

DEVELOPMENTAL DIFFERENCES IN STUDENTS' ABILITY TO  
DETECT UNDERLYING STRUCTURAL AMBIGUITY

THESIS

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## Abstract

This study examined the development of students' ability at the seventh, ninth and eleventh grade levels to detect underlying structural ambiguity. Gerund-participle ambiguity sentences and sentence fragments were constructed by the researcher to measure the detection abilities of the subjects. The findings showed that there were no developmental trends in the detection of the ambiguity. However, the incidental findings showed that the paraphrase task was performed more successfully than the completion task. Also, the subjects recognized the gerund-type ambiguity more successfully than the participle-type ambiguity. These findings led the researcher to conclude that the subjects' detection abilities were affected more by the type of task they were asked to perform and the type of structure involved in the task, than by the grade the subjects were in. Further research was suggested in the area of the effect of instruction on the ability to detect structural ambiguity when control is exercised for types of tasks and structures.

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## Chapter I

### Statement of the Problem

#### Purpose

The purpose of this study was to investigate the development of subjects' ability at the seventh, ninth and eleventh grade levels to detect underlying structural ambiguity when reading.

A secondary purpose was to determine if subjects detect underlying structural ambiguity more easily in a paraphrase task or in a sentence completion task.

Finally, the subjects' ability to recognize the gerund-type and participle-type ambiguity was investigated.

#### Need for the Study

Most children come to kindergarten fluent in their use of oral language. Most of them also have the ability to understand and process the basic sentence patterns in their language (Fagan, 1971). However, throughout the rest of their time in school, they are continuing to learn about the complexities of that language. The processing of more complex sentences and sentence structures becomes part of their learning. Ambiguity in these sentences and their structures is something children must learn to deal with if they are to fully comprehend both what they read and hear. A study of the development of ability to detect

linguistic ambiguity is, therefore, a study of the development of linguistic competence (Schultz & Pilon, 1973).

A main reason for research in ambiguity, then, is to understand what kind of processing takes place in the comprehending of a sentence. Many researchers hope that studying the way a person processes an ambiguous sentence may offer some insight as to how sentences in general are processed and interpreted (MacKay, 1966; MacKay & Bever, 1967; Shultz & Pilon, 1973).

Many studies in ambiguity deal with either all levels of ambiguity or the processing of lexical ambiguity (Brodzinsky, Feuer & Owens, 1977; Foss, 1970; Foss & Jenkins, 1973; Shultz & Pilon, 1973). What may be necessary is more specific research into the other levels of ambiguity, particularly the surface structure level and the underlying structural level. Studying these two syntactic ambiguities separately may clarify the type of development and processing occurring at each level. Also, since there is a controversy over whether noticing or not noticing ambiguity leads to slower processing, looking further into the development of subjects' ability to notice ambiguity at the structural levels may be the preliminary step in resolving the conflict (Carey, Mehler, & Bever, 1970; Foss, 1970; Foss & Jenkins, 1973; Olson & MacKay, 1974).

Readers come into contact with ambiguity on the written page. Few of the studies conducted in the area of ambiguity deal specifically with reading and, in particular, the development of

the ability to detect ambiguity while reading. It is therefore necessary to see if the findings on a developmental study of ambiguity detection and reading, support findings of developmental studies done thus far (Brodzinsky, Feuer, & Owens, 1977; Shultz & Pilon, 1973).

#### Questions to Be Answered

1. Does the subjects' ability to detect underlying structural ambiguity increase with grade level?
2. Is there a significant difference in the ability of subjects at the seventh, ninth and eleventh grade levels to detect underlying structural ambiguity in a sentence paraphrase task and in a sentence completion task?
3. Is there a significant difference in subjects' ability at the seventh, ninth and eleventh grade levels to recognize the participle-type ambiguity and the gerund-type ambiguity?

#### Definitions

1. Ambiguity - ". . . any stimulus pattern which is capable of two distinct interpretations is ambiguous" (MacKay & Bever, 1967, p. 193).
2. Underlying structural ambiguity - ". . . two deep structures that specify two different sets of structural relations between key words in the sentence. For example, in the sentence, 'The duck is ready to eat.', 'duck' can function as either the logical subject or the logical object" (Shultz & Pilon, 1973, p. 728).

3. GPA - Gerund Participle Ambiguity - A gerund is a noun formed from a verb, as in "Hunting takes skill." A participle is an adjective formed from a verb, such as "She raises hunting dogs." The association of these two forms results in an underlying structural ambiguity.

#### Limitations of the Study

1. The sample of subjects was limited to twenty students at each of the three grade levels.
2. At times the scoring of the subjects' responses was subject to the judgment of the researcher.
3. The ". . . usefulness of the ambiguity completion and ambiguity detection studies is limited by the fact that the explicit detection of ambiguity is an unnatural process" (Carey, Mehler, & Bever, 1970, p. 243).

#### Summary

The study of ambiguity is the study of linguistic processing and competence. There is need for further investigation to see if ambiguity interferes with language processing while reading and if the development of ambiguity detection coincides with what has been thus far researched. Clarity must also be given to the development of the structural levels of ambiguity, particularly when they are involved with the reading process.

## Chapter II

### Review of the Literature

This study, which examines the development of ambiguity, is essentially an investigation of language development. According to research, language is acquired and developed in specific ways or stages early in life. However, the complexities of language, such as ambiguity, are learned in later years.

#### Language Acquisition: The Development of Syntax

A great deal of research has been conducted in the area of language acquisition and the development of syntax. Simply stated, syntax can be described as the ordering of morphemes into larger structural units (Burns, 1973). Early language learners follow certain stages or patterns in their syntactic development. Between 18 and 20 months of age, children begin to put two words together to form the most basic type of syntactic structure (Dale, 1976). By 36 months, some children are ". . . so advanced in the construction process as to produce all of the major varieties of English simple sentences up to a length of ten or eleven words" (Brown & Bellugi, 1973, p. 48). In a study conducted by Strickland (1962), the oral language structures of first through sixth grade children were investigated. The findings showed that the subjects were very flexible in their use of the various oral language patterns.

This led her to conclude that the basic structures of children's language are learned at an early age.

As children increase in age they become more expert in their use of language and syntax. Wood (1976) states that ". . . children of elementary school age have acquired most of the syntactic rules of their language" (p. 128). However, as children progress through the elementary school years they learn the more complex syntactic rules.

An investigation of first, second and third graders' use of syntactic rules supports Wood's statement. The results showed that the children's ability to form grammatically correct sentences, using new words, increased with age (Brown & Fraser, 1963).

O'Donnell (1967), as cited in Kirkton (1971), found similar results when he investigated the syntax of kindergarten and elementary school children. He concluded that during the first grade there is a large and rapid amount of growth in development of the use of syntactic structures. Then, as the children progress through the fifth grade there is growth and development but it is much slower. By the time they reach adolescence, children are learning to control their use of the oral language patterns they have thus far learned, and developed.

These findings are based on the oral language of children. When dealing specifically with reading and understanding of syntactic structures, children have to learn to ". . . decode the alphabet system and to relate written sentences with the grammar

that they have internalized for oral language" (Dawkins, 1975, p. 2). In a study of fourth graders' ability to read and comprehend syntactic structures, results showed that a large number of the students were unable to comprehend the most basic syntactic structures in language (Bormuth, Manning, Carr, & Pearson, 1970). However, according to Lesgold (1974), Bormuth et al., had no control procedure to insure that their results were based on syntax differences and not on semantic differences (or an interrelationship of the two). Lesgold constructed the test items in his research so that there were two semantically acceptable answers to questions. The correct answer was determined by the syntactic structure (in this case the anaphoric structure). He concluded that ". . . there are very few syntax forms which children in the fourth grade cannot understand in at least some contexts" (p. 337). He went on to reason that children may perform poorly on particular structures for two reasons. Either they may not know interpretation rules that are needed to comprehend the structure within certain semantic contexts, or they lack the capacity to apply those rules in certain semantic contexts.

Supporting Lesgold's conclusions, Richek (1976) conducted a study of silent reading comprehension. She found that performance in comprehending syntactic structures was variable and dependent on the context and complexity of the surrounding sentence.

The interrelationship between syntax and semantics in the comprehension of language can probably best be explained by Chomsky's theory of transformational grammar.

### Transformational Grammar

According to Chomsky (1971) the syntax of sentences consists of two levels, the surface structure level and the deep structure level. The surface structure level ". . . determines the phonetic form of sentences, while the deep structure determines semantic interpretation" (p. viii). The rules that express the relation of the deep surface structure levels in a sentence are called "grammatical transformations" (p. viii).

Research has been conducted to investigate what type of transformations, if any, make language and sentence processing more difficult. Generally, the findings show that there are transformations which interfere with comprehension. In 1965, Gough's findings showed that students took longer to verify statements as the number of transformations increased. Similar results were found in other research when subjects experienced increased difficulty in processing sentences which had been transformed from kernel sentences into more difficult forms, for example negative or passive (Mehler, 1963; Miller, 1962; Miller & McKean, 1964, as cited in Pearson, 1974-1975). Experiments conducted by Coleman (1964) lend more support to the idea that some transformations are easier to comprehend than others. He specifically found that transformations are easier to comprehend than those using passive verbs. Savin (1965) concluded from his research that the more complex transformations interfered more with memory. He reasoned that this was because these transformations involved

extra processing in order to interpret the deep structure of the sentence.

### Ambiguity

Research contained in the area of ambiguity focuses on two main areas; first of all, the processing of an ambiguous word or sentence, and secondly, the development of the ability to detect all types of ambiguity. Different tasks including phoneme-monitoring, paraphrasing and sentence completion have been used as a means of studying the development of the ability to process and the processing of ambiguity. The study of ambiguity as a key to language and sentence processing is subject to some controversy among the various researchers in this area. The effectiveness of the various tasks used in the detection and processing of ambiguity studies has also come under careful scrutiny.

### The Processing of Ambiguity

Linguistic ambiguity can ". . . said to occur whenever a given sentence possesses two or more distinct semantic interpretations" (Shultz & Pilon, 1973). There are three levels at which linguistic ambiguity can occur in written sentences: the lexical level, the surface structure level, and the underlying structural level (Mackay & Bever, 1967). The lexical level refers to the meanings of individual words within a sentence. In the sentence, "The soldiers like the port." the word "port" can have two distinct meanings--a harbor or a wine. A surface structure ambiguity refers to the way words are grouped into phrases. The sentence, "He

laughed at the school." can have two meanings depending on how it is phrased. "He" could be "laughing at--the school" or "He" could be "at the school--laughing." At the underlying structural level, the logical relationship between words is what is essential. In the sentence, "The mayor asked the police to stop drinking." the relationship between "police" and "drinking" is the source of the ambiguity. Is it the request of the mayor that the police stop themselves from drinking or stop others in the community from drinking?

Some research studies concluded that ambiguity interferes ". . . with our understanding of a single meaning of a sentence and that the degree of interference varies with the linguistic level at which the ambiguity occurs" (MacKay, 1966; MacKay & Bever, 1967). MacKay and Bever found that subjects discovered the lexical level of ambiguity first, then the surface structure level and finally the underlying structural level. However, these results may be due to the fact that lexically ambiguous sentences may be constructed relatively simply whereas the presence of a structural ambiguity necessitates a relatively more complex construction (Bever, Garrett, & Hurtig, 1973). More research is needed to verify this observation.

In dealing with how ambiguity is processed, several theories have been proposed. The One Meaning Hypothesis postulates that ambiguous material is ". . . treated no differently than unambiguous material . . . a second meaning is only considered if the subsequent context proves the initially chosen meaning to be inappropriate"

(Newman & Dell, 1978, p. 359). A similar theory, known as the Suppression Hypothesis, states that in comprehending an ambiguous sentence, one meaning of that sentence would be "perceptually dominant" over the other meaning (MacKay, 1966).

The Two Meaning Hypothesis proposes that when comprehension of ambiguity takes place, all of the meanings are ". . . accessed and then a decision is made regarding the correct meaning" (Newman & Dell, p. 359). Analogous to the Two Meaning Hypothesis is the Fusion Hypothesis. This theory describes the processing of ambiguity as the "simultaneous perception" of both meanings of the ambiguity ". . . with both meanings contributing to a single integrated interpretation" (MacKay, p. 427).

Another possible theory is the Oblivion Hypothesis. In this case neither meaning of the ambiguity is seen ". . . until the ambiguity is resolved on the basis of the non-ambiguous context of the sentence" (MacKay, p. 427). Foss and Jenkins (1973) refer to this as the Prior Decision Model which states that ". . . prior context somehow has its effects before the ambiguous word is encountered" (p. 579).

Research has been conducted to find evidence to support all of these theories. However, nothing conclusive has been shown about one of them in particular. MacKay speculates that the experimental techniques used to test processing of ambiguity may have bearing on which theory is supported by the data. For example, a phoneme-monitoring task is regarded as a comprehension task

while a paraphrase task involves both comprehension and production processes (Cairns & Kamerman, 1975). Cairns and Kamerman found that a phoneme-monitoring task and a sentence completion task may not be used to test the same variable. In other words, the level of ambiguity may dictate the type of processing and comprehension taking place. For example, a ". . . sentence completion latency (task) is not sensitive to a lexical ambiguity" (Cairns & Kamerman, p. 176).

In dealing with ambiguity processing, researchers have attempted to investigate whether or not the presence of an ambiguity increases processing of a sentence. In an experiment using lexical ambiguity, evidence is given to support the hypothesis that ambiguity does provide additional processing complexity (Holmes, Arwas & Garrett, 1977). Subjects were shown a sentence on a screen, one word per frame. They were then asked to write down as many words as they remembered, in order, without guessing. Ambiguous words were reported significantly more poorly than unambiguous words. In experiment two of the same study, subjects read a sequence of words and were asked to decide quickly whether or not it formed a completely meaningful sentence. Ambiguous sentences were classified more slowly than unambiguous sentences. "However, the fact that the ambiguous effect did not reach significance in the sentence analysis indicates that not all sentences were contributing to the result and the effect may not be a general feature of all lexically ambiguous sentences" (p. 105).

Foss (1970) used a phoneme-monitoring task to clarify the processing strategies used by college undergraduates in dealing with lexical and underlying structural ambiguity. A phoneme-monitoring task requires that the subject listen for a word beginning with a particular letter within a sentence. The subject is to press a button when he hears that sound. The reaction time in performing the task is taken as an indication of sentence processing difficulty. In support of MacKay and Bever's findings, lexical ambiguities were identified faster than underlying structural ambiguities. More importantly, the phoneme-monitoring task was performed faster in unambiguous sentences than in the ambiguous ones. The evidence here suggests that ". . . subjects must deal with ambiguous stretches of input in some way that taxes their processing mechanisms more than an unambiguous input does" (p. 706).

In another phoneme-monitoring task devised by Foss and Jenkins (1973), the processing of lexical ambiguity was again investigated. Ambiguous and unambiguous sentences were constructed. Some of the ambiguous sentences had biased context and some had neutral context. Biased context, in this case, means a context that contains words closely related to one of the interpretations of the ambiguous word. In a neutral context the words are equally related to each interpretation of the ambiguous word. For example, in the sentence "When the man purchased the stock dozens of his friends objected." "Man" is a neutral context item and "stock" is the ambiguous word. If "man" were replaced by "cattleman," the context would become

biased because "cattleman" suggests one meaning for "stock," that is, animals. If "broker" replaced "man," then "stock" would mean something entirely different, but again the context would be biased. Subjects were presented with 60 sentences. Twenty of the sentences were biased in one direction and 20 were biased in another direction. There were also 20 sentences containing a neutral context. The subjects were then asked to push a button whenever a word began with a specified target phoneme, in this experiment either /b/ or /d/. The reaction times of subjects to ambiguous sentences were significantly longer than those to unambiguous sentences. The authors concluded from these results that a ". . . biased context does not reduce the sentence processing complexity caused by an ambiguous word" (p. 586). Also those subjects who claimed not to have noticed the ambiguity had overall slower reaction times. This result is the direct opposite of Carey, Mehler, and Bever's findings (1970). They concluded that when subjects claim to have seen ambiguity before making responses, their latencies strongly suggest that they carried out extra processing before responding. Olson and MacKay (1974) had similar findings. The results of their experiment showed that noticed ambiguities took longer to correctly verify than did unnoticed ambiguities.

There is some research which is not suggesting that studies using a phoneme-monitoring task in dealing with ambiguity are artificial. Newman and Dell (1972) used a phoneme-monitoring task in a neutral/biased context condition. The findings, which were directly opposed to those of Foss and Jenkins, showed that context

removed the ambiguity in the sentences. Newman and Dell also concluded that the phonological properties of the ambiguous words used in a phoneme-monitoring task must be taken into account. These properties include the initial phoneme and the length of the ambiguous word. However, they add that this conclusion refers only to a lexical ambiguity and not to a structural ambiguity since critical words were not varied at that level.

In an experiment using French sentences, Mehler, Segui and Carey (1978) controlled for length of the ambiguous words. In support of Newman and Ell's conclusions, they found that the reaction time to the targeted phoneme was not ". . . determined by the ambiguous or unambiguous status of the test word" (p. 34). Instead, the length of the test word was the more significant factor. When the test word was short the reaction time was longer. Since the majority of the ambiguous test items used by Foss and Jenkins in their phoneme-monitoring experiment were short, this may explain the longer reaction times.

The importance of studying processing in ambiguity research cannot be stressed enough, particularly in reading. As a person reads, he processes and comprehends. Techniques have been developed to discover at what level a person comprehends what he reads. Some of the techniques have proven to be more accurate in measuring this than others. What is truly lacking, however, is an accurate means of evaluating the levels of reading materials, in other words, readability.

### Ambiguity and Readability

The main criterion for evaluating the readability of materials is sentence length. This is at best a crude measure since there are long sentences which, ". . . syntactically speaking, are simple, and short ones which are quite complicated . . ." (Von Glaserfeld, 1970-1971, p. 12). As a result, it is not being suggested that syntactic complexity be taken into consideration when measuring readability (Kaiser, Neils, & Floriani, 1975 ). Von Glaserfeld believes that there are two factors which are responsible for syntactic structures and relations which are not familiar to the reader, and ambiguity of certain phrases (p. 13). The processing and comprehending of a sentence which contains an ambiguity, particularly a structural ambiguity, becomes more difficult because two or more different interpretations have to be made and temporarily stored. Since a sentence does not necessarily have to be long to be ambiguous, the interpretation and storing processes would still be taking place. Therefore, ambiguity should be taken into account when a text is being assessed for readability.

### Development of the Ability to Detect Ambiguity

Although many of the basic syntactic structures are developed early in a child's language, there are a few which are not acquired until much later. Researchers are attempting to identify these structures not only to understand the development of language and syntax more completely, but also to account for them in instructional materials (Dawkins, 1975).

In a developmental study conducted by Shultz and Pilon (1973), the ability of children at the ages of 6, 9, 12 and 15 to detect the different types of linguistic ambiguities was investigated. Sentences were constructed for each of the levels of ambiguity and presented to the individual subjects. The child first had to paraphrase the sentence. The experimenter then presented the subject with two pictures illustrating two possible meanings of the sentence. The experimenter then presented the subject with two pictures illustrating two possible meanings of the sentence. The subject was asked to point to the picture or pictures which showed what the sentence meant. He was also asked to justify his choice. The findings of the study showed that the ability to detect lexical ambiguity increased steadily with age. Lexical ambiguity was also more easily recognized than both surface structure and underlying structural ambiguity. The ability of the subjects to detect these two syntactic ambiguities was not apparent until age 12, and there was no difference in children's ability to detect one of these over the other. The results of this study suggested that the ability to detect linguistic ambiguity develops differently depending on the particular type of ambiguity and the age of the child.

Another developmental study which supports these findings was conducted with fourth and seventh graders using the sentences constructed by Shultz and Pilon (Brodzinsky, Feuer, & Owens, 1977). The authors found that seventh graders were more successful in

paraphrasing the multiple meanings of ambiguous sentences than were fourth graders. They also found that the hardest ambiguities to detect were the structural ambiguities, and again there was no difference in difficulty between surface and underlying structural levels.

These studies suggest that ambiguity particularly at the structural levels is not a basic syntactic structure which is developed early in children's language.

#### Summary

The study of ambiguity is the study of language. A word or sentence is ambiguous when it can be interpreted in two or more ways. Ambiguity occurs at three levels: the lexical level, the surface structure level and the underlying or deep structure level. How it is processed and developed at these levels may lead to more complete knowledge of how language is processed and developed. As the knowledge of language is increased more can be accomplished in the area of assessing and improving materials which are used by educators in the teaching of reading.

## Chapter III

### Design of the Study

#### Purpose

The purpose of this study was to investigate the development of subjects' ability at the seventh, ninth and eleventh grade levels to detect underlying structural ambiguity when reading.

A secondary purpose was to determine if subjects detect underlying structural ambiguity more easily in a paraphrase task or in a sentence completion task.

Finally, the subjects' ability to recognize the gerund-type and participle-type ambiguity was investigated.

#### Hypotheses

1. There is no significant difference in subjects' ability to detect underlying structural ambiguity in grade levels seven, nine and eleven.

2. There is no significant difference in the ability of subjects at the seventh, ninth and eleventh grade levels to detect underlying structural ambiguity when presented with a sentence paraphrase task and when presented with a sentence completion task.

3. There is no significant difference in subjects' ability at the seventh, ninth and eleventh grade levels to recognize the participle-type ambiguity and the gerund-type ambiguity.

## Methodology

### Subjects

Twenty subjects were randomly selected from each of the seventh, ninth and eleventh grade levels. Subjects included both volunteers from study halls and individuals randomly drawn from lists of students. Ten boys and ten girls were selected at each grade level. All of the subjects came from a white, predominantly middle income school district.

### Instruments

1. Ambiguous sentences and sentence fragments were constructed by the researcher, modeled after sentences from other research conducted in the area of ambiguity (MacKay & Bever, 1967; Shultz & Pilon, 1973; Tyler & Marslen-Wilson, 1977). The underlying structural ambiguity in these sentences and fragments was formed using a gerund participle ambiguity (GPA). These GPA sentences and fragments included 12 ambiguous patterns and 12 unambiguous patterns. Examples of these follow. The full set of sentences and fragments may be found in Appendix A.

#### Part I pattern sample - sentence fragments

ambiguous	Moving pictures	1. is	2. are
unambiguous	Wading pools	1. is	2. are

#### Part II pattern sample - sentence paraphrase

ambiguous	I like hunting dogs.
unambiguous	They are washing floors.

These were used to obtain the results for the experiment. Vocabulary was kept simple to ensure that problems with word recognition did not add to the difficulty of the task.

### Procedure

Part I of the experiment consisted of 12 sentence fragments typed on 3 x 5" cards, one to each card. Six of these fragments were ambiguous, and the other six were unambiguous. Three of the unambiguous fragments contained a gerund-type beginning and the other three a participle-type beginning.

All subjects were tested individually. The cards were presented to the subject face down and the following instructions were given:

I am trying to find out if you notice when parts of sentences have more than one meaning. The first two words on all of these cards are the beginning of a sentence. Read, to yourself, the first part of a sentence and the two verbs which follow it. Use the two verbs to finish the sentence. Sometimes you will use both verbs to make up two different sentences and sometimes only one verb will work. Tell me your completed sentence or sentences.

Two examples were then presented, one ambiguous and one unambiguous fragment as sample items. Four more examples were available for subjects who took longer to grasp what they were being asked to do. If after six examples the subjects still did not understand the task, a new subject was chosen. When Part I was completed the subject immediately went on to Part II.

For Part II, six ambiguous sentences and six unambiguous sentences were constructed and typed on 3 x 5" cards. Again three

of the unambiguous sentences contained a gerund phrase and the other three a participle phrase.

Cards were presented to the subject face down and the subject was given the following directions:

I am trying to find out if you can find more than one meaning in a complete sentence. When I tell you to turn over the first card, read the sentence to yourself. When you have finished, tell me what it means. If you see that it has two meanings, tell me the one you saw first and then the other one. Some of the sentences will have two meanings and the others will have only one.

Examples were given as in Part I.

All subjects' responses were tape recorded. Students were identified by a number coding system rather than by name. Credit was given to subjects only if the appropriate responses were made for the ambiguous sentences and sentence fragments.

In order to eliminate the practice effect, Part I and Part II of the experiment were alternated with each different subject.

#### Data Analysis

Hypothesis #1 was analyzed using a one-way analysis of variance (ANOVA).

Hypothesis #2 and #3 were analyzed using a two factor ANOVA with repeated measures on one factor.

#### Summary

Subjects for this study were chosen randomly from the seventh, ninth and eleventh grade levels. They were from a predominantly white, middle income school district. The development of subjects' ability to detect underlying structural ambiguity

was measured using gerund-participle sentences and sentence fragments. Only appropriate responses made on ambiguous sentences and sentence fragments received a score. The three hypotheses were computed using an analysis of variance.

## Chapter IV

### Statistical Analysis

#### Purpose

The purpose of this study was to investigate the development of subjects' ability at the seventh, ninth and eleventh grade levels to detect underlying structural ambiguity when reading.

A secondary purpose was to determine if subjects detect underlying structural ambiguity more easily in a paraphrase task or in a sentence completion task.

Finally, the subjects' ability to recognize the gerund-type and participle-type ambiguity was investigated.

#### Principal Findings

Three hypotheses were investigated in this study.

Hypothesis One. There is no significant difference in subjects' ability to detect underlying structural ambiguity in grade levels seven, nine and eleven.

A one-way analysis of variance was used to test this hypothesis. The results are presented in Table 1. Since the 2.21  $F$ -ratio falls short of meeting significance at the .05 level ( $F = 3.93$ ), there is no significant difference statistically in subjects' abilities at the seventh, ninth and eleventh grade levels to detect underlying

structural ambiguity. Therefore, the findings failed to reject the first hypothesis.

Table 1

One-Way Analysis of Variance for Grade Level Differences  
in Ability to Detect Underlying Structural Ambiguity

Due to	df	SS	MS	F-ratio
Grade level	2	35.83	17.92	2.21
Error	57	463.15	8.13	
Total	59	498.98		

$F (p < .05) = 3.93$

Hypothesis Two. There is no significant difference in the ability of subjects at the seventh, ninth and eleventh grade levels to detect underlying structural ambiguity when presented with a sentence paraphrase task and when presented with a sentence completion task.

Results of a two factor analysis of variance with repeated measures on one of the factors failed to reject the second hypothesis. These results are recorded in Table 2. The computed  $F$ -ratio between groups of 2.61 does not reach the level of significance at the .05 level ( $F = 3.93$ ). Therefore, no developmental pattern has been established among the seventh, ninth and eleventh grade levels on either the completion task or the paraphrase task.

Table 2  
Two-Way Analysis of Variance Using Grade Level and  
Task as Factors with Repetition on Task Factor

Source	df	SS	MS	F
Between Groups:				
Grade Level	2	22.09	11.05	2.61
Subjects (S)	58	245.20	4.23	
Within Groups:				
Completion/ Paraphrase Task	1	59.22	59.22	21.98*
Task x Grade Level	2	3.97	1.99	0.74
Task x Groups	58	156.30	2.69	
Total	121	486.80		

\*p < .05

Hypothesis Three. There is no significant difference in subjects' ability at the seventh, ninth and eleventh grade levels to recognize the participle-type ambiguity and the gerund-type ambiguity.

A two-way analysis of variance using two factors, with repetition on one factor, was used to compute the results for the third hypothesis. Table 3 shows these results.

Table 3

Two-Way Analysis of Variance Using Grade Level and Structure  
as Factors with Repetition on the Structure Factor

Source	df	SS	MS	F
Between Groups:				
Grade Level	2	35.43	17.71	2.71
Subjects (S)	58	378.92	6.53	
Within Groups:				
Gerund/Participle Structure	1	189.38	189.38	54.84*
Structure x Grade Level	2	9.33	4.67	1.35
Structure x Groups	58	200.29	3.45	
Total	121	813.34		

\*p < .03

The  $F$ -ratio (2.71) between groups did not reach the level of significance at the .05 level ( $F = 3.93$ ). The data failed to reject the third hypothesis. This indicates no statistical significant difference among groups at the three grade levels to detect the gerund or participle type ambiguity. In other words subjects at the seventh grade level did not perform significantly better or worse detecting these structures than subjects at either the ninth or eleventh grade levels.

#### Incidental Findings

Although there was no developmental trend apparent in any of the findings, there were some interesting incidental findings.

Table 2 shows that within groups, that is, all the groups combined, there is a highly significant  $F$ -ratio (21.98). It not only reaches significance at the .05 level ( $F = 3.93$ ), but also at the .01 level ( $F = 4.98$ ). This implies that the type of task, rather than grade level, influenced the ability of the subjects to detect the ambiguity. The mean scores of the two tasks strongly suggest that the completion task was not performed as well as the paraphrase task by all of the groups (Table 4).

Table 4  
Mean Scores and Standard Deviations of  
Completion/Paraphrase Tasks

Task	Mean	Standard Deviation
Completion	2.262	1.923
Paraphrase	3.656	1.852

Similar findings resulted on combined group performance of detecting participle-type and gerund-type structural ambiguities (Table 3). The 54.84  $F$ -ratio was above significance at the .05 level ( $F = 3.93$ ), as well as at the .01 level ( $F = 4.98$ ), indicating that the type of structure rather than the grade level, had more bearing on the ability of subjects to detect the ambiguity. Looking at the mean scores of the participle and gerund structures shows that performance on detecting the participle structure was considerably lower than performance on detecting the gerund structure (Table 5).

Table 5  
Mean Scores and Standard Deviations of  
Participle/Gerund Structures

Structure	Mean	Standard Deviation
Participle	7.067	2.691
Gerund	10.098	1.777

Summary

Based on the computed findings, the data failed to reject all three of the stated hypotheses. The results of the study indicated there was no developmental difference among the seventh, ninth and eleventh grade subjects in detecting underlying structural ambiguity. Neither the nature of the tasks nor the ambiguous structures used in the test items reflect a developmental difference in subjects' performances. However, incidental findings showed that the type of task and the type of structural ambiguity were more influential in the subjects' detection performance than was grade level.

## Chapter V

### Conclusions and Implications

#### Purpose

The purpose of this study was to investigate the development of subjects' ability at the seventh, ninth and eleventh grade levels to detect underlying structural ambiguity more easily in a paraphrase task or in a sentence completion task.

Finally, the subjects' ability to recognize the gerund-type and participle-type ambiguity was investigated.

#### Conclusions

The findings of this study suggest that there is no developmental pattern in ability to detect underlying structural ambiguity among the seventh, ninth and eleventh grade levels. There are two possible explanations for these findings. By the time students are at the junior high and high school levels, they may have reached a plateau in their language development. Higher ability and proficiency in language may be credited to other factors such as intelligence, amount of exposure to language or quality of teaching instruction. However the opposite may also hold true. Subjects at these levels may be just beginning development in this area. The evidence from this study and that of Shultz and Pilon (1973), that is, "Detection of syntactic ambiguity was virtually nonexistent before age 12 and

only partially completed by age 15." (p. 732), strongly suggests that this is the case. Studies dealing with ambiguity at the college undergraduate level found that some subjects noticed ambiguity and others failed to do so. Therefore, full development of this ability to detect syntactic ambiguity may not actually occur until subjects reach adulthood.

The most salient findings of this study were incidental. All of the subjects were able to detect more of the ambiguities when performing the paraphrase task than when performing the completion task. In order to successfully perform the completion task, subjects first had to provide their own context. When paraphrasing, the subjects had the complete context available to them, but they had to rearrange it. Therefore, although the ambiguous nature of sentences to be paraphrased may have required some additional processing, the type of processing needed to complete the fragments may have been more demanding.

Another area that may have caused further difficulties for subjects in the completion task was the word order of the fragments. All of the fragments began with the gerund/participle structure (refer to Appendix A). According to Dawkins (1975), rearrangement of expected word order tends to increase the difficulty of comprehension. The paraphrase task required the subjects to read a sentence which contained a subject/verb word order. This word order is basic in the English language and is used often. For the completion task, subjects were asked not only to produce a sentence ending, but also to process a word order in the sentence beginning

which was more difficult and uncommon. When adding the extra processing of the ambiguity, it is easy to see why the completion task might have had such a low performance level.

The incidental findings showed that ambiguity was detected more often in the gerund structures than in the participle structures. Perhaps the exposure to nouns and noun structures that students receive in school may be responsible for their ease at interpreting the gerund ambiguity. In other words, it may have been the adjective structure which increased the difficulty of recognizing the ambiguity, since adjective and adverb structures are less prominent features of sentences than are nouns and verbs. Whether it was the ambiguity or the adjective structure which caused the difficulty in this study is impossible to determine.

#### Implications for Research

Since the results of this study proposed new questions in the areas of language and ambiguity, there is need for further research in these areas. Such research could include:

1. using this same study with older subjects and increasing the size of the sample;
2. correlating subjects' performance on IQ, language proficiency and reading achievement tests with results of their ability to detect structural ambiguity;
3. investigating the effects of instruction on students' ability to detect structural ambiguity;
4. controlling for the difficulty of the tasks and structures used in the experimental instruments. By doing so it would be

possible to measure more accurately the subjects' ability to detect the ambiguity.

#### Implications for Classroom Practice

Since the findings strongly suggest that a completion task is more difficult than a paraphrase task, it is perhaps time to examine the techniques used in the classroom which utilize these tasks. When checking for comprehension of what a student has read, questions are often asked which a student must answer either in written or oral form. Perhaps a better way would be to make statements about the reading which the student must verify as right or wrong and then add justification for their answers. In this way the teacher may get a truer picture of what the students have understood from their reading rather than adding extra processing in the way of producing the correct answer. This is not to say that completion tasks must not be used. Since they do involve extra processing, students should be taught the steps in that process and then be asked to perform using it.

Language instruction is an essential part of curriculum in students' early schooling. However, after students go on to high school, language teaching is not as structured or specific. It is expected that the students will transfer early language knowledge to their content area subjects. If the students are still developing the ability to detect some of the more sophisticated language structures, such as ambiguity, this is an unrealistic expectation. There is a need then for continued instruction in the more complex

structural areas of language, for example the participle structure. The more exposure students have to language and its uses, the better prepared they will be to both read and interpret it.

#### Summary

The conclusions drawn in the study were based on the statistical findings. There was no apparent developmental pattern in the ability of subjects to detect underlying structural ambiguity. The stage of the subjects' language development may have been a factor in this finding. Other factors may also have contributed to the results. The added processing of both the type of task and the type of structure subjects were asked to deal with may have complicated the experiment. Suggestions for further research in these areas were offered as a means of simplifying and clarifying the results. The results did help to shed some light on how classroom practices could be improved.

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## Appendix A

## Gerund-Participle Ambiguity Sentences and Sentence Fragments

Part I	Completion Task	Ambiguous Items
Examples:	Moving pictures	is are
	Drying clothes	takes take
	Writing lessons	seems seem
Test Items:	Coloring books	make makes
	Shaking hands	make makes
	Playing cards	get gets
	Riding horses	seem seems
	Flying kites	look looks
	Cooking apples	make makes

Part I	Completion Task	Unambiguous Items
Examples:	Following orders	is are
	Wading pools	is are
	Mixing drinks	seem seems
Test Items:	Dripping faucets	waste wastes
	Travelling salesman	is are
	Cooking food	smell smells
	Working mothers	pay pays
	Fixing cars	make makes
	Telling stories	scare scares

Part II          Paraphrase Task          Ambiguous Items

Examples:          I like hunting dogs.  
                      It was drinking water.  
                      My friend likes sailing boats.

Test Items:        John likes racing cars.  
                      They are folding chairs.  
                      My mother loves growing flowers.  
                      We all like reading books.  
                      Bill and Sue are visiting friends.  
                      They are milking cows.

Part II          Paraphrase Task          Unambiguous Items

Examples:        The kids like climbing rocks.  
                      Sue saw shooting stars last night.  
                      They are washing floors.

Test Items:        We enjoy camping trips.  
                      Ann likes dancing lessons.  
                      After his sunburn, Pete had peeling skin.  
                      We are playing games.  
                      Mom is mending shirts.  
                      He is eating meat.