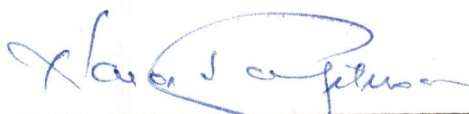


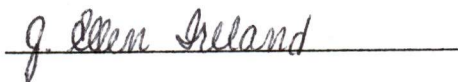
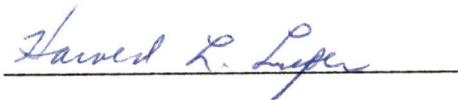
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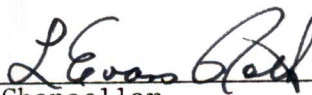


Harold A. Peterson, Major Professor

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Vice Chancellor
Graduate Studies and Research

A COMPARISON OF THE PERFORMANCE OF CEREBRAL PALSIED
AND NORMAL CHILDREN ON TWO TESTS OF
LANGUAGE CONCEPT DEVELOPMENT

A Thesis
Presented for the
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Carla J. Blaug
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ABSTRACT

The purpose of this study was to determine if any differences existed in the performance of children with cerebral palsy and normal children on two concept identification tests—the Boehm Test of Basic Concepts and the Synpro symbol identification test.

The study included ten cerebral palsied and ten normal subjects who were matched on vocabulary recognition age. The data consisted of the subjects' responses to the Peabody Picture Vocabulary Test (for vocabulary recognition age scores and IQs), the Boehm Test of Basic Concepts (BTBC) and the Synpro symbol identification test (SSIT).

Statistical analysis of the data indicated that: 1) the normal children performed better than the cerebral palsied children on the two language concept tests, 2) there was not a significant relationship between the SSIT and BTBC for either the cerebral palsied or the normal children, and 3) a moderately high and significant correlation existed between the PPVT age scores and the BTBC for the cerebral palsied subjects and a high and significant relationship existed between the PPVT IQs and the SSIT for the normal population. Analysis of the data also indicated that more subjects were able to identify concepts on the BTBC than on the SSIT, when a comparison was made for the time, space and quantity categories.

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CHAPTER I

INTRODUCTION

A number of investigations have been conducted to determine important factors in the language development and the receptive language competency of children with cerebral palsy. Several have discussed the effect of specific factors on language development and competency; for example, the importance of environment (Mecham et al., 1960; McDonald and Chance, 1964; Peters, 1964; Westlake and Rutherford, 1961), intelligence (Kastein and Hendi, 1951, Cruikshank, 1976), speech skills (Lenneberg, 1966; Liberman, 1957; Vicker, 1974), and hearing disability (Peters, 1964; Karlin et al., 1965). The studies concerning environmental factors have stressed that experiences are essential to the development of language. Intelligence also appears to play an important role in language development.

Fewer studies have examined the typical language developmental milestones, and receptive and expressive language skills of children with cerebral palsy. Byrne (1959) suggested that language development in children with cerebral palsy was delayed, as measured by the appearance of first words, and two- and three-word sentences. Gillette (1962) also found that development was delayed, as measured by these same milestones.

Conflicting information has been reported by Dunsdon (1952) and Love (1964). Dunsdon suggested that children with cerebral palsy were retarded in their development of vocabulary, while Love found no

differences between cerebral palsied children and matched controls in receptive vocabulary.

Most investigators agree that the vocabulary used by children with cerebral palsy lags behind their vocabulary of understanding. Irwin (1972) discussed the predominance of some grammatical categories in the vocabulary of use of these children, which presumably agrees with the predominance in their receptive vocabulary.

Peters (1964) considered the conceptual functioning of children with cerebral palsy. However, she only discussed conceptual functioning as it is related to the ability to use speech, hearing, and to the degree of involvement. There appears to be a lack of information concerning conceptual functioning as it is related to other receptive abilities.

Linguistic concepts are the core material of which language expression is constructed. The child's basic language concepts are identified as names he attaches to objects, actions, and relationships in his environment. Pictures which represent those things in the child's experience can therefore be considered linguistically referenced symbols. The Boehm Test of Basic Concepts (Boehm, 1971) is based on this "linguistically referenced" assumption. Pictures of objects assumed to be in the child's repertoire of experience are used to test his understanding of concepts such as space, quantity, and time. Known objects are placed in known relationships for the child's identification. It is at least theoretically possible that the child could correctly identify some of the concepts tested because he had been taught the words, but may not have generalized the concept to other circumstances.

In another aspect of language, Berko (1958) applied similar reasoning for her testing of morphological rules. Rather than asking children to supply the plural, or past tense, or comparator, etc., endings to known objects, she tested them with nonsense pictures. Children's responses that two bird-like creatures must be /w^gs/ and that a stick man /zIbd/ yesterday, and that a dog with quirks must be a quirky dog and a more quirks made him /kwIrkIØ/, indicated to her that the children supplied the correct answers because they knew the rules for the response. She used unknown items in known (supplied) contexts.

Gilley (1977) applied similar reasoning to the testing of language concepts with three- and four-year old children. Semiotic picture symbols developed for a syntax programming device-Synpro (Peterson, Brener, and Lea, 1972) were utilized. The symbols were semiotic in that they had no known linguistic referent. That is, an arrow pointing vertically downward and a second arrow pointing horizontally away have no linguistic referents. If, however, one is identified as here and the other as there, the linguistic concepts expressed by those two terms should identify the vertical arrow as here and the horizontal one as there. If the referents were time rather than locative, they should represent now and then. The semiotic symbols developed for the Synpro and utilized by Gilley were also used in this study.

The use of linguistically referenced picture symbols allows testing of the child's ability to identify familiar items in known contexts. The use of semiotic symbols, which are assigned linguistic value within

a comparator context, allow testing of whether the child has acquired (and can generalize) the linguistic concept represented. For comparison, the 50 items on the Boehm test have been assigned to one of five categories: space (23 items), quantity (18 items), time (four items), adjectives (three items), and transitive verbs (two items). The semiotic symbols were expanded to 72 items, from the original 62 for this study to included 24 to represent spatial relations, 15 items for quantity, six for time, six adjectives, eight pronouns, four conjunctions, two negated verbs, two transitive verbs, three intransitive verbs, and two nouns. A complete list of the referents and symbols utilized on the Synpro symbol identification test is shown in Appendix A.

Although the Boehm test and the Synpro symbols have been utilized to determine normal children's understanding of concepts, no studies have been conducted which deal with concept identification in the cerebral palsied population. It therefore seemed appropriate to determine the performance of cerebral palsied children on these two measures.

I. PURPOSE OF THE STUDY

This study was designed to determine if any differences existed between the performance of school-age children with cerebral palsy and normal school-age children on a language test which tested the children's conceptual development with pictures—the Boehm Test of Basic Concepts (Boehm, 1971) and on their identification of more abstract symbols developed for a syntax programming device—Synpro (Peterson et al., 1972).

II. EXPERIMENTAL QUESTIONS

This study addressed the following questions:

1. Are there significant differences between the mean scores of the cerebral palsied and the normal children on: (a) the Boehm Test of Basic Concepts, and (b) on their identification of Synpro symbols?
2. Do significant correlations exist between the children's scores for the Boehm Test of Basic Concepts and for their identification of the Synpro symbols for either of the two populations?

CHAPTER II

REVIEW OF THE LITERATURE

The relevant literature to be reviewed on this subject is divided into eight sections. The first five sections deal with the effect of specific factors on language development and competency. This is followed by a discussion of language developmental milestones in the sixth section. The seventh section examines the receptive and expressive language skills of children with cerebral palsy. Finally, conceptual processes and receptive language development are considered.

I. ENVIRONMENT

It has been suggested that varied factors influence the speech and language characteristics of children with cerebral palsy (Boone, 1972). One major influence on the level of language comprehension and usage is the child's interaction with his environment. McDonald and Chance (1964) stressed that experiences are essential to the development of language. Lorenze et al. (1962) found that an important factor in the development of language is the ability of the child to experience contact with his environment and his peers. When a human being interacts with his environment, experience comes naturally, and as time passes, an individual has more opportunities for experience to occur. Experiences occur first as awarenesses of environmental stimuli, i.e. sensations. As he matures, the child begins to detect differences between stimuli and these discriminations assist him in giving meaning

to his sensations. When sensations have been differentiated and become meaningful, perceptions occur. Perceptions which have been generalized and classified are concepts, the core material of which language is constructed.

Peters (1964) stated that any basic concept that a child forms may result from the accumulation of attributes of the stimulus through recall. Innate attributes are multiple percepts that eventually form a concept of a thing, and may be totally independent of verbal communication. In other words, within the field of concrete objects, the child begins to form basic concepts independent of the use of words. When conceptualization takes place, the word symbol then becomes meaningful.

The importance of the ability to organize and retain experiences in the form of percepts, and to associate and elaborate percepts into concepts was stressed by Westlake and Rutherford (1961). Mecham et al. (1960) studied the ability of cerebral palsied children to make associations between words and meanings. They concluded that these children were slower in this aspect, as compared to normal children. They also found that the children with cerebral palsy usually have less variety in the associations they make because of their limited daily-life experiences. They need many concrete experiences in associating words and their meanings.

II. INTELLIGENCE

A second influence on the level of language comprehension may be intelligence. Many investigators have discussed this factor. Kastein

and Hendi (1951) asserted that a greater percentage of failure to develop language occurred in their mentally retarded groups. In their study, all patients who failed to develop language, exhibited mental retardation. On the other hand, all patients with at least average mental development, irrespective of degree of impairment, developed language. They determined that the development of language is based on mental potential rather than on severity or the side of impairment (lesion) or handedness.

Cruikshank (1976) concluded that intelligence was closely related to language development. He also suggested that an intelligence test score could often be predicted from vocabulary and language structure.

III. SPEECH SKILLS

Two theories have been discussed with respect to the effect of speech skills on language development and competency. Lenneberg (1966) concluded that the needs that arise by 18 months of age and cause language to develop are primarily due to maturational processes within the individual. One of the hallmarks suggested by Lenneberg for maturationally controlled emergence of behavior was "evidence that opportunity for environmental stimulation remains relatively constant throughout development but the infant makes different use of such opportunities as he grows up."

An important idea stated by Lenneberg (1966) was that the onset of language is regulated by a maturational process, independent of motor-skeletal maturation. So, he determined that the development of language

is independent of articulatory skills. The child cannot begin to develop language until a certain level of physical maturation and growth has been attained.

Vicker (1974) believed that an individual with a motoric expressive problem presumably has receptive competency with his native language. She concluded that oral motor speech dysfunction in children does not preclude the development of language comprehension capabilities.

However, Liberman (1957) concluded that perception always goes with articulation. He thought that speech is perceived by reference to articulation. The articulatory movements and their sensory effects mediate between the acoustic stimulus and the event, perception.

These theories are obviously in conflict, concerning the importance of articulation to language development. Lenneberg and Vicker agreed that the child's speech skills are not an important factor in language development; whereas Liberman concluded that there is a relationship between speech skills and language development.

IV. HEARING DISABILITY

Conflicting information has been reported regarding the relationship between hearing disability and language development. Karlin et al. (1965) concluded that there is a close relationship between hearing disability and a delay in language development. On the other hand, Peters (1964) stated that hearing disability did not necessarily retard the development of basic concepts, nor interfere with test performance.

V. ORGANIC FACTORS

It was suggested that the cerebral palsied child always has a brain involvement which may or may not directly affect his ability to conceptualize (Lebovitz, 1951). However, Lebovitz determined that when the brain damaged child is presented with a task requiring conceptualization beyond his abilities, there is a tendency for the child to conceptualize at a lower level of abstraction.

Lorenze et al. (1962) indicated that organic damage to the areas of the brain controlling language will produce moderate or severe delays in the development of communication—either expressive, receptive or both. They also stated that organic damage, resulting in a disruption of the visual, auditory, and/or kinesthetic interpretative or integrative functions of the brain, distorts the perception of stimuli and the formation of concepts. This in turn delays or disturbs the child's development of language.

VI. LANGUAGE DEVELOPMENTAL MILESTONES

Byrne (1959), in studying athetoid and spastic children, found that speech and language develop slowly in this group. The acquisition of language follows the same sequential pattern observed in normal children, although it is retarded. In her population, the median age for the appearance of first words was 15 months, with the appearance of two-word sentences at 36 months and three-word sentences at 78 months of age. She also indicated that spastics developed words and

sentences earlier than athetoid cerebral palsied children. Gillette (1962) also concluded that language acquisition is delayed in the cerebral palsied population. Single words, according to Gillette, appear at 27 months, and two- and three-word sentences at 37 months. Normal developmental milestones reported by Gillette were: first words at 12 months, and two- and three-word sentences at 30 months.

VII. RECEPTIVE AND EXPRESSIVE LANGUAGE SKILLS

Dunsdon (1952) suggested that there is an average retardation in the development of vocabulary in the population of children with cerebral palsy from three to four years as compared to normal children. Love (1964) stated that there are no differences between cerebral palsied and matched controls in receptive vocabulary, as measured by the PPVT. However, the subjects with cerebral palsy in his study were inferior to controls in expressive naming vocabulary.

Irwin (1972) commented that the vocabulary used by children with cerebral palsy lags behind their vocabulary of understanding. Nouns predominate in their vocabulary of use, followed by adjectives, prepositions, verbs, gerunds, and pronouns. He also concluded that severely involved cerebral palsied children score somewhat better on the PPVT than mildly and moderately involved children, although this is not statistically significant.

Peters (1964) suggested that the ability to use speech does not always indicate that children will have adequate conceptual functioning, nor does the lack of speech necessarily block conceptual functioning.

She concluded that the degree of involvement does not always presuppose poor conceptual functioning. In her study, athetoids displayed better conceptual functioning than did spastics.

VIII. CONCEPTUAL PROCESSES AND RECEPTIVE LANGUAGE DEVELOPMENT

Many definitions of "concept" have been suggested in the literature. Hospers (1971) commented that a concept of X (or X-ness) exists when X's can be distinguished from Y's and Z's, and everything that is not an X. Kendler (1971) stated that concepts have three properties—they are associations, they function as cues (stimuli) and they are responses.

Dolphin and Cruikshank (1952) discussed concept formation in children with cerebral palsy. They designed a test to determine relationships between life situations as represented in pictures and a miscellaneous assortment of small objects. As compared to normal subjects, the children with cerebral palsy selected more objects, and they also selected objects on the basis of secondary characteristics. This indicated that concept formation for cerebral palsied children is different than that for normal children, with respect to their test design.

According to Gilley (1977), an important aspect of receptive language testing is the use of picture symbols. Her study was designed to determine if a child could perceive the meaning of a pictured symbol and match it to its verbal counterpart. She believed that the use of abstract symbols has important implications for the study of concept

development. Using a single word cue, she tested children's ability to choose the appropriate abstract picture. She concluded that normal four year-old subjects were able to identify abstract symbols from named concept words better than normal three year-old subjects. She also found that there was a significant relationship between PPVT IQ and the symbol identification scores of the four year-olds, but not the three year-olds. No significant correlation between the Northwestern Syntax Screening Test and the symbol identification test was observed when the same concept words were examined on both tests. Adler (1975) suggested that a direct relationship exists between the degree of abstraction of a concept and the difficulty required in learning to use it appropriately.

IX. SUMMARY OF THE REVIEW

A review of the literature revealed that many investigators have studied the factors which determine and affect the speech and language characteristics of children with cerebral palsy. The importance of environment, intelligence, and organic factors have been recognized, although conflicting information has been reported concerning speech skills and hearing disability.

The investigators who have studied language developmental milestones have suggested that children with cerebral palsy are delayed in their development of language. Contradicting information has been reported with respect to receptive and expressive language skills.

Although the preceding factors and ideas have been studied rather extensively, little research has been done in the area of the conceptual functioning of normal children or children with cerebral palsy.

The performance of the cerebral palsied child on concept picture and symbol tasks has not been previously considered. It is possible that there may be differences between the performance of school-age children with cerebral palsy and normal children on these two types of tasks.

CHAPTER III

METHODS AND PROCEDURES

I. SUBJECTS

A total of 20 subjects were selected for this study. Ten of the 20 were identified as the experimental group and satisfied the following selectional criteria: 1) normal hearing acuity as determined by a pure-tone air conduction audiometric screening for the frequencies of 500, 1000, 2000 and 4000 Hz at 20 dB (ANSI) in the better ear and no more than a 10 dB difference between ears; 2) a medical diagnosis of cerebral palsy; and 3) chronological age between 60 and 120 months and a vocabulary recognition age score (mental age) no lower than two standard deviations below the mean for their age according to the Peabody Picture Vocabulary Test. The chronological age range for the cerebral palsied children was 62 - 116 months, with a mean of 93.2 months. The other ten subjects were identified as the control group and satisfied the following criteria: 1) normal hearing acuity as described above for the experimental group subjects; and 2) no reported history of neurological or neuromuscular pathology, and no previous speech or language therapy intervention. Additionally, the control subjects were approximately matched (within plus or minus six months) to the experimental group subjects on the basis of Peabody Picture Vocabulary Test age scores. The chronological age range for the control group children was 65 - 98 months, with a mean of 79.9 months.

Experimental group subjects were selected from an available pool of subjects at the Knoxville schools Adaptive Education program and at Zachary Taylor Elementary School and Rehabilitation Center in Cedar Rapids, Iowa. Control group subjects were selected from Kingston Korner School in Knoxville and from available populations at Taylor School and in Bettendorf, Iowa.

II. MATERIALS

In addition to a hearing screening test and the Peabody Picture Vocabulary Test, two concept identification tests were utilized in this study; the Boehm test of Basic Concepts and a symbol identification test (Synpro). The Boehm Test was designed to measure children's mastery of concepts considered necessary for achievement in the first years of school. Concepts were chosen which Boehm believed were unfamiliar to large numbers of children in a class. The pictures used "represented relatively abstract basic concepts or ideas." A description of this test is found in the Boehm Test of Basic Concepts manual (Boehm, 1971).

The symbol identification test was designed to measure the child's comprehension of related abstract concepts. The linguistic concepts presented were categorized as designators (here, there), connectors (and, or), verbs, prepositions, pronouns, describers (big, small), questions, plurals, and negatives. Some of the categories included different degrees of difficulty. For example, three pictures of the face of a clock were used to identify the word clock, and the concepts of time and when. Another hierarchy was in the identification of

plurals. The singular-plural distinction was made between 1) girl-girls, 2) man-men, 3) he-they, 4) her-them, and 5) is-are. Each of these items was an increasingly more abstract representation of plurality (Gilley, 1977). Sixty-two of the 72 symbols on the test were taken from Synpro (Syntax Programmer).

III. ADMINISTRATION

A total of four test procedures were administered to each child. The pure-tone audiometric screening test and the Peabody Picture Vocabulary Test were the criterion measures and were administered on the first contact. For the hearing screening response the child was asked to raise his hand to signal that he heard the tones presented under ear phones. For the Peabody Picture Vocabulary Test, the child was asked to point to one of four pictures presented on a page which best represented the stimulus word. Stimulus words were presented by live voice. Neither of these two test procedures took more than 10 minutes to administer.

On a second day, within two weeks of the initial contact, and to subjects who met the selection criteria for the study, two picture concept recognition tests were administered. The Boehm Test of Basic Concepts required that the child point to pictures which identified the linguistic concept expressed (e.g., the child was told to look at three plates of cupcakes. He was then asked to point to the plate that "has a few cupcakes."). The fourth test procedure included 72 semiotic picture symbols developed for use with a syntax programming device (Synpro).

Four picture-symbols were presented on a page (e.g., one dot, two dots, an arrow pointing down, and an arrow pointing vertically). The subject was told that the symbols represented is, are, now, and then. He was asked to: "Point to then. Point to is." The symbols were arranged in pairs and each pair was presented twice to allow each symbol to be identified. The Boehm Test and the Synpro symbol identification tasks took approximately 15 to 20 minutes each to administer.

IV. RELIABILITY

In order to ascertain the test-retest reliability of both tests, they were readministered to a total of four randomly selected subjects, two from the control group and two from the experimental group. The examiner's judgments of correctness (yes-no) were judged reliable, since a pointing response was required from the child. If the examiner was unsure of which picture the child was pointing to, she requested that the child identify only one picture.

V. VALIDITY

Boehm (1971) believed that the items selected for her test were chosen from relevant curriculum materials and represented concepts basic to understanding directions and other communications from teachers at the preschool and primary-grade level. This is called content validity. Gilley (1977) tested the representativeness of the concepts used on the symbol identification test. All of the items were correctly identified by 12 graduate students in speech pathology.

VI. ANALYSIS OF THE DATA

The t test of unrelated means (Williams, 1968) was utilized to test for possible significant differences between the mean number of correct responses by the cerebral palsied children and normal subjects on each of the two concept recognition tests. A Pearson Product-Moment Correlation (Williams, 1968) was used to determine whether a significant correlation existed between the performance of the subjects on the Boehm Test of Basic Concepts and their performance on the symbol identification test, for either of the populations.

CHAPTER IV

RESULTS AND DISCUSSION

I. RESULTS

This study was designed to determine if there were significant differences between the performance of cerebral palsied and normal children on a picture test of linguistic concepts and on their identification of more abstract symbols representing linguistic concepts. Correlational statistics were also run to determine if significant correlations existed between the children's scores on the picture concept test and their identification of the Synpro symbols for either of the two populations. The data analyzed included the responses made by the subjects on the Boehm Test of Basic Concepts, the Synpro symbol identification test, and the Peabody Picture Vocabulary Test. In Appendix B the data obtained from the cerebral palsied and normal subjects are shown.

To answer the question of whether there was a significant difference between the cerebral palsied and normal children on the Boehm Test of Basic Concepts and the Synpro symbol identification test mean scores of performance were compared. Table I shows the mean, standard deviation and range of scores for each group of subjects. Statistical analyses using the t test of unrelated means indicated that the difference between the means was significant for the Synpro symbol identification test (t = 2.42, $p < .025$, $df = 18$), and for the Boehm

TABLE I

MEANS, STANDARD DEVIATIONS, AND RANGES OF SCORES FOR THE SYNPRO
 SYMBOL IDENTIFICATION TEST (SSIT), BOEHM TEST OF
 BASIC CONCEPTS (BTBC) AND PEABODY PICTURE
 VOCABULARY TEST (PPVT AGE SCORE AND IQ)
 FOR NORMAL AND CEREBRAL PALSIED
 SUBJECTS

Test	Normal Subjects			Cerebral Palsied Subjects			Significance
	Mean	S. D.	Range	Mean	S. D.	Range	
SSIT	58.60	4.63	50-69	49.80	9.87	24-62	.025*
BTBC	46.10	2.07	42-49	43.20	4.02	37-49	.05**
PPVT AGE SCORE (months)	93.50	12.43	69-107	94.80	14.59	69-110	NS***
PPVT IQ	110.90	11.94	96-131	101.30	12.70	77-131	NS****

* $\underline{t}$ = 2.42, $p < .025$, $df = 18$.

** $\underline{t}$ = 1.92, $p < .05$, $df = 18$.

*** $\underline{t}$ = -.21, $p > .05$, $df = 18$.

**** $\underline{t}$ = 1.65, $p > .05$, $df = 18$.

Test of Basic Concepts ($t = 1.92$, $p < .05$, $df = 18$). The normal children performed significantly better than the cerebral palsied children on both tests. The response data obtained from the cerebral palsied and normal subjects for the Boehm Test of Basic Concepts and the Synpro symbol identification test are shown in Appendices C and D.

Further statistical analyses were performed to determine if significant correlations existed between the BTBC and the SSIT for either of the groups. A Pearson Product-Moment Correlation (Table II) indicated that the relationship was not significant for either population (Cerebral palsied, $r = -.11$, $p > .05$, $df = 9$; normal subjects, $r = .22$, $p > .05$, $df = 9$).

Although not the major areas of interest in this study, statistical analyses were performed to determine if significant correlations existed between the PPVT age scores and IQs, and the Boehm Test of Basic Concepts (BTBC) and the Synpro symbol identification test (SSIT) for either of the two populations. Pearson Product-Moment Correlation tests (Table III) indicated that the relationships between the PPVT age scores and the BTBC, the PPVT age scores and the SSIT, and the PPVT IQs and the BTBC were not statistically significant for the normal population (PPVT age scores and BTBC, $r = .34$, $p > .05$, $df = 9$; PPVT age scores and SSIT, $r = .37$, $p > .05$, $df = 9$; PPVT IQs and BTBC, $r = .36$, $p > .05$, $df = 9$). The relationship was significant between the PPVT IQ and the SSIT ($r = .89$, $p < .005$, $df = 9$) for the normal subjects. For the cerebral palsied subjects, the correlations between the PPVT age scores and the SSIT, the PPVT IQs and the BTBC, and the

TABLE II
 PEARSON PRODUCT-MOMENT CORRELATIONS ($\bar{r}$'s) BETWEEN
 THE SYNPRO SYMBOL IDENTIFICATION TEST (SSIT)
 AND THE BOEHM TEST OF BASIC CONCEPTS (BTBC)
 FOR CEREBRAL PALSID AND
 NORMAL CHILDREN

Group	df	SSIT with BTBC	Significance
Cerebral Palsied Subjects	9	-.11	NS*
Normal Subjects	9	.22	NS**

* $\bar{r}$ = -.11, $p > .05$, $df = 9$.

** $\bar{r}$ = .22, $p > .05$, $df = 9$.

TABLE III

PEARSON PRODUCT-MOMENT CORRELATIONS (r 's) BETWEEN THE SCORES
FOR CEREBRAL PALSID AND NORMAL CHILDREN ON THE
SYNPRO SYMBOL IDENTIFICATION TEST (SSIT),
THE BOEHM TEST OF BASIC CONCEPTS (BTBC)
AND THE PEABODY PICTURE VOCABULARY
TEST (PPVT AGE SCORES AND PPVT IQs)

Group	df	PPVT age score with SSIT	PPVT IQ with SSIT	PPVT age score with BTBC	PPVT IQ with BTBC
Cerebral Palsied Subjects	9	.07	.08	.70*	-.07
Normal Subjects	9	.37	.89**	.34	.36

*Significance at the .10 alpha level requires $r = .69$, with $df = 9$.

**Significance at the .005 alpha level requires $r = .73$, with
 $df = 9$.

PPVT IQs and the SSIT were not significant (PPVT age scores and SSIT, $\underline{r} = .07$, $p > .05$, $df = 9$; PPVT IQs and BTBC, $\underline{r} = -.07$, $p > .05$, $df = 9$; PPVT IQs and SSIT, $\underline{r} = .08$, $p > .05$, $df = 9$). The relationship was significant between the PPVT age scores and the BTBC ($\underline{r} = .70$, $p < .01$, $df = 9$) for the cerebral palsied subjects.

Test-retest reliability scores for the Boehm Test of Basic Concepts were 95 percent for the normal children and 93 percent for the cerebral palsied children. Reliability scores for the symbol identification test were 90 percent (normal) and 85 percent (cerebral palsied).

II. DISCUSSION

The discussion of the results is divided into three sections. The first section discusses the performance of the two groups of children on the two tests. The second section is concerned with a comparison of similar items tested on the two tests. The final section deals with the easiest and the most difficult items on the two tests for the two groups.

Performance of the Two Groups of Children

The data indicate that there was a significant difference between the mean scores of performance for school-age cerebral palsied children and normal children on both the Boehm Test of Basic Concepts and their identification of Synpro symbols. One possible factor which may have contributed to the superior performance of the normal children as compared to the cerebral palsied children may be intelligence. In a

study with younger children, Gilley (1977) concluded that intelligence was one of the factors which influenced the superior performance of her four-year old subjects in relation to three-year olds. She suggested that the relationship between intelligence and the Synpro symbol identification test probably referred to the perception and identification of relations of words and symbols. Analysis of the data in this study revealed a significant relationship between the PPVT IQ and the Synpro symbol identification test scores of the normal children but not for the cerebral palsied children. Since there was not a significant difference between the normal and cerebral palsied subjects on the PPVT IQ, and no significant relationships were noted between the Synpro symbol identification test and the PPVT IQ for the cerebral palsied subjects or between the Boehm Test of Basic Concepts and the PPVT IQ for either of the populations, intelligence may not have been the only factor which contributed to the better performance of the normal children as compared to the cerebral palsied children.

Lebovitz (1951) suggested that the brain damage that the cerebral palsied child has may or may not directly affect his ability to conceptualize. Lorenze et al. (1962) also indicated that organic damage, which results in a disruption of the visual, auditory, and/or kinesthetic interpretative or integrative functions of the brain, distorts the perception of stimuli and the formation of concepts. However, central nervous system damage was not specifically considered in this study, so these views cannot be substantiated.

McDonald and Chance (1964) suggested that for many cerebral palsied children, the environment is not adequately stimulating nor accepting.

Because of their sensory-motor problems, they are unable to produce changes in their environment which create new experiences and new language learning opportunities for them. This explanation could account for the difference in the performance of the two groups on the tests. Because of their restricted environments, the children may have restricted language development. To the extent that the development and recognition of concepts is facilitated by environmental and peer group experiences, McDonald and Chance would indicate that the cerebral palsied children may not have been exposed to the same experiences as normal children.

Finally, the performance of one cerebral palsied child substantially lowered the mean score for the entire cerebral palsied population of the Synpro symbol identification test. Subject 1 achieved a score of 24 on that test, while the next lowest score achieved by a cerebral palsied child was 47. The mean scores of the two groups might have been more similar, and the difference not significant if that subject's data had been eliminated from the analysis.

The data indicated that there was not a significant correlation between the Synpro symbol identification test and the Boehm Test of Basic Concepts for either of the populations. This may have been due to the fact that the two tests represented concepts differently. ✓ The concepts were represented by linguistically referenced pictures on the Boehm Test of Basic Concepts, while they were represented by semiotic picture symbols (i.e., symbols with no known linguistic referent) on the Synpro symbol identification test. Since the tests represented concepts

differently one might expect that the performance of the children would not be significantly related for the two tests.

There was a significant correlation between the PPVT age scores and the BTBC for the cerebral palsied population. This suggests that, for this group, vocabulary recognition, as measured by the PPVT is a contributing factor to the recognition of concepts as measured by the Boehm Test. However, vocabulary recognition age would not appear to be an important contributing factor for the identification of concepts as measured by the SSIT for either population or for the BTBC for the normal population.

Comparison of Similar Items Tested on the Two Tests

The performance of all of the children was compared, according to space, time, and quantity categories, for the Boehm Test of Basic Concepts and the Synpro symbol identification test (See Appendix E). Their performance was only compared on those categories because of the relatively small number of items in the other categories. More subjects consistently identified the concepts on the Boehm Test, as opposed to their identification of Synpro symbols in the same categories. There are several possible reasons for the establishment of this type of trend.

First, it is possible that the children did not understand the meaning of particular concepts. If they had been unable to determine the meaning of a concept, they would have had difficulty recognizing the symbol which represented the concept. Since many of the errors were within categories, e.g., beside for around, it is probable that the children were at least partially aware of the meaning of the concepts.

Additionally, the children may not have been aware of all of the semantic features of particular concepts. The semiotic symbols used on the Synpro test were assigned linguistic value within a comparator context. Often the children were able to identify a symbol as a choice from a contrasting pair, but they were unable to recognize the specific symbol from the pair. If that were the case, the children apparently understood some of the features of the concept, but not all of them.

Another probable factor is the appropriateness of some of the symbols on the symbol identification test. If the children understood the meaning of a concept, it is possible that they were unable to recognize the symbol representing the concept, because the symbol was not appropriate or representative of the concept. As part of her study, Gilley (1977) asked a group of graduate students to rate the representativeness of the Synpro symbols. Those symbols which her judges rated as less representative were often misinterpreted by both the cerebral palsied and normal children in this study. Thus the poorer performance of the children on the Synpro may be due, at least in part, to the lack of representativeness of some of the symbols and the children's lack of knowledge of all of the semantic features of particular concepts.

Some linguistic concepts are obviously more easily represented than others. For example, the space concepts on the Boehm Test were recognized by a large percentage of subjects in both groups. It is apparent that the pictures representing those concepts were more recognizable and representative than were the other pictures. The

children also may have had a better understanding of the meaning of the concepts in that group. Space concepts also appear in the first sentences of children (Dale, 1972). The early use of the space concepts apparently contributed to their identification by the children. A large percentage of the normal children identified the time concepts on the Boehm Test, possibly because, for that population, the pictures were representative and the children understood the concepts in that group.

Time concepts were recognized by the fewest number of children in both groups on the Synpro symbol identification test. This may have been due to the fact that the time symbols were not representative. The children may have understood the concepts but they could not associate the meaning with the symbol shown. It is also possible that the children did not understand all of the semantic features or the overall meaning of some of the time concepts. Time concepts are not among the concepts mentioned by Dale (1972) as being among the first used by children. This may also have contributed to the difficulty in their identification on the Synpro.

Easiest and Most Difficult Items on the Synpro and Boehm

There were some similarities in the performance of the cerebral palsied and normal subjects on the Synpro symbol identification test, when their recognition, or inability to recognize particular concepts was considered. The most difficult items for all of the children to identify were is (4/20), then (5/20), and after and when (6/20). The difficulty encountered in the recognition of is and then may be at

least partially explained by the fact that they were the first items tested on the Synpro. Some of the children did not fully understand the directions given until the second page of pictures was presented. The symbol for are was correctly identified later by 8 out of 10 of the normal children and 5 out of 10 of the cerebral palsied children. Similarly, the symbol for now was recognized by more children than was the symbol for then. Therefore, the later placement of are and now on the test may have influenced the better identification of those symbols by the children.

The poor performance of the children could also be attributed to the lack of representativeness of those symbols. The symbol for is as one dot was rated as less representative than most of the other symbols on the test by the graduate student judges in Gilley's study (1977). The symbol for then was added for this study, so it is not known if children or adults believe that the symbol is representative.

It is also interesting to note that three of the four most difficult concepts to identify belong to the time category, which, as mentioned earlier, was the most difficult category overall.

The easiest symbols for the children to recognize were him, he, she, up, beside, read and love, which all of the children correctly identified. The concepts him, he, and she are in the pronoun category, which suggests that pronoun symbols were relatively easy symbols for the children to recognize. The pronoun symbols were rated as highly representative by the judges in Gilley's study. The representativeness of the symbols may have allowed for the easier recognition of those

concepts. Although the other symbols are in various categories (up and beside are in the space category), they were also rated as highly representative, and identified by all of the subjects. As mentioned earlier, some concepts can be represented more easily than others. Those symbols may have also been recognized because the children understood the meaning of the concepts.

There were only a few concepts that the children had difficulty identifying on the Boehm Test of Basic Concepts. The most often missed concepts by both populations were pair and equal. The concept pair does not appear to be a familiar concept to children. The most frequently chosen picture for that item was a picture of three candles, rather than the correct number (two). When asked to point to pictures that had equal numbers of lollipops, many children did not comprehend that they were to point to two pictures rather than one. All of the other items on the test required that the children point to only one picture.

CHAPTER V

SUMMARY AND CONCLUSIONS

I. SUMMARY

The main purpose of this study was to determine if cerebral palsied children performed differently than normal children on the Boehm Test of Basic Concepts and the Synpro symbol identification test.

The experimental study included ten normal and ten cerebral palsied subjects who were matched on vocabulary recognition age. The subjects were required to point to pictures or symbols in response to concept words named by the examiner. The data consisted of the subjects' responses to the Peabody Picture Vocabulary Test (for vocabulary recognition age scores and IQs) the Boehm Test of Basic Concepts (BTBC) and the Synpro symbol identification test (SSIT). Evaluation of the data included a comparison of scores for the two populations; correlations between the performance of the two groups on the BTBC and the SSIT, and between the vocabulary recognition age scores and PPVT IQs and the results from the BTBC and the SSIT; and a comparison of the responses of the cerebral palsied and normal children for categories that the two tests had in common. Analysis of the data was accomplished by the t test of unrelated means and the Pearson Product-Moment Correlation. The results of the study were as follows:

1. The normal children performed better than the cerebral palsied children on the two language concept tests. Intelligence probably contributed to the superior performance of the normal children.

2. Nonsignificant correlations existed between the BTBC and the SSIT for both populations. This may have been due to the fact that the two tests represent concepts differently.

3. Significant correlations existed between the PPVT age scores and the BTBC for the cerebral palsied subjects, and between the PPVT IQs and the SSIT for the normal population.

4. When a comparison was made for the time, space and quantity categories, more subjects were able to identify concepts on the Boehm Test of Basic Concepts than on the Synpro symbol identification test.

II. CONCLUSIONS

Based on the results of this study, and considering the restricted age range and the relatively small population of subjects, the following conclusions can be tentatively drawn:

1. Normal children identify pictures and symbols from named concept words better than cerebral palsied children.

2. Pictures representing concepts are easier to identify than abstract symbols representing concepts.

3. It is easier to represent some concepts than other concepts.

4. On the three major categories of concepts, space and time items are identified by more children for the Boehm Test of Basic Concepts, and space and quantity items are recognized by more children for the Synpro symbol identification test.

Suggestions for Future Study

1. To further chart the developmental sequence of abstract concepts, it is suggested that the Synpro symbol identification test

be administered to normal (and cerebral palsied) children between the ages of nine and twelve years.

2. The experimental design could be used to test other groups of children (e.g., children with learning disabilities, children with spina bifida) to determine if their performance is different from that of normal children on the two tests.

3. The environmental experiences of the cerebral palsied children could be analyzed to determine their relationship to concept identification.

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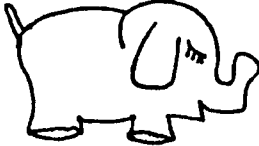
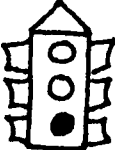
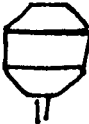
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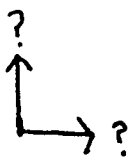
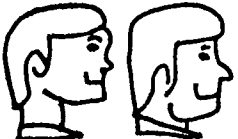
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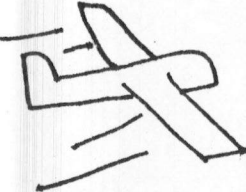
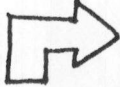
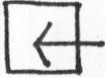
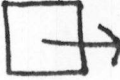
APPENDICES

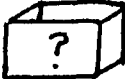
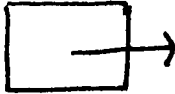
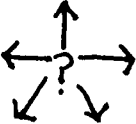
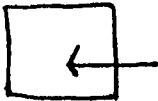
APPENDIX A

SYMBOLS AND REFERENTS

<u>Symbol</u>	<u>Referent</u>	<u>Symbol</u>	<u>Referent</u>
	read book		him
	time		her
	fruit		under
	more		over
	less		little
	a		big
	some		go
			stop

<u>Symbol</u>	<u>Referent</u>	<u>Symbol</u>	<u>Referent</u>
	he		this
	she		that
	it		how many
	they		which
	around		and
	beside		or
	here		if
	there		but
	men		is
	man		are

<u>Symbol</u>	<u>Referent</u>	<u>Symbol</u>	<u>Referent</u>
	on		hard
	off		soft
	full		slow
	empty		fast
	give		right
	love		left
	can't		up
	don't		down
	few		in
	many		out

<u>Symbol</u>	<u>Referent</u>	<u>Symbol</u>	<u>Referent</u>
	who		by
	what		through
	when		out of
	where		into
	girl		toward
	girls		from
	before		now
	after		then

APPENDIX B

RAW DATA

Listing of the subjects with chronological ages, Peabody Picture Vocabulary Test (PPVT) vocabulary recognition age scores and intelligence quotients, Boehm Test of Basic Concepts (BTBC) scores, and Synpro symbol identification (SSIT) scores.

<u>Cerebral Palsied Subjects</u>	<u>C. A. (months)</u>	<u>PPVT age score (months)</u>	<u>PPVT IQ</u>	<u>BTBC score</u>	<u>SSIT score</u>
S ₁	107	103	96	49	24
S ₂	116	85	77	39	49
S ₃	83	82	98	45	47
S ₄	97	103	106	47	62
S ₅	62	69	107	37	48
S ₆	70	75	103	38	50
S ₇	115	110	95	43	56
S ₈	109	107	100	46	58
S ₉	67	107	131	41	48
S ₁₀	106	107	100	47	56
<u>Normal Subjects</u>					
S ₁₁	73	107	131	48	60
S ₁₂	83	82	98	47	59
S ₁₃	76	105	129	46	57
S ₁₄	83	87	102	47	55
S ₁₅	73	99	123	49	69
S ₁₆	79	99	112	43	57
S ₁₇	79	80	96	47	50
S ₁₈	65	69	107	42	59
S ₁₉	90	101	104	47	58
S ₂₀	98	105	107	45	62

APPENDIX C

RESPONSE DATA—SYNPRO¹

Raw scores obtained from the cerebral palsied and normal subjects.

Correct Words (category)	Cerebral Palsied Subjects				Normal Subjects			
	1	2	3	4	1	2	3	4
1. now								
2. then (time)	3	<u>2</u>	2	3	2	<u>3</u>	2	3
3. is (quantity)	2	4	<u>1</u>	3	1	1	<u>3</u>	5
4. are								
1. him (pronoun)	<u>10</u>				<u>10</u>			
2. her								
3. here (space)			<u>3</u>	7			<u>9</u>	1
4. there								
1. beside								
2. around (space)	1	<u>7</u>	1	1		<u>8</u>	2	
3. who								
4. what (pronoun)			4	<u>6</u>	1		2	<u>7</u>
1. before (time)	<u>5</u>	2	2	1	<u>5</u>		3	2
2. after								
3. more								
4. less (quantity)	1	2		<u>7</u>	1			<u>9</u>
1. under								
2. over (space)	2	<u>8</u>			<u>10</u>			
3. time (time)		1	<u>9</u>				<u>10</u>	
4. read								

¹The row numbers (1, 2, 3, 4) correspond to the column numbers (1, 2, 3, 4) so that a (1:1) or a (2:2) correspondence indicates a correct answer. A (1:2) correspondence indicates that the second word was chosen for the first stimulus word. For example, three of the cerebral palsied subjects chose here and seven chose there when the stimulus word here was given. Nine of the normal subjects correctly identified here, while one chose there.

Correct Words	(category)	Cerebral Palsied Subjects				Normal Subjects			
		1	2	3	4	1	2	3	4
1. man (quantity)		<u>9</u>	1			<u>10</u>			
2. men									
3. if									
4. but (conjunction)				6	<u>4</u>			5	<u>5</u>
1. toward (space)		<u>6</u>	4			<u>7</u>	2		1
2. from									
3. full (quantity)			1	<u>8</u>	1			<u>10</u>	
4. empty									
1. how many									
2. which (space)		5	<u>3</u>	1	1	3	<u>7</u>		
3. girl									
4. girls (quantity)				1	<u>9</u>				<u>10</u>
1. it (pronoun)		<u>5</u>		3	2	<u>4</u>		1	5
2. they									
3. hard (adjective)			1	<u>5</u>	4			<u>6</u>	4
4. soft									
1. give (tran. verb)		<u>5</u>	4		1	<u>10</u>			
2. love									
3. right									
4. left (space)		1		3	<u>6</u>			2	<u>8</u>
1. she									
2. he (pronoun)			<u>10</u>				<u>10</u>		
3. in (space)				<u>9</u>	1			<u>10</u>	
4. out									
1. on									
2. off (space)		1	<u>9</u>				<u>9</u>		1
3. and									
4. or (conjunction)		1		3	<u>6</u>	1		2	<u>7</u>

Correct Words	(category)	Cerebral Palsied Subjects				Normal Subjects			
		1	2	3	4	1	2	3	4
1. empty (quantity)		<u>9</u>			1	<u>10</u>			
2. full									
e. before									
4. after (time)			4	2	<u>4</u>		2	6	<u>2</u>
1. read (intran. verb)		<u>10</u>				<u>10</u>			
2. time									
3. few									
4. many (quantity)				3	<u>7</u>				<u>10</u>
1. fast									
2. slow (adjective)		1	<u>9</u>			1	<u>9</u>		
3. now (time)				<u>4</u>	6			<u>5</u>	5
4. then									
1. into									
2. out of (space)			<u>9</u>	1			<u>10</u>		
3. is									
4. are (quantity)		2	1	2	<u>5</u>			2	<u>8</u>
1. don't									
2. can't (negated verb)		3	<u>7</u>			2	<u>8</u>		
3. right (space)			1	<u>7</u>	2			<u>7</u>	3
4. left									
1. and (conjunction)		<u>3</u>	4		3	<u>5</u>	5		
2. or									
3. love (tran. verb)				<u>10</u>				<u>10</u>	
4. give									
1. soft (adjective)		<u>5</u>	4		1	<u>6</u>	4		
2. hard									
3. man									
4. men (quantity)				2	<u>8</u>				<u>10</u>

Correct Words	(category)	Cerebral Palsied Subjects				Normal Subjects			
		1	2	3	4	1	2	3	4
1.	a (quantity)	<u>5</u>	1		4	<u>6</u>		2	2
2.	some								
3.	there (space)			<u>7</u>	3			<u>4</u>	6
4.	here								
1.	beside (space)	<u>10</u>				<u>10</u>			
2.	around								
3.	how many (quantity)		2	<u>8</u>				<u>8</u>	2
4.	which								
1.	when (time)	<u>3</u>	6	1		<u>3</u>	7		
2.	where								
3.	her (pronoun)	1		<u>9</u>				<u>10</u>	
4.	him								

APPENDIX D

RESPONSE DATA—BOEHM

Raw scores obtained from the cerebral palsied and normal subjects.

Concept (Category)	Cerebral Palsied Subjects		Normal Subjects	
	Correct	Incorrect	Correct	Incorrect
1. top (space)	10		10	
2. through (space)	10		10	
3. away from (space)	9	1	10	
4. next to (space)	10		10	
5. inside (space)	10		10	
6. some but not many (quantity)	10		10	
7. middle (space)	9	1	10	
8. few (quantity)	10		6	4
9. farthest (space)	9	1	10	
10. around (space)	10		10	
11. over (space)	10		10	
12. widest (quantity)	9	1	10	
13. most (quantity)	10		10	
14. between (space)	10		10	
15. whole (quantity)	9	1	8	2
16. nearest (space)	10		10	
17. second (quantity)	8	2	10	
18. corner (space)	9	1	10	
19. several (quantity)	10		10	
20. behind (space)	10		10	
21. row (space)	10		10	
22. different (adjective)	8	2	10	
23. after (time)	10		10	
24. almost (quantity)	3	7	7	3

Concept (Category)	Cerebral Palsied Subjects		Normal Subjects	
	Correct	Incorrect	Correct	Incorrect
25. half (quantity)	9	1	10	
26. center (space)	10		9	1
27. as many (quantity)	10		10	
28. side (space)	7	3	8	2
29. beginning (time)	7	3	9	1
30. other (adjective)	10		10	
31. alike (adjective)	10		10	
32. not the first or the last (quantity)	10		10	
33. never (time)	10		10	
34. below (space)	10		10	
35. matches (tran. verb)	10		9	1
36. always (time)	5	5	9	1
37. medium-sized (quantity)	6	4	9	1
38. right (space)	7	3	7	3
39. forward (space)	9	1	10	
40. zero (quantity)	10		10	
41. above (space)	10		10	
42. every (quantity)	10		10	
43. separated (space)	9	1	7	3
44. left (space)	6	4	8	2
45. pair (quantity)	3	7	3	7
46. skip (intran. verb)	6	4	10	
47. equal (quantity)	4	6	2	7
48. in order (space)	7	3	10	
49. third (quantity)	6	4	10	
50. least (quantity)	7	3	9	1

APPENDIX E

PERCENTAGE OF NORMAL AND CEREBRAL PALSIED CHILDREN IDENTIFYING CONCEPTS BY CATEGORY ON THE BOEHM TEST OF BASIC CONCEPTS (BTBC) AND THE SYNPRO SYMBOL IDENTIFICATION TEST (SSIT)

<u>Categories</u>	<u>Cerebral Palsied</u>		<u>Normal</u>	
	<u>BTBC</u>	<u>SSIT</u>	<u>BTBC</u>	<u>SSIT</u>
Space	91.7	69.2	95.2	85.4
Time	80	45	95	46.7
Quantity	80	75.3	85.5	87.3
Transitive verbs	100	75	90	100
Intransitive verbs	100	73	60	80
Negated verbs		55		70
Adjectives	93	77	100	85
Pronouns		80		85
Conjunctions		42.5		62.5
Nouns		90		100

Number of items in each category:

Space—Synpro (24), Boehm (23)
 Time—Synpro (6), Boehm (4)
 Quantity—Synpro (15), Boehm (18)
 Transitive verbs—Synpro (2), Boehm (1)
 Intransitive verbs—Synpro (3), Boehm (1)
 Negated verbs—Synpro (2)
 Adjectives—Synpro (6), Boehm (3)
 Pronouns—Synpro (8)
 Conjunctions—Synpro (4)
 Nouns—Synpro (2)

VITA

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