. <u>SHE WANTED A CANDY BAR MORE THAN A POP.</u>		
a) She wanted a bar of candy more than she wanted a pop.	_____	_____
b) It was a candy bar that she wanted more than a pop.	_____	_____
c) What she wanted more than a pop was a candy bar.	_____	_____

	<u>GIVES</u> <u>A MEANING</u>	<u>DOES NOT</u> <u>GIVE A MEANING</u>
22. <u>THE DOG FOUND TOM MORE QUICKLY THAN BOBBY.</u>		
a) It was Bobby who was found by the dog more quickly than Tom.	_____	_____
b) The dog found Tom more quickly than the dog found Bobby.	_____	_____
c) The dog found Tom more quickly than Bobby found Tom.	_____	_____
23. <u>A NEW WRIST WATCH WAS GIVEN TO THE WINNER.</u>		
a) The winner was given a new wrist watch.	_____	_____
b) A wrist watch that was new was given to the winner.	_____	_____
c) What was given to the winner was a new wrist watch.	_____	_____
24. <u>MOST ANIMALS THAT SWIM LIKE CATCHING FISH.</u>		
a) Fish like catching most animals that swim.	_____	_____
b) Most animals that swim like to catch fish.	_____	_____
c) It is most animals that swim that catch like fish.	_____	_____
25. <u>LITTLE JACK AND GRANDFATHER DECIDED TO GO CAMPING.</u>		
a) It was decided by little Jack and Grandfather than they go camping.	_____	_____
b) To go camping was what little Jack and Grandfather decided.	_____	_____
c) Grandfather and little Jack decided to go camping.	_____	_____
26. <u>HE WENT TO FETCH THE RED CRAYON BOX.</u>		
a) He went to fetch the box for red crayons.	_____	_____
b) It was the red box for crayons that he went to fetch.	_____	_____
c) He went to fetch the red crayons for the box.	_____	_____

	<u>GIVES</u> <u>A MEANING</u>	<u>DOES NOT</u> <u>GIVE A MEANING</u>
27. <u>THE DANCING TEENAGERS KNEW HOW GOOD MUSIC SOUNDED.</u>		
a) The dancing teenagers knew how to sound good at music.	_____	_____
b) The dancing teenagers knew how good the sound of music was.	_____	_____
c) The teenagers who were dancing knew how music which is good sounded.	_____	_____
28. <u>THE PRINCIPAL ASKED THE TEACHERS TO STOP SMOKING.</u>		
a) The principal asked the teachers to stop others from smoking.	_____	_____
b) Other people were smoking and the teachers asked the principal to stop them.	_____	_____
c) The teachers were smoking and the principal asked them to stop.	_____	_____
29. <u>THE CAT DRINKS MILK FASTER THAN THE BABY.</u>		
a) It is the cat that drinks milk faster than the baby.	_____	_____
b) The cat drinks milk faster than the baby drinks milk.	_____	_____
c) Milk is drunk faster by the cat than by the baby.	_____	_____
30. <u>THE WHITE RACE HORSE WAS THE FIRST TO FINISH.</u>		
a) The white race horse was the one that finished first.	_____	_____
b) The first to finish was the race horse that was white.	_____	_____
c) It was the white race horse that was first to finish.	_____	_____
31. <u>MOST PEOPLE WHO SHOP LIKE PLEASING SALESMEN.</u>		
a) Salesmen who are pleasing are liked by most people who shop.	_____	_____
b) Most people who shop like to please	_____	_____

		<u>GIVES</u> <u>A MEANING</u>	<u>DOES NOT</u> <u>GIVE A MEANING</u>
	salesmen.		
	c) Salesmen like pleasing most people who shop.	_____	_____
32.	<u>MY OLD UNCLE HAD WORKED HARD TODAY.</u>		
	a) It was my old uncle who had worked hard today.		
	b) Today was when my old uncle had worked hard.	_____	_____
	c) Today my old uncle had worked hard.	_____	_____
33.	<u>LITTLE CATS AND DOGS LIKE TO GO EXPLORING.</u>		
	a) Cats and little dogs like to go exploring.		
	b) Little cats and little dogs like to go exploring.	_____	_____
	c) It is dogs and little cats that like to go exploring.	_____	_____
34.	<u>THE DISCOVERY OF THE ISLAND PLEASED THE KING.</u>		
	a) That the island was discovered pleased the king.		
	b) The king was pleased by the discovery of the island.	_____	_____
	c) What pleased the king was the discovery of the island.	_____	_____
35.	<u>JOHN'S BALL BROKE THE WINDOW IN THE DOOR.</u>		
	a) The window in the door was broken by John's ball.		
	b) John's ball was broken by the window in the door.	_____	_____
	c) The door by the window was broken by John's ball.	_____	_____
36.	<u>DAD TOOK THE BROTHERS TO WATCH BOXING.</u>		
	a) The brothers took Dad to watch boxing.		
	b) Boxing was what Dad took the	_____	_____

	<u>GIVES</u> <u>A MEANING</u>	<u>DOES NOT</u> <u>GIVE A MEANING</u>
brothers to watch.	_____	_____
c) The brothers were taken by Dad to watch boxing.	_____	_____
37. <u>MICHAEL'S BROTHER WATCHED THE GAME ON THE PATIO.</u>		
a) The game on the patio was watched by Michael's brother.	_____	_____
b) While on the patio Michael watched his brother's game.	_____	_____
c) While on the patio Michael's brother watched the game.	_____	_____
38. <u>MOM GAVE THE BOY MONEY FROM HER PURSE.</u>		
a) The boy gave Mom money from her purse.	_____	_____
b) It was the boy who gave Mom money from her purse.	_____	_____
c) Mom gave money to the boy from her purse.	_____	_____
39. <u>BOYS LIKE ICE CREAM BETTER THAN GIRLS.</u>		
a) It is ice cream that boys like better than they like girls.	_____	_____
b) Boys like ice cream better than girls like boys.	_____	_____
c) Boys like ice cream better than girls like ice cream.	_____	_____
40. <u>THE TEAM'S SELECTION WAS ANNOUNCED IN THE MORNING.</u>		
a) The morning's selection was announced by the team.	_____	_____
b) That the team was selected was announced in the morning.	_____	_____
c) The selection made by the team was announced in the morning.	_____	_____

APPENDIX B
ITEM ANALYSIS OF THE
SENTENCE INTERPRETATION TEST

ITEM ANALYSIS OF THE SENTENCE INTERPRETATION TEST

Test Item No.	Sentence Type	Item Difficulty Index	Biserial Correlation
1	6	.250	.299
2	6	.400	.334
3	3	.833	.398
4	2	.317	.541
5	4	.317	-.240
6	3	.900	.184
7	4	.567	.645
8	7	.667	.632
9	5	.433	.856
10	1	.633	-.122
11	3	.083	.065
12	7	.467	.749
13	5	.317	.525
14	8	.867	-.208
15	4	.833	-.034
16	2	.117	.227
17	5	.133	.129
18	2	.333	.679
19	5	.150	.608
20	5	.633	.896
21	3	.433	.553
22	6	.183	.654
23	7	.567	.754
24	8	.433	.062
25	4	.550	.741
26	1	.217	.622
27	1	.467	.513
28	6	.033	-.107
29	8	.800	.485
30	4	.550	.942
31	6	.083	.176
32	7	.533	.851
33	1	.117	.618
34	8	.433	.748
35	3	.583	.367
36	3	.750	.621
37	1	.400	.510
38	7	.900	.168
39	2	.383	.218
40	2	.233	.226

APPENDIX C

TEST OF RECOGNITION OF AMBIGUITY

TEST OF RECOGNITION OF AMBIGUITY

1. The pretty school secretary was the one to ask.
2. The leader's choice surprised the boys in the team.
3. The polar bear cub wanted to play.
4. The hard rocks hurt our aching feet.
5. Dad gave her baby clothes rather than money.
6. The starving man had forgotten how good meat tastes.
7. The new mayor and Tom decided to stop racing.
8. The girl's wish came true on her birthday.
9. Only those people who liked racing cars stayed.
10. Peter's mother looked at the girl with the telescope.
11. Young Sue and Mom like to watch wrestling.
12. She must like Tom more than Ann.
13. The girl was hoping to leave early.
14. That dirty shirt and sweater seem to need washing.
15. The broken water pump was difficult to fix.
16. The loss of the ship to pirates caused alarm.
17. He sold the man oranges rather than apples.
18. The old car salesman came to visit.
19. Old men and women like to go visiting.
20. The store clerk worked harder than the manager.

APPENDIX D

SIT ITEM NUMBERS FOR INDIVIDUAL RETESTING

SIT ITEM NUMBER FOR INDIVIDUAL RETESTING

<u>Student</u>	<u>SIT</u> Item Numbers
A	1, 5, 10, 17, 24, 28
B	4, 11, 13, 15, 22, 26
C	2, 9, 14, 20, 23, 39
D	2, 3, 9, 20, 36, 39
E	6, 15, 26, 33, 39, 40
F	1, 7, 9, 27, 36, 40
G	4, 10, 14, 15, 26, 39
H	9, 12, 15, 18, 37, 39

APPENDIX E

TEST OF IDENTIFICATION OF AMBIGUITY IN CONTEXT

Passage 1

"After school the teachers had to meet with the principal to talk about the timetable for next year. As the meeting went on, the air in the room became very stale because some of the teachers were smoking. Finally the principal asked the teachers to stop smoking and opened the windows. Soon the room was full of fresh air again and the meeting continued."

Which of the following sentences give a meaning of the underlined words in the paragraph?

- a) The principal asked the teachers to stop others from smoking.
- b) Other people were smoking and the teachers asked the principal to stop them.
- c) The teachers were smoking and the principal asked them to stop.

Passage 2

"Last year the teachers in some high schools allowed the students to smoke. In one school there was a fire caused by a student who threw away a burning cigarette, and so the principal asked the teachers to stop smoking. When the teachers in one school stopped the students from smoking, the teachers in the other schools decided that they would do the same, and now smoking is not allowed in any high schools."

Which of the following sentences give a meaning of the underlined words in the paragraph?

- a) The principal asked the teachers to stop others from smoking.
- b) Other people were smoking and the teachers asked the principal to stop them.
- c) The teachers were smoking and the principal asked them to stop.

Passage 3

"If you want a cat or a dog that will stay close to home and not go wandering about the streets, it is better to buy one that is as large as possible. Big cats and big dogs seem to like to stay close to their own homes, but little cats and dogs like to go exploring."

Which of the following sentences give a meaning of the underlined words in the paragraph?

- a) Cats and little dogs like to go exploring.
- b) Little cats and little dogs like to go exploring.
- c) It is dogs and little cats that like to go exploring.

Passage 4

"When Bobby went to live on the farm, he had to look after his uncle's three large dogs. He liked this job until his uncle gave him six little kittens to look after as well. The big dogs and the little cats got on together well but Bobby soon found out that little cats and dogs like to go exploring. All day long he would be trying to catch one or the other of them.

Which of the following sentences give a meaning of the underlined words in the paragraph?

- a) Cats and little dogs like to go exploring.
- b) Little cats and little dogs like to go exploring.
- c) It is dogs and little cats that like to go exploring.