

INFORMATION TO USERS

This material was produced from a microfilm copy of the original document. While the most advanced technological means to photograph and reproduce this document have been used, the quality is heavily dependent upon the quality of the original submitted.

The following explanation of techniques is provided to help you understand markings or patterns which may appear on this reproduction.

- 1. The sign or "target" for pages apparently lacking from the document photographed is "Missing Page(s)". If it was possible to obtain the missing page(s) or section, they are spliced into the film along with adjacent pages. This may have necessitated cutting thru an image and duplicating adjacent pages to insure you complete continuity.**
- 2. When an image on the film is obliterated with a large round black mark, it is an indication that the photographer suspected that the copy may have moved during exposure and thus cause a blurred image. You will find a good image of the page in the adjacent frame.**
- 3. When a map, drawing or chart, etc., was part of the material being photographed the photographer followed a definite method in "sectioning" the material. It is customary to begin photoing at the upper left hand corner of a large sheet and to continue photoing from left to right in equal sections with a small overlap. If necessary, sectioning is continued again — beginning below the first row and continuing on until complete.**
- 4. The majority of users indicate that the textual content is of greatest value, however, a somewhat higher quality reproduction could be made from "photographs" if essential to the understanding of the dissertation. Silver prints of "photographs" may be ordered at additional charge by writing the Order Department, giving the catalog number, title, author and specific pages you wish reproduced.**
- 5. PLEASE NOTE: Some pages may have indistinct print. Filmed as received.**

University Microfilms International

300 North Zeeb Road
Ann Arbor, Michigan 48106 USA
St. John's Road, Tyler's Green
High Wycombe, Bucks, England HP10 8HR

7816122

BERNSTEIN, DEENA K.
SEMANTIC DEVELOPMENT IN CONGENITALLY BLIND
CHILDREN.

CITY UNIVERSITY OF NEW YORK, PH.D., 1978

University
Microfilms
International

300 N. ZEEB ROAD, ANN ARBOR, MI 48106

SEMANTIC DEVELOPMENT
IN
CONGENITALLY BLIND CHILDREN

by

Deena K. Bernstein

A dissertation submitted to the Graduate Faculty in
Speech-Hearing Sciences in partial fulfillment of the
requirements for the degree of Doctor of Philosophy,
The City University of New York.

1978

This manuscript has been read and accepted for
Graduate Faculty in Speech-Hearing Sciences in satisfaction
of the dissertation requirement for the degree of Doctor of
Philosophy.

May 11, 1978
(Date)

Norma S. Rees
Chairman of Examining Committee

May 11, 1978
(Date)

Walter Horstberg
Executive Officer

Joseph Glick, Ph.D.

Helen Cairns, Ph.D.
Supervisory Committee

Abstract

SEMANTIC DEVELOPMENT IN
CONGENITALLY BLIND CHILDREN

by

Deena K. Bernstein

Advisor: Dean Norma Rees

Matched groups of normal and congenitally blind children (possessing only light perception or less) were compared on their comprehension of dimensional adjectives (big-little, long-short, and thick-thin); relational terms (same-different) and locatives (front, back, side, in, on, under). All of the children tested were $2\frac{1}{2}$ - 4 years of age. Half of the normal subjects performed the experimental tasks blindfolded. On all tasks measured blind children's performance was significantly delayed when compared to that of the normal children.

The data suggest that the significant differences found between the blind and sighted subjects may be attributable to the more basic cognitive deficits of the blind. It confirms the position taken by that of Hatwell (1966), Stephens and Simpkins (1974), and Foster (1977).

The fact that language delays were found in the blind population as early as $2\frac{1}{2}$ years serves to underscore the need for early language intervention. While the

correlation between language development and cognition remain controversial, it may be the case that while some concepts develop relatively independent of language (Piaget, 1960; Morehead and Morehead, 1976; Slobin, 1973) others may develop because "language gives the child a little nudge" (Bowerman, 1976). Appropriate language intervention may aid the blind child in learning certain concepts and provide him with the symbols which code them. Language teaching, however, must be designed to promote greater interaction of the blind with his environment and must take place as the child is in direct contact with it. For the blind child, the complex relationship between language acquisition and cognition is particularly important in all program planning.

The data obtained from this study confirmed E. Clark's (1973) hypothesis regarding both the order and the nature of the acquisition of dimensional adjectives. The most general of the dimensional adjectives (big-little) were acquired before the more specific ones (long-short, thick-thin). Furthermore, the unmarked adjective of each adjectival pair (big, long, thick) was acquired before its marked counterpart (little, short, and thin). The findings regarding the acquisition of relational terms and the acquisition of locatives did not entirely conform to E. Clark's predictions.

The youngest children in this study interpreted

different to mean same performing like Donaldson and Wales' (1970) subjects . However, the older children seemed to go through a stage where different meant similar. This stage occurred at about $3\frac{1}{2}$ years of age. The children who picked a stimulus similar to the target when asked to choose one that was different were only able to attend to one dimension of difference when making their judgment. The dimension to which the children attended depended on the modality used for the task.

In regard to the locatives studied, three findings emerge: (1) While the unmarked locative front was acquired before back and back was acquired before side, the complexity of the task (that is, the non-linguistic context) influenced the children's performance. Thus, the intrinsic characteristic of the objects used as well as the subjects' own relationship to the objects influenced their comprehension of these terms. (2) While the non-linguistic context and the children's knowledge of the usual spatial relationship of objects influenced their comprehension of the locatives in, on and under, the data do not support E. Clark's claim of the order of acquisition of these terms. In this study on was acquired before in, followed by the acquisition of under. (3) Furthermore, it was found that when children did not comprehend the language directed at them and when they did not have knowledge about the relationship of the

objects to each other, they used an action-based response strategy. This occurred for the youngest normals and for nearly all the blind subjects.

While the Full and the Partial Semantics Hypotheses provide a useful framework for the interpretation of data on the acquisition of word meaning, the hypotheses do not account for the development of concepts which words code. There remains a need for a theoretical model which would integrate perceptual input, linguistic input, and cognitive development to explain both the stages and processes of language acquisition.

ACKNOWLEDGEMENTS

I would like at this time to acknowledge the assistance of three outstanding members of the CUNY faculty who helped bring this work to fruition: Dean Norma Rees, who encouraged me throughout - not merely during the writing of this dissertation but during my entire career as a CUNY doctoral student; Professor Helen Cairns, who provided me with keen insights into the nature of research and; Professor Joseph Glick who assisted me in gaining valuable information about the nature of "the mind".

My thanks also to two Queens College graduate students, Ms. Miriam Litwack and Ms. Esther Schnaittacher for assistance in recording of the data. Ms. A. Gordon and Ms. M. Lang of the New York Association for the Blind, and Ms. E. Patt and Ms. Berger of the Industrial Home for the Blind, were of great assistance in locating suitable subjects in the New York Metropolitan area. I am very grateful to Mr. K. Meegan, Children's Consultant for the New York State Commission for the Blind for his help in locating subjects in upstate New York and for the information he provided me about the nature of the pre-school blind population in this state. I would also like to thank Mr. D. Schur for his technical assistance in constructing the test stimuli, Dr. J. Stark (Queens College) for his encouragement, Dr. H. Levitt for his help in finding sources for financial support

VI.

during my student days, and Dr. I. Pressman (Baruch College) for his help in the statistical analysis of the data.

Last, but not least, my appreciation to my husband, Josh, for his moral and intellectual support, to my children, Ariella Y. and Chaim Z. for their understanding, and to my mother, Mrs. Pearl Kahan who was always there when needed.

This work is dedicated to my late father, Mr. Julius Kahan, of blessed memory, a scholar in his own right, who appreciated learning and scholarship. He would have been proud.

Table of Contents

Chapter I: Introduction	7
Chapter II: Semantic Development in the Normal Child . .	15
Chapter III: Review of Relevant Research: The Blind Child	45
Chapter IV: Methodology	67
Chapter V: Results	85
Chapter VI: Discussion	109
Chapter VII: Summary and Implications for Further Research	128
Tables	134
Figures	160
Appendix A	188
Bibliography	189

List of Tables

	<u>Page</u>
I General Pattern of Each Array Used in Experiment II (Part B).	134
II The Composition of Test Arrays Used in Experiment II (Part B).	135
III Stimuli Used to Test the Comprehension of the Locatives in Experiment III (Part B).	136
IV Comprehension of Dimensional Adjectives: Number of Correct Responses by Each Subject Within Each Type and Age Level.	137
V Comprehension of Dimensional Adjectives: Percen- tage of Correct Responses to Specific Lexical Items by Child Type and Age Level.	138
VI Comprehension of Dimensional Adjectives: Results of Analysis of Variance.	139
VII Comprehension of Dimensional Adjectives: Neuman-Keuls Analysis of Components in the Child Type Factor.	140
VIII Comprehension of Dimensional Adjectives: Neuman-Keuls Analysis of Components in the Age Factor.	141
IX Comprehension of Dimensional Adjectives: Neuman-Keuls Analysis of Components in the Specific Adjective Factor.	142
X Comprehension of Dimensional Adjectives: Neuman-Keuls Analysis of Components in Child Type x Dimension Interaction.	143
XI Comprehension of Dimensional Adjectives: Neuman-Keuls Analysis of Components in Age Level x Dimension Interaction.	144
XII Comprehension of Same and Different by Level III Subjects: Results of Analysis of Variance. .	145
XIII Patterns of Responses to Different by Level III Subjects	146
XIV Dimension to Which Subjects Attended When Making Judgments About Differences Among Stimuli. . . .	147

XV	The Comprehension of Locatives: Number of Correct Responses to <u>Front</u> , <u>Back</u> and <u>Side</u> by Each Subject at Each Age Level for the Four Tasks.	148
XVI	Comprehension of Locatives <u>Front</u> , <u>Back</u> and <u>Side</u> : Results of Analysis of Variance.	149
XVII	Comprehension of Locatives (Part A): Neuman-Keuls Analysis of Components in the Child Type Factor.	150
XVIII	Comprehension of Locatives (Part A): Neuman-Keuls Analysis of Components in the Age Level Factor	151
XIX	Comprehension of Locatives (Part A): Neuman-Keuls Analysis of Components in the Task Factor.	152
XX	Comprehension of Locatives (Part A): Neuman-Keuls Analysis of Components in the Position Factor.	153
XXI	Comprehension of Locatives (Part A): Analysis of Components in Position x Task Interaction	154
XXII	Comprehension of Locatives <u>In</u> , <u>On</u> and <u>Under</u> in the Congruent and Incongruent Contexts: Total Number of Correct Responses by Child Type and Age Level.	155
XXIII	Comprehension of Locatives (Part B): Neuman-Keuls Analysis of Components in the Child Type Factor.	156
XXIV	Comprehension of Locatives (Part B): Neuman-Keuls Analysis of Components in Age Level Factor	157
XXV	Comprehension of Locatives In, On and Under: Results of Analysis of Variance.	158
XXVI	Motoric Responses Necessary for Each Locative Placement in the Congruent and Incongruent Contexts . .	159

List of Figures

<u>Figure</u>	<u>Page</u>
1. Comprehension of Dimensional Adjectives: Percentage of Correct Responses by Child Type . . .	.160
2. Comprehension of Dimensional Adjectives: Percentage of Correct Responses by Age Level . . .	.161
3. Comprehension of Marked and Unmarked Dimensional Adjectives: Percentage of Correct Responses for All Subjects.	.162
4. Percentage of Correct Responses to Specific Lexical Items Used to Code Dimensions	.163
5. The Main Effects of Child Type and Age on the Comprehension of Dimensional Adjectives	.164
6. The Main Effects of Type of Dimensional Adjec- tive on Childrens' Comprehension of Dimensional Adjectives.	.165
7. The Main Effects of Adjectives (Specific Lexical Items) on Childrens' Comprehension of Dimensional Adjectives	.166
8. Comprehension of Dimensional Adjectives: Interaction of Child Type x Dimension	.167
9. Interaction of Age Group Dimension for the Comprehension of Dimensional Adjectives	.168
9b. Comprehension of Dimensional Adjectives: Interaction of Child Type x Dimension x Age Level	.169
10. Interaction of Child Type x Specific Lexical Term for the Comprehension of Dimensional Adjectives . .	.170
11. Interaction of Specific Lexical Terms x Age Group on the Comprehension of Dimensional Adjectives . .	.171
12a. Comprehension of Same and Different: Percentage of Correct Responses by Child Type (Across all Age Levels).	.172
12b. Percentage of Correct Responses to <u>Same</u> by Normal, Blindfolded and Blind Children According to Age Level.	.173

13.	Percentage of Correct Responses to <u>Different</u> by Normal, Blindfolded and Blind Children According to Age Levels	174
14.	The Comprehension of Locatives: Percentage of Correct Responses for <u>Front</u> , <u>Back</u> and <u>Side</u> for All Tasks by Child Type	175
15.	The Comprehension of Locatives: Percentage of Correct Responses for <u>Front</u> , <u>Back</u> and <u>Side</u> by Task.	176
16.	The Comprehension of Locatives: Percentage of Correct Responses for <u>Front</u> , <u>Back</u> and <u>Side</u> by Child Type and Task	177
17.	Percentage of Correct Responses to Specific Locatives by all Children Across all Age Levels. . .	178
18.	Comprehension of <u>Front</u> , <u>Back</u> and <u>Side</u> : Main Effect of Age and Child Type	179
19.	Comprehension of <u>Front</u> , <u>Back</u> and <u>Side</u> : Inter- action of Task x Position.	180
20.	Comprehension of <u>In</u> , <u>On</u> and <u>Under</u> : Percentage of Correct Responses by Child Type	181
21.	Comprehension of <u>In</u> , <u>On</u> and <u>Under</u> : Percentage of Correct Responses by Age Level.	182
22.	Comprehension of <u>In</u> , <u>On</u> and <u>Under</u> : Percentage of Correct Responses in Congruent/Incongruent/ Neutral Contexts	183
23.	Comprehension of <u>In</u> , <u>On</u> and <u>Under</u> : Percentage of Correct Responses Across all Tasks.	184
24.	Main Effect of Child Type on the Comprehension of <u>In</u> , <u>On</u> and <u>Under</u>	185
25.	The Effect of Age on the Comprehension of <u>In</u> , <u>On</u> and <u>Under</u>	186
26.	The Effect of Context on the Comprehension of <u>In</u> , <u>On</u> and <u>Under</u>	187

Chapter I

Introduction

The development of language and communication skills in blind children has not traditionally been an area of concern to specialists in communication disorders. While it is agreed that the deaf, cut off from hearing speech and language, would indeed have difficulties in learning speech and language, it has been presumed that such would not be the case with the blind. Thus educators of the blind have not readily seen the need to provide language intervention programs for the young blind child. They have reasoned that since blind children can hear the language directed to them, there would be no reason to assume that they would exhibit delays in their language development. Indeed, only a handful of centers servicing the blind provide speech and language services to their clients; and those that do have a speech-language pathologist on their staff use the service for the multihandicapped youngsters.

Nevertheless, in a recent paper delivered at the American Speech and Hearing Association, Fay (1975) described a 1955 study in which 53 blind children were evaluated upon entrance to Nursery School. Of those children studied, 25% of the children had normal speech, 25% of the children had no speech, and 50% of the children had delayed or defective speech. Fay (1975) further describes the triple trauma of blindness (neurological insult, sensory deprivation and the

autistic process) and its relationship to the development of language and communication. Fay argues strongly for the "belated recognition needed" for the communication problems of the blind and the appropriate programs of remediation. Although Fay skips lightly over the second trauma, i.e., "sensory deprivation", he admits that "due to sensory deprivation simple vocabulary growth as well as more complex cognitive operations are vulnerable" (in the blind) and that "we are all aware of the effects of perceptual disorders to language growth".

Rees and Wollner (1975) agree with Fay's position (1975) and point out that there presently exist no comprehensive procedures or materials for assessing language skills in blind children. They state this is the case not only because the blind have not been regarded as a target population for speech pathology services, but also because the communication disorders found in some blind children are more similar to the communication problems of the emotionally disturbed. Rees and Wollner's (1975) thrust was to develop an assessment tool which would deal with "the characteristics of communicative competence that set this group [the blind] apart from other types of language disordered children."

A survey of the literature reveals that there exist no experimental data on how congenital blindness affects the child's acquisition of language. While Clark has alluded to

the importance of visual perception in early lexical acquisition (Clark, 1973, 1974), no experimental research has been carried out to determine the role of vision in semantic development. Furthermore, no data exist regarding the role vision plays in providing the contextual cues the child uses to formulate non-linguistic strategies for learning word meaning. Most of the recent experimental research on this population describes the cognitive functioning of the blind (Hatwell, 1966; Cromer, 1973; Stephens and Simpkins, 1974; Gottesman, 1971, 1973; Foster, 1977). A survey of the literature reveals only observational reports and/or descriptive studies about the language development of blind children. These reports seem to indicate that the language development of blind children is delayed (Burlingham, 1961; Fay, 1975; Nagera and Colonna, 1965), and some researchers claim that the "methods used (by blind children) in learning language or the sequences of language development are different," (Zweibelson and Barg, 1967, p. 218)

There are approximately 4,000 pre-school (under the age of seven years) blind children in the United States today (Hatfield, 1972). In the most recent study available, undertaken by the National Society for the Prevention of Blindness, Hatfield (1972) compares the incidence and causes of blindness as taken from survey data obtained in 1950 and in 1965. In her paper she notes that the 1950 data show a greater inci-

dence of children with severe visual loss (either total blindness of light perception) than appeared in the 1965 survey. Hatfield (1972) attributes the higher incidence of severe visual impairment of the 1950's to RLF (retrolental fibroplasia). RLF, a disorder unknown prior to the early 1940's, was first identified by Terry (1942). Within a short span of approximately ten years, RLF became one of the leading causes of blindness in children in the world, and in the United States, greater than all other causes of child blindness combined (Patz, 1970). The cause of blindness due to RLF was the excessive use of oxygen therapy given to premature infants. While RLF produced blindness early in life, it did not seem to leave the child with additional physical anomalies such as cardiac impairments, deafness, or orthopedic handicaps.

In a paper concerned with the problems of managing oxygen therapy for premature infants, Patz (1970) points out that the pediatrician of the late 1950's and early 1960's was frequently confronted with a dilemma: either not treating premature babies with oxygen therapy, or risking blindness due to RLF.

Data taken from the Hatfield (1972) study seem to indicate that within the early and mid 1960's modern medicine had learned to curtail and restrict the amount of oxygen given to premature infants, for the incidence of blindness in 1965 due to RLF had drastically decreased. Hatfield

(1972) points out, however, that by 1965 maternal rubella had replaced RLF as the leading cause of blindness. It is well documented that maternal rubella is an exceptionally virulent destructive agent to the fetal organs when it occurs in the mother during the first trimester of pregnancy. The clinical sequelae of rubella are hearing losses, ocular disorders, and enlargement of the liver and/or the spleen and other physical anomalies (Goodhill and Guggenheim, 1971).

It appears then that while there has been a decrease in the number of normal congenitally blind children due to RLF, there has been an increase in the number of multihandicapped blind children. There exist no current survey data (for the 1970's) on the number of pre-school congenitally blind children who possess no other handicaps, or on the number of pre-school handicapped blind children in the United States today. Surveys are at this moment being undertaken.¹ On the basis of their school enrollments, however, educators of the blind are convinced that there has been a reduction in the pre-school "normal" congenitally blind population group, while there has been an increase in the population of multihandicapped blind children.^{2,3,4} Indeed the majority of young children serviced by centers for the blind today are

¹Hatfield (personal communication).

^{2,3,4}Patt, Berger, Lang (personal communication).

in fact multihandicapped youngsters; that is, in addition to their blindness, the children may be hard of hearing, mentally retarded, severely or moderately emotionally disturbed, and/or brain damaged. In addition, many have orthopedic handicaps.

The subjects of the research reported in this dissertation were congenitally blind children without other handicapping conditions, here referred to as "normal" congenitally blind. While the total number of subjects used in this study is small, it is clear that this is in part attributable to the limited number of normal congenitally blind subjects available, and also because of the criteria formulated for subject selection. (See Chapter 4.) Those children that were selected for the study were well-known to the directors, teachers, and social workers in their respective clinics. In each case the child and his or her family had been serviced by the center from the time they were infants (one year or younger). The children tested were enrolled in pre-school programs for blind children and in most cases the families were receiving supportive services from the centers (e.g., family counseling).

While I.Q. scores were not available for every child tested, the nine congenitally blind children under study were judged to be functioning within normal limits by the pre-school teacher and by either the social worker, the psychologist, or the director of the center. In fact, the three oldest blind children of the study were tested during July and August of 1977 and were "mainstreamed" into normal nursery school classes in the Fall of 1977.

The purpose of this study was to discover how congenital blindness affects the acquisition of meaning of lexical items that code dimensional, relational, and spatial relations. It was hypothesized that given the delays in certain aspects of cognitive development reported by researchers (Hatwell, 1966; Stephens and Simpkins, 1974; Foster, 1977) and the effects of "sensory deprivation" (Fay, 1974), experimental research would show delays in blind childrens' language development as well. Within the framework of the experimental design, the following questions were asked:

1. Are the lexical representations of blind children the same as those of normal children?

2. In the absense of complete lexical representations, do blind children set up different strategies for decoding word meaning?

3. Does the blind child acquire the meaning of relational and dimensional adjectives and the meaning of locatives in the same developmental sequence as the normal child?

While the focus of this research was only on certain aspects of language development, that is, semantic development, the existence of other types of communication problems of blind children have been reported (Rees and Wollner, 1975) and should be of concern to educators of the blind as well as to the speech and language pathologist.

A review of the literature is divided into two chapters. Chapter II reviews the relevant research and the current hypotheses regarding semantic development in normal children. Chapter III reviews the research pertaining to language development in blind children.

Chapter II

Semantic Development in Normal Children: A Review of Relevant Research

Recent research in developmental psycholinguistics has addressed the question of how children attach meaning to lexical items. Based upon her own research (1972, 1973) and that of Donaldson and Wales (1970) and Donaldson and Balfour (1968), E. Clark first advanced the Full Semantics Hypothesis to account for lexical acquisition. The Full Semantics Hypothesis states that when a child first begins to use identifiable words, he does not know their full meaning; that is, he has only partial entries for them in his lexicon. These partial entries correspond in some way to the features that are present in the entries for the same words in the adult's lexicon. The child begins to learn word meanings by identifying the word with one or two of its semantic features. Children eventually come to know the adult meanings of words by compiling sets of features sequentially. The acquisition of semantic knowledge consists of adding more features of meaning to the lexical entry of a word until the combination of features in the entry of that word corresponds to that of the adult's. The hypothesis also posits a fixed order of acquisition of semantic features,

starting with the more general ones, and moving toward the more specific ones.

E. Clark (1973) provided considerable evidence supporting the Full Semantics Hypothesis. When she extensively examined the diary data on young children's early language development in English and in other languages (Russian, German, French), she noted that the children consistently misapplied words from the adult point of view. For example, the very young child referred to all four-legged animals such as dogs, cats, cows, horses or sheep as "bow-wows" or "doggies." Clark (1973) labelled these "errors" overextensions. Clark maintains that there is a commonality which can account for overextensions seen in the cross-cultural diary literature. She states:

...the features that are used critically in the overextensions of words appear to be derived predominantly from the perceptual input to the child....The majority of overextensions reported...appear to be based on the perceived similarities between the objects or events that are included referentially within a single category. (1973, p. 79)

Clark argues that perceptual input provides a primary source of information about the meaning of words. According to

Clark:

The principal critical characteristics that form the basis of overextensions can be sorted into six categories: those based on shape, on movement, on size, on sound, on taste, and on texture. The perceptual modality employed for the different categories of overextensions can be listed as follows with visual perceptual playing the primary role...1) shape: visual, tactile; 2) movement: visual, auditory; 3) size: visual, tactile; 4) sound: auditory; 5) taste:

gustatory, olfactory; 6) texture: visual, tactile. (1974 b., p. 111)

Implicit in the Clark hypothesis that the child's perceptual knowledge influences what features he will use for the meanings of words is the assumption that the child starts out with an hypothesis about what a new word might mean. She states: "A word refers to some identifiable, perceptually salient characteristic of the object pointed." (Clark, 1974b) Given that the child begins with the above perceptually-based hypothesis, the child then adopts the following strategy for comprehension and production: "Pick out whatever seems to be the most salient characteristic perceptually and assume, until given counter-evidence, that this is what the word refers to. Act on this assumption whenever you want to name, request and call attention to something" (Clark, 1974b)

According to Clark, therefore, the process of formulating perceptually-based hypotheses about word meanings accounts for the large number of overextensions observed during the first year or so of speech. To summarize Clark's theory, much of the conceptual basis for early language acquisition consists of perceptual information which the child "has successfully interpreted and organized by the time he starts to work on language." (1974b) In acquiring the meaning of words that refer to classes of objects, children employ strategies based on their perceptual knowledge of the world. In the learning of tangible referents children attend

to the salient perceptual features involving shape, movement, size, and texture.

Wilcox and Palermo (1976) point out some of the difficulties with E. Clark's Full Semantics Hypothesis. They state that while the Full Semantics Hypothesis can account for the overextensions observable in the speech of young children, (that is, in their speech production), it also predicts that the children should exhibit overgeneralizations (that is, overextensions) in their language comprehension as well; especially in their comprehension of words that refer to concrete objects. For example, if a child takes "dog" to mean "four legged animal" he should sometimes respond to questions about the location of the dog (i.e., "Where's the dog?"), by pointing to the cat. This should especially occur in situations when the dog is not present (and the cat is). Few such examples, say Wilcox and Palermo (1976), are reported in the literature. Huttenlocher (1974) found no evidence of overgeneralization in the comprehension of words that refer to concrete objects by 10-19 month old children. Huttenlocher's subjects were 10-18 month old children who were tested over a period of six months in their homes. The test procedure involved asking the children to select an object from an array of items. According to Huttenlocher (1974), if the children didn't know a word they simply didn't respond. Interestingly, this phenomenon occurred with the same children

who were reported by their mothers to display overextensions in their speech production.

Nelson's (1974) position on how children form the categories that underlie their early use of words (for objects) differs from that of Clark's. To Nelson, perception plays a secondary rather than a primary role in concept formation. According to Nelson, function is more basic than perception. She argues that children do not start out by analyzing the objects they encounter into perceptual components such as "round" or "four-legged" and use such components as a basis for classifying these objects with other objects. Rather, they experience objects as wholes, in terms of the sets of dynamic relationships and actions they can enter into. Objects are regarded as similar not because they look similar but because they enter into the same relationships, or put another way, because they function in the same way.

In assessing the two theories Bowerman (1976) states that "the bulk of evidence seems to favor Clark's perception-based theory." In attempting, however, to integrate the two theories, Bowerman (1976) writes:

...the evidence indicates that perceptual similarities are stronger determinants than functional similarities of children's judgments among objects. However, the potential that objects have for acting and being acted upon is evidently an important determinant of which objects children initially "select" to learn names...It seems, then, that children's attention is drawn to

objects with potential for acting or being acted on, and they will tend to learn names for such objects earlier than names for more static objects. However, classifying such objects as equivalent for purposes of word use appear to depend more upon their perceptual qualities than on their function. (pp.126-127)

Returning to the nature of Clark's model, it may be recalled that the Full Semantics Hypothesis states that children learn word meanings by identifying a word with one or two of its semantic features. What, however, is the nature of a "semantic feature"? One of the basic principles of Semantic Feature Theory is that word meaning is some combination of units of meaning smaller than that represented by the word. These units can be described in various ways and have been called features, components, or minimal units of content. Bierwisch (1970) attempts to describe the relationship between components of meaning and their relation to the external physical attributes of objects and events in the following way:

The semantic features...represent psychological conditions according to which human beings process their physical and social environment. Thus they are not symbols for physical properties and relations outside the human organism, but rather for the internal mechanism by means of which such phenomena are perceived and conceptualized. This then leads to the...hypothesis that all semantic structures might finally be reduced to components representing the basic dispositions of the cognitive and perceptual structures of the human organism. According to this hypothesis, semantic features cannot be different from language to language, but are rather part of the general human

capacity for language, forming a universal inventory used in particular ways by individual languages (pp.181-182).

The above passage suggests that Bierwisch claims that there is a common interpretative format into which all "semantic structures" are translated. Moreover, he suggests that individual features constitute linguistic universals in that all languages of the world use a common set of semantic features which represent dimensions of contrast available to all humans.

One assumption of E. Clark's Full Semantics Hypothesis is that the earliest semantic features belong to a universal set of semantic primitives. The primitives are assumed to be universal because they derive from the human organism's perceptions and cognitions. Research on the development of perception (Gibson, 1969) tends to lend support to the assumption that development progresses from attention to and use of single central features followed by attention to and use of configurations of features. Gibson (1969) states that the young infant first attends to single features when looking at objects. This initial attention to single features then develops into the use of what Gibson (1969) calls "bundles of features":

Distinctive features develop later out of these properties as contrasts are discovered... the specificity of discrimination is thereby increased. Gestalten or higher order structural units develop still later, as

bundles of features are processed with greater simultaneity and relations between features are registered as units of structure.(p.345)

The development of perception going from attention to individual features to attention to configurations or structural relations between features is similar, says E.Clark, to what appears to go on in the use of early semantic features that are attached to a word.

It is possible that the use of perceptual features that are...interpreted as the meaning of a word...follows a developmental pattern of perception. To begin with, only single features are interpreted and put down as the meaning for a word, but later on, configurations of perceptual features are used as a structured whole to code some of the word's meaning.(Clark, 1973, p.103)

In lexical development, Clark hypothesizes that the child will begin by using a single feature as the basis for word meaning and gradually add other features until the entry of all the features of that word is complete.

The Relationship of Language Development to Cognitive Development

Research done at the beginning of this century viewed childrens' development as strongly influenced by or even determined by the language to which they were exposed (the hypothesis advanced by Benjamin Lee Whorf, (1956): The current prevalent view is that cognitive development is relatively

independent of language. The child is now viewed as coming to the language learning task well-equipped with a stock of basic concepts that he built up through his interactions with the world. His problem is to discern how these concepts can be mapped onto language, rather than to learn from language what the necessary concepts are (Slobin, 1973; Bloom, 1973; Nelson, 1974). This point of view has been termed the cognition-first position of language development and has been discussed fully by Cromer (1974). Experimental evidence for this point of view has been provided by many researchers including Piaget (1973), Furth (1969), Slobin (1973), Sinclair-de-Zwart (1967), and Morehead and Morehead (1974).

A modification of the strict cognition-first viewpoint is discernible in some of the most recent literature on language acquisition. Schlesinger (1974, 1977) rejects the notion of cognitive determinism which postulates a one-way influence from cognitive to linguistic development. He argues that cognitive development is determined by a variety of factors, linguistic input among them. His position is similar to that taken by Wells (1974). Schlesinger (1974, 1977), Bowerman (1976), and Wells (1974) all take what is termed an interactionist position. They accept the hypothesis that language input can have an influence on the child's cognitive structuring of the world from his earliest attempts to make sense of

language, but they nevertheless acknowledge the role of the child's inherent disposition to develop cognitively along certain lines. In explaining the interactionist position Bowerman (1976) writes:

According to this position there are many relationships possible between language and concept formation depending both on the kinds of concepts involved and on the type of linguistic input. Some early concepts undoubtedly develop autonomously (i.e., independently of language), particularly those which are universal (e.g., object permanence). Other early concepts might be considered autonomous only insofar as they require a nonlinguistic potential for recognizing certain sorts of similarities across experiences. However, they would start to develop primarily because the child's caretakers call his attention to the possibility of grouping along certain lines by repeated uses of the same word in superficially variable situations. (p.113)

Bowerman (1976) states that the issues concerning the relationships between cognitive and semantic knowledge as well as the ultimate source for the child's earliest semantic categories "are complex ones" and "are relevant to the study of word meanings." Furthermore, she says:

...it is not surprising that children often show by the way they use or understand given words in new situations that they have misconstrued the meanings which adults intended in their prior uses of the same words. The ways in which they misconstrue give valuable insights into the nature of the processes by which word meanings are acquired. (pp. 114-115)

It is precisely "the processes by which word meanings are acquired" to which E. Clark's model addresses itself. Her Full

Semantics Hypothesis assumes that a) the child learns the meaning of a word by identifying it with one or two of its semantic features; that b) the first semantic features that the child uses are perceptually derived; c) as the child adds new features of meaning to his lexical entries his overgeneralized categories will be reduced to something nearer the adult size. E. Clark (1973) stresses that this is accomplished as the child increases the differentiation of lexical entries by learning the semantic features which separate lexical items.

The Acquisition of Dimensional Adjectives

The Full Semantics Hypothesis predicts the order of acquisition of semantic features; that is, that the more general semantic features are acquired earliest and the more specific ones later. Thus, for example, the hypothesis predicts that the dimensional adjectival pair big-little will be acquired before long-short, because the former pair encodes general meaning. This prediction has been confirmed in experimental studies of children's comprehension of dimensional adjectives (Donaldson and Wales, 1970; Eilers et al., 1974; Tashiro, 1971).

In the Tashiro (1971) experiment children's comprehension of adjectival pairs was tested by a picture - identification task. The children tested were $2\frac{1}{2}$ - 4 years of age

and were asked to point to one of the two pictures which depicted the non-comparative forms of some pairs of dimensional adjectives. Overall, Tashiro (1971) found that the pair big-little was significantly better understood by the children than the other dimensional terms (i.e., long-short; wide-narrow, thick-thin). Tashiro (1971) argues that these results support an order of acquisition going from the "more general concepts to the more specific ones." The children in her study also appeared to comprehend tall better than high, and found thick and wide the most difficult of the unmarked dimensional adjectives.

Donaldson and Wales (1970) reported on children's comprehension and use of several pairs of dimensional adjectives. Their comprehension task involved testing 15 children between the ages of $3\frac{1}{2}$ - 5 on their understanding of the comparative and superlative forms of dimensional adjectives. The adjective pairs tested were big-wee (small), long-short, thick-thin, high-low, tall-short, and fat-thin.

In the comprehension task the children had to point first to the biggest and to the wee-est of the objects in an array and then to an object that was bigger or wee-er than a standard among the stimuli. The same procedure was carried out to test their comprehension of the other dimensional adjective. Their results indicated that in both the superlative and comparative tasks, the more general adjectival pair big-wee

was better understood than the more specific ones (i.e., long-short or thick-thin).

In a more recent study Eilers et al. (1975) tested 14 children between $2\frac{1}{2}$ - $3\frac{1}{2}$ years of age on their comprehension of the dimensional adjectives big-little, long-short, wide-narrow. The children were shown a pair of objects and were asked to give the experimenter the "_____" one, where "_____" was one of the dimensional adjectives. The results of their study indicated that fewer errors occurred on the more specific pair big-little than on the more specific ones (long-short and wide-narrow). In a production task in which four-year-old children were asked to give the opposites of the same dimensional adjectives, E. Clark (1972) found that big was treated as a synonym for many of the more specific (unmarked) dimensional adjectives. Furthermore, small or little was substituted in the same way for the corresponding more specific (marked) members of each adjective pair. For example, the children in her study gave big as the opposite of small, short, thin, and low; while small or little was given as the opposite to big, high, tall, long, wide, and thick (ranked by frequency). E. Clark (1972) argues that these data support the interpretation that the meaning of big at first extends over the meanings of the more specific dimensional adjectives such as long, high, tall, and wide; and only later does the child learn to apply the other dimensional adjectives to more specific areas of semantic domain. Likewise, small (little, wee) acts

as the cover for the more specific of the marked members of dimensional adjectival pairs.

In summary, then, the prediction of the Full Semantics Hypothesis that the order of acquisition of dimensional adjective pairs corresponds to their order of semantic generality seems to be confirmed by experimental research.

The Full Semantics Hypothesis also predicts that the child learns the positive or unmarked member of an antonym pair before he learns the negative or marked member. Furthermore, at an early stage of his linguistic development, he will take both members of an antonym pair to have the same meaning.

H. Clark (1973) discusses how the concept of markedness can explain the phenomena of children's misunderstanding of antonym pairs. He points out, for example, that within the English adjectival pair high-low both adjectives refer to a single dimension and both specify that the dimension is a vertical one; but high refers to a positive distance along the dimension while low refers to a negative distance along that dimension. High is also the "name of the dimension (for example one says, "How high is X?"). It therefore may be considered the positive, the linguistically simpler and thus the unmarked member of the antonym pair, while low may be considered the negative and marked member. With respect to dimensional adjectives, the Full Semantics Hypothesis predicts that the unmarked linguistically

simpler dimensional adjectives (which refer to the most extended dimension of objects) will be understood before their marked counterparts. Evidence to support this prediction came from the Donaldson and Wales (1970) study of children's comprehension of the comparative and superlative forms of dimensional adjectives (previously described). In this study, the children made fewer errors in comprehending the positive-pole set of adjectives (such as big, tall, long, high,) than the marked, negative-pole set of adjectives (such as wee, short, long.)

A search of the literative reveals only one study which is contrary to the findings previously reported regarding children's comprehension of marked and unmarked dimensional adjectives. In a study with children younger than those previously reported Eilers et al. (1974) assessed the comprehension of the terms big-little, long-short, and wide-narrow by children between $2\frac{1}{2}$ - $3\frac{1}{2}$ years of age. The task involved asking the children to give the experimenter the "_____" one from a pair of appropriate objects. They found that for all three pairs of dimensional adjectives under study, correct responses were more likely to occur for the negative terms or marked members (that is little, short, narrow) than for the positive one.

In a production task used to elicit dimensional adjectives Wales and Campbell (1970) found that the unmarked adjective big was the dimensional adjective most frequently used by children 3.5-4.1 years. Their data further revealed the unmarked adjectives big, long, tall, wide were used an average of 68.5 times, while the marked adjectives little, short, narrow were used only an average of 29.5 times. Farnham-Diggory and Berman (1968) also found that children described objects by using adjectives with greater extent. These data seem to indicate that children have a strong preference for using unmarked rather than marked terms in their spontaneous speech and in their descriptions.

The Comprehension of Relational Terms

There is additional evidence that at an early stage of development children treat other kinds of adult antonyms as if they were synonyms. This has been found to be true in their comprehension of the temporal terms before and after (E. Clark, 1972), and the relational terms same-different (Donaldson and Wales, 1970) and more-less (Donaldson and Balfour, 1978).

Donaldson and Balfour (1968) looked at how three year old children interpreted the relational terms more and less. The stimuli they used were two cardboard apple trees on which one

could hang up to six apples. Beginning from the situation in which the trees had the same or different numbers of apples on them, the examiner asked various questions about the trees ("Does one tree have more/less apples on it than the other?"). They also asked the children to manipulate the "state" of the trees ("Make this tree so that it has more/less apples..."). Their findings indicated that the majority of the children did not differentiate between less and more. Questions that contained the word less were answered in the same way as those with the word more. When asked whether one tree had more or less apples on it than the other, the children nearly always responded "Yes". Then, when asked to point to the tree which had more on it, 91% of the responses were correct. However, the surprising finding occurred when the children were then asked to point out which tree had less on it. In the second case 72.7% of the responses were wrong. Thus, on 50 of the trials in which children had previously judged that one tree had less on it, they subsequently chose as the one with less the one that actually had more. All the questions asked by the experimenter produced the same results: less was treated as synonymous with the word more. Donaldson and Balfour (1968) point out that the children responded to less as if they knew that it referred to quantity: "What seems to occur is that less is understood to refer to quantity but...it remains largely undifferentiated from more as the consistently dominant interpretation for the undifferen-

tiated pair."

Although the experimental design of Donaldson and Balfour (1968) has been criticized, an extensive experiment by Palermo (1974) has replicated Donaldson and Balfour's (1968) major findings. Palermo (1974) assessed pre-schooler's understanding of more and less in five contexts: judging which glass had more/less water; which block weighed more/less; which rows of poker chips had more/less wheels, and finally which cup contained less candy (with the understanding that the child would receive the other cup.) Performance on questions containing more was generally very good. In contrast, the children divided into two groups on the questions containing less.

Half the children responded correctly on nearly all of the items. In contrast, about half the three year olds and a quarter of the four year olds responded incorrectly consistently; that is, they selected the object with more in response to a request to pick the object with less. Even when the children were motivated to obtain the larger amount, in response to the question about the candy in the cups, those children who treated less as more generally gave the experimenter the cup with more candy and thus kept the cup with less candy. Very few children fell between these two extremes of performance.

In another study dealing with childrens' comprehension of relational terms, Donaldson and Wales (1970) looked at

the performance of fifteen children whose ages ranged from 3.5-4.1 years on tasks designed to test their understanding of the words same and different. The task involved sorting either everyday objects such as toothbrushes and eggcups (Conditions III and IV). Within each of these classes, form and color were either coincident (Conditions I and IV) or not coincident (Conditions II and IV). The experimenter in the task asked the children to give him an object that was either "the same in some way" or "different in some way" from a target item the examiner picked. The results of the experiment showed that the children nearly all picked objects that were the same both when asked to choose one that was the same and when asked to choose one that was different. In effect, the word different was interpreted by the children as though it meant same. Donaldson and Wales (1970) also reported that when analyzing the spontaneous speech samples of the children under study they found that utterances containing the word same were "appreciably more frequent" than those containing the word different. While the word same occurred in sixteen spontaneous utterances, the word different was recorded only five times.

In a more recent study investigating the meaning of different in the language of young children, Webb et. al. (1974) presented children 3.1-5.7 years with a variety of tasks. In the first part of their experiment they presented

the children with a set of twelve objects (i.e., three pink toothbrushes, three yellow cups, three blue combs, etc.) They then removed one object from the set and asked the children "Will you pick one for me that is different than this one" or "Will you pick one for me that is the same as this one?" Twenty-one of 49 subjects tested responded to the question of picking a different one by picking an object that was the same. In part II of their study, Webb et al. (1974) presented children between the ages of 2-9 to 3-11 years with an array of eight objects and the children were questioned with a series of five target objects. The sets of choice and target objects were constructed so that each target object had a "same", "similar" and "completely different" counterpart in the array. For example, if the target was a white comb, the array contained a "same" object (another white comb), a similar object (a blue comb) and a number of "completely different" objects (such as a red square, a yellow cup, etc). The children were asked to give to the experimenter an object from the array that was different from the target object. Of the 29 subjects tested, 20 subjects choose either objects that were the same or similar to the target object. In part III of their experiment Webb et al. (1974) tested children ranging in age from 3.0-3.3 at 2 month intervals for about 9 months (a longitudinal study). All testing sessions included a version of the procedure used in part II of their experiment. Their findings revealed that the younger subjects

of the sample (3.0-3.3) responded to the question of selecting a different object by selecting the same object from the array. At about 3.6 to 3.7 the children began to choose objects that differed on at least one dimension from the target object. Webb et al. concluded that "at an early stage of development...and that at about 3.6 to 3.7 when asked to choose an item different than a target they begin to choose objects that differ on at least one dimension from the target object."

The Comprehension of Spatial Relations

The Full Semantics Hypothesis also attempts to predict children's comprehension of certain spatial relations. For example, the hypothesis predicts that children will confuse the meaning of front and back and understand the positive term (front) before the negative one (back). H. Clark (1973) has argued that this should be so because front refers to the prominent side of an object and back is often defined simply as being the opposite of front. Therefore, in order to know what the back of an object is, one must know what the front is, and in addition, one must also know that the polar

opposite side is back. Thus, Clark says, an understanding of front should developmentally precede an understanding of back. Using parallel arguments, an understanding of the term side should follow the comprehension of front and back, since the side is simply defined as an area which is neither front or back.

While Clark points out that the front of an object is usually the side which is prominent in some way, this is true only for one type of front, namely, objects with intrinsic fronts. The fronts of a car, a dog, a stove, and a plane are examples of such objects. What, however, can be said about the front and back of objects such as drinking glasses, which lack inherent fronts? For example, a request to put something in front of a glass means to put it between oneself and the glass, while putting it in back means putting it on the opposite side, behind the glass. Thus the front-back locational system in the case of non-fronted objects is not defined by the characteristics of the object, but by the speaker's own spatial relation to the objects.

Kuczaj and Maratsos (1974) investigated childrens' comprehension of front, back, and side. Their procedure involved testing 45 children between 2.5-4.0 years of age on five tasks: 1) a self-referent task in which the child was asked to place a standard either in front, back or side of himself; 2) a touch task in which the child was asked to touch the front, back and side of four categories: (animates, vehicles, tools and appliances); 3) a fronted

object placement task in which the child was asked to place a standard in front, in back or on the side of the objects used in the touch task; 4) a non-fronted object placement task in which the child was asked to place a standard in front, back, or on the side of nonfronted objects; 5) a generalization task in which the child was asked to touch the front and back of two nonsense machines (both with manipulatable gadgets).

Their findings did not support Clark's hypothesis that front is acquired before back. Rather they found that children understood front and back equally well. Thus they argued that front and back are understood as opposites and are acquired simultaneously. Furthermore, their study indicated that the correct understanding of front and back begins with reference to the self and then spreads to objects with fronts. Side is acquired after front and back, being understood both in reference to the self and to other fronted objects. Correct understanding of the terms front, back, and side when they refer to non-fronted objects are acquired last. In their summary statement Kuczaj and Maratsos (1975) wrote:

The late acquisition of competence with unfronted objects indicates that in fact...inducing the meaning of terms that depend on the characteristics of the objects themselves (front, back, and side for fronted objects) was easier for the subjects than constructing the front-back-side locational system based on relations between the self and external objects. Others (Pufall and Shaw, 1973) found similar results using purely perceptual tasks in other spatial reference systems, so problems in perceptual analysis seem to have direct effects on the ease with which semantic analyses may be made.(p.209)

The Partial Semantics Hypothesis

In more recent papers EClark (1974a, 1974b) proposes the Partial Semantic Hypothesis to supplement the Full Semantics Hypothesis previously stated. The Partial Semantics Hypothesis states that prior to and during their acquisition of certain lexical items, young children rely heavily on a combination of their linguistic hypotheses and non-linguistic strategies in their attempt to comprehend those lexical items. Clark states that while it is children's interpretation of their percepts that provide a basis for their linguistic hypotheses about word meanings, "children...also show certain biases in their treatment of the world around them that bear no direct relation to their linguistic hypothesis." Furthermore, Clark writes (1974a):

...if a young child is shown a piece of chocolate and a pebble and is allowed to choose one, he will probably always choose the chocolate. This choice would then be independent of the meanings of words used in the instructions to choose; his choice is the outcome of a non-linguistic strategy. This form of behavior is traditionally referred to as a preference or response bias and may be present in the child (or the adult) for a variety of reasons. If the child relies consistently on such preferences, though, it is important to identify them. This is because they could make it appear that the child has understood something when, in fact, his response was simply due to a non-linguistic strategy. This question is a particularly important one where children's comprehension of word meanings is concerned. The child might appear to have grasped the adult meaning of some complex word when he was actually only responding on the basis of a nonlinguistic strategy. (p.162)

Non-linguistic strategies are viewed by Clark as being used

by children prior to having full semantic knowledge and are derived from their knowledge about the world. Clark infers that non-linguistic strategies are general and consistent from child to child and are ordered developmentally so that young children use one particular strategy and older children another. Evidence supporting the Partial Semantic Hypothesis comes from E. Clark's study of young childrens' (ages 1.6 - 5 years) comprehension of the locatives in, on, and under (1974a). In her experiment, each child was asked to follow instructions containing the words in, on, and under and was asked to place one of eight small toys relative to (locative) one of six reference point objects (box, tunnel, crib, table, bridge, dump truck.) When the children's errors were analyzed, a consistent pattern emerged. If the reference point (RP) was a container of any kind (i.e., box, tunnel, truck or crib), the younger children tended to act as though all the instructions for object placement (locatives) contained the instruction in. When the RP was not a container but had a supporting surface (i.e., bridge, table) the children tended to treat all the instructions as though they contained on. Clark therefore hypothesized that her data could be accounted for if one ascribed to the child the use of two simple ordered rules based on the child's non-linguistic knowledge of the usual or expected spatial relationship between an object (x) and a reference point (RP).

- Rule 1. If the RP is a container, x goes in it.
Rule 2. If the RP has a horizontal surface, x goes on it.

Clark (1974a) stresses that the responses of the younger children in her study (ages 1.6 - 2.6) were "not a direct reflection of how well they understood the spatial prepositions in, on or under. Instead they appear to reflect the childrens' use of non-linguistic strategies (the child schema) that are used in the virtual absence of comprehension" (p.169). Clark (1974) found that the older subjects in her study progressed through three stages: a stage where they relied on non-linguistic strategies plus partial semantic knowledge of the words; a transition stage; and a stage where they relied on full semantic knowledge of the word.

Although Palermo and Wilcox (1974) agree that the responses of Clark's subjects were based in part on non-linguistic strategies, they argue that there was a flaw in Clark's design. They state:

It appears to us that Clark's results may have been a contextually determined artifact of the particular objects she used. The children were given small toy animals and asked to put them in or on a tunnel and a box; in or under a truck and a crib; and on or under a bridge or table. It seems reasonable to assume that children would be predisposed to put the objects in a tunnel or box rather on it, in a truck or crib rather than under it, and on a bridge or a table rather than under it, thus confirming Clark's predictions...Thus it appears that the contextual support for the linguistic statement presented to the children was such that the children had no alternative to the specific non-linguistic strategies which the children in that study selected when they did not know not to respond to the statements including on and under. (p.247)

In an attempt to replicate Clark's findings, Palermo and Wilcox presented their subjects with tasks using in, on, and under, but where the context and the language were both congruent and incongruent. Thus, in the contextually congruent tasks, the subjects in their experiment were asked to put a teapot on a table, a boat under a bridge and a road under a truck; and in the contextually incongruent task, they were asked to put a teapot in a table, the boat on the bridge and a road in the truck. Their results showed that the children in their study responded as if in meant under, and responded to on as if on meant under. It should be noted, however, that within Palermo and Wilcox's design, 1) the instructions to the child in the contextually incongruent task were such that in only one case (truck-road) was the stationary object to be placed (locative) relative to the movable one, while in the other two cases (teacup-table, bridge-boat) the movable objects were used for placement; b) the stimulus objects (used in their experiment) loaded the contextual bias in favor of under and on rather than in; c) the contextually neutral pair (Pair IV) consisted of table with a shelf, such that the request for the placement of an object under the table could have been taken two ways.

While not in agreement with the particular strategies Clark proposes nor with the kinds of errors children make in their comprehension of locatives, Palermo and Wilcox (1975) nevertheless state:

The order in which words are acquired is surely a complex conceptual matter involving both the abstraction of concepts from instances and the abstraction of attributes from instances. The

contextual factors (non-linguistic strategies) and their interaction with hypotheses fostered in the child appear to be in the direction toward which further research must be aimed. (p.253)

Summary of Research

Current hypotheses concerned with how normal children attach meaning to lexical items have been advanced by E. Clark (1973, 1974, a, b) and Nelson (1974). Based upon her own research (1972, 1973) and that of Donaldson and Wales (1970) and Donaldson and Balfour (1968), E. Clark first advanced the Full Semantics Hypothesis. The Full Semantics Hypothesis posits that children learn word meanings by identifying them with one or two of their semantic features and that they add more features of meaning to the lexical entry of a word until the combination of features (in the entry of that word) corresponds to that of the adult's. The hypothesis also posits a fixed order of acquisition: (a) that the more general features are learned first; and (b) that the positive or unmarked members of antonym pairs are learned before their marked counterparts.

Data supporting E. Clark's Full Semantics Hypothesis are found in research conducted on children's comprehension of dimensional adjectives, relational terms and locatives (Eilers et al., 1975; Tashiro, 1971; Donaldson and Wales, 1970; Donaldson and Balfour, 1968; Palermo, 1974, Kuczaj and Maratsos, 1975; Webb et al., 1976). E. Clark argues that

perceptual input, particularly information that the young child obtains from the visual modality, provides him with the primary source of knowledge about the meaning of words. This in turn accounts for the types of overextensions observable in his speech production. Nelson's (1974) position on the other hand is that perception plays a secondary rather than a primary role in how young children form the categories that underlie their early use of words. According to Nelson (1974) function is more basic than perception. Bowerman (1976) asserts that the potential that objects have for being acted upon (that is, their function) determines which objects children initially select to learn names for, but that classifying objects for the purpose of word use appears to depend on their perceptual qualities.

E. Clark (1974, a, b) has also proposed the Partial Semantics Hypothesis to supplement the Full Semantics Hypothesis. The Partial Semantics Hypothesis asserts that in the absence of complete lexical representations, children use non-linguistic strategies to comprehend lexical items. Data supporting this hypothesis have been reported by E. Clark (1974,a) and Wilcox and Palermo (1975).

While some researchers have claimed that cognitive development is relatively independent of language and precedes language development (Piaget, 1960, 1970; Sinclair-deZwart, 1967; Slobin, 1973; Morehead and Morehead, 1974), a modification of the strict cognition-first viewpoint is discernable in some of the most recent literature on language acquisition

(Bowerman, 1976; Schlesinger, 1974, 1977; and Wells, 1974).

In the next chapter the literature dealing with the development of the blind child is reviewed.

CHAPTER III

Review of Relevant Research:

The Blind Child

The lack of vision, according to Lowenfeld (1973), results in three basic limitations: a) range and variety of experience, b) mobility, and c) interaction with the environment. These in turn, says Lowenfeld, place the blind child at a disadvantage in the areas of sensory stimulation, concept formation, and communication. While some research has been conducted on the deficits blind children show in the areas of sensory stimulation and concept formation (see Warren, 1976 for a detailed statement about the lack of adequate studies in these areas), a search of the literature dealing with the communication deficits of blind children produces no experimental findings whatever.

The development of language in the blind child has been reported in the literature mostly in terms of observational reports (Burlingham, 1961, 1965) and descriptive studies (Wills, 1965). Fay (1975) argues that "due to sensory deprivation simple vocabulary growth as well as more complex cognitive operations are vulnerable" (in the blind), and agrees with Nagera and Colonna (1965) that "lack of vision interferes with the ability to acquire and make use of words as symbols". While no experimental studies have been reported comparing the language development of the blind child to that

of the normal child, researchers working with blind children agree that the language development of the blind child is delayed and/or deviant.

Zweibelson and Barg's (1965) position is that the language-learning strategies as well as the sequences of language development of the young blind child will be different from those of the normal child. They state:

One difficulty in the language development of the blind child seems to be word cognition...there is a confusion between the spoken word and the meaning of the word as it relates to phenomenological experiences ...that blind children's conceptualizing and perceiving of reality are different than the sighted. It can therefore be expected that the methods used in learning language or the sequence of language development of blind and sighted children will be different. (p.218)

Burlingham (1961) feels that blind children exhibit a delay in the beginning of verbalization. In addition, she stresses that blind children use words for which they do not have true or complete meanings. She writes:

they...use words which are meaningless to them...they use verbal context in order to orientate themselves in space.

The inaccurate use of words or "verbalisms" is a phenomenon which is often noted in the language of the blind (Cutsforth, 1951; Burlingham, 1961; Nagera and Colonna, 1965). Nagera and Colonna (1965) describe verbalism as an "indiscriminate use of words", or "using words in a parroting fashion without having a proper understanding of their true and complete meaning". Foster (1977) notes many examples of verbalisms,

or what she terms "unusual responses...peculiar to the blind." She classified these unusual verbal responses in two categories (1) inappropriate use of language due to lack of understanding of relational or other terms; and (2) inappropriate use of language due to a lack of physical and personal experience with the environment. An example of the first category occurred when Foster (1977) asked her 6.5 year old blind subject which pie had more (a conservation of matter task). He replied "I have more because it looks like a circle, yes it is a circle, so both are more." (p. 58) An example of the second category occurred when the same subject was asked to make a hotdog from clay. He replied by saying "Can I make a sausage since I don't know how to make a hotdog?" (p. 58)

Burlingham (1961) describes the speech development of the blind child in the following way:

The advances of speech in the blind seem to proceed on two lines, one of which is their own and which they develop on their own guided by their intelligence and inventiveness, finding words for their own affects and body feelings and things heard, more readily than the sighted; and the second one which is personally strange to them but also highly cathected as being the speech of the seeing world, i.e., the type of verbalization shared with the parents.

What reasons are given for the blind child's use of verbalisms? Cutsforth (1951) attempts the following explanation. He argues that since speech is one of the first of his mother's

acts that the blind child can imitate and since interpersonal relations between mother and child are limited in the early stages of life primarily to caretaking, the mother grasps at a longed-for opportunity to communicate with her child. The mother may tell her child that cats and dogs are animals, that cats "go me-ow" and dogs "go bow-wow"; and she may talk about other objects in the child's environment such as tables, chairs, dishes, etc. But if the child is not given the opportunity to explore dogs and cats and tables and chairs tactually, he will not "know" which objects are called by what labels. The ability of the blind child to "talk" about objects in the world for which he has incomplete knowledge, Cutsforth (1951) calls "verbal unreality."

Nagera and Colonna (1965) argue that word-parroting by the blind child occurs because it takes him longer to assimilate many of the concepts symbolized by words and to grasp the meaning of abstract words. Burlingham (1961) agrees with Nagera and Colonna's (1965) position that blind children are delayed in concept formation. Wills (1965), on the other hand, argues that the blind child is not merely delayed in conceptual development but that he understands his world in a manner different from that of the sighted child. Furthermore, she argues that the blind child's understanding of the world follows a course different from that of the sighted child. Wills' (1965) position is that the blind child exhibits a language deviance, a position which is close to that of

Zweibelson and Barg (1967). It should be noted, however, that Wills' (1965) conclusions are based on observational studies of young pre-school blind children, rather than on experimental research.

Blindness and Development

Some researchers argue (Wills, 1965; Zweibelson and Barg, 1967) that almost every aspect of the blind child's life is affected by his disability. Cutsforth (1951) writes:

No single mental activity of the congenitally blind child is not distorted by the absence of sight. Not a single sense escapes; the sensory equipment and processes of observing are organized quite differently in the blind person from the normal seeing child. His social world, his world of objects, his perceptual world is not the same world in which the seeing child lives. It is denying the facts to hold as a great many of our educators of the blind do that the blind child's organization and growth can continue as in the normal child except for the absent sense.

However, there is literature to support the premise that it is not the blindness per se that causes delays in conceptual development, social development and language development.

O'Brian (1967) states:

Only a disability that severely limits children's opportunity to interact with their environment and limits the mastering of communication with it, has an irreversible effect upon intellectual development.

She agrees with Blank (1975) and Klein (1962) that it is the "lack of opportunity to explore and manipulate the environ-

ment which produces an individual with limited coping strategies and with little inclination to explore" (O'Brian, 1976).

Klein (1962) stresses that blindness cannot be understood in terms of the loss of visual function, but must be understood "in the manner and organization of information provided by the residual modalities". The implication of Klein's statement is that cognitive development is not in the "optical centers," but that it develops as the organism adapts to its environment by organizing it into a coherent system through those senses stimulated. The process of this organized thought can only be developed by the child's understanding of reality and by his engaging in activity that will enable him to discover and construct concepts that he can understand.

Piagetian theory provides an explanation of how a normal child develops the concepts which enable him to understand the language around him. (Flavell, 1963; Sinclair, 1971). While the problem of using Piagetian theory as an explanatory theory for language development have been raised by Cairns and Cairns (1976), Piagetian theory has much appeal for developmental psycholinguists and speech and language pathologists, for it is clear that language development and conceptual development are closely related.

Piaget (1960) hypothesized that cognitive development proceeds as an individual interacts with his environment. His theory stresses the "active role" the child must play in

organizing his environment. For Piaget, intellectual development involves the formulation and description of coherent and meaningful stages which reflect the direction and course of mental development. Intelligence is a process of adaption and organization. The two processes of adaptation suggested by Piaget are assimilation, which involves the incorporation of the environment into present patterns of behavior, and accommodation, which involves the change in intellectual structures or schemas. This change is necessary to adjust to the demands which the external environment makes on the individual. Thus for Piaget, intelligence is a theory of interaction, a system of hierarchical development organized in "general structures" which do not become fully operational until the end of a long and slow genetic process. Piaget has maintained that a child must act upon objects to obtain an understanding of them, before he can really "know" them. To know an object or event is not simply to look at it or hear about it or make a mental image or copy of it; rather, it is to act upon it or transform it and, in the process, to understand the way the object is constructed. This act is an operation, and an operation is the essence of knowledge (Copeland, 1970).

The empirical position, however, differs from the position stated by Piaget. The empiricists claim that the source of knowledge is derived from one's sense experiences. To the empiricists sight constitutes one of the principal

means of appraising the surrounding world, since visual stimuli are by far the most numerous and the most varied stimuli. Indeed, sight and cognition are so inter-related in the popular mind that "to see" is equated with "to know" or "to understand". Furthermore, empiricists believe that one cannot know everything that is not observable and therefore construct theories whose elements are either observable events or direct reductions of observable events. Moreover, behaviorists argue that an individual's personal knowledge can be no more than the sum of all his sense experiences; that is, the child cannot know anything he has not observed. It is clear that a behavioristic theory cannot account for the normal child's acquisition of language (for a more detailed exposition see Cairns and Cairns, 1976; McNeill, 1970; Chomsky, 1959). Unfortunately, laymen at times consider the inability to see indicative of mental retardation; that is, as though the loss of sight rendered impossible intellectual acquisition. Indeed, an extension of the empiricist position may account for some researchers' view (Cutsforth, 1951; Wills, 1965; Zweibelson and Barg, 1967) that the blind child's language development as well as his conceptual development is deviant from that of the normal child's, although there are presently no experimental data to support this position.

While it is true that the congenitally blind child is deprived of seeing and observing the world in which he lives,

there is evidence that he does not act upon or interact with his environment as does the normal child (Lowenfeld, 1973; Hatwell, 1966; Stephens, 1974; Stephens and Simpkins, 1974). Fraisse (1966) states that eyesight is the sense that enables man to perceive simultaneity and that knowledge acquired from the tactual modality is successive in nature. Therefore, says Fraisse (1966), for the blind child there will be a slowing down of "the development of the operations leading to the conceptualization of the permanence of the object and the establishment of a network of reciprocal relation between objects".

The Assessment of the Cognitive Abilities of Blind Children

The work of Piaget and Inhelder has made major contributions to the analysis of children's cognitive development and has provided ingenious methods to assess cognitive processes (Piaget, 1928; Piaget and Inhelder, 1969).

Through his research Piaget (1960) concluded that cognitive development proceeds through a hierarchical sequence of stages. As a child inwardly organizes or assimilates and outwardly copes with or accommodates to environmental experiences, thought is elaborated and organized. Change from a reflective to an inventive organism is defined by four hierarchical stages: sensory motor, preoperational, concrete

operational, and formal operational.

The assessment of the cognitive development in the visually handicapped traditionally has relied primarily on verbal procedures. Bauman (1973) stated that the single test most frequently used with blind clients of all ages by psychologists in the United States is some form of the Wechsler Scales. Yet research by Cutsforth (1932), Nolan (1960) and Harley (1963) indicate that although the blind manipulate verbal symbols with considerable fluency, their degree of understanding in terms of object reality is significantly impaired. While the Haptic Intelligence Scale (Schurrager and Schurrager, 1964) represents a noteworthy attempt to develop a performance test for the blind, the scale is a modification of the WAIS and is appropriate only for subjects about 16 years of age.

Hatwell (1966) was the first to use the Piagetian model successfully to assess the cognitive abilities of blind children. She tested 6-18 year old congenitally blind and normally sighted subjects on a variety of Piagetian tasks. Her experiment provided measurements of (a) conservation, (b) logic-classification, (c) operativity and symbolic imagery, and (d) formal operations. She concluded that although the blind children followed the same sequence of cognitive development as the sighted children, their rate of development was slower. For example, in her study the Piagetian task termed the Rotation of Squares Around an Axis was administered

to the blind and sighted subjects. The subjects were presented with a board on which two cardboard squares were mounted. The normal subjects were presented with a board on which the top square was red and the bottom square was blue, while the blind subjects were presented with a board on which the top square was covered with sandpaper and the bottom square was covered with smooth cardboard. One square was placed on top of the other and then the two squares were attached at the lower right hand corner of the board by a thumbtack in the same manner as hands on a clock. During the test the subject was asked to anticipate the position of the two squares (i.e., their relative position to each other) if the top left hand corner of the top square were to be rotated to different positions around the fixed point (the thumbtack) in a clockwise direction. It should be noted that in this task the situation is hypothesized for the child. The square is not rotated but instead a thumbtack is placed at the position at which the subject must imagine the top square would be rotated. In order to perform the task successfully, the subject is required to form an accurate mental image of the original position of the squares and then to rotate mentally the top square to the position indicated. A correct response was recorded if the blind subject picked the correct position from six raised line drawings which illustrated the position of the two squares if the top one would have been rotated. (For the normal subjects a correct response was recorded if they picked the correct

position from six pencil drawings.) The ability to perform correctly on this task requires that a child anticipate transformations or rotations in the position of an object. In other words, this task assesses the ability of the child to predict the position of an object should it be rotated to a certain point without engaging in the actual activity of rotating it. This ability is characteristic of the child who is in the stage of concrete operations and generally occurs between the ages of seven and 12 years of age in normal children. When Hatwell (1966) compared the performance of the blind and normal children on this task she found a delay of approximately four years in the performance of the congenitally blind. That is, her 10-year old blind subjects performed similarly to the sighted subjects of six years of age. In addition Hatwell (1966) compared the performance of her blind and normal subjects on other Piagetian tasks (e.g., conservation of substance, conservation of volume, classification tasks). On all of the measures the blind showed delays in their development, even when their performance was compared to sighted subjects who performed the tasks tactually. Hatwell (1966) concluded that the congenitally blind children in her study were considerably delayed at the stage of concrete operation. In her report she cites the need for additional studies which would use Piagetian measures to assess the cognitive development of the blind.

Stephens and Simpkins (1974) compared the performance of congenitally blind and sighted children on a variety of

Piagetian tasks. The subjects of their study were 75 sighted and 75 congenitally blind children between the age of 6-18 who were matched in age and socioeconomic background. Congenital blindness was defined by the above researchers as blindness occurring before the age of four years, and where vision was no greater than light perception. The Piagetian tasks they employed provided measurements of (a) conservation, (b) logic-classification, (c) operativity and symbolic imagery and (d) formal operations. Blind and normal children's ability to perform on tasks of conservation of substance, weight, volume, length and liquids was measured. In addition classification tasks, tasks of rotation of squares and of beads, and tasks measuring mobile and stationary changing perspectives were also given. In all, 26 tasks were administered. Simpkins and Stephens (1974) found few significant differences when the performance of blind subjects CA 6-10 was compared with that of blind subjects CA 10-14. Significant differences were revealed, however, between the blind subjects CA 6-10 and CA 10-14. Simpkins and Stephens (1974) state:

These data serve to suggest that although little change can be ascertained in the early years, growth of cognitive structures is taking place at a slow rate. In contrast, the sighted age groups revealed significant growth between CA 6-10 and CA 10-14 age ranges. Comparisons across groups of older blind (CA 14-18) with younger sighted subjects (CA 6-10) indicated few significant differences. This suggested an average lag of eight years for blind subjects. (p. 35)

In summarizing the results and the implications of their re-

search Simpkins and Stephens (1974) wrote:

The findings...of equivalent performance of CA 14-18 blind with CA 6-10 sighted subjects on 19 of the 26 reasoning variables...suggest that there is a SEVERE DEFICIT in the cognitive functioning of the blind child, and they serve to emphasize the need to develop intervention programs which are designed to promote cognitive functioning in blind children. A second implication derived from the present study is: Now that there are data which indicate congenitally blind children exhibit severe deficits in reasoning, [as measured by Piagetian tasks] additional research should be conducted to determine if partially sighted children or children blinded later in life experience similar inadequacies. (p. 40)

Stephens, Simpkins and Wexler (1976) investigated blind and normal subjects' performance on the task of Rotation of Squares Around an Axis. They found no difference between the performance of 14-18 year old blind subjects and sighted 6-10 year subjects, thereby indicating an eight-year delay in the congenitally blind subjects' development of the ability basic to performance on this task. They concluded:

While findings from the present study substantiate those of Hatwell, they serve to indicate a greater deficit in the performance of blind persons than was suggested by her study. (p. 69)

More recently Foster (1977) studied the cognitive development of eight congenitally blind and four adventitiously blind children between 6-11 years of age. The subjects of Foster's study had mean verbal I.Q. scores within the normal range of intelligence as measured by the WISC. Foster (1977) tested the blind children using Piagetian techniques on tasks of conservation, space, and elementary logic. She then compared

her subjects' performance to the performance reported for normal children on these tasks. She found that the performance of all of the blind subjects was inferior to that reported for normals. However, the children blinded after birth performed better on these tasks than the congenitally blind children.

A review of the literature in blindness reveals interest in the ability of children to "conserve", a cognitive ability characteristic of STAGE III--the period of concrete operations. In a conservation study by Miller (1969) blind students 6-10 years of age were found to experience the same hierarchical stages of Piagetian reasoning as their sighted peers, although their development was delayed. In similar studies, Gottesman (1971, 1973) and Tobin (1972) also found the same developmental patterns, but again the rate of development was slower for the blind. Brekke, Williams, and Tait (1974) determined three variables significantly related to blind children's performance on conservation tasks ; these were age, sex and home-reared versus institutionalized.

Stephens (1972), Taylor (1973), Stephens and Simpkins (1974), and Foster (1977) all point out that the sensory disturbance peculiar to the blind hampers development of sensory-motor schemas from the outset and therefore slows down the blind child's cognitive development. They argue, therefore, that blind children are delayed both at the sensory-motor stage (Piagetian Stage I) as well as at the preoperational stage (Piagetian Stage II). Stephens and Simpkins (1974) write:

Because the blind are retarded in the acquisition of operations which precede concrete reasoning, they would be expected to be retarded in their achievement of operational processes which characterize the third stage of cognitive development, the concrete stage. (p. 7)

While it is true that the experiments previously reviewed did find lags in blind children's development at the stage of concrete operations (Stephens and Simpkins, 1974; Hatwell, 1966; Stephens et. al., 1976; Miller, 1969; Gottesman, 1971, 1973), it can only be inferred that blind children are delayed at the sensory-motor stage and at the preoperational stage. The blind subjects in the research reported were all between 6-18 years of age and assessed blind children's abilities on Piagetian tasks of conservation, logic classification, operativity, and formal operations. No experimental research has been reported which assesses the young blind child at the sensory-motor or preoperational stage of cognitive development.

When considering implications to be derived from Piagetian research for training programs for blind students, Hatwell (1966) noted that the "blind child operates within a verbal system which is handled more easily than objects, but which if its ties to reality is lost, (it) becomes a closed and necessarily inadequate system." She concludes that blindness introduces a "rupture of equilibrium between assimilation and accomodation ." Hatwell (1966) believes that although the blind child has the intellectual instruments "necessary for

the integration of outside data he is deprived of a great deal of the means by which a sighted child controls his adjustment to reality." Hatwell (1966) points out that blind children do not have the opportunity "to verify the adequacy of their representations in relation to objective reality." She believes that there is less pressure on the blind child to accommodate to contradictions presented by the outside world; these contradictions promote comparisons between that which is perceived and that which is really there. Because of this lack of contradiction from which forced comparisons arise, blind persons form faulty generalizations. Hatwell concludes that there should be an effort to promote interaction between the child and his environment, an "effort which would emphasize the tactual perceptive exploration of objects to counter-balance, in part, the negative effects of sensory deprivation."

Warren (1976), in his review of the literature dealing with "what is known about blindness and early development and what needs to be studied," noted that an area of special importance to those interested in the language development of the blind is the "blind child's understanding and use of spatial relations vocabulary." No research, however, has been done on how blind children comprehend linguistic structures which code spatial relations. The only studies recorded have been on visually impaired children's (visual acuity 20/70 to

20/400) concept of space (Swallow, 1973; .. Swallow and Poulsen, 1972). A review of the performance of the ten subjects used in the Swallow and Poulsen (1972) study showed that nine mastered topological space, while none mastered all tasks of projective or Euclidian space at the concrete operation stage. It should be noted that Swallow (1973) and Swallow and Poulsen's (1972) subjects were visually impaired, not congenitally blind, and that their investigation was of children at Stage III of development--the period of concrete operations. Swallow (1973) concluded that "lack of sufficient encounters is probably more detrimental than loss of vision."

Summary of Research

Research on the cognitive abilities of blind children has primarily dealt with the area of conservation (Miller, 1969; Gottesman, 1971, 1973; Cromer, 1973; Tobin, 1972) and the study of the concept of space by visually impaired children (Swallow, 1972; Swallow and Poulsen, 1972). Only the studies by Hatwell (1966), Stephens and Simpkins (1974) and Foster (1977) have attempted to examine extensively several areas of reasoning in blind children by using Piagetian tasks. Foster's study, however, included both congenitally blind and adventitiously blind children, while the Stephens and Simpkins study (1974) used subjects who displayed a wide range in age when blinded.

It is clear that the focus of research has been on blind children's functioning during the period of concrete

operations. No attention has been directed to the early span of the preoperational period. This is true not merely in the blind child, but in the study of the normal child as well. This limitation is unfortunate from the point of view of developmental psycholinguistics because the rate of language acquisition is at its peak during the early years of the preoperational period, and it is the symbolic development of this period that enables children to learn language. Moreover, in terms of the language development of blind children, there have been no experimental studies comparing blind and normal children. Observational reports and descriptive studies of young pre-school blind children (Burlingham, 1961, 1965; Wills, 1965) have reported language delay and/or deviance. Data are needed comparing the early language development of blind and normal children so that early and appropriate remediation strategies may be formulated for the blind.

The Use of the Residual Modalities

There can be no doubt that the blind child's lack of vision deprives him of valuable information about the world around him. But the visual modality is not the human organism's only source of information. Cannot the residual modalities, primarily the tactual modality, provide the blind child with adequate information about the organization and structure of his environment?

Some educators of the blind have argued that development of the blind child can proceed in the same way as that of the normal child. They state that the remaining intact modalities can provide the child with the knowledge that he needs about the world around him. Barraga (1973) argues that the blind child needs to gain skills in manual inspection which he says are imperative for their cognitive development. He emphasizes that since the blind child lacks one source of sensory input, his perceptual processes are deficient. He concludes that other sources of sensory input, primarily the tactual modality, should be exploited to the maximum. Indeed, it has been argued by some psychologists that information coming from two modalities about the same thing is equivalent. The best example of this "cross-modal equivalence" is between vision and touch. It is theoretically possible to state exactly what any shape will look like merely by feeling it and vice versa. For example, if someone holds a circular object it will produce a quite distinctive tactual impression, and if he looks at it, it will produce a similarly distinctive visual impression. The tactual and visual impressions are equivalent in that any other shape will produce a different tactual and visual impression.

There is evidence that young children are aware of this visual-tactual equivalence and can use it to solve "cross-modal" problems (Birch and Lefford, 1963; Blank and Bridger, 1964; Connors et. al., 1967). It has been

hypothesized that as children grow older their performance on cross-modal matching tasks improves. Thus some research has confirmed the hypothesis of cross-modal development (Birch and Lefford, 1963; Blank and Bridger, 1964; Conners et al., 1967).

Research has also been conducted on cross-modal transfer of training in animals, adults and young children (Moffet and Etlinger, 1966; Ryan, 1970). Ryan (1970) studied the cross-modal transfer of training relationships between shape and texture dimensions in children. She investigated kindergarten and third grade children's ability to attend to more than one dimension of information at a time in original learning "such that they could use either dimension in transfer to a second discrimination task." She presented her subjects with stimulus shapes which were covered with varying textures and presented the stimuli in two conditions: one in which the subjects were trained only using the tactual modality and one in which the subjects were trained on the tactual and visual modality. The results of her research indicate that while cross-modal transfer existed, "transfer was not determined solely by the ability of one modality to encode information in a form usable by another modality" (Ryan, 1970) Ryan points out that one must be concerned with the relationship between a stimulus and the modalities in which it is processed. She found, for example, that within her experimental paradigm, shape

was the more salient dimension for the visual modality than it was for the tactual modality. Thus the subjects of her experiments took significantly longer to learn a shape discrimination in touch than to learn the same discrimination in vision.

It should be emphasized, however, that there are no reports in the literature dealing with cross-modal equivalence or cross-modal transfer with children under four years of age. While it may be the case that children under four years of age can perform cross-modal equivalence or cross-modal transfer of training tasks, there are no data to support this notion. Furthermore, since we have no data about young normal children's awareness of visual-tactual equivalence, one must question the position of some educators of the blind that the young blind child's "intact modalities," that is, the tactual modality, can provide him with the knowledge that he needs about the world around him to formulate the concepts which underlie language.

Chapter IV

Methodology

Introduction

The experiments reported investigate blind children's comprehension of dimensional adjectives, relational terms and locatives. The blind children's performance is compared to matched groups of normal children performing the experimental tasks in two conditions, visually (Condition I) and tactually (Condition II). Experiment I compares the blind and normal children's comprehension of lexical items which code dimensional properties. The lexical items tested were big-little, long-short, and thick-thin. Experiment II compares the blind and normal children's comprehension of the relational terms same-different. In addition, it attempts to pinpoint the stimulus dimensions (size, shape, texture) to which the children attended in making their judgments. Experiment III compares the blind and normal children's comprehension of lexical items which code spatial relations. The lexical items tested were: in, on, under, front, back, side.

Subjects

Blind Subjects

Nine congenitally blind children (five boys and four girls) between 2-1/2 - 4 years of age were selected. All of the subjects were enrolled in special nursery school programs. Five children were from the New York metropolitan area and the remaining four children were from upstate New York. Once selected, clearance was obtained from the subject's parent or guardian. Multiply handicapped blind children, that is, children with orthopedic handicaps, hearing losses, brain damage and/or mental retardation, were excluded.

While I.Q. scores were not available for seven of the nine children, all the blind children tested were judged to be functioning within normal limits. In order for a child to be considered a suitable subject, two professionals who had worked or were currently working with the child had to concur on the child's overall level of functioning. These judgments were made by the classroom teacher and either the psychologist in the center where the child attended school, the director of the center, or the case social worker. The two children for whom I.Q. scores were available had been

tested by the school psychologist and had obtained scores of 93 and 102, respectively, on the verbal portion of the Wechsler Intelligence Test for Pre-School Children.

The children selected were then divided into three age groups. Group I consisted of three children ranging in age from 2.6-3.0 years of age. Group II consisted of three children ranging in age from 3.1-3.5 years, and Group III consisted of three children ranging in age from 3.6 - 4.0 years of age.

Normal Subjects

Eighteen normal children (ten boys and eight girls) were selected for testing. All of the children were between 2 1/2-4 years of age. Six children were between 2.6-3.0 years of age; six children were between 3.1-3.5 years of age; and six children were between 3.6-4.0 years of age. All of the children were enrolled in a pre-school (nursery or play group) program. Criteria for the acceptance of a normal subject were the absence of any physical, mental, or social/emotional handicap. I.Q. scores were not available for sixteen of the eighteen normal children. Judgments about each child's overall level of functioning were obtained from ratings made by the child's classroom teacher, and either the principal or the psychologist at the child's school. The

two children for whom I.Q. scores were available achieved scores of 104 and 101, respectively, on the Wechsler Intelligence Test for Pre-School Children. Half the normal children, that is, three children in each age group, were tested blindfolded.

Setting

Six of the blind children were tested in a school setting. The remaining three blind subjects were tested in their homes. The normal subjects were tested either in the child's school, the child's home, or the experimenter's home. Testing each child took approximately 1-1/2 hours, either done at one time, with breaks, or split into sessions on different days. Each child was given a toy for his or her participation in the study. All of the experimental tasks were administered by the author with the recording assistance of two graduate students in Communication Disorders.

Experiment I - Comprehension of Dimensional Adjectives

The blind and normal children were tested on comprehension of adjectives which code properties of size, length and thickness. The lexical items tested were big-little, long-short, and thick-thin. It was hypothesized that:

- 1) significant differences would be found between the blind and normal children's performance across all age groups;
- 2) the more "general" of the dimensional adjectives would be acquired before either of the two more specific ones;
- 3) the unmarked adjectives would be acquired before the marked ones;
- 4) performance within each of the two groups of children (blind and normal) would improve with age.

Stimulus Materials

For each pair of adjectives under study, three test object pairs were chosen:

- a. For the big-little pair, objects that differed only on the dimension of size: 2 paper cups, 2 combs, 2 toy dogs.
- b. For the long-short contrast, objects that differed only on the most extended dimension (length): 2 pencils, 2 sticks, 2 lollipops.
- c. For the thick-thin contrast, objects that differed only on the dimension of thickness: 2 wooden rectangular blocks, 2 plastic doughnuts, 2 cylindrical pieces of tinker toy.

Procedure

The child was seated at a play table or on the floor in a quiet room opposite the experimenter. A pair of objects was

presented to the child. The following instructions were given:
 (object labels) (adjective 1)
 "Here are two _____. One is _____ and one is
 (adjective 2) _____. Give me the _____ one." Counter-balancing
 was achieved by varying the order of mention of marked and un-
 marked adjectives across trials and by varying the placement
 of the desired object to the right and left positions of the
 subject. Each object pair was presented twice: once when
 the experimenter asked for the unmarked member of the adjective
 pair and once for the marked member. Since there were nine
 object pairs, each child had 18 test trials. No object pair
 was presented twice in succession.

Experiment II - Comprehension of Relational Terms Same-Different

The purpose of Experiment II was to compare blind and nor-
 mal children's comprehension of the adjectival pair same and
different. Although same and different appear superficially
 to be similar to the dimensional adjectives studied in the
 previous experiment, they do not refer to any particular
 physical dimension but to an indefinite number of possible
 dimensions depending on the physical conditions or the con-
 text in which the adjectives are used. There were two parts
 to this experiment. Part A, replicated the Donaldson and
 Wales (1970) experiment with these subjects. Part B attempted
 to discern the stimulus dimension to which the three

groups of children (blind, normal children performing tactually, normal children performing visually) attended when making their judgment of same and different. For a child to be tested with Part B of this experiment, he first had to achieve 75% correct responses to Part A.

Part A

Stimulus Materials

Two toy dogs (identical in every way) and two identical cars.

Procedure

The child and the examiner were seated at a table or on the floor. The experimenter presented the child with one of the dogs and one of the cars. She asked the child to name the objects. She then presented the child with the target object, which was identical to one of the objects (either dog or car) in the stimulus array.

X

Y

X

The experimenter asked the subject: "Show me one that is different from this one"; "Show me one that is the same as this one".

Counterbalancing was achieved by varying the order of same and different as well as by varying the position of the objects.

It was hypothesized that:

- 1) the younger children in all three groups would take different to mean same:
- 2) differences would be found between the blind and normal children's responses across all age levels.

Part B

Inasmuch as objects can vary on many physical dimensions, this portion of the experiment was designed to see what kinds of dimensions the blind and normal children would attend to when asked to make judgments about similarities and differences among stimuli. In keeping with Clark's claim about the perceptual attributes children attend to when formulating strategies about word meaning, it was decided to construct the test stimuli so that they varied on three dimensions; size, shape and texture. (Further discussion of the role of shape and texture in a transfer of training paradigm with older children is found in Ryan, 1970.) For the purpose of the experiment same was defined as the condition in which stimuli shared all object properties (size, shape, texture); similar was defined as the condition in which objects shared two dimensional properties but differed on one dimension; and different was defined as the condition in which an object differed on two dimensions. Each test array contained three stimuli. The target object presented to the subject had a

same, similar, and different corresponding object in the array. In every case one dimension (size, shape, or texture) was held constant, so that each array had a stimulus which was the same as the target, while the remaining two stimuli differed on one dimension and two dimensions. Table I describes the general pattern of the arrays. Table II describes the specific stimuli which composed each of the six arrays.

Stimulus Materials

Three shapes, two sizes, and three textures were used to design the test stimuli. All the stimuli were cut from 1/4-inch masonite. The large rectangle was 4x6 inches, the small one 2x3 inches. The large square was 4x4 and the small one 2x2 inches. The "furry" shapes were covered on both sides with a brown borganza material. All of the "smooth" shapes were covered with glossy brown vinyl paper. The "rough" shapes were covered on both sides with standard 120 grit sandpaper and were painted brown.

Procedure

A stimulus array was presented to each subject. Then a target object was presented. Half of the blind subjects, half of the normal subjects and half of the blindfolded subjects were first tested on Arrays 4-6. To control for position, the

placement of objects was randomized. Each subject was presented with all of the arrays; i.e., arrays 1-3 when he was asked to choose a same object (Show me one that is the same as this one) and arrays 4-6 when he was asked to choose a different object (Show me one that is different than this one). Responses were scored by noting which of the stimuli in the array the child pointed to or gave to the experimenter.

It was hypothesized that:

- a) There would be differences between the blind and normal children's performance across all age levels:
- b) that the comprehension of different would improve with age across the blind and normal groups such that children in Group III would select stimuli differing on at least one (and possibly two) dimensions when asked to choose a different object from the stimulus array:
- c) that normal children performing in Condition I (visually) would perform better than those in Condition II (blindfolded) when asked to make equivalency judgments about shape and size; and
- (d) that the dimensions of texture would be more salient for the normal subjects performing in Condition II.

Experiment III - The Comprehension of Locatives

Foster in her 1977 dissertation wrote: "Blind children are inferior at all age levels on spatial tasks". That this should be the case may be due, say researchers, to the role

of vision in the perception of space (Lashley, 1961; Kaufman, 1974). There are many lexical items in the English language c o d e spatial relations. The experiments reported in this section compare blind and normal children's comprehension of the locatives front, back and side (Part A) and in, on and under (Part B).

Part A - The Comprehension of front, back and side

The method used to test the blind and normal children's comprehension of front, back and side was a modification of the design used by Kuczaj and Maratsos (1975). The blind and normal children were given four different tasks. The order of the presentation of tasks was counterbalanced. The subjects were told they were going to play a game with the examiner and the examiner proceeded to introduce whatever task the subject was to perform first. The tasks were then given to the subject in the assigned order. During each task the examiner sat next to the subject. All tasks were given successively in the same session. The four tasks were: 1) a self-referent task; 2) a fronted object touch task; 3) a fronted object placement task; and 4) a non-fronted object placement task. Half of the normal subjects performed the experimental task blindfolded.

It was hypothesized that:

- a) significant differences would be found between the normal and blind subjects across all age groups in all of the tasks;
- b) the unmarked term (front) would be acquired before the

marked one (back), followed by the understanding of side;
c) that subjects would know their own front and back and side before those of objects; and,
d) that the intrinsic characteristics of the objects (that is, whether they were fronted or non-fronted) would influence the children's performance.

Procedure

Task I - Self-Referent Task

The child and the experimenter sat next to each other on the floor. A toy doll or a toy car was shown to the subject and placed about eight inches in front of the subject. The subject was instructed: "Here is a doll (or car). Put it in front (back, on the side) of you". When the response was recorded the object was returned to the initial position and the next request was made. The order of front, back, and side placement requests was randomized, with one order used for the doll and the other for the car. Each subject responded to the placement requests with the doll first, and then gave the doll back to the experimenter. He was then given a toy car and responded to the next set of placement requests with it.

Task II - Fronted Object Touch Task

The child was seated on the floor with the examiner. He was asked to point to the front, back of side of six toy objects: 1) dog, 2) plane, 3) small box with a latch, 4) toy stove, 5) truck, and 6) telephone. The objects were presented separately and the experimenter labelled them as she presented them. The objects were presented in a horizontal position relative to the child. Half of the objects were presented with the front of the object facing the child and half were presented with the front of the object away from the child. All possible six orders of front, back and side were used. Each of the objects received a different order. Each subject had the same order of placement for each object.

Task III - Fronted Object Placement Task

The subject was seated on the floor and was given a doll. He/she was asked to place the doll in front, back or to the side of the objects used in the above task. All possible six orders--front, back and side--were used. Each of the objects received a different order, and each object had the same order of placement for each subject. The objects were presented horizontally. Half of the objects were presented with the front of the object facing the child, and half of the objects were presented with the front of the object away from the child.

Task IV - non-Fronted Object Placement Task

The subject was seated on the floor, given a doll and asked to place it in front of, in back of, and on the side of the following objects: 1) drinking glass, 2) plastic doughnut, 3) bowl, 4) wooden block, 5) plastic cube, 6) a sponge. All possible six orders of front, back, and side were used. As before, each object received a different order and each subject had the same order of placement for each of the objects.

Scoring

Self-referent Task

A response was judged correct if the child placed the object in a position judged to be appropriate for the request. For example, both a subject who put the object in his lap and a subject who put the object on the floor in front of himself received correct scores for the "in front of" request. A subject who put the object on top of his head did not receive a correct score.

Touch Task

For the six objects used in the touch task, the fronts were defined as follows: dog--the head; plane--the nose; box with latch--the portion where the latch was; the boat--

the more pointed portion (where the seats and steering wheel were): the truck--the cab portion, the phone--the side with dials and numbers.

Fronted Object Placement Task

Correct responses were recorded for those in which the subject placed the standard object in the appropriate space as defined by the object and the request. Thus a correct response to the request to place the standard "in front of the dog" consisted of placing the standard in the space in front of the dog's head.

Non-Fronted Object Placement Task

A correct response was recorded for an "in front" request if he placed the standard between himself and the object. It should be noted that there were a number of cases where an experimenter could not make an adequate judgment of the child's response. For example, if a child was asked to put a doll in back of the bowl and he placed it somewhat to the back, but also to the side of the bowl, this response was regarded as uncodable.

Part B. The Comprehension of in, on, and under

The experimental tasks used in this portion of this study were similar to those used by Palermo and Wilcox (1975) and were designed to compare blind and normal children's comprehension of the locatives in, on and under in two conditions--a congruent one and an incongruent one. In the congruent task the linguistic request made for object placement was incongruent with the "usual" spatial relationships of the objects involved. In the contextually incongruent task, the subject was asked to place an object in an incongruent or "unusual" spatial relationship. It was hypothesized that:

- a) differences would exist between the normal and blind subjects across all age groups;
- b) performance within each group of subjects would improve with age on both tasks; and,
- c) that the nonlinguistic contextual support provided in the congruent task would aid the children in their performance on the tasks designed to test their comprehension of the locatives such that their performance would be better in the congruent situation than in the incongruent one.

Stimuli

Four pairs of objects were used: Pair A - consisted of a ball and a bag; Pair B - consisted of a boat and a bridge; Pair C - consisted of a truck and a road; and Pair D - consisted of a round block and a 16"x16"x16" box constructed out of

cardboard with a flat horizontal surface and a drawer with a prominent knob (which could be pulled out) on one side. An eight-inch horizontal portion was cut out at the bottom of the box. Diagrams of the stimuli are in Appendix A.

Procedure

Pairs A, B, and C were used to test the children's comprehension of in, on, and under both in the congruent situation and in the incongruent one. In the congruent condition, the child was asked to place the movable object in, on, or under the stationary one. In the incongruent condition the child was asked to place the usually stationary object in, on, or under the movable one. Thus, Stimulus Pair A, the ball (movable object) and the bag (stationary object), were used to test the locative in in the congruent condition (Put the ball in the bag) and the locative under in the incongruent condition (Put the bag under the ball). Stimulus Pair B, the boat (movable object) and the bridge (stationary object), were used to test the locative under in the congruent situation (Put the boat under the bridge) and the locative on in the incongruent task (Put the bridge on the boat). Stimulus Pair C, the truck (movable object) and the road (stationary object), were used to test the locative on in the congruent task (Put the truck on the road) and the locative

in in the incongruent task (Put the road in the truck). Pair D, the round block and the box which was designed to be contextually neutral, was used to test all three locatives after Pairs A, B, and C had been used. The children's responses were scored not merely as correct or incorrect, but rather the experimenter noted the child's response pattern. Table .III summarizes the stimuli used to test the locatives.

Half the subjects were presented with the incongruent task first, and half with the congruent task first.

Chapter V

Results

Introduction

Results of the experiments are reported in three sections. In the first section the data on comprehension of dimensional adjectives are recorded. A descriptive summary of the data is presented, followed by an analysis of variance. Where appropriate, interaction graphs are shown. In the second and third sections the results of the children's comprehension of the relational terms same and different and locatives are presented in this same two-phased format.

Comprehension of Dimensional Adjectives - Experiment I

The Data

Table IV is the data set for this experiment. It presents the number of correct responses for each subject (normal, blind-folded and blind) within each age level for each of the dimensional adjectives. Figure 1 indicates that while the percent of correct responses for all subjects across all age levels within the normal population performing visually (Condition I)

was 77%, the percent of correct responses for the blind subjects was 34%. Blindfolded subjects (Condition II) achieved 55% correct responses. Figure 2 presents the percent of correct responses for all of the dimensional adjectives by age levels. The data reveal that for the blind children comprehension of the dimensional adjectives advanced most between Levels II and III. At Level I blind children responded correctly only 18% of the time. At Level II they responded correctly 29%, and at Level III their correct responses increased to 56%. Although progress for the blind children appears noteworthy, performance at Level III remained considerably lower than normal children's performance at Level I. At Level I normal children responded correctly 69% of the time, while blind children at Level III responded correctly only 56% of the time.

The number of correct responses by blind and normal children at the three different age levels is interesting. As shown in Table IV, Level I normal children responded correctly 37 times as compared to 9 correct responses by blind children. The normal children performed four times better than the blind children in overall comprehension of the dimensional adjectives. At Level II normal children achieved 42 correct responses and blind children 16 correct responses. The normal children performed two and one-half times better than the blind children. At Level III the differential in number of correct responses is reduced to one-and-a-half times. Normal children

achieved 46 correct responses as compared to the blind children's 30 correct responses. The number of correct responses for blind children rose from 9 to 30 between Level I and III, while at the same time the number of correct responses for the normal children rose from 37 to 46.

Figure 3 shows that all children responded with a greater percentage of correct responses when presented with unmarked adjectives (66%) than with marked ones (48%). In Figure 4 the graph shows the percentages of correct responses by all the children to the specific lexical items across all age levels. A comparison of the percentage of correct responses to the specific lexical items by normal, blindfolded and blind children is shown in Table V. Unmarked terms big, long, and thick evoked a higher percentage of correct responses than their marked counterparts little, short and thin. Within unmarked adjectives big was understood better than long, and long was understood better than thick. Similarly, for marked adjectives, little was understood better than short, and short was understood better than thin. In addition, big-little was learned first, followed by long-short and thick-thin.

Tracing the development of the comprehension of the dimensional pairs through the three age levels for all children reveals the following: (1) The most general adjectival pair big-little was always comprehended best. The understanding of long-short and thick-thin followed. (2) For big-little there was almost no improvement in the normal children's performance

(in Condition I) across age levels because they achieved nearly perfect response scores at age Level I. Perfect scores on big-little were achieved by blind children and blindfolded children at Level III. (3) For long-short there was an improvement in all the children's performance between Levels I and III. The percentage of correct responses at Level III for the normal children (performing visually and tactually) was 100% for both lexical items, while the blind subjects obtained scores of 55% and 33% for long and short respectively. (4) For thick-thin there was almost no improvement shown by the normal group. At Level I 66% correct responses are recorded for the unmarked adjective thick and 33% for the marked adjective thin. At Level III there was only a 10% improvement to 43% in the normal children's comprehension of the marked adjective thin. Blindfolded children's performance improved from 22% correct responses for thick at Level I to 55% at Level III. Their percentage of correct responses to thin rose from 0 at Level I to 33% at Level III. The blind children showed no understanding of thick till Level III (33% correct), and no understanding of thin at any level.

Analysis of Variance

An analysis of variance was performed to assess the contribution each factor made to the children's performance. Four

factors were considered: (a) Child Type (normal, blind-folded and blind); (b) Age of child (Levels I, II, and III); (c) Dimensional adjective type (marked or unmarked); and, (d) Specific Adjectives (lexical items which code size (big-little, length (long-short) and thickness (thick-thin)).

The results of the analysis are summarized in Table VI. Four significant main effects appear: Age, Child Type, Dimension and Specific Adjective. The first two, Child Type ($F = 67.37$, $df = 2, 18$, $p < .01$) and Age ($F = 35.63$, $df = 2, 18$, $p < .01$) are graphed in Figure 5. These main effects account for the significant differences found between normal, blind-folded and blind children's performance across all age groups. In addition, it also accounts for the significantly better performance of the older subjects in the normal, blindfolded and blind populations.

The Dimension factor, that is, whether the lexical item tested was a member of the marked or unmarked set of adjectives, was the third main effect. It was found to be significant ($F = 1500.60$, $df = 1, 18$, $p < .01$). In Figure 6 the impact of the dimension on performance is shown.

The main effect of Specific Adjective ($F = 71.08$, $df = 4, 72$, $p < .01$) is graphically presented in Figure 7. It illustrates that the specific lexical items within each of the dimensional categories determined the children's performance levels.

Three double interaction effects were also found to be

significant: Child Type x Dimension ($F = 9.00$, $df = 2,18$, $p < .01$), Age Level x Dimension ($F = 95.44$, $df = 2,18$, $p < .01$), and Child Type x Specific Adjective ($F = 2.35$, $df = 8,72$, $p < .05$). One triple interaction, Child Type x Age Level x Dimension was also found to be significant ($F = 83.43$, $df = 4,18$, $p < .01$).

The first double interaction, that of Child Type x Dimension, is graphed in Figure 8. Blind children's comprehension of both unmarked and marked adjectives was poorer than normal children's. However, blind children's performance levels for the comprehension of the unmarked and marked adjectives approximate each other more closely than does the comprehension levels for these adjectives by the normal children.

When looking at the interaction of Age Level x Dimension in Figure 9 we find that children's performance on unmarked adjectives, regardless of age, was better than for the marked adjectives. The rate of improved performance, however, was proportionately greater for the marked adjectives as age Level III was approached. At age Level III comprehension of marked adjectives began to approach the comprehension level of their unmarked counterparts (although a difference between the two still remained).

The third interaction is that of Specific Adjective x Child Type, as shown in Figure 10. Although an overall decrease was recorded in the number of correct responses for blind as compared to blindfolded and normal children for all specific lexical items, a disproportionately greater decrease was

recorded for marked adjectives little, short and thin. The rate of decrease in the number of correct responses from the normal to the blind children is disproportionately greater for little as compared to big, short as compared to long and thin as compared to thick. The smallest difference between the marked and unmarked adjectives was recorded for the case of thick versus thin.

The last element in this analysis was the interaction of Age Level x Adjective, which is statistically insignificant when unmarked and marked adjectives are grouped as one factor. If however, unmarked adjectives (Group One adjectives) and marked adjectives (Group Two adjectives) are treated separately, the comprehension of adjectives of the marked set appeared significantly different with age ($F = 3.20$, $df = 4,8$, $p = .05$). Figure 11 plots the interaction effect of the marked adjectives x Age with unmarked adjectives shown to provide a basis for comparison. By Age Level III the comprehension of the marked member of each adjectival pair approaches the comprehension level of its marked counterpart.

The triple interaction of Child Type x Age x Dimension summarizes the findings detailed above. In Figure 9b a graphic representation is provided, illustrating the relationship of the factors to the children's performance. It demonstrates how the comprehension of dimensional adjectives disproportionately changed with the child's age, the dimensional adjective type

used (marked or unmarked) and the child's type (normal, blindfolded, or blind).

A subsequent analysis was performed on each of the main effects and interactions to determine how the components within each factor accounted for the variance for that factor. For example, the analysis of variance revealed that the comprehension of dimensional adjectives was affected by child type in the aggregate form. The question to be answered, however, was if the comprehension of the blind children differed significantly from that of the blindfolded and normal children.

The Neuman-Keuls Range test¹ was utilized to analyze if each component within the factors identified by the analysis of variance was significant in determining children's performance. (Results are reported as the contrast between the mean scores of component pairs in a factor and contrasted to a least significant range which is a score calculated at the 95% confidence interval.)

The first factor analyzed was Child Type, as shown in Table VII. The three components within the Child Type factor differed significantly from each other. While each child type contributed to the variance in the Child Type factor, it is

¹The Neuman-Keuls Range test is one of the tests used to analyze components of variance. It gives the researcher all possible contrasts between all components of a factor in pairs of two. (Hick, C. R., Experimental Design. Holt, Rhinehart and Winston, 1973, p. 35.)

important to note that the least significant of the three paired components was that of Normal vs. Blindfolded. The greatest difference was found between the normal and blind children.

Age Level was the second factor to be considered. As with Child Type, the three different Age Levels which composed the Age Factor contributed to age being a significant determinant in the children's performance. These results are reported in Table VIII.

The third effect studied was that of Specific Adjective. This analysis, as reported in Table IX, was performed separately for marked and unmarked adjectives in keeping with the findings reported in the analysis of variance. For both marked and unmarked adjectives, each component (specific lexical items) was significantly different.

Two double interactions were analyzed next. Table X reveals that all the components of the Child Type x Dimension interaction were significant with the exception of one: normal subjects' performance on marked adjectives vs. blindfolded subjects' performance on unmarked adjectives. (This implies that unmarked adjectives were generally better understood than marked adjectives. As such, blindfolded subjects tested with unmarked adjectives did not achieve performance levels significantly poorer than normal subjects who were tested with marked adjectives.)

The six components which comprised the Age x Dimension interaction were all found to be significant (see Table XI).

The Comprehension of Relational Terms - Experiment II

The Comprehension of Same and Different - Part A

The Data

Figure 12a displays the differences in the percent of correct responses to same and different by normal, blindfolded and blind children. While all groups produced fewer errors on same than on different, normal children responded with more correct responses to both terms than did the blind children. Looking at blind, blindfolded and normal children by age levels, we found that normal children at age Level I responded without error to same. In comparison, blind children at age Level III only achieved 67% correct responses to same (see Figure 12b). Normal, blindfolded and blind children failed to achieve any correct responses on different till age Level III. The percentage of correct responses to different at age Level III was: normal children performing visually 67%; blindfolded children 33%; blind children 17% (see Figure 13).

Two χ^2 tests were performed to determine whether: 1) the proportion of incorrect to one or more correct responses on same was related to age and child type; 2) the proportion of incorrect to one or more correct responses on different was

related to age and child type. Significant differences ($x^2=8.09$, $p.<.05$) were found between normal, blindfolded and blind children's comprehension of same. No significant differences were attributable to age. For comprehension of different significant differences ($x^2=12.25$, $p.<.01$) were found across age levels: age Level III did significantly better than Levels II and I. No significant differences could be attributable to child type.

Analysis of Variance

An analysis of variance was performed on the data obtained for Level III subjects because only children between 3.6-4.0 years of age achieved any correct responses to different. The following factors were defined (a) Child Type (normal, blindfolded, and blind); (b) Relational Terms (same and different). The results revealed a main effect ($F = 16.19$, $df=1, 6$, $p.<.05$) for Relational Terms (see Table XII.)

The Comprehension of Same and Different:

Part B

Only five Level III subjects reached criterion and were presented with the stimulus arrays. The subjects included four normal children (three of whom performed the task visually and one who performed the task blindfolded) and one blind child. All five children were totally correct when given the target

and asked to choose one that was the same from the three stimuli which composed the stimulus arrays. Each child was also asked to select a stimulus which differed from the target (three trials). Only one normal child (performing in Condition I) responded totally correctly. Of the two remaining subjects who performed visually, both children chose one same stimulus and two similar stimuli from the arrays. When the one blindfolded subject was asked to choose a stimulus which differed from the target, he chose one stimulus which was the same, one that was similar, and one that was different from the target. When the blind child was asked to choose a stimulus which differed from the target, he chose two stimuli which were the same as the target and one which was similar to the target. Table XIII summarizes the pattern of responses for Level III subjects on the comprehension of different. When analyzing the kinds of dimensions to which the subjects attended when asked to make judgments about differences, the following pattern emerged:

(1) For the normal subjects who performed visually and who selected stimuli which were similar to the target, the dimensions to which they attended when making their judgments were that of shape and size. The one normal subject who performed in Condition I and who responded totally correctly attended to size, shape and texture.

(2) The normal child who performed the task in Condition II attended to texture when he selected a stimulus which was

similar to the target, and to shape and texture when he correctly chose a stimulus which differed from the target.

(d) The blind child who was presented with this task picked a similar stimulus when presented with the target. She attended to size and texture. Table XIV summarizes the dimensions to which the subjects attended to when asked to make judgments about differences among stimuli.

Implications about the saliency of specific dimensions to the subjects is difficult to make since the data collected were from five children spread across the three child types (normal, blindfolded and blind).

Experiment III - The Comprehension of Locatives

The Comprehension of front, back, side (Part A)

The Data

Table XV is the data set for this experiment. It presents the number of correct responses for each subject within each age level for each of the three locatives in the four tasks.

Figure 14 indicates that while the total percent of correct responses for all the subjects across all age levels within the normal population (performing visually) was 43%, the percent of correct responses for the blind subjects was 23%. Blindfolded subjects achieved 33% correct responses. The number of uncodeable responses (as defined in Chapter IV) are not reflected in the summary table of the data. They are, nevertheless, interesting responses and will be discussed in Chapter VI. Figure 15 presents the percent of correct responses by all children according to task. Fewer errors were made on all locative placements in Task I (the Self-Referent Task) than in Task IV (the Non-Fronted Object Placement Task). Figure 16 graphs the percent of correct responses by child type and task. It reveals that: (1) in each of the four tasks the normal subjects responded with more correct responses; (2) the number of correct responses for the normal, blindfolded and blind subjects decreased from Task I to Task IV; (3) the blind children responded with fewer correct responses than the normal subjects who performed blindfolded. Figure 17 indicates that for all children more correct responses were obtained when the direction to the child utilized the locative front (41%) than when the direction contained requests for back (35%) or side (25%) placements.

Analysis of Variances

Analysis of variance was performed to assess the contribution

of each of the factors to the children's performance. Four factors were considered: (a) Child Type (normal, blindfolded and blind); (b) Age of Child (Levels I, II, III); (c) Task (Tasks I, II, III, IV); (d) Position (the lexical items which code each specific spatial relation--front, back and side). The results of the analysis are summarized in Table XVI. Four significant main effects were found. The first two were that of Child Type ($F=14.99$, $df=2,18$, $p < .01$) and Age ($F=36.75$, $df=2,18$, $p < .01$). There was no interaction between them. Significant differences were found between blind and normal children's performance across all age levels.

Normal children produced more correct responses than blind children and within each child type, significant differences were found between Level I and Level III children's performance (see Figure 18). While blind children's performance appears to be delayed when compared to that of normal children, normal and blindfolded children's performance resembled each other more closely than did blindfolded and blind children's performance. (This seems to hold more for age Level I and II than for age Level III. Between age Level II and III there is a dramatic increase in correct responding by normal and blind subjects but only a slight increase in the performance of the blindfolded.)

The other two main effects were that of Task ($F=48.22$, $df=3,54$, $p < .01$) and that of the specific lexical items which

code Position ($F=26.81$, $df=2,36$, $p=.01$). The nature of the task, that is, whether the task was the Self-Referent Task (Task I) or the Non-Fronted Object Placement Task (Task IV) influenced the children's performance. Lastly, which of the lexical terms were used to code the spatial relation influenced the children's performance. One interaction, that of Task x Position, was found to be significant ($F=3.87$, $df=6,108$, $p<.01$) and is graphed in Figure 19. It illustrates that there is a disproportional relationship between the comprehension of front, back and side within the four tasks. (As the tasks increase in difficulty, the mean number of correct responses to front, back and side are reduced disproportionately.)

The Neuman-Keuls test was performed for the factors identified as significant by the analysis. Results in Table XVII revealed that comprehension of the locatives differed significantly for the three types of children in the Child Type factor. However, greater differences were found between the normal and blind children's performance than between the blindfolded and normal children's performance.

A second significant factor was that of Age Level. The disaggregated components showed significant differences between the performance of the subjects within the three age levels, as shown in Table XVIII.

Results of the Neuman-Keuls test performed on the Task factor revealed (Table XIX) that except for the differences between Tasks III and IV (which were not significant) all other tasks significantly affected the children's performance. (This

reflects the consistently poorer performance of all subjects in Tasks III and IV.)

The specific locatives used to test Position were analyzed next. Results indicated that the comprehension of the locative front was significantly different when compared to back and side; furthermore, the comprehension of back was significantly different than the comprehension of side. This is shown in Table XX.

The interaction of Task x Position was analyzed in Table XXI such that the three positions (front, back, side) were contrasted within each task. Results revealed nonsignificant differences due to the interaction effect except for Task I, where the comprehension of front and back were significantly different from that of side.

The Comprehension of In, On and Under (Part B)

The Data

Table XXII presents the set of data for this experiment. It summarizes the number of correct responses by the normal, blindfolded and blind children within each age level for in, on and under in the congruent and the incongruent contexts. Figure 20 indicates that while the total percent of correct responses for all the normal subjects in the three contexts (congruent, incongruent and neutral) was 45%, the percent of

correct responses for the blind subjects was 12%. Blindfolded subjects achieved 43% correct responses. Figure 21 presents the percent of correct responses for the three locatives by age level. It reveals that all subjects produced more correct responses at Level III (46%) than at Level I (18%). Level II subjects produced 39% correct responses. Figure 22 reveals that the different contexts (congruent, incongruent and neutral) influenced the children's performance. All children did consistently better in the congruent task (43% correct responses) than in the incongruent one (18%). Figure 23 indicates which of the locatives was better understood in all the tasks. It reveals that in all of the conditions (congruent, incongruent and neutral) more correct responses were produced for the locatives on (45%) than for the locatives in (33%) or under (23%).

When analyzing the response patterns of the subjects in the different contexts, the following was observed:

Normal children at age Level I correctly responded to all on placements in the congruent and neutral contexts. Their percentage of correct responses to in was 66% in the congruent context and 33% in the neutral context. Their percent of correct responses to under was 33% in the congruent and neutral contexts. They produced no correct responses to any of the locatives in the incongruent situation.

Their errors in the congruent and neutral contexts showed that they interpreted in and under as on. When, however, they

were tested in the incongruent context, two response patterns were apparent. They either

- (1) placed the objects in the same relationship they had done in the congruent task
(Type A Responses)

or

- (2) they manipulated the objects, moved them about, but did not place them in any locational relationship (Type B Responses).

For example, a subject in the congruent context was asked to put the ball in the bag. He responded correctly. When, however, he was asked to place the bag under the ball (in the incongruent task), he responded by placing the ball in the bag. He produced a Type A response. Type A responses accounted for 7 out of 9 responses to all requests for locational placements for normal Level I children in the incongruent condition.

Another subject was asked to place the bridge on the boat. She picked up the boat, moved it about the table, and returned it to its original place. Her response was a Type B response. Type B responses accounted for 2 out of 9 responses for the normal Level I subjects in the incongruent context.

At age Level II all normal subjects achieved 100% correct responses for all the locatives in the congruent and neutral contexts. Their errors occurred only in the incongruent situation for the locative in (1 out of 3 incorrect responses) and

under (all three incorrect). No errors were recorded for on.

All children who responded incorrectly produced Type A Responses-- that is, they put the objects in the same spatial relationship they had done in the congruent task. For example, when asked to place the road in the truck, one subject responded by putting the truck on the road, and when asked to put the bag under the ball, all three subjects responded by putting the ball in the bag. No examples of Type B Responses were recorded.

Level III normal subjects correctly understood all locatives in the congruent and neutral contexts. Their only errors in the incongruent situation were for the locative under. They responded by putting the ball in the bag. Thus the two subjects who made errors produced Type A Responses.

Blindfolded children performed much like the normal subjects (who performed visually) in all three contexts. Level I subjects correctly responded to all on placements in the congruent and neutral contexts. Their percentage of correct responses to in was 66% in the congruent context and 33% in the neutral context. Their percent of correct responses to under was 33% in the congruent context. They produced no correct responses to any of the locatives in the incongruent context and no correct responses to under in the neutral context. Their errors in the congruent and neutral tasks showed that they interpreted in and under as on. Their responses in the incongruent task were exactly as those of the normals (who performed visually).

They did not respond correctly to any of the three locatives, and seven of 9 subjects produced Typa A Responses while 2 subjects produced Type B Responses.

Level II blindfolded children responded correctly to all the locatives in the congruent context and one subject responded to under as if it meant on in the neutral context. All their responses in the incongruent situation were just like the normal children's responses (Condition I); that is, their errors reflected a Type A response pattern.

Level III blindfolded subjects correctly understood all the locatives in the congruent and neutral contexts. Their errors in the incongruent situation were only for the locative under. They responded by producing Type A Responses, that is, they put the two objects in their usual spatial relationship (ball in bag).

Level I blind children produced only Type B Responses. When asked to place the objects in a specific spatial relationship (in, on or under), their responses in all three contexts were to move and/or manipulate one or both of the objects. They did not place them in any spatial relationship. In the neutral context, all three subjects played with the block, turned it or twirled it and then replaced it on the floor or on the table.

At age Level II, the only locative correctly understood by the blind subjects was on. This occurred only in the congruent

and neutral contexts. No correct responses were produced to in and under in the congruent and neutral contexts. There were no correct responses to any of the locatives in the incongruent contexts. Type B Responses were produced by all of the subjects in the congruent and neutral contexts to in and under, and in the incongruent situation to all three locatives. Type B Responses, that is, acting upon and manipulating the objects but not placing them in any spatial relationship, accounted for all 9 responses in the incongruent situation, 6 out of 9 responses in the congruent situation and 6 out of 9 responses in the neutral context.

Level III blind subjects performed similarly to Level I normals. They responded correctly to all on placements in the congruent and neutral contexts. Their errors in the congruent and neutral tasks showed that they interpreted the other two locatives in and under as on. In the incongruent context they produced no correct responses. Their errors, however, showed that 2 out of 9 responses were Type B Responses, while Type A Responses accounted for 6 out of 9 responses. Thus, at Level III the number of Type B Responses decreased while the number of Type A Responses increased.

Analysis of Variance

Analysis of variance was performed to assess the contribution each factor made to the children's performance. Four factors were defined: (1) Child Type (normal, blindfolded, and

blind); (2) Age (Levels I, II, III); (3) Context (congruent vs. incongruent); and (4) Specific Locatives (in, on, under). The results of the analysis are presented in Table XXIII. Four main effects were found to be significant: Child Type ($F=16.9$, $df=2,4$, $p=.01$); Age ($F=12.6$, $df=2,4$, $p=.01$); Context ($F=25.25$, $df=1,4$, $p=.01$); and Locative ($F=6.31$, $df=2,8$, $p=.05$). Thus significant differences were found between normal and blind children's comprehension of the locatives (see Figure 24). All subjects' performance improved with age. The nature of the context (congruent vs. incongruent) affected the children's performance (see Figure 25), and lastly, all children's performance depended on the locative term used to test them. Two x^2 tests were carried out to compare children's performance in the congruent and incongruent contexts by measuring their respective proportion of correct to incorrect responses. The first x^2 tests included the neutral condition. Significant differences were shown between normal and blind children ($x^2 = 58.8$, $p=.01$), age levels ($x^2 = 38.8$, $p=.01$), context ($x^2 = 37.7$, $p=.01$), and the specific locatives themselves ($x^2 = 24.1$, $p=.01$). Within the specific locatives significant differences were shown between children's comprehension of in and on ($x^2 = 11.17$, $p=.01$) and in and under ($x^2 = 4.15$, $p=.05$), and between on and under.

The second set of x^2 tests excluded the neutral condition. Children's comprehension of on and under ($x^2 = 13.4$, $p=.01$) was even more significantly different.

Two main effects were studied through the Newman-Keuls test: Child Type and Age Level. (Although a third main effect of context was revealed, it was not studied because it embodies only one degree of freedom. In such cases the t score is the same as the F score and thus no new information is provided.) The results on child type indicated that normal and blindfolded children's comprehension of in, on, and under was not significantly different. Table XXIV reports these data. This finding conforms with similar results found for the comprehension of dimensional adjectives and the locatives front, back, and side. However, in the results of the two former experiments, slight significant differences between normal and blindfolded children were recorded, whereas in this experiment no significant differences were found between normal and blindfolded children's performance.

Two components of the Age Level factor were found to be significant, as shown in Table XXV: Age Level I vs. Age Level III, and Age Level II vs. Age Level III. No significant differences were found between Age Levels I and II.

Chapter VI

Discussion

This chapter will discuss the findings of each of the experiments conducted: the comprehension of dimensional adjectives, the comprehension of relational terms, and the comprehension of locatives by blind, blindfolded and normal children.

The Comprehension of Dimensional Adjectives

Significant differences were found between blind and normal children's comprehension of dimensional adjectives. When compared to normal children, blind children showed delayed development in the comprehension of the adjectives tested. While one might argue that blind children would perform better on this task than blindfolded children because they have had more "practice" using the tactual modality for learning about the nature of objects, the data did not support this premise. Blind children's performance was significantly poorer than both the normal children who performed the task visually and the blindfolded children who performed the task tactually.

The nature of the adjectives that code various dimensions affected both the normal and blind children's performance. The linguistically simpler or unmarked adjectives were as a whole

better understood by both groups of children at all age levels. In addition, there were fewer errors for the unmarked member of each adjectival pair. While the children's comprehension of the marked members of each pair improved with age, both groups of children showed the greatest gains in the comprehension of little, followed by short and thin. The younger children in this study picked the "long" one when asked to show the experimenter the "short" one; and the "thick" one when asked to show the experimenter the "thin" one. They seemed to treat both words as if they both contained the feature + Polar. These young children had not quite reached the stage where the unmarked adjective (+Polar) was contrasted with its marked counterpart (-Polar). The children treated both members of the adjectival pair as if they simply referred to the "more extent", as H. Clark (1973) has suggested. Thus the data seem to confirm E. Clark's Full Semantics Hypothesis (1973). Furthermore, they lend support to the position that there is an order of acquisition for the dimensional adjectives: namely, that big is understood before little; long is understood before short; and thick is understood before thin.

The data also indicate that there were fewer errors on the more general adjectival pair big-little than on the two other pairs studied. E. Clark (1973 a) has suggested that this is so because big is specified as +Dimension and +Polar; and that the child who does not comprehend the more specific unmarked dimensional adjectives (e.g., thick or long) has not worked out how many dimensions are presupposed by that speci-

fic term. Put differently, the child has not yet learned to differentiate between different dimensions. While big applies to three dimensions, thick refers to a more specific aspect of dimensionality. Thus big is a less complex term linguistically, but it also codes a less complex concept. Similarly, the child who comprehends little shows his understanding of the general nature of dimensionality, and also that little refers to -Polar of general dimensionality. The child might comprehend little, it may not have worked out the specific dimensions which characterize the other dimensional adjectives. He would therefore not understand the marked adjectives short and thin. Thus it appears that the adjectival pair big-little is both cognitively and linguistically less complex than the other adjectives studied, and is therefore acquired before them.

It is interesting to note that the only adjectival pair on which the blind children made no errors was that of big-little. This did not occur, however, till the blind children were $3\frac{1}{2}$ - 4 years of age. In contrast, the normal children (performing in Condition I) understood big-little 100% correctly by 3.0-3.5 years of age, and long-short by $3\frac{1}{2}$ - 4 years of age. However, even the normal Level III children did not perform 100% correctly on the thick-thin pair.

The Overall Performance of the Blindfolded Subjects

While it is true that the blindfolded subjects made more

errors than the normal subjects who performed without blindfolds, their performance was more like the normal subjects who performed the task visually than the performance of the blind subjects. It appears that imposing a barrier to vision (via the blindfold) did affect the children's performance on this task. One must ask, however, why the performance of the blindfolded children was not the same as that of the normal children who performed the task visually. If indeed the "lexical representations" of the blindfolded subjects were the same as those of the subjects who performed without the blindfold, what can account for the differences in performance between the two groups of normal children? It may be the case, as Fraisse (1966) has suggested, that differences in visual and tactual perception can account for the different performance levels. While visual perception is simultaneous in nature, tactual perception is successive. This means that if two objects are presented visually, they can both be explored "at one glance". Objects that are presented tactually, however, must be explored one at a time. Thus, tactual exploration of objects may be more difficult than visual exploration, especially for the young population used in this experiment. Further research is needed to learn about very young children's ability to distinguish among objects in these two modalities.

The Performance of the Blind Subjects

While the differences between visual and tactual perception might explain the differences in performance between the subjects who performed visually and tactually, this explanation cannot account for the differences in performance between the blind and the blindfolded groups.

Indeed, one can argue that the blind subjects in this experiment were at an advantage when compared to the blindfolded subjects for they have had to rely on the tactual modality from birth. As previously indicated, however, the blind subjects made more errors than the blindfolded subjects.

For the child to comprehend a word that codes a particular dimension, he must have stored information or a mental representation about the nature of that dimension. For the sighted child this means that he must be able to recognize an attribute of an object he sees as being an instance of that dimension. We will call it a "dimension schema." In addition, he must have stored information about the sound of a particular word that codes that dimension. We can refer to that stored information as a "sound schema." Finally, he must have stored a mapping of the "sound schema" onto the "dimension schema" to know when the word is appropriately applied.

Words that refer to perceptible objects, events, or properties are mapped onto stored information about these precepts. However, the link from a particular perceptual experience to a particular word is not always a direct one. First of all, during many of one's encounters with objects

and events there may be no verbal coding by others of the event taking place or the objects in the environment. One continually sees big and little houses, long and short sticks and wide and narrow streets. There seems to be no reason to believe that people assign words or describe all such objects that readily allow for verbal description. In any case, particular perceptible events or attributes of objects are certainly not automatically named by particular words, since countless different things may be said about any single event or object. Indeed, the most common utterances pertaining to objects or events are probably not descriptions of these events, but rather comments on them (Huttenlocher, 1974).

What is the nature of the young blind child's linguistic and non-linguistic environment? To compensate for his lack of vision, the blind child must depend on direct contact with his environment, which in turn requires more mobility. However, it is precisely in this realm that he is at a serious disadvantage, for he is exposed to a narrower range of stimulation from which he must distinguish, interpret and organize his concepts. He lives in a limited world and his interaction with objects in them is limited as well. This in turn impedes the development of "object schemas." Furthermore, in order for the blind child to know about the attributes of objects (a dimension schema), it is necessary that he have

repeated interactions with objects of various dimensions. In order for him to understand a word that codes a particular dimension, it is necessary that the word schema be mapped onto the dimension schema. This means that the verbal encoding must take place at the same time the child is physically interacting with the objects, and that the language directed at him calls attention to the nature of the objects and their attributes. To talk to a blind child about big trucks when the child is not in direct contact with them will not enable him to map the linguistic symbol or word schema onto the dimension schema. Furthermore, in order to help facilitate the learning of the symbols which code contrastive dimensions, it is necessary that the blind child be able to explore successively those objects which are exemplars of this contrast. In order for the blind child to comprehend words which code dimensions, he must be allowed to directly interact with objects of various dimensions and be simultaneously exposed to the language which codes them.

Both Bowerman (1976) and Schlesinger (1977) suggest that the development of certain kinds of concepts by the normal child may be influenced by the linguistic input of the child's caretakers. Structured linguistic input (that is, repeated use of a word consonant with the non-linguistic context) may aid the blind child in developing certain concepts and call his attention to the attributes of objects.

The Comprehension of Same and Different:

Parts A and B

Both the normal and blind subjects tested responded to same and different much like Donaldson and Wales' (1970) subjects. The younger subjects responded to different as if it meant same. Thus they gave the experimenter an object that was the same as the target even when asked to give the experimenter an object which was different from the target. It was not until $3\frac{1}{2}$ years of age that normal children's performance on different improved. A slight improvement in the blind children's performance on different was noted. For the most part, normal children of $3\frac{1}{2}$ could only attend to one dimension in making judgments about differences among stimuli. This finding supports the hypothesis of Webb et al. (1974) that the development of different progresses through stages. At an early stage of development different is synonymous with same (till $3\frac{1}{2}$), and at a later stage of development different means similar. This hypothesis is supported by our data, for indeed there was only one subject (the oldest one in Level III) who responded to different by choosing a stimulus which differed on two dimensions. Thus, while based on a very small number of subjects, the data are consistent with the notion that when they first begin selecting differing objects, children try to find choices that have some

basis of similarity with a target. A tentative model for the comprehension of different would indicate the following:

Stage I: Different = Same

Stage II: Different = Similar

Stage III: Different = Different

Using a greater number of subjects as well as older subjects at higher age levels than those used in this study, would help elucidate when the change from Stage II to Stage III takes place.

While shape and size seemed to be the dimensions to which the normal subjects who performed in Condition I attended, texture was the dimension to which both the blind and blindfolded children attended. While these data are not in conflict with Ryan's hypothesis (1970) about the saliency of differing dimensions for the different modalities, the data cannot be said to support Ryan's hypothesis for the total N tested on this task was very small and the data are extremely limited. A detailed analysis about very young children's ability to make discrimination and equivalency judgments within different modalities will have to await further research.

One should note, however, that normal children performed better on this task than did the blind children; both in terms of the number of subjects who reached criterion and were presented with the task, as well as the quality of their

responses.

The Performance of the Blind Subjects

As in Experiment I, differences were found between normal and blind children's comprehension of same and different. Blind children were delayed when compared to normal children. Greater differences were found between normal and blind children's comprehension of different, than on their comprehension of same.

There seems to be two basic abilities which are needed to perform this task correctly: (a) the ability to make judgments of classification (recognizing equivalency among stimuli), and; (b) the ability to comprehend words which code equivalence (same) and non-equivalence (different). The ability of blind children to make judgments of classification has been noted by researchers to be delayed (Higgins, 1973; Foster, 1977; Stephens and Simpkins, 1974). In fact, Stephens and Simpkins (1974) state:

Findings from the present study suggest that class inclusion and classification tasks are particularly difficult for visually handicapped children. Further research is needed to analyze and trace this deficit developmentally (p. 62).

This deficit was apparent in the young blind children of this study. The fact that the young blind child has fewer and less meaningful interactions with his environment may account for the cognitive deficit seen in the ability to classify and make comparisons among stimuli, as well as the ability

to comprehend words which code the concepts. Our data, though limited, support Hatwell's (1966) premise that blind children have fewer opportunities to verify their representations in relation to objective reality and thus form faulty comparisons.

The Comprehension of Locatives

The Comprehension of Front, Back and Side

Determining the exact nature of the concepts of front, back and side is no easy task, as linguists and psychologists have discovered (H. Clark, 1973; Pufall and Shaw, 1973). At least part of the problem is the complex nature of the concepts. What is the principle which allows one to know what the (commonly accepted) fronts of such diverse objects as a car, a dog, a store, and a house are? No such principle seems to exist, but most of us agree as to what the fronts of these objects are.

One hypothesis put forth about the acquisition of front, back and side is a linguistic one--that of H. Clark (1973). Clark's (1973) hypothesis is that the linguistically simpler locative front would be acquired first, followed by back and side. Clark assumes that the unmarked locative front would be learned for all situations and contexts in which it could be used.

The data obtained from this study did in part confirm H. Clark's hypothesis. The understanding of front preceded the understanding of back, which in turn preceded the understanding of side. Thus, in all the four tasks presented to the subjects, more correct responses were recorded for the locative front; fewer correct responses were recorded for back; and the least number of correct responses for side. However, the interesting finding is that even the linguistically simpler locative front was not acquired as a "unitary meaning" which was applied to all contexts. If one accepts H. Clark's hypothesis one would expect that children's comprehension of front would be equal in each of the four tasks. Our data, however, showed that this was not the case. All the children in this study consistently did better on the comprehension of front in the self-referent task than they did in either of the other tasks. It appears that children know their own fronts, back and sides before they know the front, back and sides of fronted objects. This may be because they have greater experience with themselves and other humans. In addition, the very young child is the unwitting center of his universe (Piaget, 1952), and his knowledge of himself is better than his knowledge of objects in the world. Children also know the front, back and sides of fronted objects before they can place a standard in a locational position relative to those objects. Thus knowledge of the front, back and sides of objects precedes the knowledge

which would enable one to place a standard in a locational position relative to the object. Lastly, children can perform better on placing a standard in a locational position relative to objects which have salient fronts (fronted objects) before they can perform the task with objects that are non-fronted. Thus, the intrinsic characteristics of the objects (whether they were fronted or non-fronted) clearly influenced the performance of the children.

It therefore seems that the comprehension of a word that codes a spatial relation is in part determined by the nature of the word which codes the spatial relation as well as by the non-linguistic context (the spatial-locational system) in which the term is used. Certain contexts (e.g., a self-referent one) are less complex than others (e.g., non-fronted object placement task).

In this light that the uncodable responses recorded in this experiment may be explained. As the complexity of the task increased (from Task I to Task IV) so did the number of uncodable responses. While no uncodable responses were recorded in Task I by either the normal or blind children, uncodable responses were recorded in Task IV for all the subjects at all age levels. It was not that the children did not respond to the experimenter in Task IV. They appeared to know that the examiner had asked them to place the standard in a spatial position relative to the non-fronted objects. They were unsure, however, of the exact space required for

placement. They therefore picked up the standard and placed it anywhere relative to the object (sometimes toward the front and side; sometimes toward the side and back, but not in a clearly defined space).

The differences between the blind and normal subjects on all tasks at all age levels serves to indicate that blind children's knowledge of words which code spatial relations is delayed when compared to that of normal children. More significantly, however, is the fact that they appear to be defective in knowledge of their own bodies as well as their knowledge of objects in the world.

The Comprehension of In, On and Under

Significant differences were found between normal and blind children's comprehension of the locatives in, on, and under. Blindfolded subjects performed much as the normals who performed the tasks visually.

While all the children's performance improved with age, the performance of the oldest group of blind subjects resembled the performance of the youngest normals. Thus, significant delays can be seen between normal and blind children's comprehension of the locatives tested.

The data are in agreement with one aspect of E. Clark's Partial Semantics Hypothesis (1974 a,b): in the absence of complete lexical representations children rely on non-linguistic

contextual clues to derive meaning from the language they hear. All children tested in this study produced more correct responses in the congruent context than in the incongruent one.

However, the data do not support the interpretation that the order of acquisition of the locatives studied is that in is acquired before on and that on is acquired before under. The subjects in our study made fewer errors to on than to the other locational requests. This finding may be due to the nature of the stimuli used to test the locatives. Stimulus Pair C, the truck and the road, was used to test on in the congruent task. Stimulus Pair B, the bridge and the boat, was used to test on in the incongruent context. To respond correctly to on in both the congruent and incongruent contexts required that the subject manipulate only one of the objects. Stimulus Pair C, the ball and the bag, were used to test the locative in in the congruent context and under in the incongruent one. To respond correctly using these objects requires that the child manipulate both objects. Table XXVI summarizes what appears to be the motoric responses necessary for each locative placement in the congruent and incongruent contexts. For the congruent condition the request for an in placement requires the more complex motoric response, while the request for an under placement in the incongruent condition requires the more complex motoric response. The fact that as a whole

on required a motoric response which was easier than the responses necessary for the other two locative placements may account for more correct responses to on.

What can account for the pattern of errors recorded for the children? It is proposed that the children tested used "response strategies" in interpreting the requests for locational placements. These response strategies may be termed "a heuristic for dealing with poorly understood sources of information" (Shatz, forthcoming). Shatz (forthcoming) describes response strategies as being similar to Slobin's (1973) operating principles in that they provide the child with a means of dealing with language without possessing the complete set of linguistic rules which enable one to comprehend messages.

The most primitive strategy discernible in this study was that of an "action strategy". This strategy can account for all Type B responses recorded. The "action strategy" was used by the youngest normal subjects and Level I, II and even Level III blind subjects who did not know about the usual spatial relationship of the stimulus objects, but had understood that an interaction was taking place. They therefore responded to the language they heard with action; that is, language to these children was taken as a call to action. They therefore moved and manipulated one or both of the objects of the stimulus pair but did not place them in any locational relationship. (The non-linguistic strategy

described here is similar to the action strategy proposed by Shatz et al. (1977) that normal and language impaired children use for understanding indirect directives. Schlesinger notes that an action strategy may be an example of what Luria terms the impellant function of language. At one stage, Luria claims language has a mere triggering function.)¹

Some of the more sophisticated children in this study knew the usual relationship of objects, but had "incomplete knowledge" of the meaning of the locatives. These children used the non-linguistic context to derive meaning from the language they heard, and responded to requests for spatial-locational placements by putting the stimuli in their usual spatial relationship. This strategy accounts for Type A responses.

The most sophisticated (older normal) children were able to disregard the non-linguistic context in dealing with the language directed at them. They knew the usual spatial relationship of the objects which composed the stimulus pairs, and they also knew the meaning of the locatives used. They therefore responded correctly when asked to place objects in an unusual spatial relationship. This accounted for all the correct responses in the incongruent task.

In summary, the following response strategies are proposed:

¹Schlesinger, personal communication, 1978.

- (1) If you don't understand the language directed at you, assume that language is a call to action. Act upon the objects present in the (non-linguistic) context.
- (2) If you know the usual spatial relationship of the objects present, and you recognize that a spatial locational request has been made, but don't understand the specific locative used in the request, assume that the request made was to place the objects in their usual spatial relationship. Rely on the non-linguistic context to give you clues to the meaning of the locatives.
- (3) If you know that a spatial locational request has been made and you comprehend the specific locative used in the request, put the objects in the spatial relationship requested. You may disregard the non-linguistic context and the usual spatial relationships of the objects. Rely only on the linguistic ones.

Some of the younger normal children in this study as well as most of the blind children responded by using an action strategy (Strategy I) or a contextual strategy (Strategy II).

This means that those subjects who used Strategy I did not understand the language directed at them and did not even possess "knowledge" about the objects in the stimulus pairs and their relationship to each other. Subjects who used Strategy II, however, possessed "knowledge of objects and their usual spatial relationship to each other and used this knowledge to interpret the linguistic message. It should be noted that not even the oldest normal children ($3\frac{1}{2}$ - 4 years of age) responded 100% correctly in the incongruent situation. This would indicate their still "imperfect knowledge" of the meaning of the locatives used.

CHAPTER VII

SUMMARY AND IMPLICATIONS

Matched groups of normal and congenitally blind children between $2\frac{1}{2}$ -4 years of age were compared on their comprehension of dimensional adjectives (big-little, long-short, and thick-thin); relational terms (same-different) and locatives (front, back, side, in, on, under). On all tasks blind children's performance was significantly delayed when compared to that of normal children. There were no indications of deviant development on the part of blind subjects.

While an attempt was made to match the subjects of this study for chronological age and intellectual functioning, the findings of this study indicate that the subjects may not have been matched in terms of their over-all cognitive development. DeVries (1974) notes:

"I.Q. tests are not derived from any theory of intelligence but are based, instead, on certain assumptions about intelligence....To a large extent these items simply tap bits of surface information....In contrast Piaget's tasks are derived from...a research-based theory of intelligence....Piagetian tasks are concerned with how the individual views and reasons about reality. Each task has theoretical significance and in itself reveals something important about the individual's general development of his intelligence" (p.747).

It is possible that the deficits in the blind children's language comprehension reflected more basic cognitive deficits.

Although the data obtained in this study were based on very young children's performance, they seem to confirm Stephens

and Simpkins' (1974) position. Stephens and Simpkins (1974) wrote:

"Although chronological age and intelligence have shown some relationship to cognitive functioning....the differences between blind and sighted subjects cannot be explained on the basis of chronological or mental age. Therefore it may be concluded that significant differences exist....between blind and sighted subjects which are not attributable to CA or MA; however, it may be inferred that experiential differences between the two groups; i.e., the sensory deprivation experienced by the blind subjects, has contributed to these differences" (p.41).

Future research should assess the cognitive abilities of young blind children both at the sensory-motor stage and the pre-operational stage. Normal and blind children should be matched in terms of cognitive levels and then tested on language comprehension. (Matching children in terms of cognitive levels rather than CA or MA has recently been used when comparing normal and language impaired children's use of performatives. Snyder (1976) used standardized Piagetian measures of sensorimotor intelligence as a basis for matching normal and language impaired children.)

In addition, longitudinal studies of blind children are needed to determine the course of both cognitive and linguistic development over an extended time span. Ideally, such studies would begin at birth and would examine both cognitive and linguistic development at the sensorimotor and preoperational stages as well as the stages of concrete and formal operations.

The relationship between language and cognition is being reexamined as researchers continue to study the complex links between the two processes. From the very beginning of language development a process of selection is at work. From the enormous quantity of words he encounters the child focuses his linguistic attention on a subset, guided by factors only partially understood. Such features as shape, size, change, and the possibility of acting upon objects (self-induced change) seem to play a role. The question of whether the selection of words which are acquired and the selection of aspects of their meaning to be used at first are governed entirely by conceptual factors broader than language or whether specifically linguistic factors play a role, still remains unresolved.

How does a cognitive concept become a semantic one? One possibility is that at least initially words are learned only as labels for concepts which have been formed non-linguistically. Nelson (1974) and Clark (1974) have proposed versions of this view, Nelson placing more emphasis on the functional properties of objects, and Clark on their static perceptual attributes. Perhaps some concepts develop relatively independent of language, and others may develop only because "language gives the child a little nudge" (Bowerman, 1976). Still others may begin cognitively in a relatively primitive form, but the development is greatly influenced by linguistic input (Bowerman, 1976; Schlesinger, 1977). The solution of this issue

requires more precise specification of cognitive and semantic categories than is presently available.

The fact that language delays are found in the blind population as early as $2\frac{1}{2}$ years of age serves to underscore the need for early language intervention. Appropriate language intervention may aid the blind child in learning certain concepts and provide him with the symbols which code them. Language teaching, however, must be designed to promote greater interaction of the child with his environment and must take place when the child is in direct contact with his environment. Care must be taken to ensure that the child forms concepts based on his interaction with people and objects relevant to his world, coupled with meaningful language.

When early intervention ensures that parents and teachers of the blind are alert and sensitive to the need for adequate language and cognitive skills based on reality, these children will be less likely merely to verbalize and "form abstractions based on abstractions." (O'Brian, 1976). For the blind child, the complex relationship between language acquisition and cognition is of particular importance in all program planning.

The data obtained from this study supports E. Clark's hypothesis regarding both the order and the nature of the acquisition of dimensional adjectives. The most general of the dimensional adjectives (big-little) were acquired before the more specific ones (long-short, thick-thin). Furthermore, the unmarked adjectives of each adjectival pair (big-long, thick) were acquired before their marked counterparts

(little, short, thin). The findings of this study regarding the acquisition of relational terms and the acquisition of locatives did not entirely conform to Clark's predictions.

The youngest children in this study interpreted different to mean same, performing like Donaldson and Wales' (1970) subjects. However, the older children, about $3\frac{1}{2}$ years of age seemed to go through a stage where different meant similar. The children who picked a stimulus similar to the target when asked to choose a different one attended to only one dimension of difference when making their judgment. The dimension to which the children attended depended on the modality used for the task. Future research should investigate the meaning of different using a population older than that which was employed in this study.

In regard to the locatives studied, three findings emerge: (1) While the unmarked locative front was acquired before back and back was acquired before side, the complexity of the task (that is, the non-linguistic context) influenced the children's performance. The intrinsic characteristic of the objects used as well as the subjects' own relationship to the objects influenced their comprehension of these terms. (2) While the non-linguistic context and the children's knowledge of the usual spatial relationship of objects influenced their comprehension of the locatives in, on, and under, our data do not support E. Clark's claim of the order of acquisition of

these terms. We found that on was acquired before in, followed by the acquisition of under. (3) Finally, when the children did not comprehend the language directed at them and when they did not have knowledge about the relationship of the objects to each other, they used an action-based response strategy. This finding occurred for the youngest normals in the sample and for nearly all the blind subjects.

While the use of Clark's hypotheses regarding the nature and the pattern of the acquisition of lexical items were the basis for the design of the research reported, the results are inconclusive regarding the confirmation or disconfirmation of Clark's theory as an explanatory theory of semantic development. The specific role of visual input and visual perception in the acquisition of word meanings requires further research. -

While the Full and the Partial Semantics Hypotheses provide a useful framework for the interpretation of data on the acquisition of word meaning, the hypotheses do not account for the development of concepts which words code. A more comprehensive theoretical model integrating perceptual input, linguistic input, and cognitive development is required to explain both the stages and processes of language acquisition.

STIMULI	X	X'	X''
TARGET	X		

X = same, identical on
all dimensions
X' = differing on one
dimension
X'' = differing on two
dimensions

TABLE I

General pattern of each array
used in Experiment II, Part B.

SHAPE CONSTANT

<u>ARRAY 1</u>				<u>ARRAY 4</u>	
Small	Large	Large	Large	Small	Small
Furry	Furry	Smooth	Smooth	Smooth	Rough
Circle	Circle	Circle	Rectangle	Rectangle	Rectangle
TARGET:Small	Furry	Circle	TARGET:Large	Smooth	Rectangle

SIZE CONSTANT

<u>ARRAY 2</u>				<u>ARRAY 5</u>	
Small	Small	Small	Large	Large	Large
Rough	Smooth	Smooth	Smooth	Rough	Rough
Square	Square	Circle	Circle	Circle	Square
TARGET:Small	Rough	Square	TARGET:Large	Smooth	Circle

TEXTURE CONSTANT

<u>ARRAY 3</u>				<u>ARRAY 6</u>	
Large	Large	Small	Large	Large	Large
Furry	Furry	Furry	Smooth	Rough	Rough
Square	Circle	Circle	Circle	Circle	Square
TARGET:Large	Furry	Square	TARGET:Large	Smooth	Circle

TABLE II

The composition of test Arrays used in
Experiment II, Part B.

	<u>Congruent</u>	<u>Incongruent</u>
PAIR A ball-bag (movable-stationary)	in	under
PAIR B boat-bridge (movable-stationary)	under	on
PAIR C truck-raod (movable-stationary)	on	in
PAIR D round block-box (movable-stationary)	<u>Contextually neutral</u> in, on, under	

TABLE III

Stimuli used to test the Comprehension
of the Locatives in Experiment III,
Part B.

		NORMALS									BLINDFOLDED									BLIND								
		I			II			III			I			II			III			I			II			III		
UNMARKED ADJECTIVES		S ₁	S ₂	S ₃	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃
		3	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2	2	2	3	2	3	3	3	3	3
				9			9			9			8			8			9			6			8			9
		3	2	2	2	3	3	3	3	3	1	2	1	2	2	3	2	3	3	0	1	1	1	1	1	2	1	1
MARKED ADJECTIVES		2	2	2	2	2	2	2	2	2	1	1	0	2	1	1	2	2	1	0	0	0	0	0	0	2	1	0
				6			6			6			2			4			5			0			0			3
		3	2	3	3	3	3	3	3	3	3	1	2	2	2	3	3	3	1	0	0	0	0	1	3	3	3	3
				8			9			9			6			6			9			1			4			9
		2	1	1	2	2	2	3	3	3	1	0	0	1	2	2	2	3	3	0	0	0	0	1	0	2	0	1
				4			6			9			1			5			8			0			1			3
		1	1	1	1	2	1	1	2	1	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0	1	0	0
				3			4			4			0			1			3			0			0			1

S=Subject

COMPREHENSION OF DIMENSIONAL ADJECTIVES:
 NUMBER OF CORRECT RESPONSES FOR EACH SUBJECT
 WITHIN EACH TYPE AND AGE LEVEL

TABLE IV

Note: The number in the right hand box of each cell represents the total number of correct responses by age level for each of the dimensional adjectives.

Dimension	Child Type	Level I	Level II	Level III
Big-Little	Normal	<u>100/ 88</u>	<u>100/100</u>	<u>100/100</u>
	Blindfolded	<u>88/ 66</u>	<u>88/ 66</u>	<u>100/100</u>
	Blind	<u>66/ 11</u>	<u>88/ 44</u>	<u>100/100</u>
Long-Short	Normal	<u>78/ 44</u>	<u>88/ 67</u>	<u>100/100</u>
	Blindfolded	<u>44/ 11</u>	<u>78/ 56</u>	<u>88/ 88</u>
	Blind	<u>22/ 0</u>	<u>33/ 11</u>	<u>44/ 33</u>
Thick-Thin	Normal	<u>66/ 33</u>	<u>66/ 44</u>	<u>66/44</u>
	Blindfolded	<u>22/ 0</u>	<u>44/ 22</u>	<u>55/ 33</u>
	Blind	<u>0/ 0</u>	<u>0/ 0</u>	<u>33/ 0</u>

COMPREHENSION OF DIMENSIONAL ADJECTIVES:
PERCENTAGE OF CORRECT RESPONSES TO SPECIFIC LEXICAL ITEMS
BY CHILD TYPE AND AGE LEVEL

* The number to the left of the diagonal line is the percentage correct for the unmarked adjective of the dimensional pair. The number to the right of the slash is the percentage correct for the marked adjective of the adjectival pair.

TABLE V

Source of Variation	Degrees of Freedom df	Sum of Squares SS	Means Square MS	F
Child Type	2	45.68	22.84	.37**
Age Level	2	24.16	12.08	35.63**
Child Type x Age Level	4	3.06	.765	-2.26
Subject	18	7.11	.339	--
Dimension	1	12.5	12.5	1500.60**
Child Type x Dimension	2	.15	.075	9.00**
Age Level x Dimension	2	1.59	.795	95.44**
Child Type x Age Level x Dimension	4	2.78	.695	83.43**
Subject x Dimension	18	.15	.00833	--
Adjective	4	70.2	17.55	71.08**
Child Type x Adjective	8	4.65	.58	2.35*
Child Type x Adjective unmarked	4	4.27	1.067	4.33*
marked	4	.38	.095	1
Age Level x Adjective	8	3.95	.4938	2.0
unmarked	4	.79	.20	.81
marked	4	3.16	.79	3.20*
Child Type x Age Level x Adjective	16	7.42	.4638	1.878
Adjective x Subject	72	17.78	.2469	--

COMPREHENSION OF DIMENSIONAL ADJECTIVES
RESULTS OF ANALYSIS OF VARIANCE

* .05
 ** .01

TABLE VI

COMPREHENSION OF DIMENSIONAL ADJECTIVES:
 NEUMAN-KEULS ANALYSIS OF COMPONENTS
 IN THE CHILD TYPE FACTOR

<u>FACTOR</u>	<u>Difference of Means</u>	<u>Least Signi- ficant Range</u>	
Child Type			
Normal vs. Blind	1.30	> .29	Significant at .05
Normal vs. Blindfolded	.55	> .23	Significant at .05
Blindfolded vs. Blind	.75	> .23	Significant at .05

TABLE VII

COMPREHENSION OF DIMENSIONAL ADJECTIVES:
 NEWMAN-KEULS ANALYSIS OF COMPONENTS
 IN THE AGE FACTOR

<u>FACTOR</u> Age	<u>Difference of Means</u>	<u>Least Signi- ficant Range</u>	
Age Level I vs. Age Level II	.94 >	.29	Significant at .05
Age Level II vs. Age Level III	.51 >	.23	Significant at .05
Age Level III vs. Age Level I	.43 >	.23	Significant at .05

TABLE VIII

COMPREHENSION OF DIMENSIONAL ADJECTIVES:
NEUMAN-KEULS ANALYSIS OF THE COMPONENTS
IN THE SPECIFIC ADJECTIVE FACTOR

<u>FACTOR</u>	<u>Difference</u>	<u>Least Signi-</u>	
<u>Adjective #1</u>	<u>of Means</u>	<u>ficant Range</u>	
(Unmarked)			
Big vs. Thick	1.6	> .322	Significant at .05
Big vs. Long	.820	> .269	Significant at .05
Long vs. Thick	.787	> .269	Significant at .05
 Adjective #2			
(Marked)			
Little vs. Thick	1.63	> .322	Significant at .05
Little vs. Short	.890	> .269	Significant at .05
Short vs. Thin	.740	> .269	Significant at .05

TABLE IX

COMPREHENSION OF DIMENSIONAL ADJECTIVES:
NEWMAN-KEULS ANALYSIS OF COMPONENTS
IN TYPE X DIMENSION INTERACTION

<u>FACTOR</u> Type x Dimension	<u>Difference of Means</u>		<u>Least Signi- ficant</u>	
Normal Unmarked x Blind Unmarked	1.86	7	.08	Significant at .05
Normal Unmarked x Blind Unmarked	1.23	7	.088	"
Normal Unmarked x Blindfolded Marked	1.08	7	.072	"
Normal Unmarked x Blindfolded Unmarked	.52	7	.005	"
Normal Unmarked x Normal Marked	.49	7	.053	"
Normal Marked x Blind Unmarked	1.37	7	.077	"
Normal Marked x Blind Marked	.74	7	.072	"
Normal Marked x Blindfolded Marked	.59	7	7.065	"
Normal Marked x Blindfolded Marked	.03	7	.053	"
Blindfolded Unmarked x Blind Unmarked	.134	<	.078	Not Significant
Blindfolded Unmarked x Blind Marked	.71	7	.065	Significant at .05
Blindfolded Unmarked x Blindfolded Marked	.56	7	.053	"
Blindfolded Marked x Blind Unmarked	.78	7	.065	"
Blindfolded Marked x Blind Marked	.15	7	.053	"
Blind Marked x Blind Unmarked	.63	7	.053	"

TABLE X

Comprehension of Dimensional Adjectives:
Neuman-Kuels
Analysis of Components in Type X Dimension Interaction:

<u>Factors</u>		<u>Difference of Means</u>		<u>Least Signi- ficant Range</u>	
Age X Dimension					
Level III unmarked objectives	X Level I marked adjectives	1.48	>	.08	Significant at .05
"	X Level II marked adjectives	.96	>	.077	"
"	X Level I unmarked adjectives	.70	>	.072	"
"	X Level II unmarked adjectives	.37	>	.065	"
"	X Level II marked adjectives	.30	>	.053	"
Level III marked objectives	X Level I marked adjectives	1.18	>	.077	"
"	X Level II marked adjectives	.66	>	.072	"
"	X Level I unmarked adjectives	.10	>	.065	"
"	X Level II unmarked adjectives	.07	>	.053	"
Level II unmarked adjectives	X Level I marked adjectives	1.11	>	.072	"
"	X Level II marked adjectives	.59	>	.065	"
"	X Level I unmarked adjectives	.33	>	.053	"
Level I unmarked adjectives	X Level I marked adjectives	.78	>	.065	"
"	X Level II marked adjectives	.26	>	.053	"
Level II marked adjectives	X level II marked adjectives	.52	>	.053	"

T A B L E X I

.145.

Source of Variation	Degrees of Freedom	Sum of Squares	Means Square	F.
Child Type	2	2.11	1.055	2.11
Subject	6	3.0	.5	--
Relational Term	1	4.5	4.5	16.19*
Child Type x Relational Term	2	.33	.165	<1
Subject x Relational Term	6	1.69	.278	--

* <.95

TABLE XII

COMPREHENSION OF SAME AND DIFFERENT
BY LEVEL III SUBJECTS (PART A):
RESULTS OF ANALYSIS OF VARIANCE

		DIFFERENT		
		SAME	SIMILAR	DIFFERENT
Normal (Condition I)	S ₁ S ₂ S ₃	1	2	3
Blind- folded (Condition II)	S ₁	1	1	1
Blind	S ₁	2	1	

TABLE XIII
PATTERN OF RESPONSES TO DIFFERENT
(EXPERIMENT II PART B)
BY LEVEL III SUBJECTS

S=SUBJECT

	SIZE	SHAPE	TEXTURE
Normal (Condition I)	111	111	1
	Total 3	Total 3	Total 1
Blindfolded (Condition II)	0	1	11
		Total 1	Total 2
Blind	1	0	1
	Total 1		Total 1

TABLE XIV

DIMENSIONS TO WHICH SUBJECTS ATTENDED
WHEN ASKED TO MAKE JUDGMENTS
ABOUT DIFFERENCES AMONG STIMULI

		NORMAL												BLINDFOLDED												BLIND											
		LEVEL I			LEVEL II			LEVEL III			LEVEL I			LEVEL II			LEVEL III			LEVEL I			LEVEL II			LEVEL III											
		S ₁	S ₂	S ₃	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃						
TASK 1	Front	6	3	3	6	6	3	6	6	6	6	3	3	6	6	3	6	6	6	3	3	3	3	3	3	3	3	3	3	6	6	3	6				
	Back	6	3	3	6	6	3	6	6	6	6	3	3	6	6	3	6	6	6	3	0	0	3	3	6	6	3	6	6	3	6	6					
	Side	6	3	3	0	3	3	6	6	6	0	3	3	3	3	3	6	0	6	0	0	0	0	0	3	5	0	6									
TASK 2	Front	2	4	2	5	4	4	4	5	5	2	1	1	3	2	4	3	4	4	1	1	1	5	2	2	5	4	3									
	Back	2	1	1	5	4	4	5	5	4	1	1	1	1	2	4	2	4	3	1	0	0	3	2	1	2	2	2									
	Side	3	0	0	1	2	2	4	5	5	2	1	0	3	0	2	3	1	4	0	0	0	0	1	1	5	1	1									
TASK 3	Front	2	1	2	3	4	2	4	4	5	1	1	2	2	2	2	5	2	3	0	1	1	1	1	2	4	2	3									
	Back	1	1	1	2	3	3	4	5	4	1	1	1	3	1	1	3	2	3	0	0	0	1	1	1	3	1	1									
	Side	3	0	0	1	1	1	4	4	5	1	1	0	3	0	1	5	0	3	0	0	0	0	0	0	4	2	0									
TASK 4	Front	2	1	1	1	4	3	5	2	4	1	1	2	1	2	2	4	1	3	0	0	0	1	1	0	3	3	2									
	Back	1	1	0	3	1	1	5	1	4	0	0	2	1	2	2	1	1	3	0	0	0	0	0	0	3	3	1									
	Side	1	0	1	0	0	3	5	2	3	1	0	1	1	0	2	3	1	1	0	0	0	0	0	0	3	3	0									

S = Subject

TABLE XV
THE COMPREHENSION OF LOCATIVES (PART A) NUMBER OF
CORRECT RESPONSES TO "FRONT", "BACK", "SIDE"
BY EACH SUBJECT AT EACH AGE LEVEL FOR THE
FOUR TASKS

COMPREHENSION OF THE LOCATIVES "FRONT", "BACK" AND "SIDE":
RESULTS OF ANALYSIS OF VARIANCE (EXPERIMENT III, PART A)

Source of Variation	Degrees of Freedom df	Sum of Squares SS	Means Square MS	F
Child Type	2	118.74	59.37	14.99**
Age Level	2	291.06	145.53	36.75**
Child Type x Age Level	4	10.59	2.65	1
Subject	18	71.28	3.96	--
Task	3	306.7	102.23	48.22**
Child Type x Task	6	7.61	1.27	1
Age Level x Task	6	7.8	1.3	1
Child Type x Age Level x Task	12	13.58	1.13	1
Subject x Task	54	114.72	2.12	--
Position	2	74.0	37.0	26.81**
Child Type x Position	4	1.87	0.47	1
Age Level x Position	4	17.44	4.36	3.16*
Child Type x Age Level x Position	8	9.8	1.23	1
Subject x Position	36	49.72	1.38	--
Task x Position	6	17.9	2.98	3.87**
Child Type x Task x Position	12	7.49	.62	1
Age Level x Task x Position	12	4.52	.38	1
Child Type x Age Level x Task x Position	24	10.32	.43	1
Subject x Task x Position	108	83.61	.77	--

* .05
 ** .01

TABLE XVI

Comprehension of Locatives (Part A):
Neuman-Keuls

Analysis of Components in the
Child type Factor:

<u>Factor</u>	<u>Difference of Means</u>		<u>Least Signi- ficant Range</u>	
Child Type				
Normal vs. Blind	1.48	>	.691	Significant at .05
Blindfolded vs. Blind	.80	>	.568	"
Normal vs. Blindfolded	.68	>	.568	"

T A B L E XVII

Comprehension of Locatives (Part A):
 Neuman-Keuls
 Analysis of Components in the
 Age Level Factor:

<u>Factor</u>	<u>Difference of Means</u>		<u>Least Signi- ficant Range</u>	
Age Level				
Age Level I vs. Age Level III	2.31	>	.691	Significant at .05
Age Level I vx. Age Level II	1.39	>	.568	"
Age Level II vs. Age Level III	.92	>	.568	"

T A B L E XVIII

Comprehension of Locatives (Part A):
 Neuman-Keuls
 Analysis of Components in the
 Task Factor:

<u>Factor</u> <u>Task</u>	<u>Difference</u> <u>of Means</u>		<u>Least Signi-</u> <u>ficant Range</u>	
Task I vs. IV	2.56	>	.606	Significant at .05
Task II vs. III	2.16	>	.551	"
Task I vs. II	1.62	>	.458	"
Task II vs. IV	.94	>	.551	"
Task II vs. III	.54	>	.458	"
Task III vs. IV	.40	<	.458	NS

T A B L E X I X

Comprehension of Locatives (Part A):

Neuman-Keuls

Analysis of Components in the
Position Factor:

<u>Factor</u>	<u>Difference of Means</u>		<u>Least Signi- ficant Range</u>	
Position				
Front vs. Back	1.17	>	.389	Significant at .05
Front vs. Side	.50	>	.323	"
Side vs. Back	.67	>	.323	"

T A B L E XX

Comprehension of Locatives (Part A):
 Neuman-Keuls
 Analysis of Components in Posi-
 tion X Task Interaction:

<u>Factor</u> Position x Task #1	<u>Difference of Means</u>		<u>Least Signi- ficant Range</u>	
Front x Side	1.78	>	1.23	Significant at .05
Back x Side	1.56	>	1.11	"

T A B L E XXI

		Normal			Blindfolded			Blind			
Age Level		I	II	III	I	II	III	I	II	III	
CONTEXT	Congruent	In	2	3	3	2	3	3	0	0	2
		On	3	3	3	3	3	3	0	3	3
		Under	1	3	3	1	3	3	0	0	1
	Incongruent	In	0	2	3	0	2	3	0	0	0
		On	0	3	3	0	3	3	0	0	0
		Under	0	0	1	0	0	1	0	0	0

TABLE XXII

COMPREHENSION OF LOCATIVES "IN", "ON" AND "UNDER"
IN THE CONGRUENT AND INCONGRUENT CONTEXTS: TOTAL
NUMBER OF CORRECT RESPONSES BY CHILD
TYPE AND AGE LEVEL

Comprehension of Locatives (Part B):
Neuman-Keuls

Analysis of Components in the
Child Type Factor

<u>Factor</u> Child Type	<u>Difference</u> <u>of Means</u>		<u>Least Signi-</u> <u>ficant Range</u>	
Normal vs. Blind	1.5	>	.84	significant at .01
Normal vs. Blindfolded	0	<	.68	NS
Blindfolded vs. Blind	1.5	>	.68	significant at .01

T A B L E XXIII

Comprehension of Locatives (Part B):

Neuman-Keuls

Analysis of components in Age
Level Factor:

<u>Factor</u>	<u>Difference of Means</u>		<u>Least Signi- ficant Range</u>	
Age Level				
Age Level I vs. Level III	1.45	>	.84	Significant at .05
Age Level I vs. Level II	.39	<	.68	NS
Age Level II vs. Level III	1.06	>	.68	Significant at .05

T A B L E XXIV

TABLE XXV
COMPREHENSION OF THE LOCATIVES "IN", "ON" AND "UNDER":
RESULTS OF ANALYSIS OF VARIANCE (EXPERIMENT III, PART B)

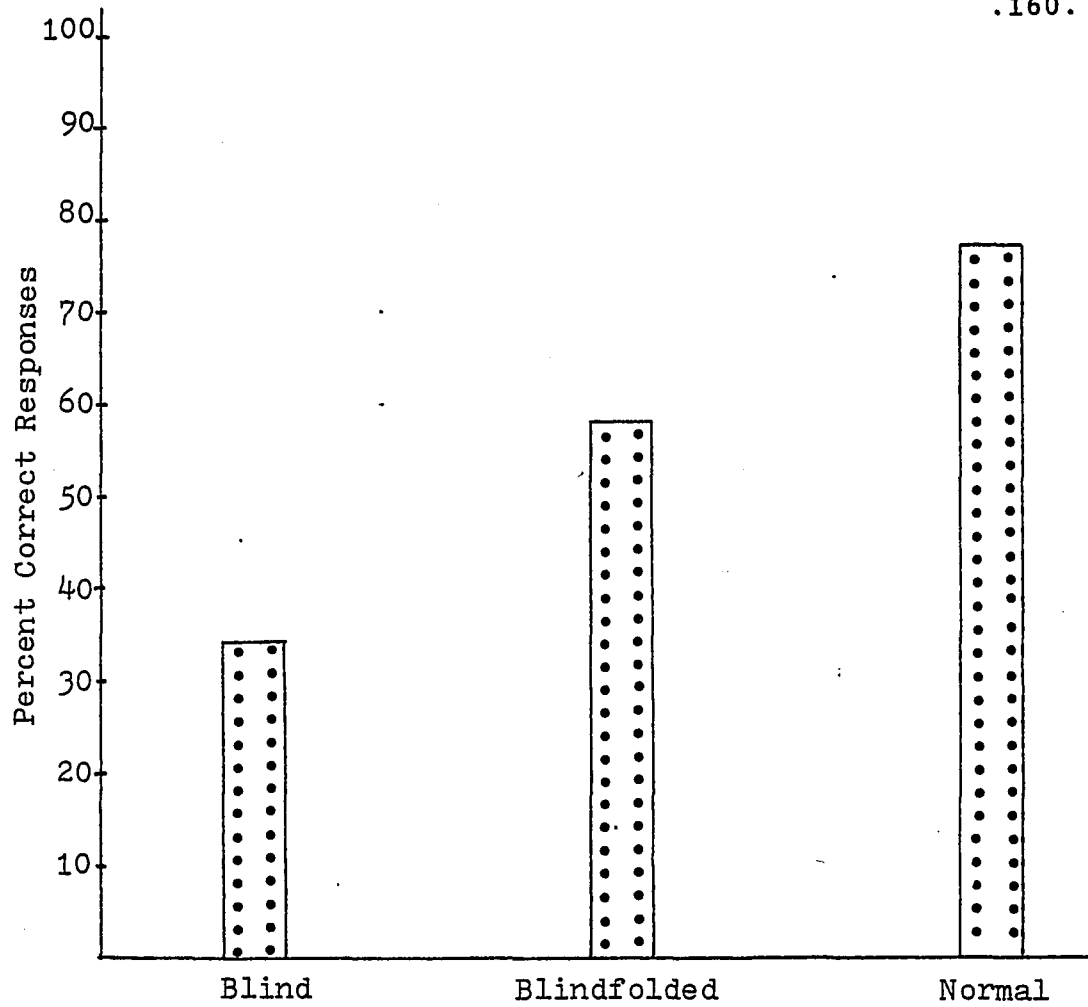
Source of Variation	Degrees of Freedom df	Sum of Squares SS	Means Square MS	F
Child Type	2	27.0	13.5	16.9**
Age Level	2	20.1	10.5	12.6**
Child Type x Age Level	4	1.6	.4	<1
Context	1	20.2	20.2	25.25**
Child Type x Context	2	.3	.15	<1
Age Level x Context	2	.1	.05	<1
Child Type x Age Level x Context	4	5.5	1.38	1.73
Locative	2	10.1	5.25	6.31*
Child Type x Locative	4	.9	.225	1
Age Level x Locative	4	1.5	.375	<1
Child Type x Age Level x Locative	8	.8	.1	<1
Child Type x Context x Locative	4	3.5	.875	1.09
Age Level x Context x Locative	4	2.7	.675	1
Child Type x Age Level x Context x Locative	8	6.4	.8	1

** .01
 * .05

	CONGRUENT TASK	INCONGRUENT TASK
In	Manipulation of 2 objects simultaneously	Manipulation of 1 object
On	Manipulation of 1 object	Manipulation of 1 object
Under	Manipulation of 1 object	Manipulation of 2 objects simultaneously

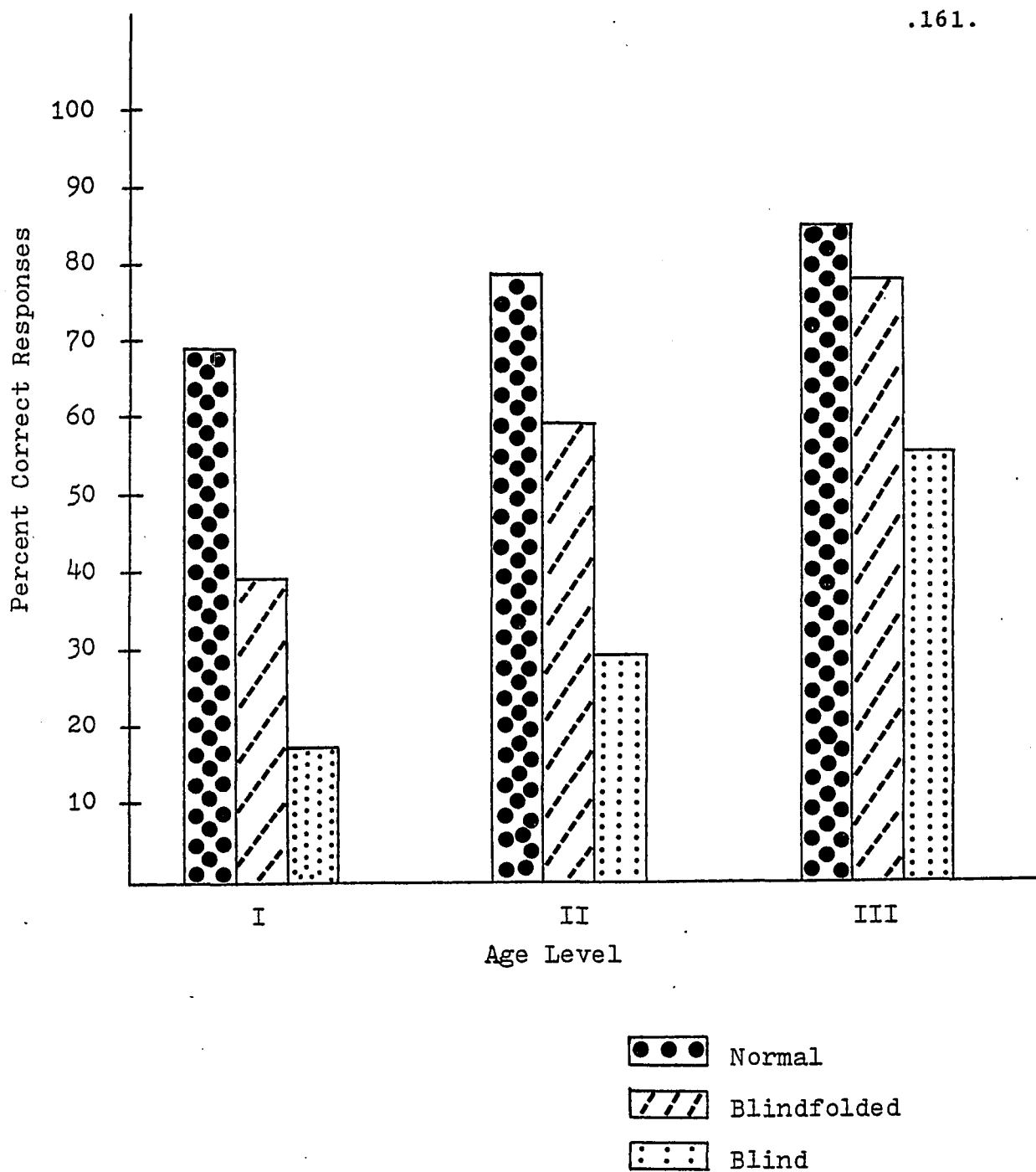
TABLE XXVI

MOTORIC RESPONSES NECESSARY FOR EACH
LOCATIVE PLACEMENT IN THE CONGRUENT
AND INCONGRUENT CONTEXTS



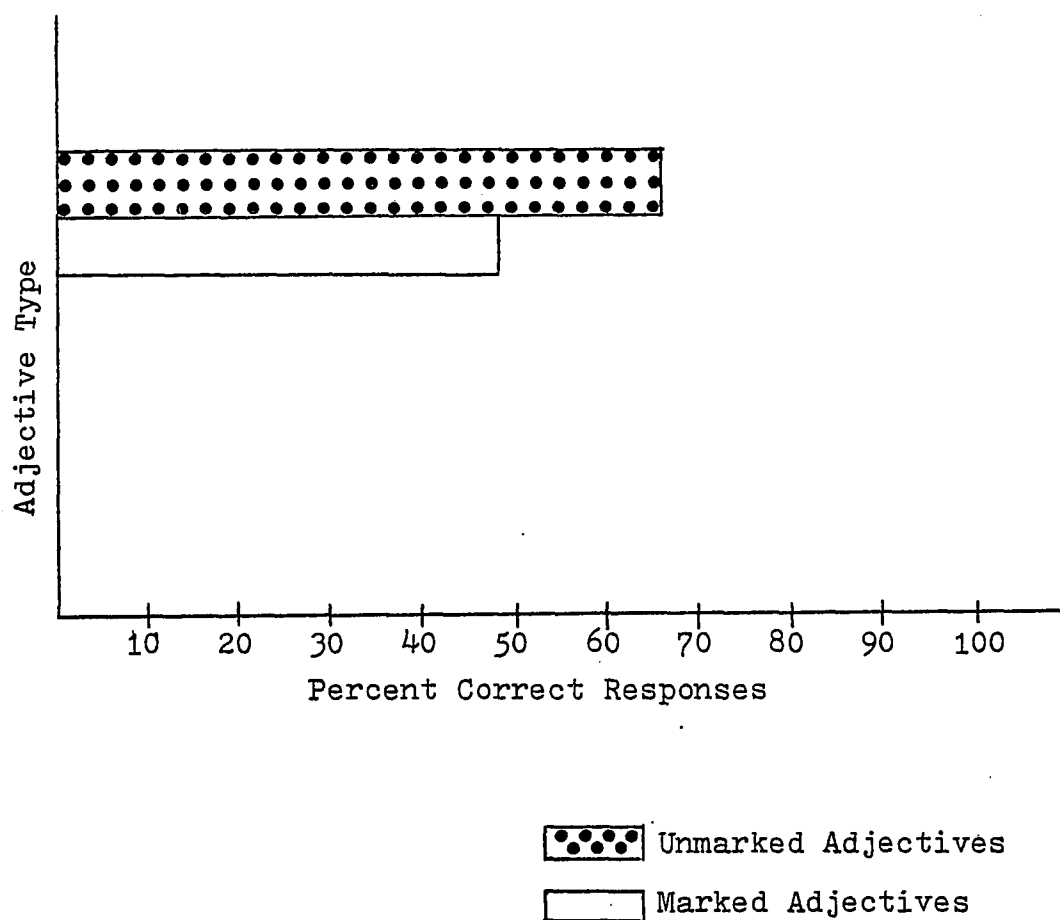
Comprehension of Dimensional Adjectives:
Percentage of Correct Responses by Child Type
(For All Age Groups)

FIGURE 1



Comprehension of Dimensional Adjectives:
Percentage of Correct Responses by Age Groups

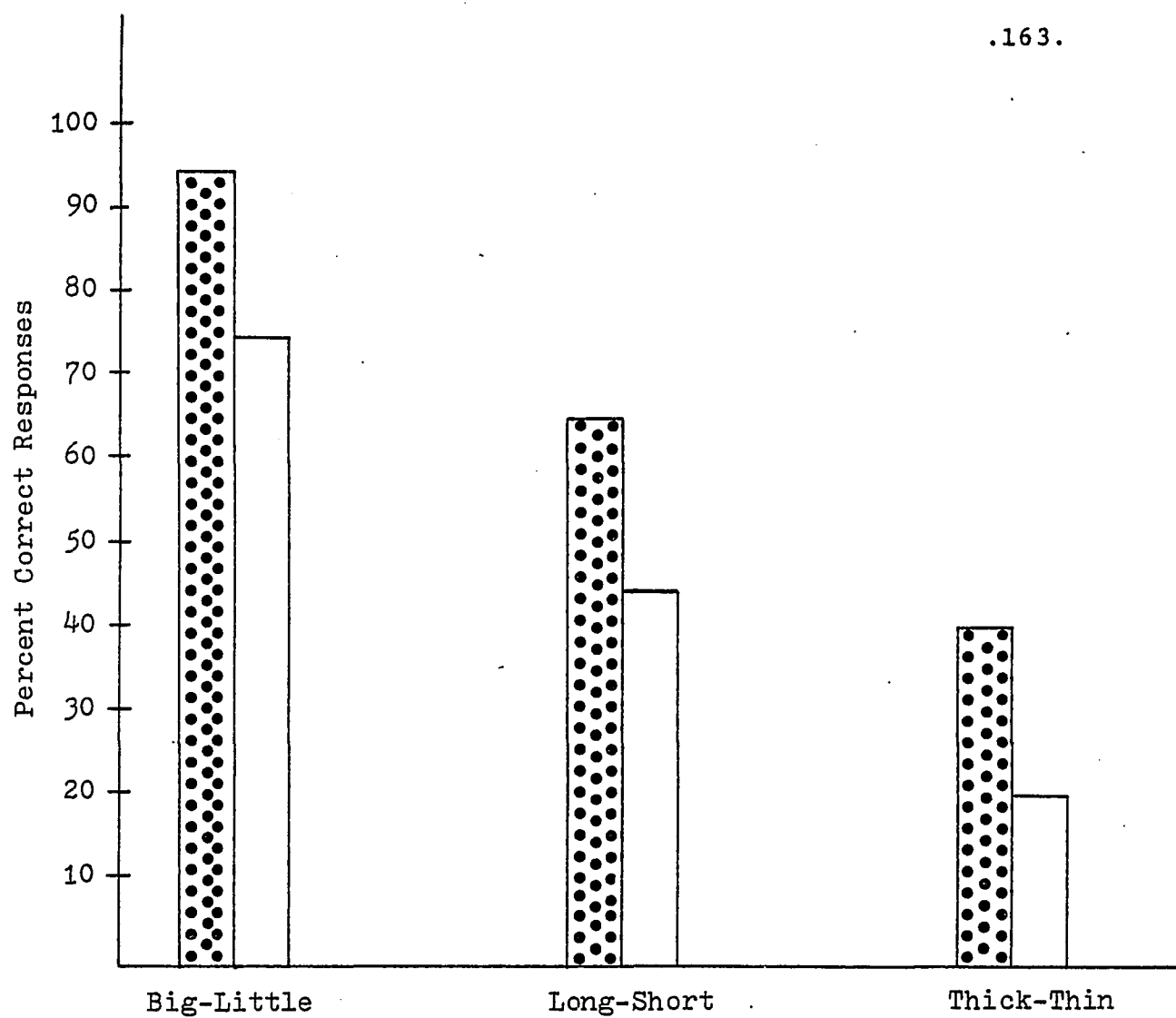
FIGURE 2



Comprehension of Marked and Unmarked Dimensional Adjectives:
Percentage of Correct Responses for
All Subjects

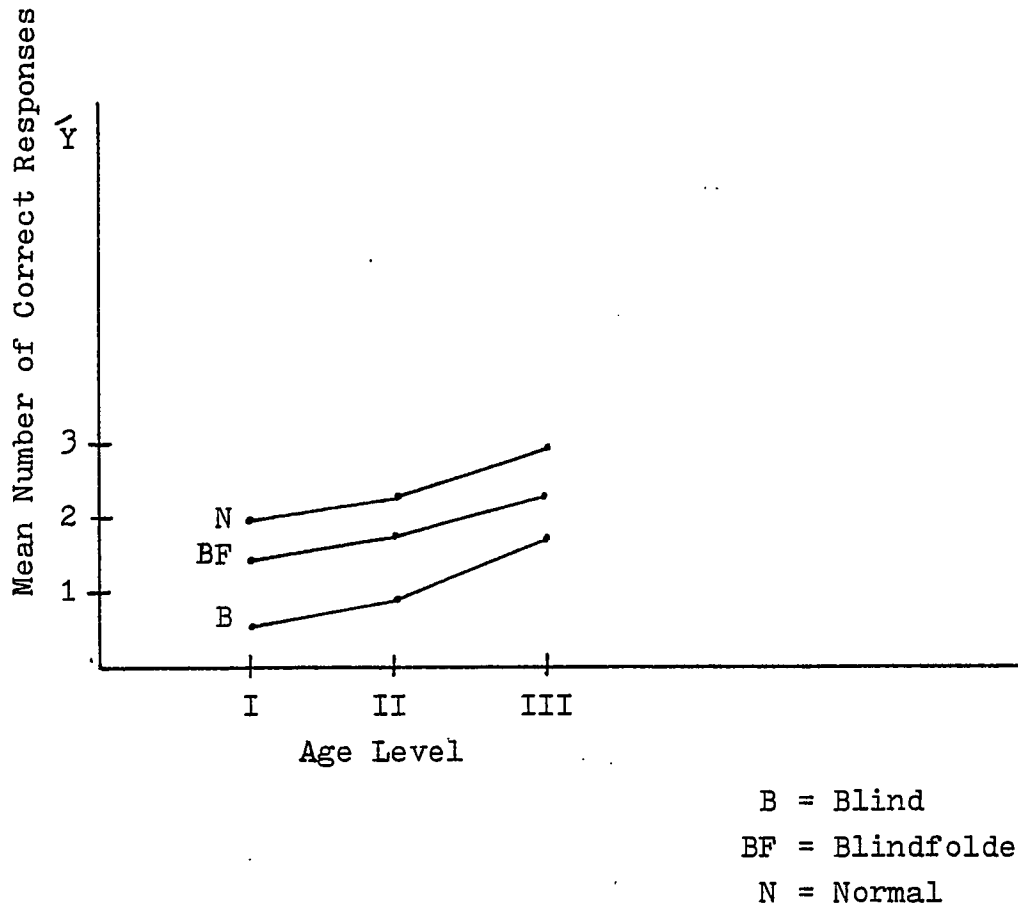
FIGURE 3

.163.



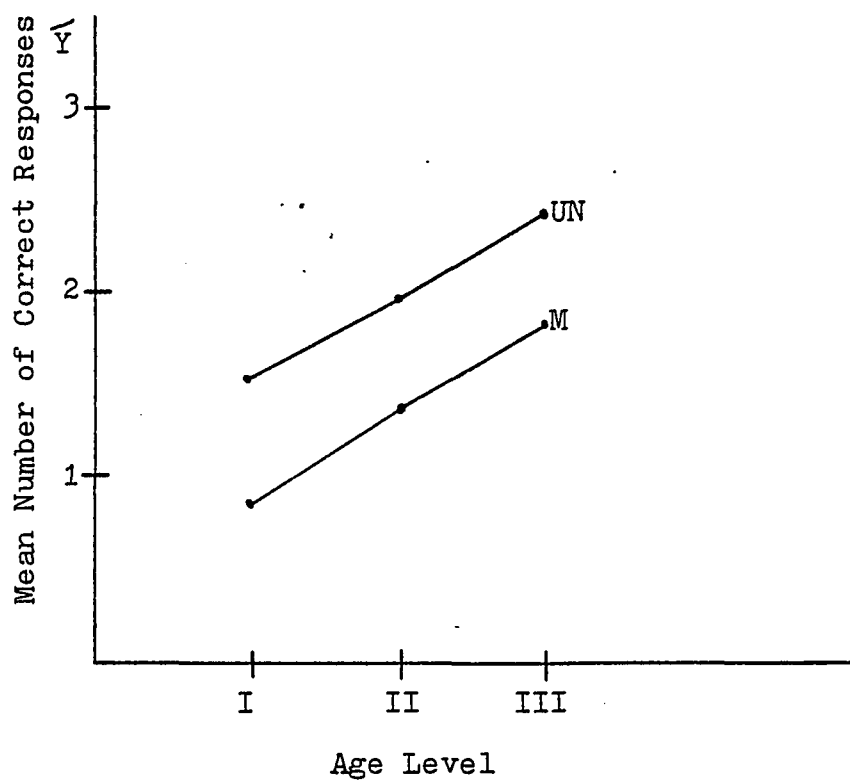
Percentage of Correct Responses to Specific Lexical Items
Used to Code Dimensions

FIGURE 4



The Main Effects of Child Type and Age
on the Comprehension of Dimensional Adjectives

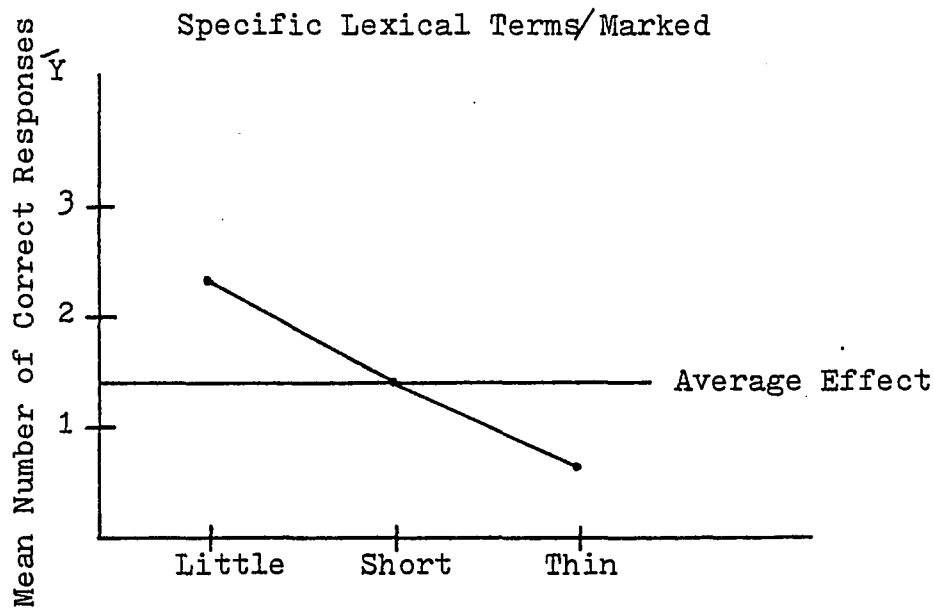
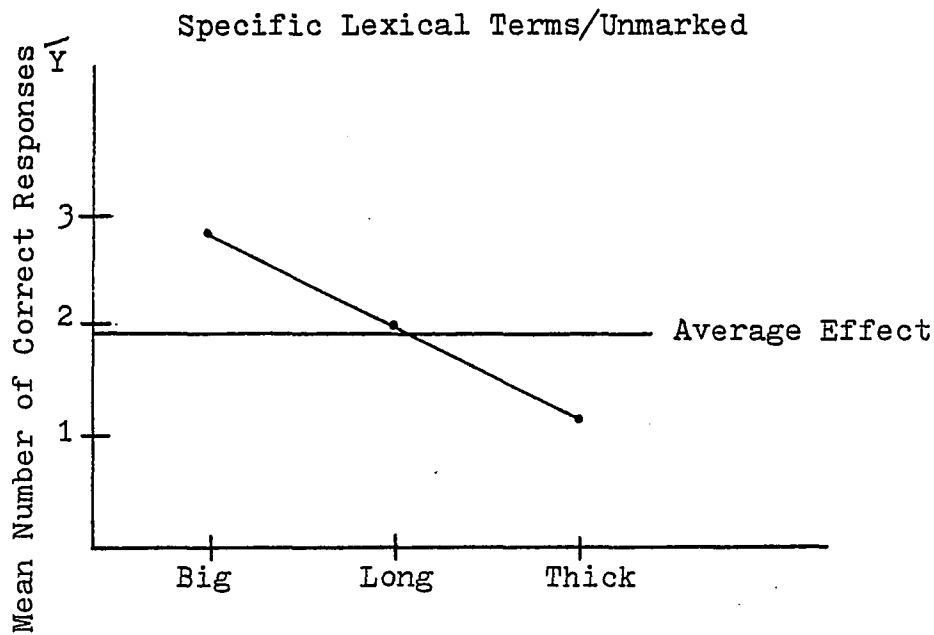
FIGURE 5



UN = Unmarked Adjectives
M = Marked Adjectives

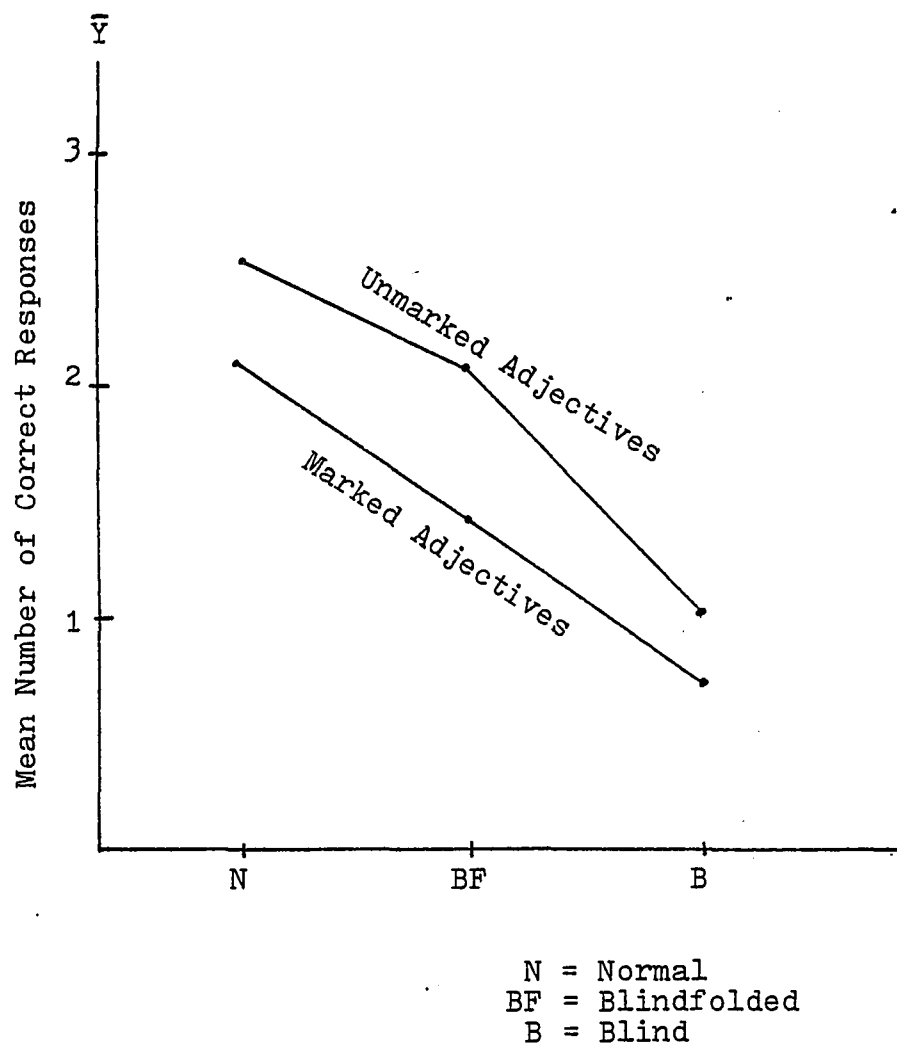
The Main Effects of Type of
Dimensional Adjectives on Children's
Comprehension of Dimensional Adjectives

FIGURE 6



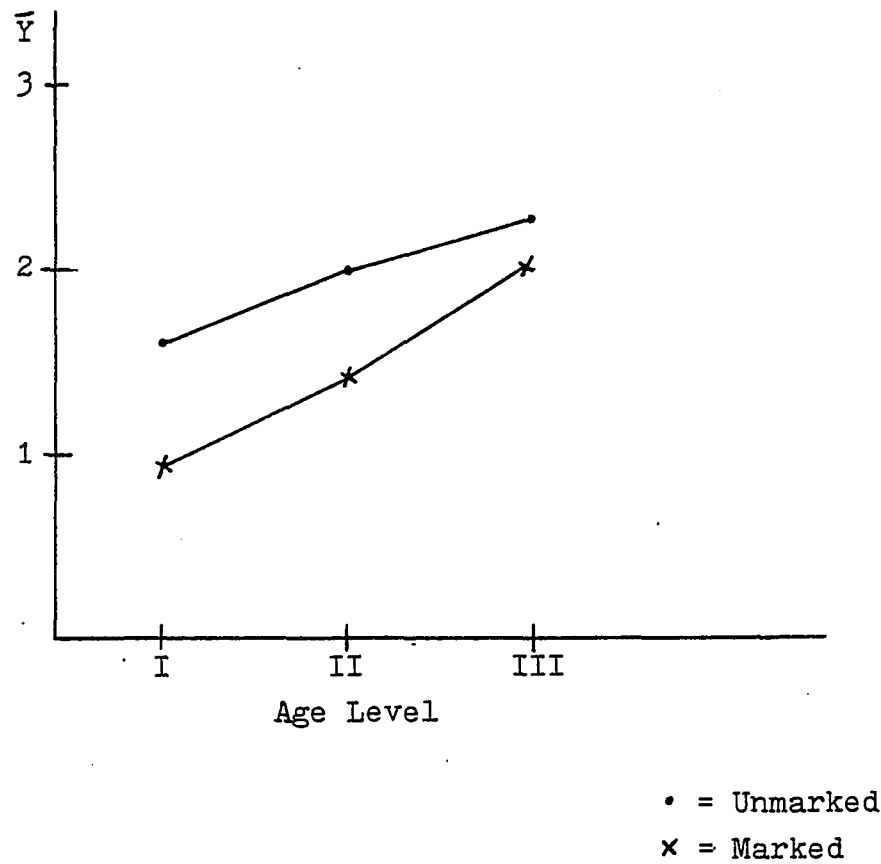
The Main Effect of Adjectives (Specific Lexical Items)
On Children's Comprehension of Dimensional Adjectives

FIGURE 7



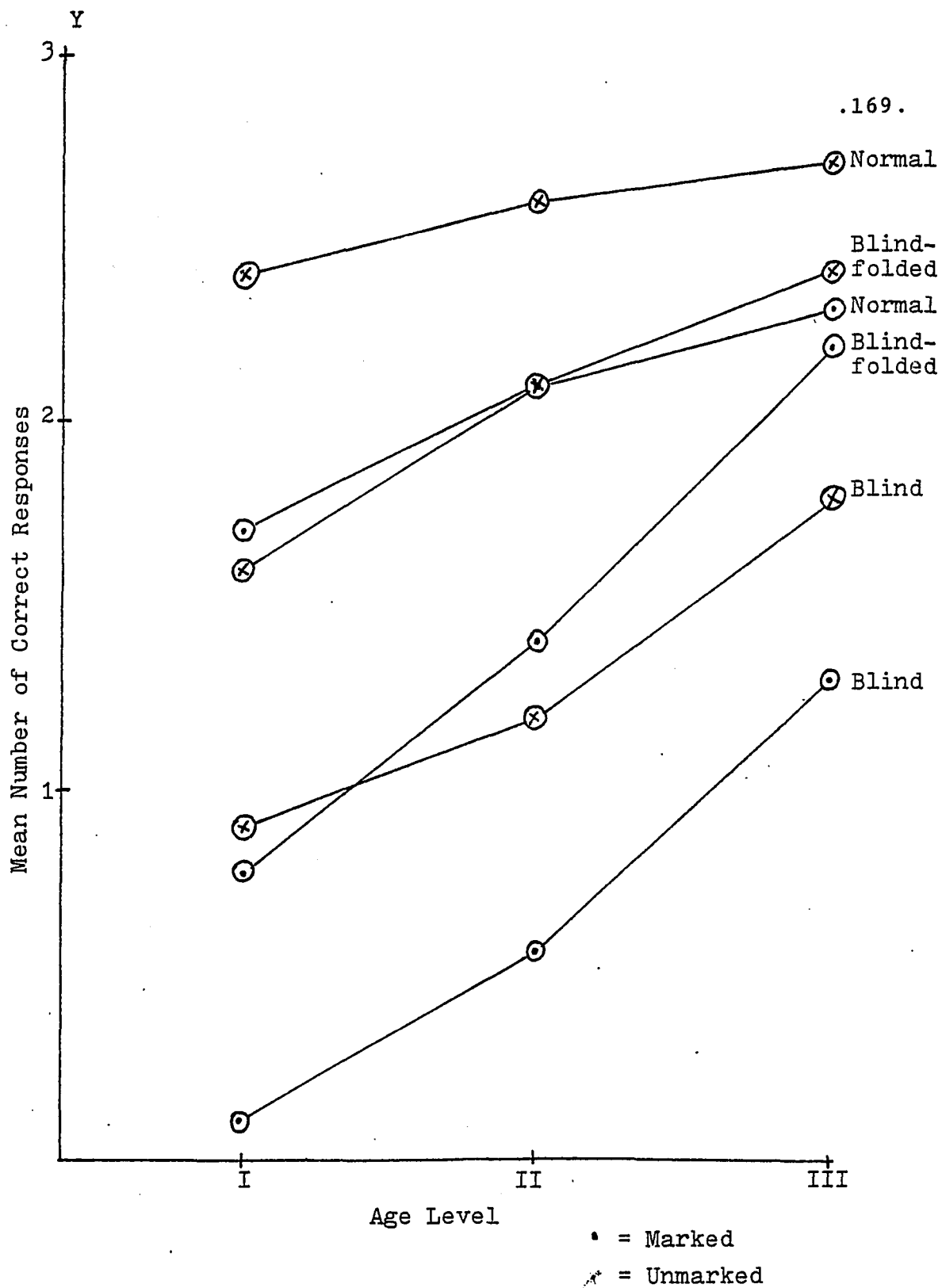
Comprehension of Dimensional Adjectives:
Interaction of Child Type x Dimension

FIGURE 8



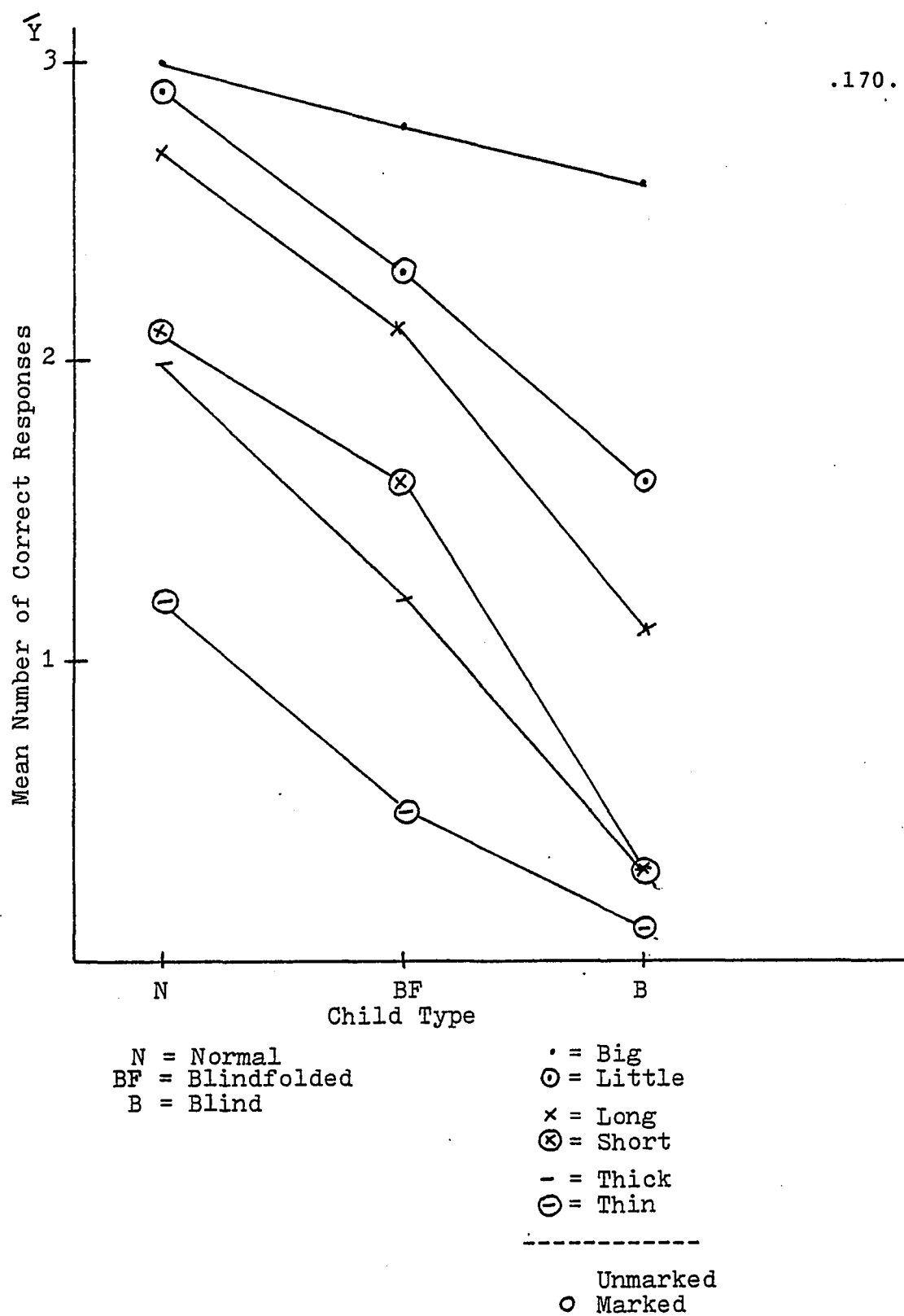
Interaction of Age Group X Dimension
for the Comprehension of Dimensional Adjectives

FIGURE 9



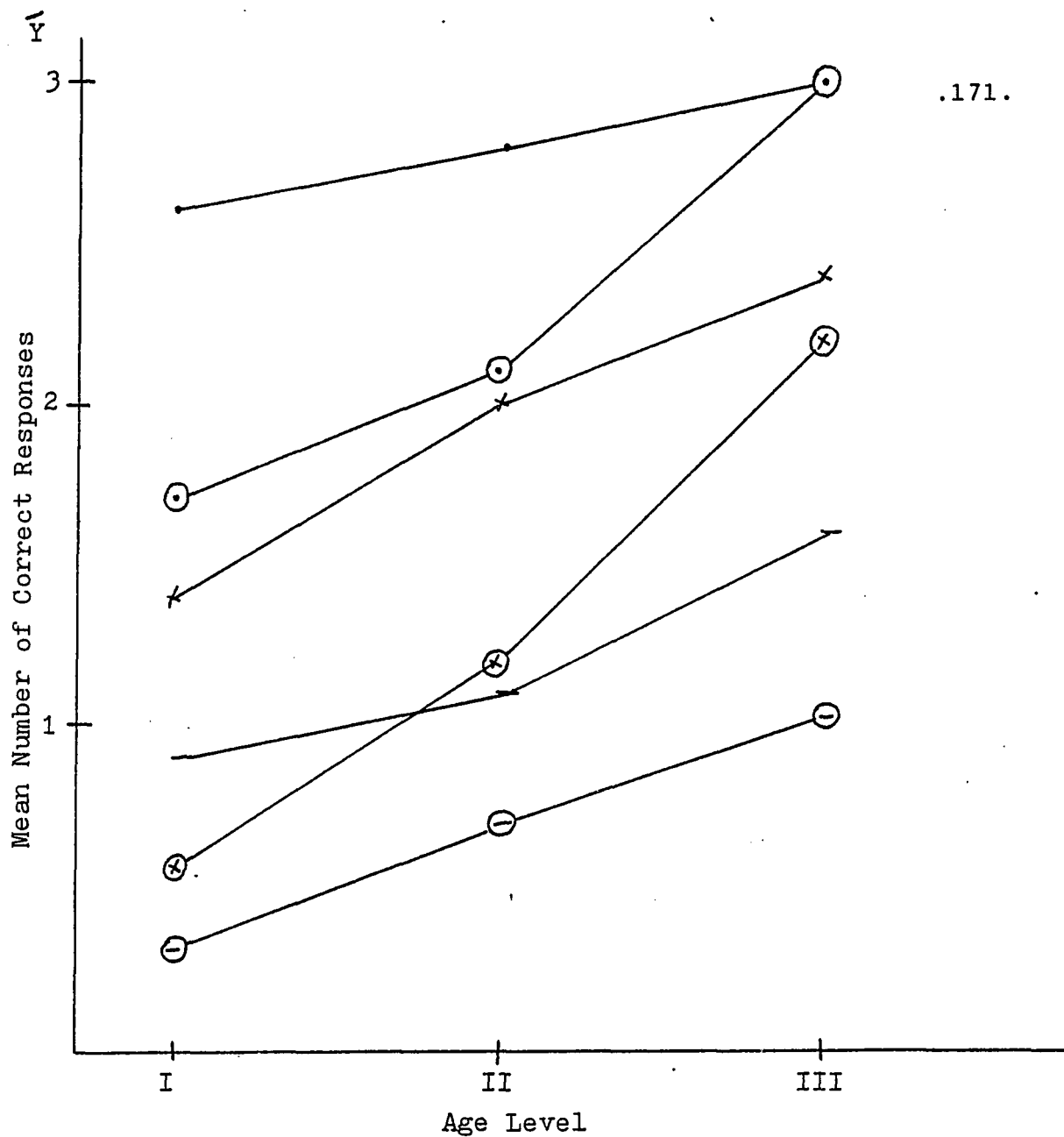
Comprehension of Dimensional Adjectives:
Interaction of Child Type X Dimension X Age Level

FIGURE 9b



Interaction of Child Type X Specific Lexical Term
for the Comprehension of Dimensional Adjectives

FIGURE 10

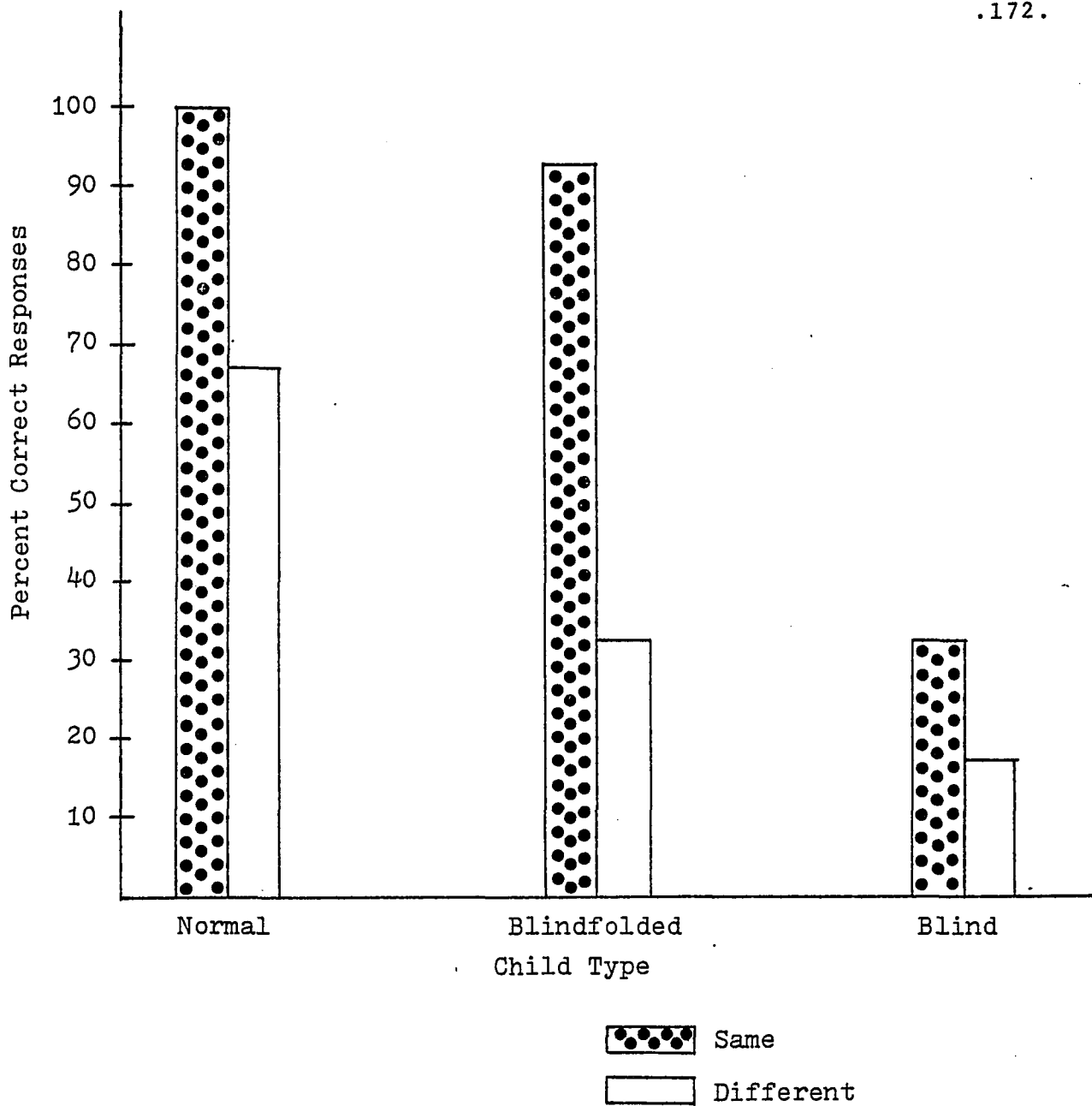


• = Big
 ⊙ = Little
 x = Long
 ⊗ = Short
 - = Thick
 ⊖ = Thin

 = Unmarked
 ⊙ = Marked

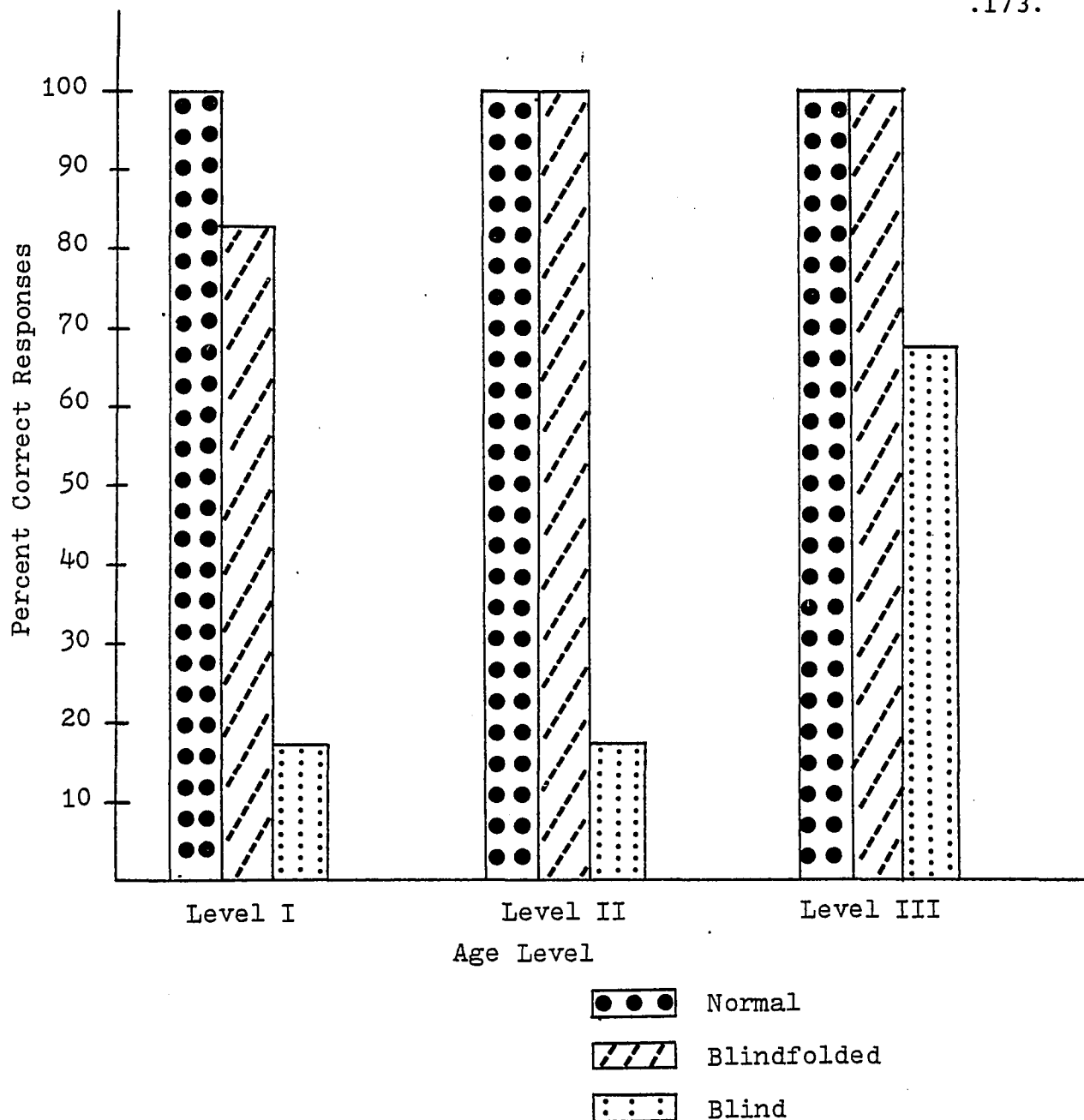
Interaction of Specific Lexical Terms X Age Group
 On the Comprehension of Dimensional Adjectives

FIGURE 11



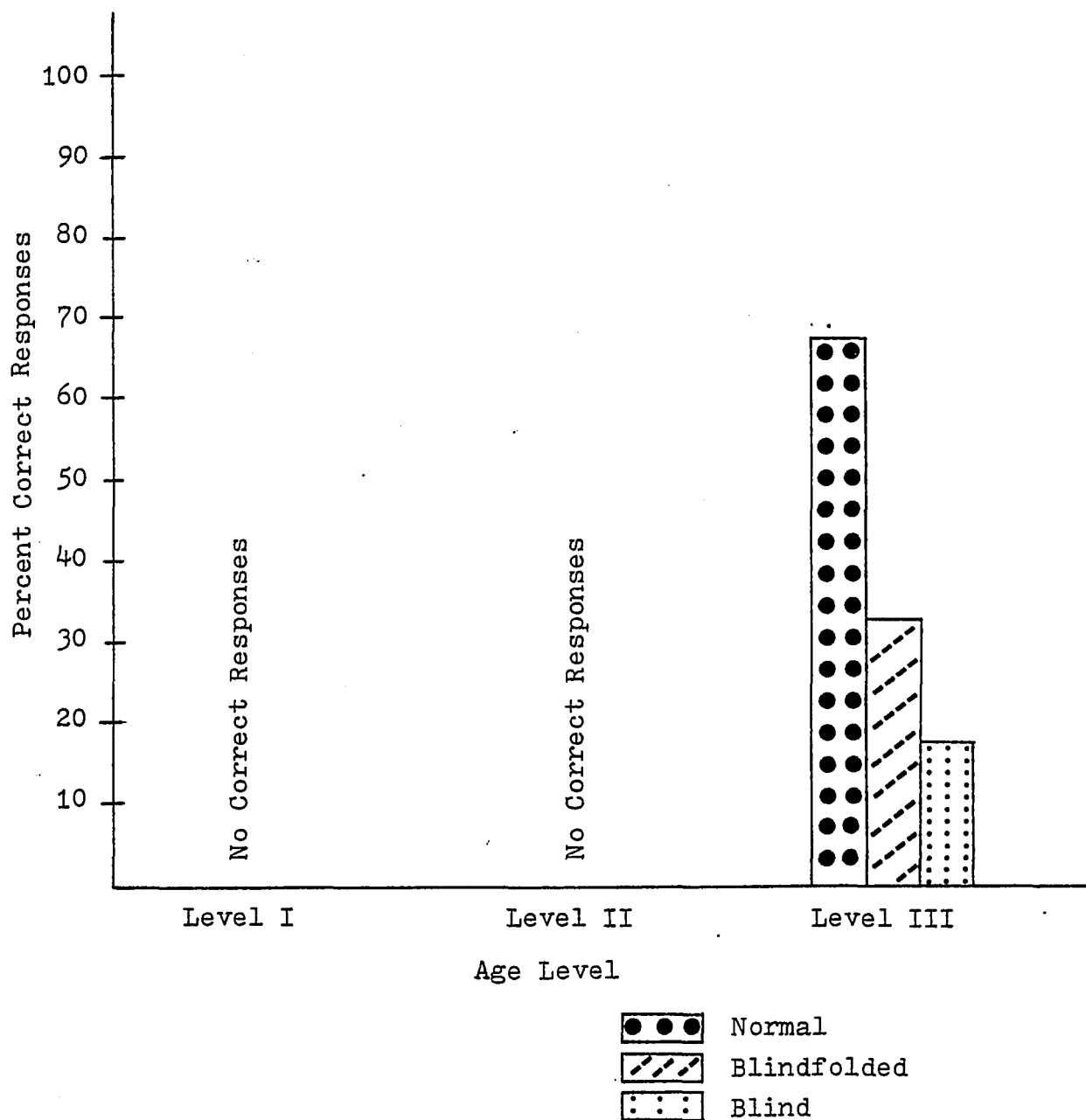
The Comprehension of Same and Different:
Percentage of Correct Responses by Child Type
(Across All Age Levels)

FIGURE 12a



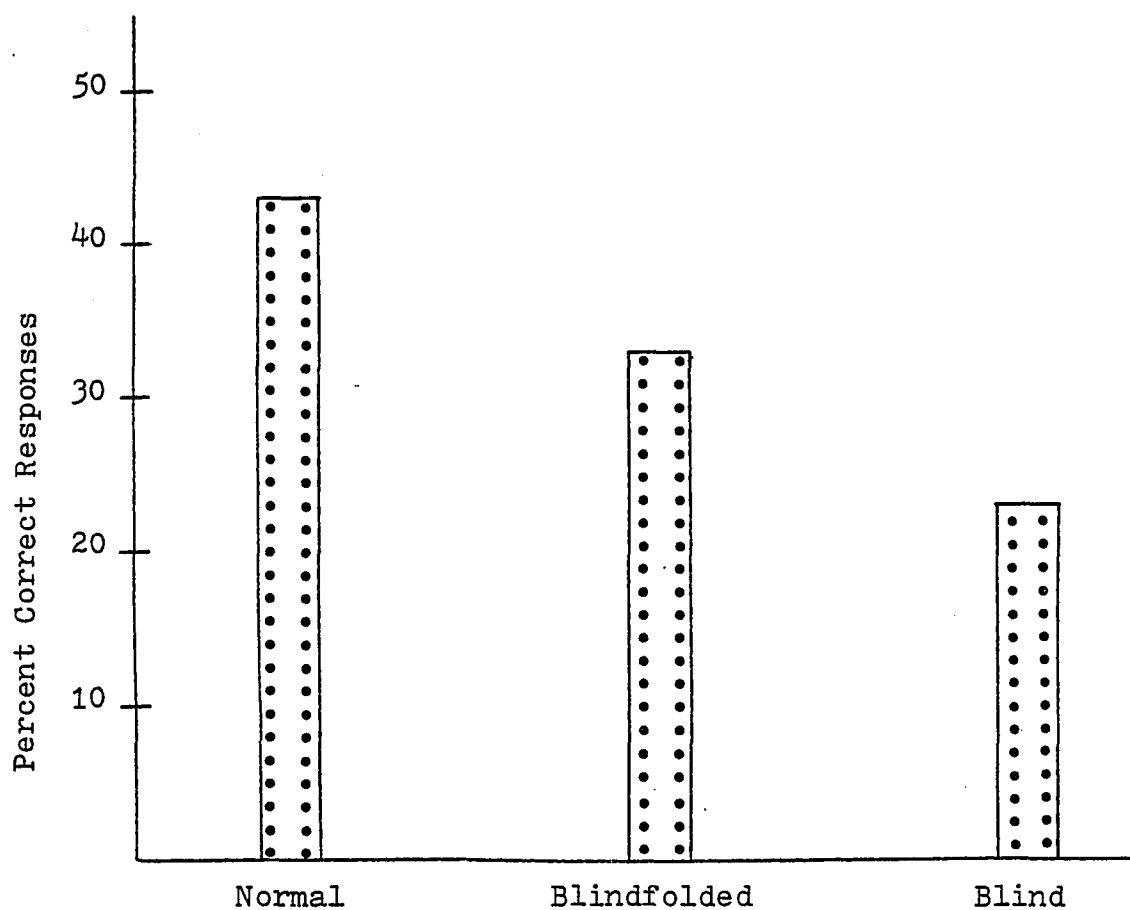
Percentage of Correct Responses to Same By Normal, Blindfolded and Blind Children According to Age Level

FIGURE 12b



Percentage Correct Responses to Different By Normal, Blindfolded and Blind Children According to Age Levels

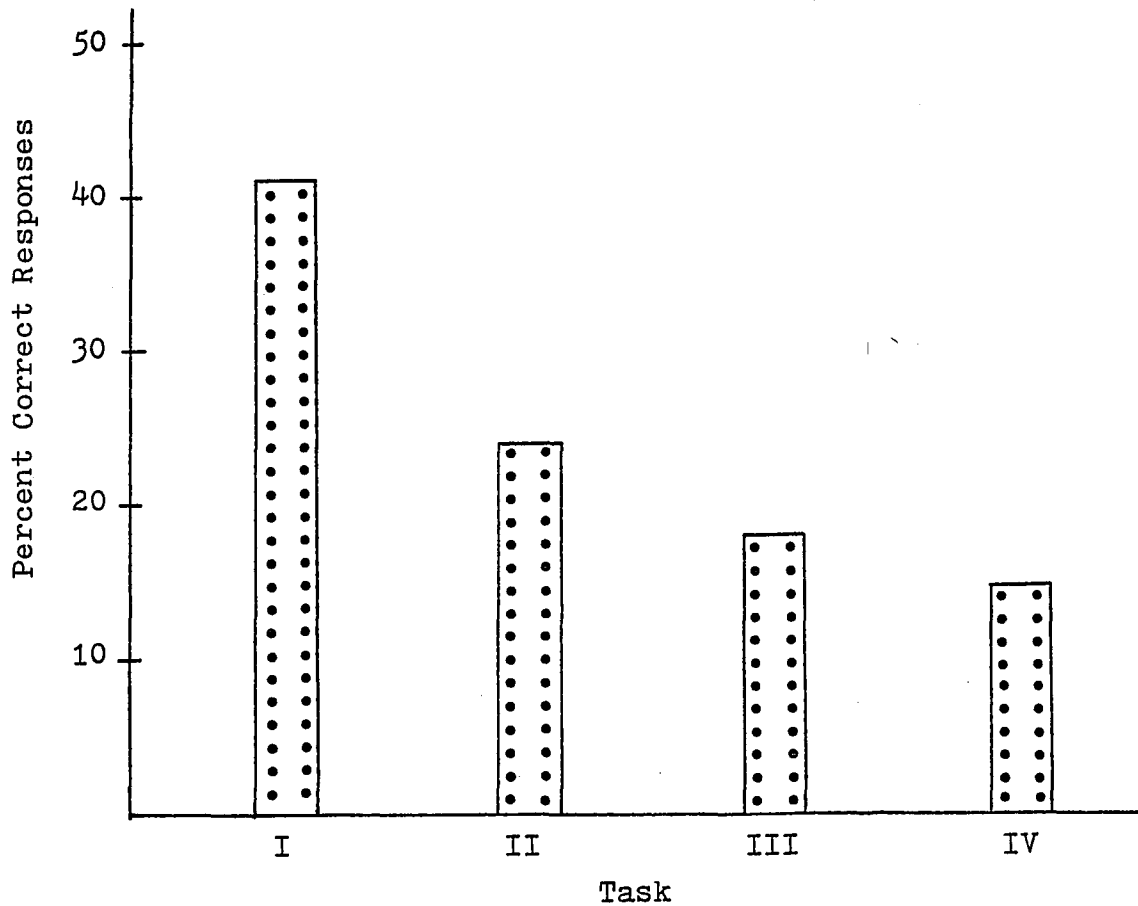
FIGURE 13



*1% error due to rounding

The Comprehension of Locatives:
Percentage of Correct Responses for Front, Back and
Side for All Tasks by Child Type
(Exp. III, Part A)

FIGURE 14

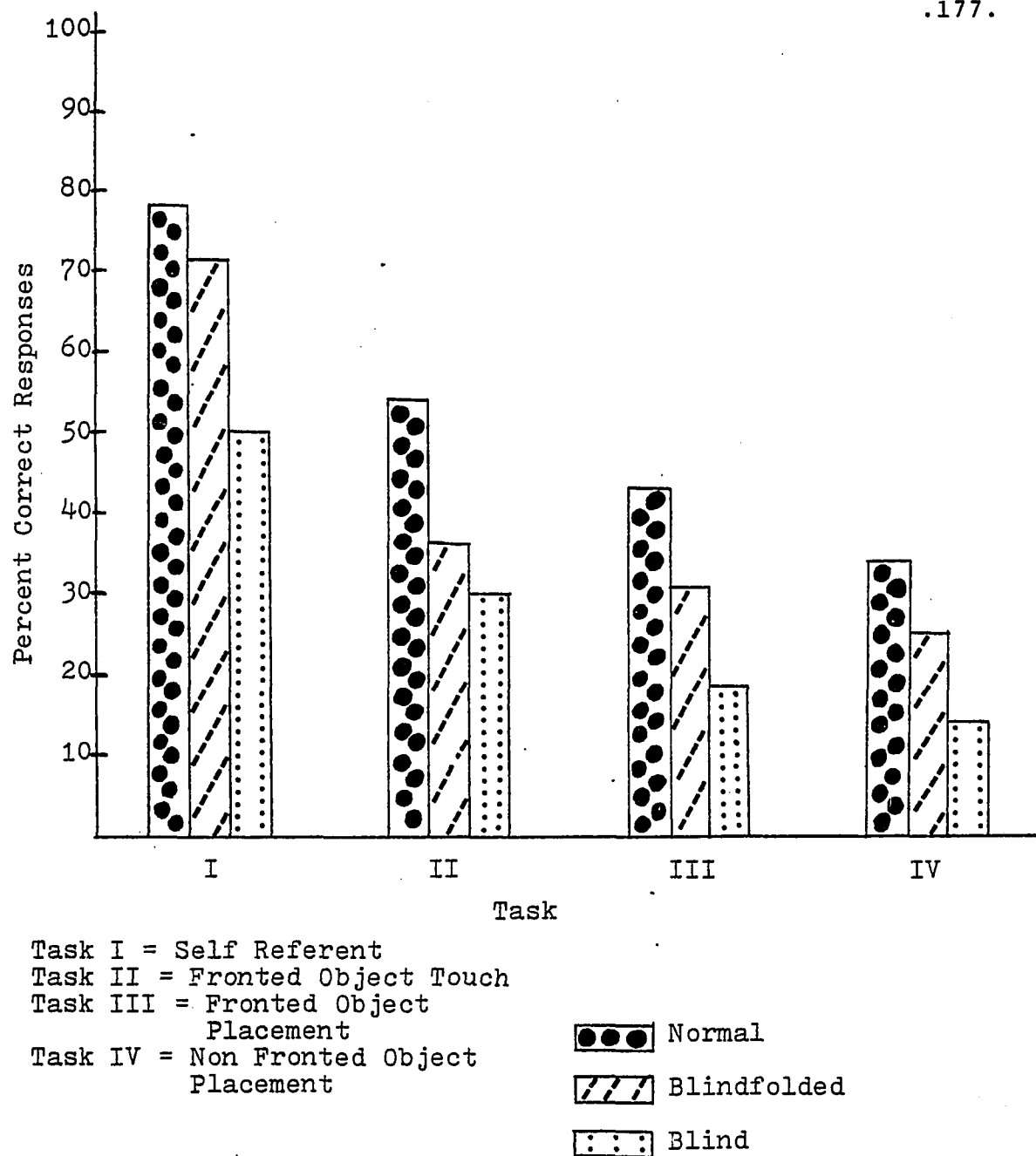


*2% error due to rounding

Task I = Self Referent
Task II = Fronted Object Touch
Task III = Fronted Object Placement
Task IV = Non Fronted Object Placement

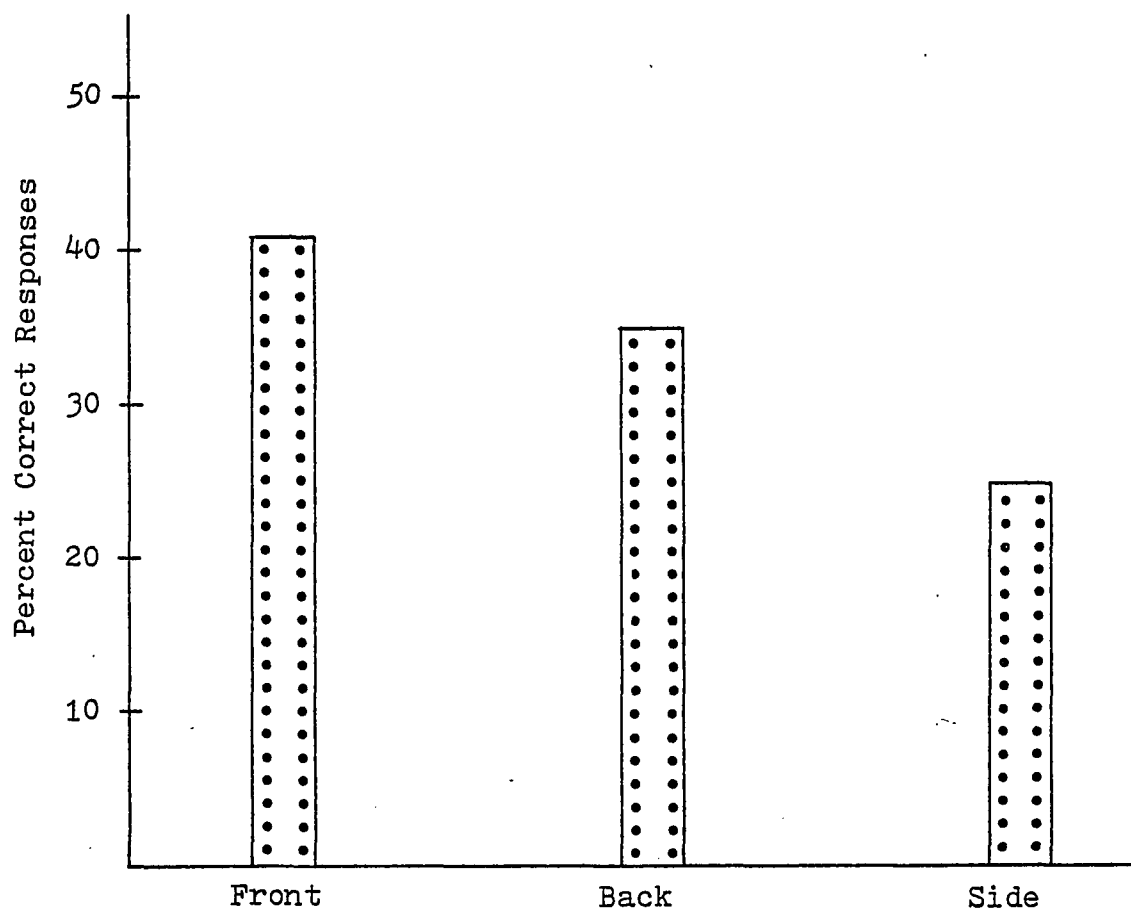
The Comprehension of Locatives: Percentage of Correct
Responses for Front, Back and Side By Task
(Exp. III, Part A)

FIGURE 15



The Comprehension of Locatives:
Percentage of Correct Responses for Front, Back and
Side by Child Type and Task
(Exp. III, Part A)

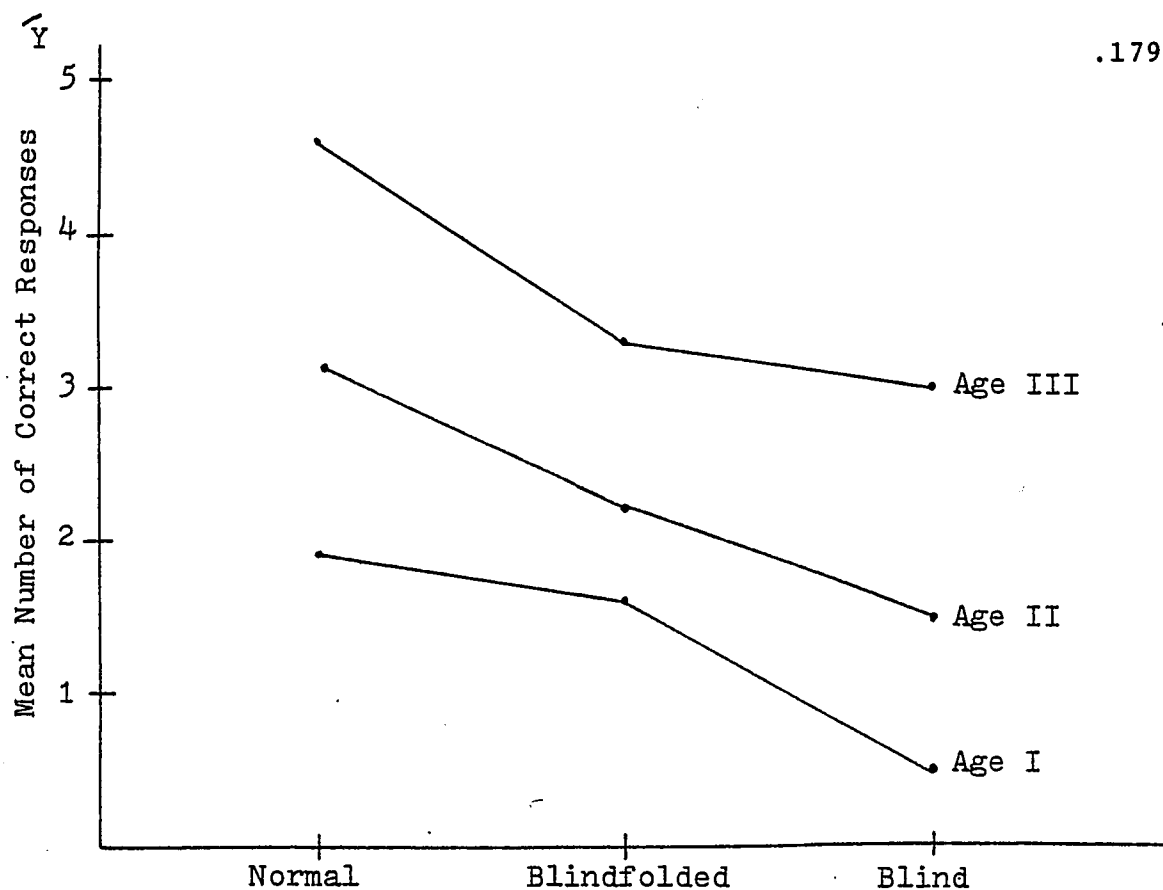
FIGURE 16



*1% error due to rounding

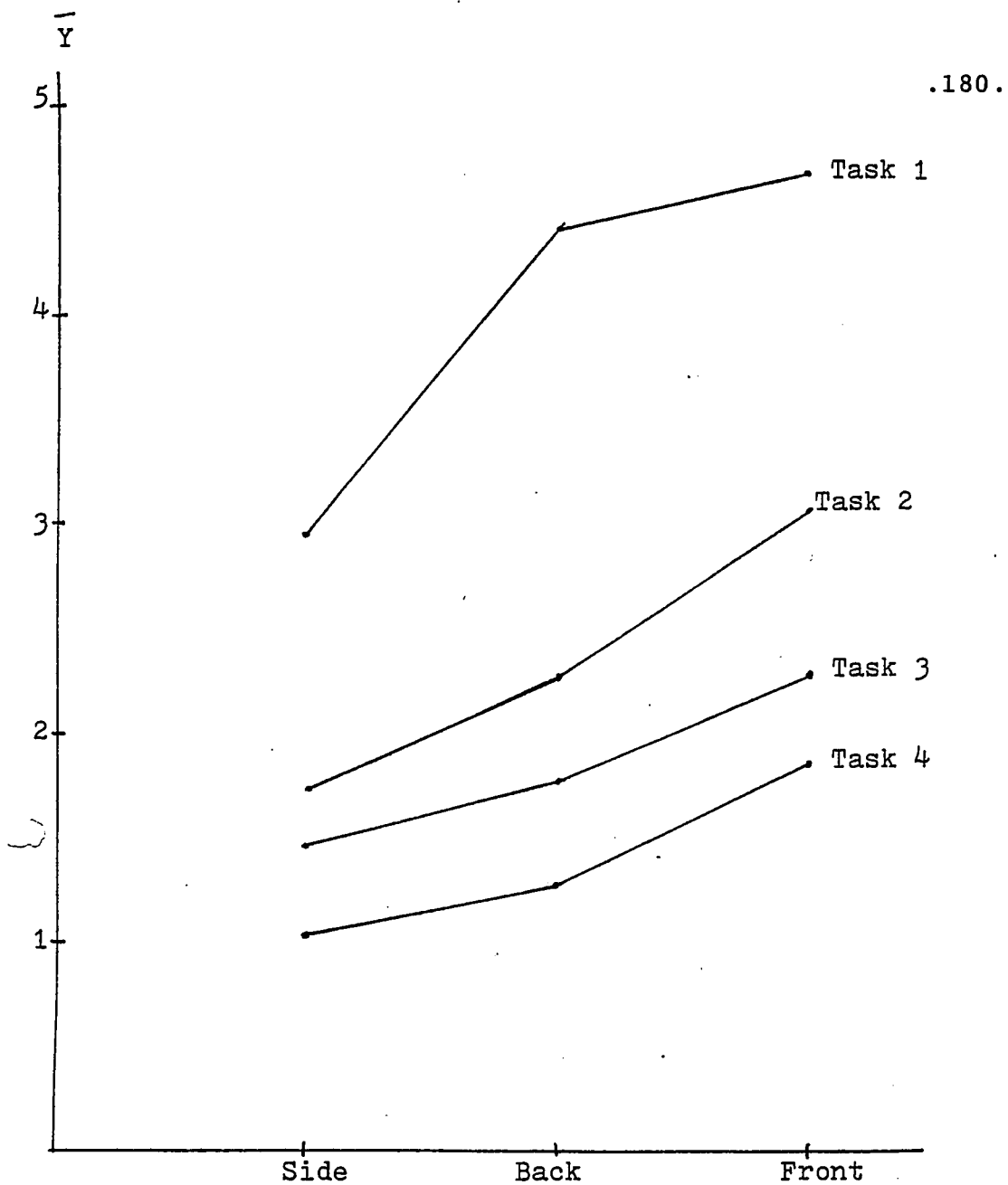
Percentage of Correct Responses to Specific Locatives
(Front, Back, Side) by All Children Across All Age Levels

FIGURE 17



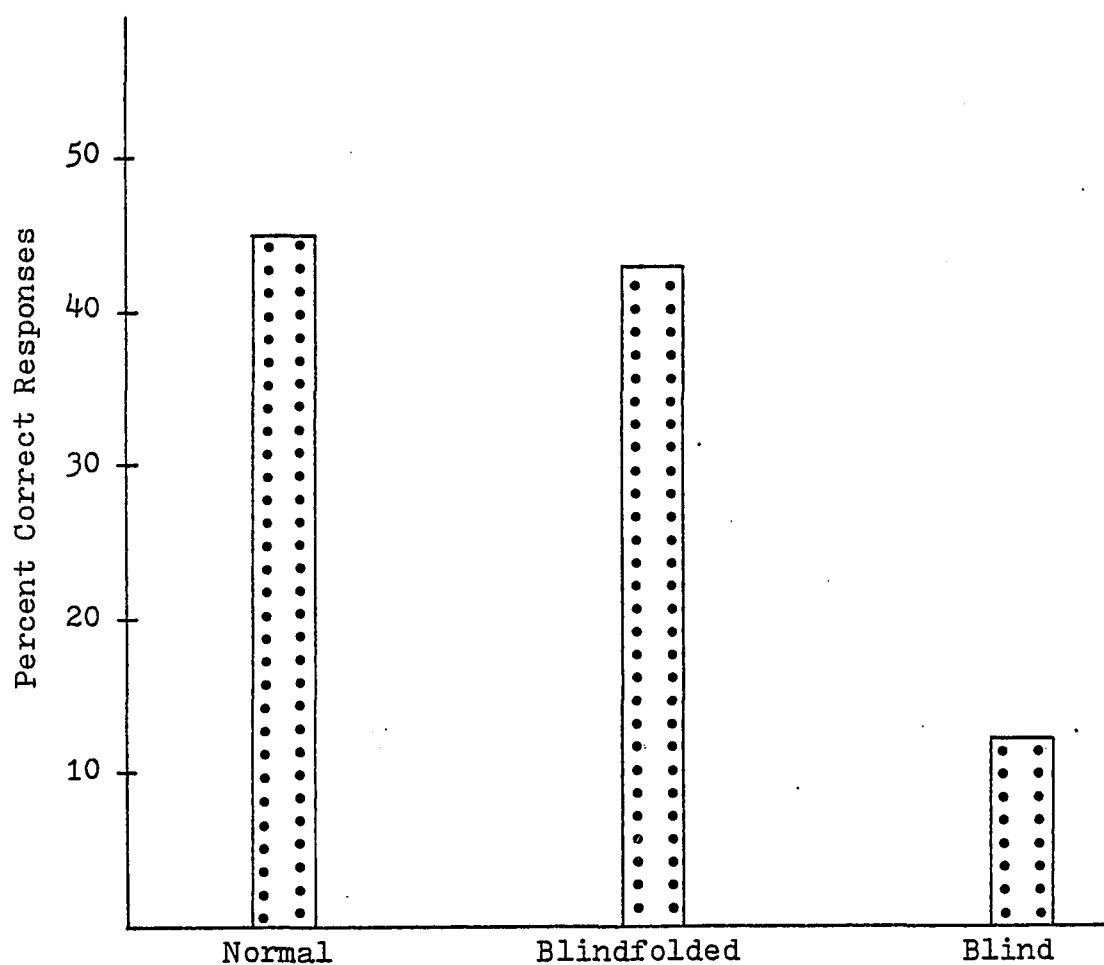
Comprehension of Front, Back, Side: Main Effect of Age and Child Type (Exp. III, Part A)

FIGURE 18



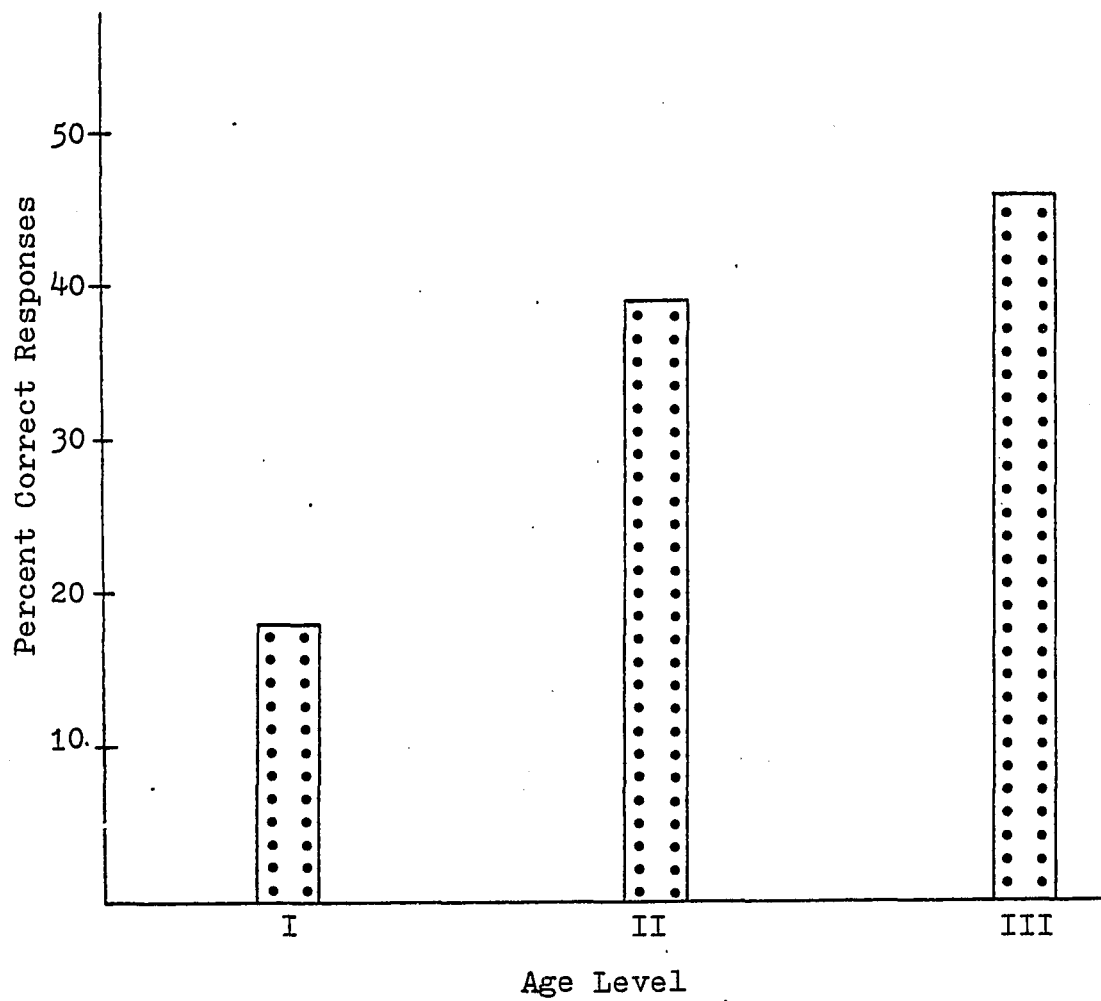
Comprehension of Front, Back and Side:
Interaction of Task X Position

FIGURE 19



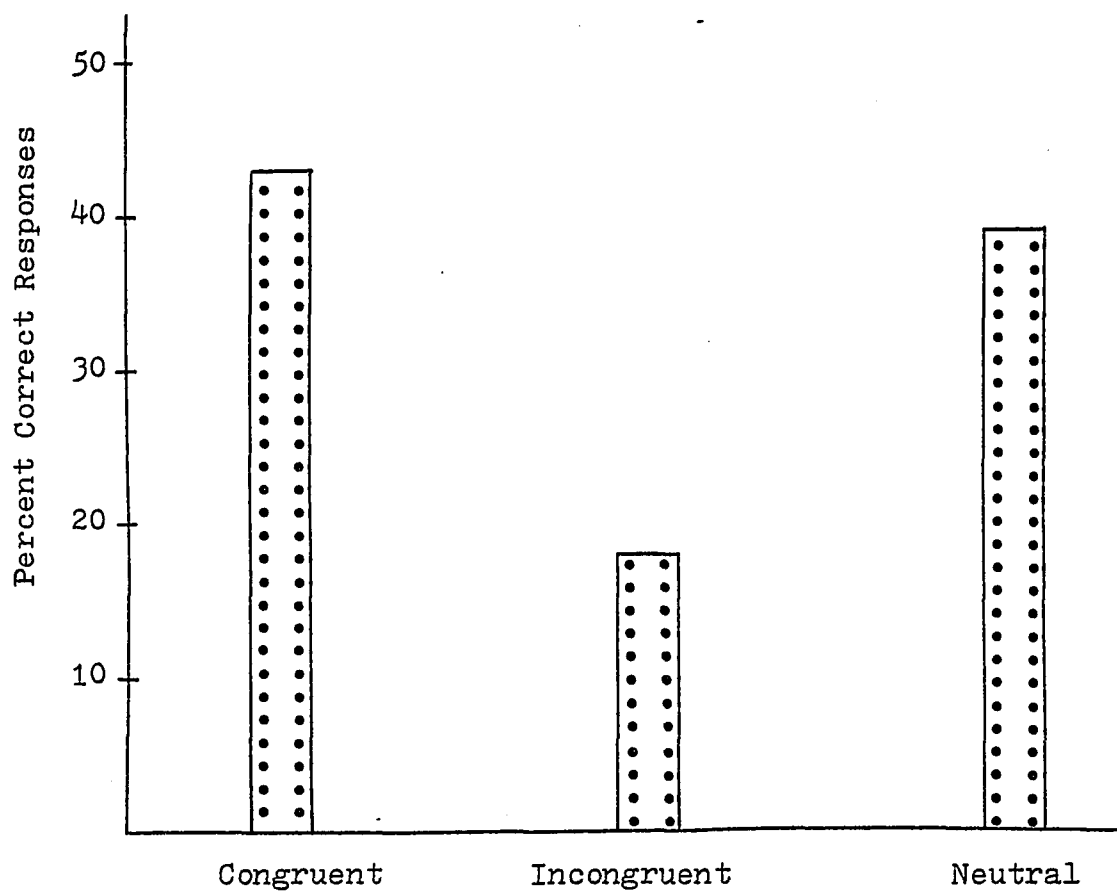
Comprehension of In, On and Under:
Percentage of Correct Responses by Child Type
(Exp.III, Part B)

FIGURE 20



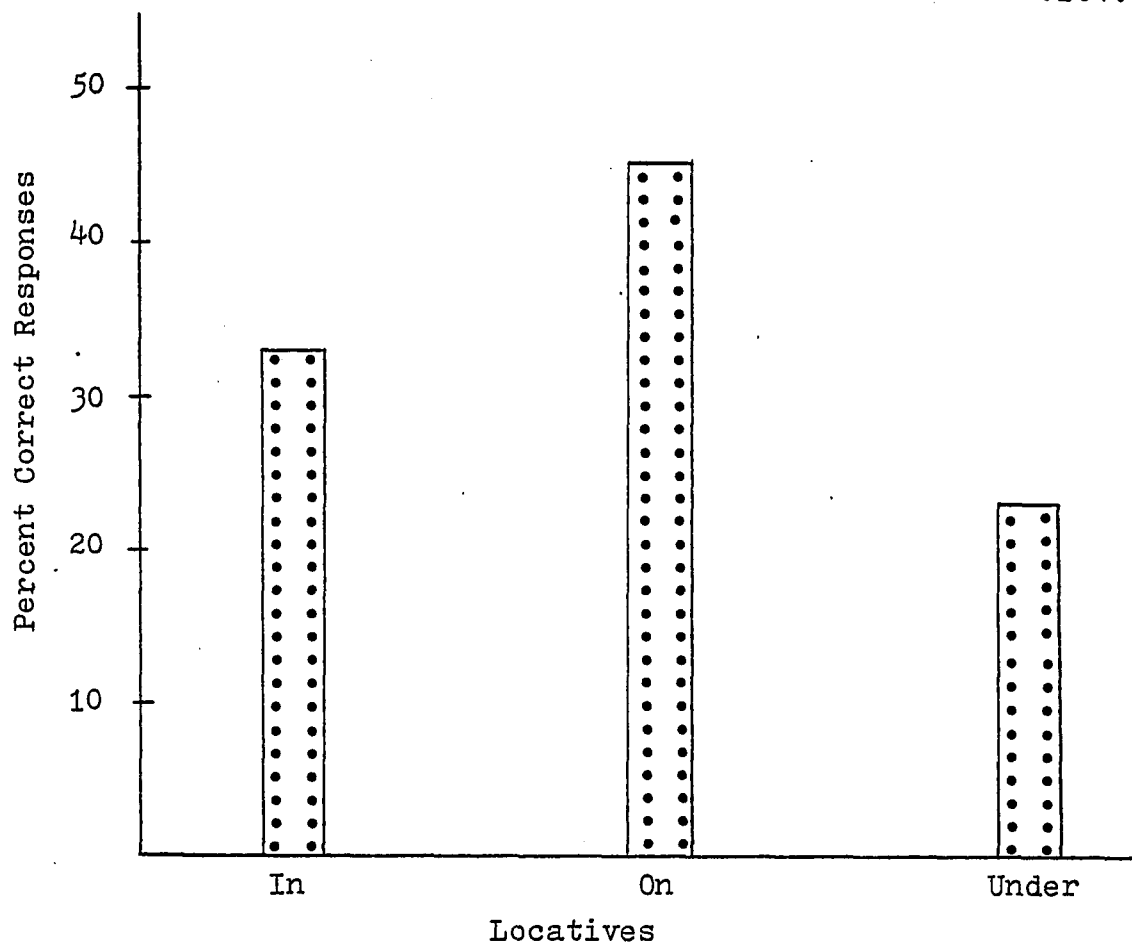
Comprehension of In, On and Under:
Percentage of Correct Responses by Age Level
(Exp. III, Part B)

FIGURE 21



Comprehension of In, On and Under:
Percentage of Correct Responses in Congruent/Incongruent/
Neutral Contexts

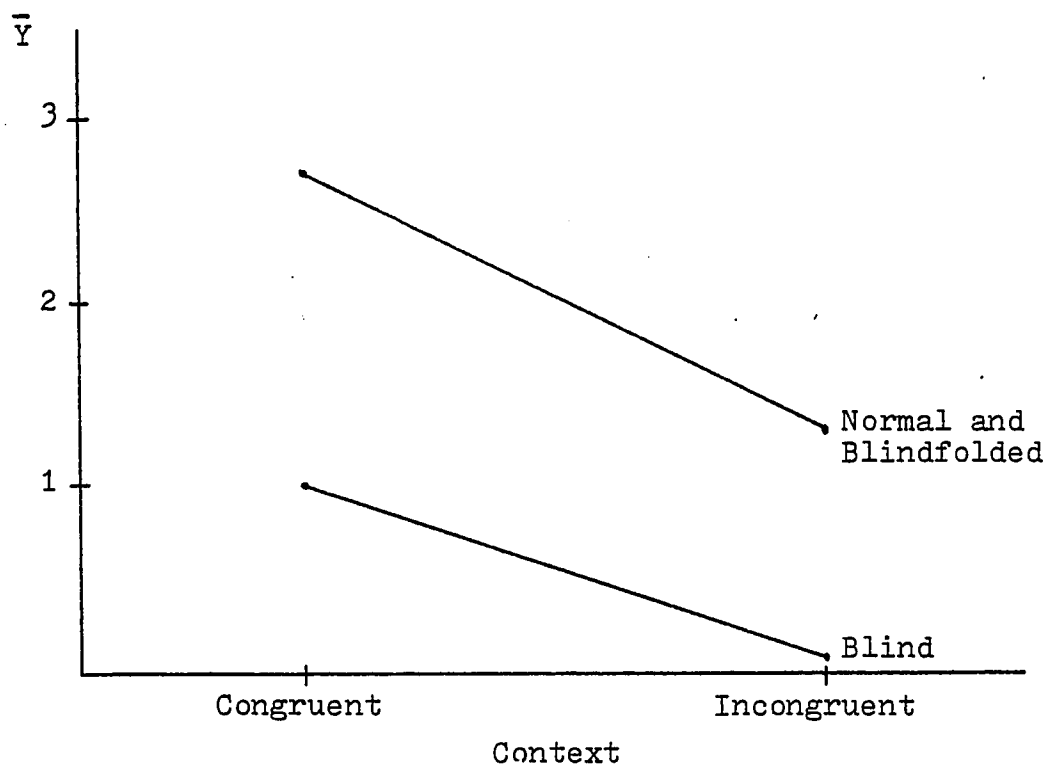
FIGURE 22



*1% error due to rounding

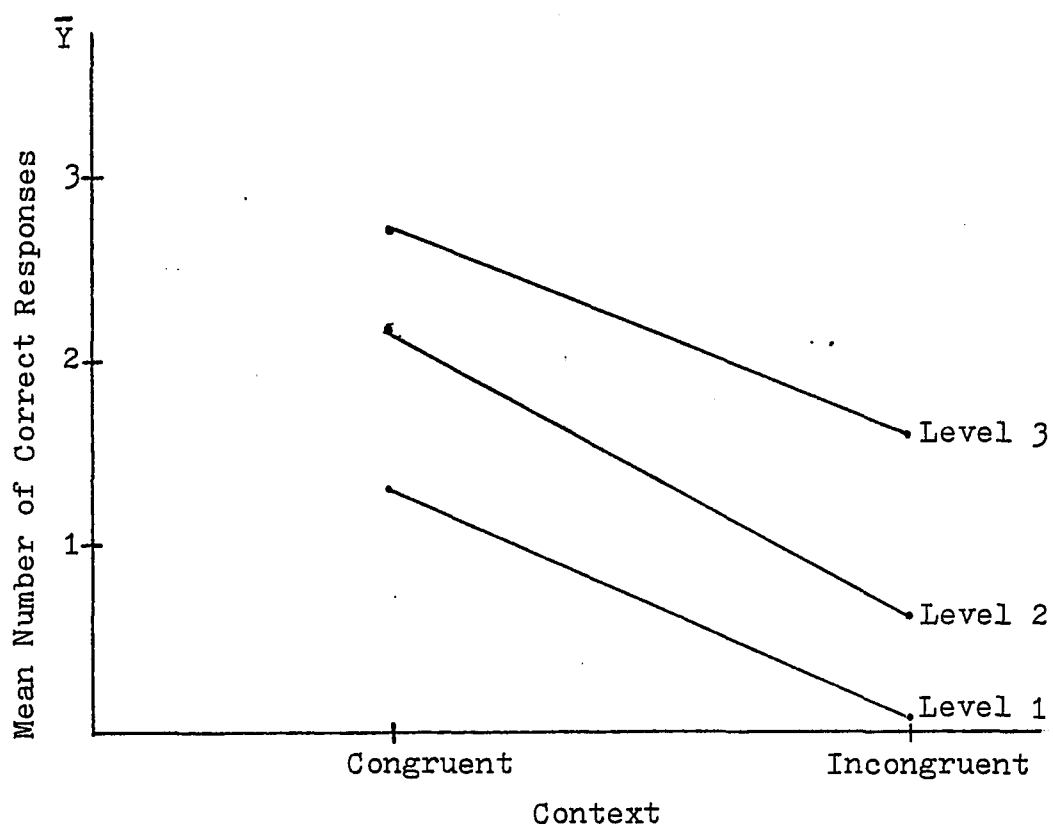
Comprehension of In, On and Under:
Percentage of Correct Responses
Across All Tasks

FIGURE 23



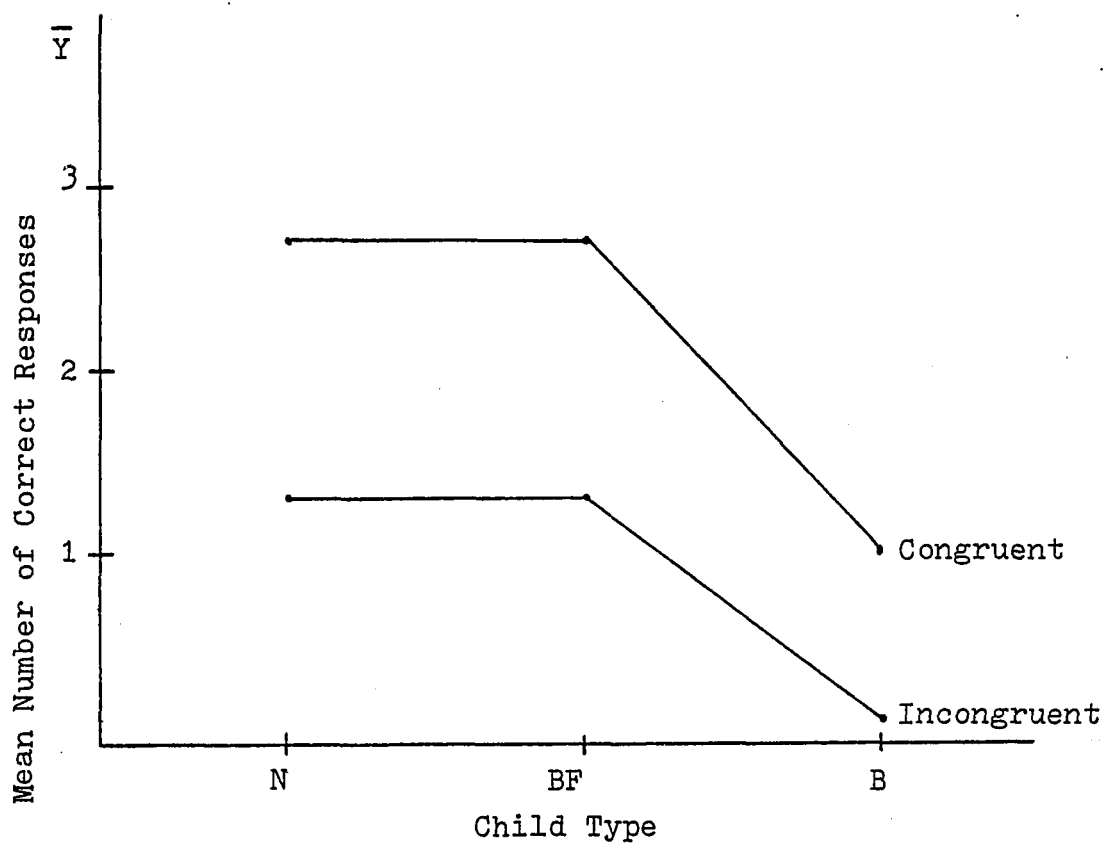
Main Effect of Child Type on the Comprehension of
In, On and Under (Exp. III, Part B)

FIGURE 24



The Effect of Age on the Comprehension of
In, On and Under (Exp. III, Part B)

FIGURE 25



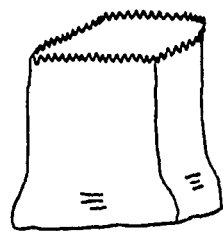
N = Normal
BF = Blindfolded
B = Blind

The Effect of Context on the Comprehension
of In, On and Under (Exp. III, Part B)

FIGURE 26



Ball



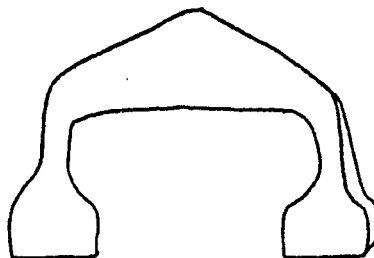
.188.

Bag

Pair A

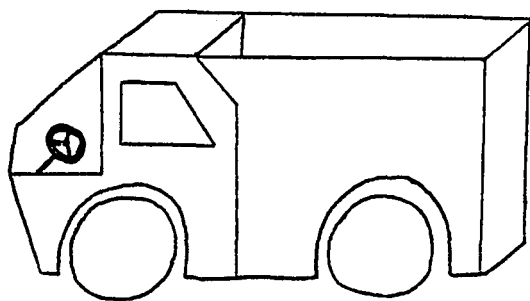


Boat

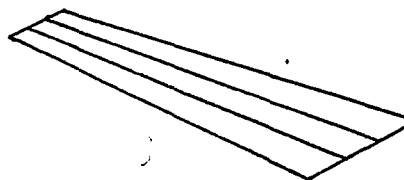


Bridge

Pair B

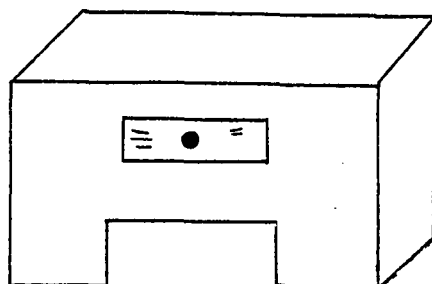


Truck



Road

Pair C



Pair D

Stimulus Pairs Used to Test In, On, Under

APPENDIX A

Bibliography

- Barraga, N.C. Utilization of sensory-perceptual abilities. In B. Lowenfeld (Ed.), The Visually Handicapped Child in School. New York, John Day Co., 1973, 117-34.
- Bauman, M.K. Psychological and educational assessment. In B. Lowenfeld, (Ed.), The Visually Handicapped Child in School. New York, John Day Co., 1973, 93-116.
- Bierwisch, M. Semantics. In J. Lyons (Ed.) New Horizons in Linguistics. Baltimore, Penguin Books, 1970.
- Birch, H.G. and Lefford, A. Intersensory development in Children. Monographs of the Society for Research in Child Development, 1963, 28, No. 5.
- Blank, M. and Bridger, W.H. Crossmodal transfer in nursery school children. Journal of Comparative Physiological Psychology, 1974, 48, 277-282.
- Bloom, L.M. One Word at a Time; The Use of Single Word Utterances before Syntax. The Hague, Mouton Press, 1973.
- Bowerman, M. Semantic factors in the acquisition of rules for word use and sentence construction. In D.M. Morehead and A.E. Morehead (Eds.) Normal and Deficient Child Language. Maryland, University Park Press, 1976, 99-173.
- Brekke, B., Williams, J. and Tait, P. The Acquisition of conservation of weight by visually impaired children. Journal of Genetic Psychology, 1974, 124, 89-97.
- Burlingham, D. Some notes on the development of the blind. Journal of the Psychoanalytic Study of the Child, 1961, 77, 15-116.
- Burlingham, D. Some problems in ego development in blind children. Journal of the Psychoanalytic Study of the Child. 1965, 20, 194-208.
- Cairns, H. and Cairns, C. Psycholinguistics. New York, Holt, Rinehart and Winston, 1976.
- Chomsky, N. Review of Skinner's Verbal Behavior. Language, 1959, 35, 26-58.
- Clark, E. On the child's acquisition of antonyms in two semantic fields. Journal of Verbal Learning and Verbal Behavior, 1972, 11, 750-758.

- Clark, E. What's in a word? On the child's acquisition of semantics in his first language. In T.E. Moore (Ed.), Cognitive Development and the Acquisition of Language. New York, Academic Press, 1973, 76-110.
- Clark, E. Non-linguistic strategies and the acquisition of word meaning. Cognition, 1974(a), 2, 161-182.
- Clark, E. Some aspects of the conceptual basis for first language acquisition. In Schiefelbusch and Lloyd (Eds.), Language Perspectives-Acquisition, Retardation, and Intervention. Maryland, University Park Press, 1974(b), 105-128.
- Clark, H. Space, Time, Semantics and the Child. In T.E. Moore (Ed.), Cognitive Development and the Acquisition of Language. New York, Academic Press, 1973, 28-64.
- Copeland, R.W. How Children Learn Mathematics. New York, The Macmillan Co., 1970.
- Conners, G.R., Schuette, C. and Goldman, A. Informational analysis of intersensory communication in children of different social classes. Child Development, 1967, 38, 251-266.
- Cromer, R. The cognitive hypothesis of language acquisition and its implications for child language deficiency. In D.M. Morehead and A.E. Morehead (Eds.), Normal and Deficient Child Language. Maryland, University Park Press, 1976, 283-333.
- Cromer, R. Conservation of congenitally blind, British Journal of Psychology, 1973, 64, 241-250.
- Cutsforth, T.D. The unreality of words to the blind. The Teachers Forum, 1932, 86-89.
- Cutsforth, T.D. The Blind in School and Society. New York, American Foundation for the Blind, 1951.
- Donaldson, M., Balfour, G. Less is more: a study of language comprehension in children. British Journal of Psychology, 1968, 59, 461-472.
- Donaldson, M., Wales R. On the acquisition of some relational terms. In J.R. Hayes (Ed.), Cognitive Development and the Development of Language. New York, John Wiley and Sons, 1970, 235-268.

- Eilers, R.E., Oller, D.K. and Ellington, J. The acquisitions of word meaning for dimensional adjectives: the long and short of it. Journal of Child Language, 1975, 1, 195-204.
- Farnham-Diggory, S., Berman, M. Verbal compensation, cognitive synthesis and conservation. Merrill-Palmer Quarterly, 1968, 14, 215-227.
- Fay, W. The triple trauma of blindness to language development. Paper presented at the American Speech and Hearing Association Convention in Washington, D.C., Nov. 1975.
- Flavell, J.H. The Developmental Psychology of Jean Piaget. New York, Van Nostrand, 1963.
- Foster, E. Cognitive development and mental imagery in congenitally blind and adventitiously blind children. City University of New York, Doctoral Dissertation, unpublished.
- Fraisse, P. Preface to Y. Hatwell Privation Sensorielle et Intelligence. Paris, Press Universitaires de France, 1966.
- Furth, H.G. Thinking without language: Psychological Implications of Deafness. New York, The Free Press, 1966.
- Gibson, E.J. Principles of Perceptual Learning and Development. New York, Appleton-Century and Crofts, 1969.
- Gottesman, M. A comparative study of Piaget's developmental scheme of sighted children with that of a group of blind children. Child Development, 1971, 42, 573-580.
- Gottesman, M. Conservation development in blind children. Child Development, 1973, 44, 824-827.
- Goodhill, V. and Guggenheim, P. Pathology, diagnosis and therapy of deafness. In L. Travis (Ed.), Handbook of Speech Pathology and Audiology. New York, Appleton-Century and Crofts, 1971, 279-345.
- Hatfield, E. Blindness in Infants and Young Children. Sight Saving Review, 1972, 42, 69-89.
- Hatwell, Y. Privation Sensorielle et Intelligence. Paris, Presses Universitaires de France, 1966.
- Harley, R.K., Jr. Verbalism among blind children: An investigation and analysis. American Foundation for the Blind, Research Series, 1963, No. 10.
- Huttenlocher, J. The origins of language comprehension. In Solso, R. (Ed.). Theories in Cognitive Psychology, New York, John Wiley and Sons, 1974, 331-368.

- Klein, G.S. Blindness and isolation. Journal of the Psychoanalytic Study of the Child, 1962, 19, 82-93.
- Kuczaj, S. and Maratsos, A.P. On the acquisition of front, back and side. Child Development, 1975, 46, 202-210.
- Lowenfeld, B. Psychological considerations. In B. Lowenfeld, (Ed.) The Visually Handicapped Child in School. New York, John Day Co., 1973, 27-60.
- Mc Neill, D. The Acquisition of Language: The Study of Developmental Psycho-linguistics. New York, Harper and Row, 1970.
- Miller, C.K. Conservation in blind children. Education of Visually Handicapped, 1969, 1, 101-105.
- Morehead, D.M. and Morehead, A. From signal to sign: A Piagetian view of thought and language during the first two years. In R. Schiefelbusch and L. Lloyd (Eds.), Language Perspectives: Acquisition, Retardation and Intervention. Maryland, University Park Press, 1974, 153-190.
- Nagera, H., Colonna, A. Aspects of the contribution of sight to ego and drive development: a comparison of the development of some blind and sighted children. Journal of the Psychoanalytic Study of the Child, 1965, 20, 267-287.
- Nelson, K. Concept, word and sentence. Interrelations in acquisition and development. Psychological Review, 1974, 267-284.
- Nolan, C.Y. On the unreality of words to the blind. The New Outlook for the Blind, 1960, 54, 100-102.
- O'Brien, R. Alive...Aware...A... Person: A developmental model for early childhood services. Maryland, Montgomery County Public Schools, Title III, ESEA, 1976.
- Palermo, D.S. Still more about the comprehension of "less". Developmental Psychology, 1974, 10, 827-829.
- Patz, A. The need for further research in retrolental fibroplasia. Sight Saving Review, 1970, 40, 7-11.
- Piaget, J. Psychology of Intelligence. New Jersey, Littlefield, Adams and Co., 1960.
- Piaget, J. Piaget's Theory in P. Mussen (Ed.), Charmichael's Manual of Child Psychology. New York, John Wiley and Sons, 1970.

- Piaget, J. Judgment and reasoning in the child. New York, Harcourt Brace, 1928.
- Piaget, J. Psychology of Intelligence. New Jersey, Littlefield, Adams and Co., 1960.
- Piaget, J. and Inhelder, B. The Psychology of the Child. New York, Basic Books, Inc., 1969.
- Pufall, P., Shaw, R. An analysis of the development of children's spatial reference systems. Cognitive Psychology, 1973, 5, 151-175.
- Rees, N., Wollner, S. Some problems and fewer solutions in assessing the language skills of blind children. Paper presented at the American Speech and Hearing Association Convention at Washington, D.C.
- Ryan, S. A developmental investigation of crossmodal transfer of shape and texture dimensions in children; University of Minnesota, Doctoral Dissertation, Unpublished.
- Schlesinger, I.M. Relational concepts underlying language. In R. Schiefelbusch and L. Lloyd (Eds.) Language Perspectives: Acquisition, Retardation and Intervention. Maryland, University Park Press, 1974, 129-152.
- Schlesinger, I.M. The role of linguistic input in cognitive development. Journal of Child Language, 1977, 4, 152-169.
- Schurrager, H.D. and Schurrager, P.S. Haptic intelligence scale for adult blind. Chicago, Psychology Research Technology Center, 1964.
- Sinclair, H. Sensorimotor action patterns as a condition for the acquisition of syntax. In R. Huxley and E. Ingram (Eds.), Language Acquisition: Methods and Models. New York, Academic Press, 1971.
- Sinclair deZwart, H. Language acquisition and cognitive development. In T.E. Moore (Ed.), Cognitive Development and Acquisition of Language. New York, Academic Press, 1973, 9-25.
- Slobin, D.I. Cognitive prerequisites for the development of grammar. In C.A. Ferguson and D.I. Slobin (Eds.) Studies of Child Language Development. New York, Holt, Rinehart and Winston, 1973.
- Stephens, W.B. Cognitive processes in the visually impaired. Education of the Visually Handicapped, 1972, 4, 106-111.

- Stephens, W.B., Simpkins, K. The Reasoning, Moral Judgment and Moral Conduct of the Congenitally Blind. Research Project, 1123-3197, Philadelphia, Temple University, 1974.
- Stephens, B., Simpkins, K. and Wexler, M. A comparison of the performance of blind and sighted subjects age 6-10 years on the rotation of Squares test. Education of the Visually Handicapped, 1976, 66-70.
- Swallow, R.M. Spatial education for blind children. In the Proceedings of the Third Annual UAP Conference Piagetian Theory and It's Implications for the Helping Professions. University of Southern California and Children's Hospital of Los Angeles, 1973.
- Swallow, R.M., Poulsen, M.D. Application of Piagetian theory to the development of the concept of space in the visually limited., In the Proceedings of the Second Annual UAP Conference, University of Southern California and Children's Hospital of Los Angeles, 1972.
- Tashiro, L. On the acquisition of non-comparative terms. Seniors Honor Thesis, Stanford University, 1971, unpublished.
- Taylor, J.L. Education programs. In Lowenfeld, B. (Ed.), The Visually Handicapped Child in School. New York, John Day Co., 1973, 1955-184.
- Terry, T.L. Extreme prematurity and fibroplastic overgrowth of persistent vascular sheath behind each crystalline lens. American Journal of Opthamology, 1942, 25, 7-11.
- Wales, R., Campbell, R. On the development of comparison and the comparison of development. In G.B. Flores d'Arcais and W.J.M. Levelt (Eds.), Advances in Psycholinguistics. Amsterdam, North Holland, 1970, 373-396.
- Tobin, M.S. Conservation of substance in the blind and partially sighted. British Journal of Educational Psychology, 1972, 42, 192-197.
- Warren, D. Blindness and early development: What is known and what needs to be studied. The New Outlook, 1976, 5-16.
- Webb, R., Oliveri, M. O'Keefe, L. Investigating the meaning of difference in language of young children. Child Development, 1974, 45, 984-991
- Wells, G. Learning to code experience through language. Journal of Child Language, 1974, 1, 243-269.

Wilcox, S. and Palermo, D. In, on, and under revisited.
Cognition, 1975, 3, 245-254.

Wills, D. Some observations of blind nursery school nursery
childrens' understanding of their world. Journal of the
Psychoanalytic Study of the Child, 1965, 20, 334-364.

Zweibelson, I. and Barg, C.F. Concept development of blind
children. New Outlook, 1967, 61, 218-222.