AN INVESTIGATION OF THE RELATIONSHIP BETWEEN THE OMISSION-ARTICULATION PATTERN AND NEUROLOGICAL IMPAIRMENT

By

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CHAPTER I

THE PROBLEM

During the past few years, specific learning disorders, thought to be neurological in nature, have emerged as a distinct area of research, education, and habilitation.

Myklebust (1964) explains that among the various types of learning problems are those evidenced by children who are unable to "...comprehend, speak, read, write, tell time, play, calculate, distinguish between right and left and relate well to others," (p. 354), who show no deficiencies in intelligence or emotional adjustment and whose sensory modalities appear to be functioning normally. In recent publications, much attention has been given to children who appear to be unable to learn to read and to children who evidence learning problems dealing with the comprehension and usage of verbal symbols. There has however, been little recognition or discussion in the literature concerning children with "severe articulation learning problems." An articulation problem, as defined by Van Riper (1963), includes "all those disorders characterized by the substitution, omission, addition and distortion of the speech sounds" (p. 19). Of the various types of articulation problems, the omission-type error has traditionally been judged to be more severe than substitution or distortion-type errors, and is most likely to interfere with intelligibility (Jordan, 1960).

Silverstein (1967) and Renfrew (1966) have described an articulation syndrome characterized by the omission of many constant phonemes in the medial and final positions in words. In addition, Silverstein noted that the individuals with the omission-type pattern evidenced short auditory memory spans, hyperactivity, distractability, short attention spans, and case histories which suggested the possibility of brain damage.

> Because the symptomatology found in so many of these cases suggested brain damage, and since this differential diagnosis was frequently supported by case history information, the constellation of symptoms described...has been variously referred to by the author as a "neurological syndrome" or as an "aphasoid type articulation disorder," but perhaps can be best understood as an articulation learning disability resulting from mild cerebral dysfunction (Silverstein, 1967, p. 4).

Locke (1968) states that measurement of severity of an articulation problem is made more accurate by assessing error types, rather than by merely counting number of defective sounds as is often done in articulation research. Investigators have often neglected to differentiate between various types of articulatory errors. They frequently categorize all articulation-defective subjects into one group without adequately describing the population under study. It is to the speech pathologist's advantage to be fully aware of and to describe the entire scope of an individual's speech difficulty.

Since the child with many omission-type errors is often completely unintelligible and since he appears to be unresponsive to most conventional therapy approaches (Renfrew, 1966; Silverstein, 1967), it was felt that the child with this type of problem warrants special study in exploring the possible etiological factors and behavioral characteristics underlying this persistent articulation disability. Therefore, the purpose of this study is to further investigate the relationship between the omission articulation syndrome and possible neurological involvement.

CHAPTER II

REVIEW OF THE LITERATURE

This chapter is devoted to a selected review of the previous investigations concerning normal speech sound development, the omission-type articulation disorder, and psychological measuring devices which are commonly used in the diagnosis of brain injury. The hypotheses formulated for this study are also included.

Normal Acquisition of Consonant Sounds

Before a discussion of defective articulation ensues, one must look at the normative data for consonant development. A normative gauge is needed as a point of reference with which a child's speech level can be compared. If a child's articulation ability lags behind the norm, then it can be considered atypical (Metraux, 1950).

Irwin has conducted one of the most extensive studies dealing with the acquisition of consonant sounds in the newborn infant up to two and one half years of age. Irwin (1947) analyzed the development of consonant sounds as they emerge during infancy. Table I displays each consonant sound as a proportion of the total sound production of an infant at a given age level. Each age level consists of a two month period, i.e., level one consists of months one and two, level three consists of months five and six, and so on. As shown in Table I, the velar (/k/, /g/) and glottal (/h/, /ʔ/) sounds are the first to appear

TABLE I

CONSONANT PHONEME PERCENTAGES DURING INFANCY

Age Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Adult*
p	.10	.20	.30	1.13	.67	1.63	1.07	2.10	1.27	2.73	4.17	4.32	3.57	3.63	4.47	2.41
b	.19	1.54	2.50	4.47	7.97	9.79	9.48	11.95	14.95	13.38	13.52	8.97	8.81	7.34	7.64	3.18
m	.21	.66	3.07	5.21	7.53	6.69	9.23	5.74	5.43	7.38	8.45	8.41	7.14	7.29	7.99	4.47
w	.07	1.10	1.49	.96	2.64	3.31	4.36	4.55	7.02	4.61	5.19	6.42	5.77	3.83	3.31	2.99
ʍ					.02	.08	.34	.05	.04	.15	.20	.03	.21	.11	.20	.60
f			.27	.56	.73	.37	.45	.47	.63	.81	1.37	1.18	2.19	1.73	1.79	3.48
v		.16	.16	.90	1.22	1.03	.44	.42	.29	.49	.29	.52	.68	.57	.63	2.52
θ		.40	.39	.49	1.49	.85	.67	.38	.29	.36	.11	.36		.06	.14	1.06
ð		.37	.34	.30	.17	.34	.43	.30	.36	.56	.61	.61	.68	.62	1.70	5.13
t	.17	.39	.22	1.05	1.68	4.34	3.96	4.14	4.61	5.57	7.43	8.31	10.12	11.17	11.68	11.66
d		2.64	2.06	6.46	15.73	20.58	19.42	20.04	20.56	18.45	15.07	15.31	14.25	16.20	13.98	8.28
n	.14	.35	.52	1.68	1.03	2.65	2.07	3.11	5.38	7.89	8.85	9.74	9.31	10.07	9.49	11.85
s		.05	.20	.17	1.65	3.45	2.81	3.08	3.59	3.51	6.06	7.42	7.98	8.11	6.87	7.54
z		.07		.12	5.21	.56	.69	1.23	1.00	1.14	.65	.51	.58	.23	.41	3.48
ʃ	.17	.09	.02		.33	.37	.25	.29	.41	.50	1.08	.84	1.40	.93	.82	1.64
ʒ				.12		.10		.02	.11	.04	.07	.09	.07			.67
ɚ	.21	.99	.23	.51	1.37	.96	.57	1.57	1.04	1.47	1.93	2.08	2.51	3.06	3.37	6.32
r			.15			.10	.18	.53	1.09	.99	1.54	2.67	3.96	4.12	4.64	10.51
j		.72	1.12	1.14	2.15	1.77	3.78	2.29	1.95	2.80	1.64	1.73	1.69	2.04	1.50	1.89
ç		.09		.06	.16	.06	.11	.29		.02			.06	.09	.10	
ŋ		.26	.17	.80	.03	.33	.31	.03	.14	.42	.31	.62	.84	.99	.48	1.68
k	8.80	2.78	4.90	2.05	1.82	2.12	2.36	2.76	2.73	4.04	6.04	4.36	6.74	6.16	6.98	4.15
g	2.79	11.73	7.46	5.43	4.12	4.15	4.91	5.55	5.17	4.46	4.47	2.67	3.33	3.18	4.05	1.75
x		.04	.10	.01	.14	.08	.05		.02	.09	.04		.07	.03		
h	44.22	59.88	61.93	57.87	41.29	31.77	29.75	26.69	20.75	16.29	9.84	10.93	7.53	8.14	7.65	2.66
ʔ	42.91	15.48	12.41	8.51	5.84	2.52	2.31	2.19	1.12	1.85	1.07	1.90	.44	.22	.07	

*Voelker data. (Irwin, 1947, p. 398)

during the first two months of life. They comprise approximately 99% of the one-to-two month-old infant's sound repertoire. As other consonant types increase in usage, the velar and glottal sounds decrease. By the age of twenty-nine or thirty months, the child is approximating the frequency of adult consonant usage.

Irwin (1951) analyzed the development of consonant sounds according to each of the three word positions in which they may occur--initial, medial, and final. He found that initial consonants occur more frequently than medials and finals, and medials more frequently than finals. Initial consonants begin to emerge at about one month and develop at a consistent rate. Final consonants are infrequent in the speech of the zero to six-month-old infant but their development accelerates remarkable during the period from eighteen months to three years. Medial consonants are used more frequently than finals with their major growth taking place during the first one and one half years of life. The development of the consonant sounds during the first two and one half years of life are illustrated in Figure 1.

Metraux (1950) found that by the age of two years, many initial and final consonants are present, but most medials are omitted. By the age of four and one half, the consistent correct usage of medial and final sounds is beginning to emerge.

Templin (1957) studied the articulatory responses to a picture articulation test of 480 children, aged three to eight years. She made a comparison of the ages at which 75% of her subjects correctly produced specific consonant sounds and compared these with the findings of Poole (1934) and Wellman (1936). Table II presents the comparison of

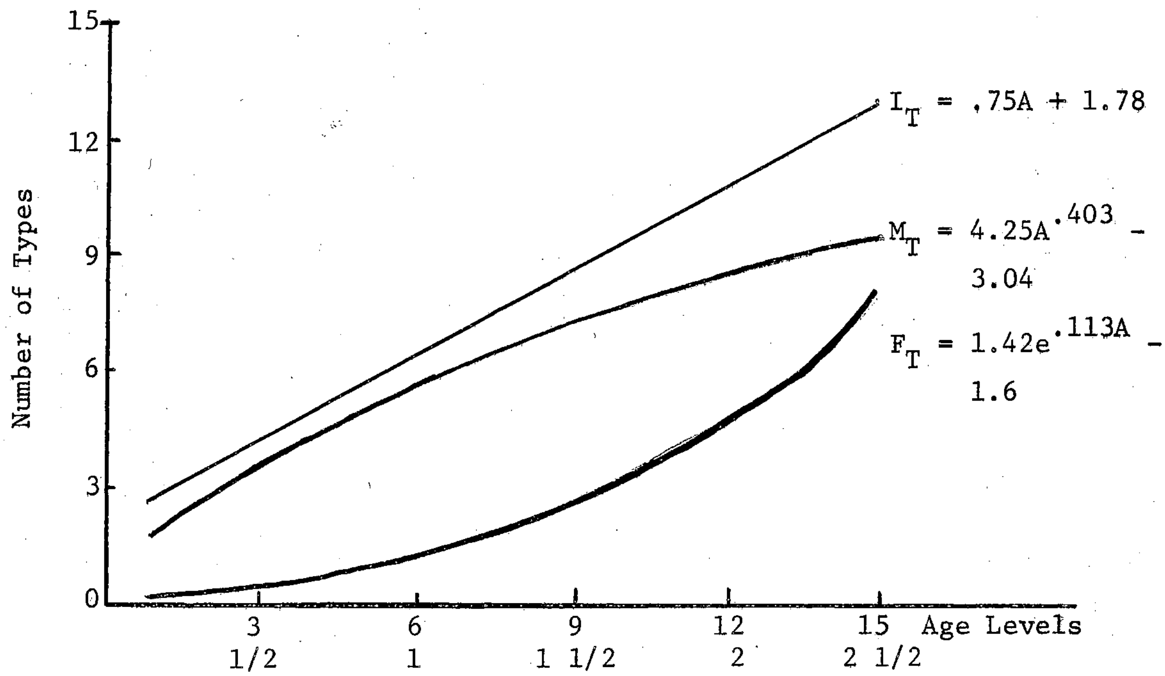

Figure 1. Development of Consonants in Three Positions, Initial, Medial, and Final, During the First Two and One Half Years of Life (Irwin, 1951, p. 161)

TABLE II

COMPARISON OF THE AGES AT WHICH 75 PER CENT OF THE SUBJECTS CORRECTLY PRODUCED SPECIFIC CONSONANT SOUNDS IN THE TEMPLIN, THE WELLMAN, AND THE POOLE STUDIES

	Age Correctly Produced				Age Correctly Produced		
Sound	Templin	Wellman	Poole	Sound	Templin	Wellman	Poole
m	3	3	3.5	r	4	5	7.5
n	3	3	4.5	s	4.5	5	7.5†
ng	3	–*	4.5	sh	4.5	–+	6.5
p	3	4	3.5	ch	4.5	5	– +
f	3	3	5.5	t	6	5	4.5
h	3	3	3.5	th	6	–*	7.5†
w	3	3	3.5	v	6	5	6.5†
y	3.5	4	4.5	l	6	4	6.5
k	4	4	4.5	~~th~~	7	–+	6.5
b	4	3	3.5	z	7	5	7.5†
d	4	5	4.5	zh	7	–+	6.5
g	4	4	4.5	j	7	6	– +
				hw	–*	–*	7.5

*Sound was tested but was not produced correctly by 75 per cent of the subjects at the oldest age tested. In the Wellman data the "hw" reached the percentage criterion at 5 but not at 6 years, the medial "ng" reached it at 3, and the initial and medial "th" and "~~th~~" at 5 years.

†Poole, in an unpublished study of 20,000 preschool and school-age children reports the following shifts: "s" and "z" appear at 5.5 years, then disappear and return later at 7.5 years or above; "th" appears at 6.5 years and "v" at 5.5 years.

+Sound not tested or not reported.

(Templin, 1957, p. 53)

findings regarding phoneme development as found by these three investigators.

Although reports on developmental age levels for the acquisition of consonant sounds are at times inconsistent, a general heirarchical pattern of development does exist. It was generally concluded that the glottal and velar sounds were the first to emerge, the glottals being sharply reduced in frequency by the third month of life. At about the age of two and one half years, children begin to approximate the frequency with which adults use specific consonant sounds. By the time a child has reached the age of five, he should be correctly producing the majority of consonant phonemes.

The frequency of error types in young children was examined by Snow (1963). She tested the articulation abilities of 438 first-grade children who had not received speech therapy. A total of 60,337 speech responses was elicited through the use of a picture articulation test. She found that only one percent of the total speech responses obtained from this population were of the omission type. The greatest number of error responses was the substitution of sounds. Substitutions comprised 8.3%, moderate distortions 1.8%, omissions 1.0% and severe distortions 0.5% of the total speech responses obtained.

The omission-type error seems to be related to the position of the sound in the word. Templin (1957) found that errors of omission in all word positions were less frequent than distortion and substitution errors and that omission errors decreased with increasing age. Omission errors were also found to increase from the initial position to the medial to the final position at all age levels studied. At the age of five, only 2.2% of initial consonants were omitted, 2.4% of medials were omitted and 20.1% of finals were omitted.

It appears that most consonant sounds are being used in the initial, medial, and final positions in words by the age of five, although there is still a tendency to omit some final sounds. The omission of sounds is one of the most infrequent types of articulation errors made in a "normal" population. However, when it does occur, it is more likely to occur in the final position than in any other. In summary, it appears that a child's articulation pattern is becoming fairly well established by the age of five, with some spontaneous changes occurring after that age.

The Omission Articulation Syndrome

Very often in the area of speech pathology, the clinician encounters various _patterns_ or _syndromes_ of defective articulation. Webster (1968) defines _pattern_ as "definite direction, tendency, or characteristics" (p. 1073) and _syndrome_ as "a number of symptoms occurring together and characterizing a specific disease" (p. 1479). Prins (1962a) and Silverstein (1968) suggested that a variety of articulation syndromes exist, which include not only speech variables, but other nonspeech variables as well. Wepman (1963) stated, "We use the acquisition of sounds (articulatory development) to demonstrate _patterns_ found in cleft palate, mentally retarded, emotionally disturbed, and so forth" (p. 12). It is therefore, advantageous to recognize and identify particular characteristics or signs of defective articulation which may fall into a pattern. A total evaluation of an articulation-defective individual usually reveals important information. It has been suggested that factors such as language abilities, motor skills, auditory memory span and others may be related to articulation difficulties and their persistence (Dickson, 1962; Vandemark and Mann, 1965; Irwin, West and Trombetta, 1966). Diagnostic and remediation procedures will thus be enhanced if the clinician is fully aware of the entire scope of the individual's difficulty and if he is able to pull the pieces together into a coherent picture.

Powers (1957) and Van Riper (1963) have identified and described an articulation disorder characterized by consonant omissions and substitutions which they call "infantile perseveration." Powers states

> If a child's speech immaturity is confined largely to omissions and substitutions, if he has learned to rely mainly on speech as his means of communication, if there is considerable output of speech, if the onset of speech has been fairly typical, if he attempts sentences as well as words and phrases, his speech deviation can best be referred to as infantile perseveration (p. 718).

Renfrew (1966) and Silverstein (1967), as mentioned earlier, have identified a defective articulation syndrome characterized by the omission of many consonant sounds in the medial and final positions. The individuals with the omission pattern

> reveal very few consonant sounds which are normally articulated and those sounds which are correctly produced are usually sounds found early in the normal developmental sequence and are produced correctly primarily in the initial positions (Silverstein, 1967, p. 1).

Silverstein identified this pattern in 26% of all the "functional" articulation-defective individuals seen in a clinic setting, indicating that this type of problem occurs fairly often within a clinic population.

> These were children and adults whose defective articulation could not be etiologically related to hearing impairment, intellectual deficit, emotional maladjustment, poor speech environment, or organic defects involving the peripheral speech mechanism (Silverstein, 1967, p. 1).

Seventy-two percent of the population displaying the omission syndrome were males and ages ranged from three years to forty-two years. The mean total percentage of omissions was 35% of the sixty-two consonant positions tested, with little variation among age levels. In some cases, there was a tendency to omit the initial semivowels, to distort vowels, and to voice the voiceless stop-plosives in the initial position. Renfrew (1966) also noted that these individuals frequently distorted vowels. Renfrew and Silverstein (1967) observed that these children were usually quite talkative and appeared to be relatively unaware of their communication difficulties. This characteristic was also noted by Powers (1957) in describing "infantile perseveration."

The case histories of children with omission errors revealed significant information concerning the possibility of brain injury. Silverstein found presumptive evidence of brain injury in 44% of the case histories of individuals with the omission syndrome, and considered this a low estimate of the actual occurrence. The most typical positive history factors reported were febrile illness, premature delivery, difficult pregnancy, long or difficult labor and convulsions. Blaunstein (1967) found significantly more factors suggestive of brain injury in the case histories of the omission group as compared to the substitution-distortion group. These factors included childhood diseases and familial speech problems.

Blaunstein (1967) studied the occurrences of abnormal electroencephalographic signs (assymetry, slowing, rhythm, voltage, spikes, etc.) in a small group of children with sound omissions and a comparable group with substitutions and distortions. She found that more abnormal EEG signs occurred in the group of children with multiple omissions of consonant sounds than in the group of children with substitutions and distortions of sounds.

Memory span appears to be related to the omission-type disorder. Silverstein found that the major portion of his population had auditory memory spans for digits below their age norms. Scott (1967) and Blaunstein (1967) however, found that children with omissions did not differ significantly in digit span from those children who committed substitution and distortion errors, but that both types of articulation-defective children were lower than normal-speaking children. Even though Scott's results did not reach statistical significance, a higher percentage of the omission group subjects had shorter memory spans for digits than did the substitution-distortion subjects.

The results of a study by Prins (1962a) indicated that children who had a large proportion of omission-type errors were of low socioeconomic status compared to children who interdentalize the /s/ and /z/ and to children who substitute phonemes. The omission group was also depressed in intelligence, as measured by a receptive vocabulary test, in a diadochokinetic motor activity, and in digit span. He also indicated that children with the omission pattern displayed one of the most extreme forms of "infantile perseveration," i.e., included in the articulation pattern of many of these children was a high proportion of glottal stops and glottal fricatives. It was noted by Irwin (1947) that the glottal stop comprises 40-50% of the total sounds produced by the infant during the first two months of life and then drops off to less than three percent by one year of age.

Children with the omission syndrome have been identified and described as a clinical entity. In summary, many of these children, in addition to their handicapping speech difficulties, present a variety of complicating attributes described by the above investigators, some of which point to the possibility of neurological involvement.

Psychological Indicators of Organicity:
The Bender-Gestalt Test

There are many psychological measurement tools used in the diagnosis of organic involvement. One of the most frequently and confidently used tests when the question of neurological damage arises is the Bender Visual Motor Gestalt Test developed by Lauretta Bender. Tolor and Schulberg (1963) write, "Perhaps no other single psychological test has held as much promise for assisting the diagnostician in making an organic evaluation as has the Bender-Gestalt Test" (p. 106). The Bender-Gestalt Test consists of a set of nine designs. Each design is presented individually to the subject and he is asked to copy it on a sheet of blank paper. No time limit or restrictions are imposed upon the subject during the test. The designs are presented in Figure 2.

The rationale for use of the Bender-Gestalt Test as a clinical tool in determining the presence of brain injury is best stated by Bender herself (1949, p. 165 in Tolor and Schulberg, 1963, pp. 4-5).

> The organism has a "gestalt function" which is defined as that function of the integrative organism whereby it responds to a given constellation of stimuli as a whole, the response being a constellation or pattern or gestalt which differs from the original stimulus pattern by the process of the integrative mechanism of the individual who experienced the perception. The whole setting of the stimulus and the whole integrative state of the organism determines the pattern of response.

The test was designed to explore an individual's performance in the visual-motor gestalt function, his responses representing his attempts "to integrate a percept into an acceptable pattern" (Tolor and

Schulberg, 1963, p. 17).

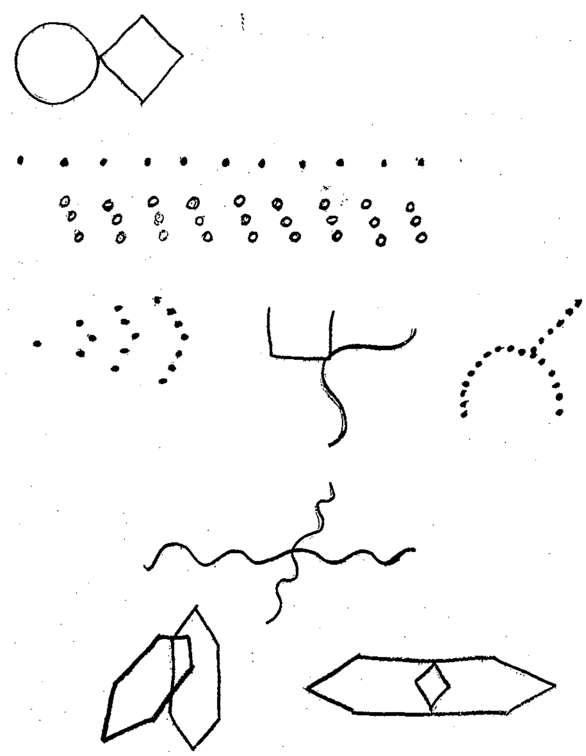

Figure 2. Nine Figures of the Bender-Gestalt Test (Bender, 1938)

Koppitz (1964) states that visual-motor perception includes four basic steps or processes. The first is vision or the end-organ sensation of seeing a stimulus. Second is perception or understanding what has been seen. Third is expression, or translating the perception into a motor act, and fourth is coordination, or the integration of the motor act.

In normal perception, the whole or gestalt is recognized immediately and its parts in relation to it and to each other. Perception occurs instantaneously with no need to examine details. One may speak of this principle also in terms of figure-ground distinctions. In normal perception, a figure or whole is perceived as a foreground, standing out from a background. Children who have perceptual disturbances are unable at times to perceive the whole as an entity. One or more parts of the whole may stand out and reduce the other parts to "background status." The child therefore has difficulty in establishing figure-ground relationships (Strauss, 1951).

Clements and Peters (1962) describe the perceptual-motor deficits often seen in children with known brain dysfunction.

> Printing, writing, and drawing poor; poor and erratic performance when copying geometric figures (Bender Visual Motor Gestalt); often the child attempts to compensate for the latter by task perseverance and/or innumerable and meticulous tiny strokes of the pencil; often has difficulty in reproducing geometric designs with blocks; difficulty with figure-ground and/or whole-part discrimination (p. 69).

The Bender Gestalt Test can detect deviations in visual-motor perception. It can also differentiate between disturbances of visual perception and motor expression if only one or the other is present. However, most young children who are neurologically impaired show disturbances in both the receptive or visual perceptual areas as well as in the expressive or motor areas of the cortex (Koppitz, 1964).

Pascal and Suttell (1951) point out that brain-injured persons tend to show more immaturity and more primitive features in reproducing the designs than do "normal" persons. M. L. Hutt in Tolor and Schulberg (1963) describes the most important response features of organic brain-damage cases: "partial rotations, vagueness and sketchiness, exclamations and behavior involving impotency, perplexity and incompetence, marked perseveration, loss of detail, fragmentation, difficulty with acute angles, concreteness and over-simplification, and overlapping" (p. 109).

Koppitz (1964) obtained normative data on the Bender-Gestalt Test with 1,055 school children between the ages of five and ten in various urban and rural areas. She states that brain-injured children, regardless of intelligence level, performed more poorly on the Bender than did their non-organic counterparts. Table III illustrates the differences found between brain-injured and non-brain-injured subjects.

TABLE III

BENDER PERFORMANCE OF BRAIN INJURED SUBJECTS AND CONTROLS

	Brain Injured		Controls			
Age	Good Bender	Poor Bender	Good Bender	Poor Bender	Chi-square	P
5 & 6	0	10	23	7	15.04	<.001
7	5	21	58	16	26.00	<.001
8	2	28	64	16	45.88	<.001
9	2	21	46	17	25.71	<.001
10	0	14	23	11	15.56	<.001

(Koppitz, 1964, p. 75)

Specific signs, distortions, and deviations in performance differentiated the brain-injured from the non-brain-injured children.

Quast (1961) tested the validity of the Bender as an indicator of organic involvement in ten to twelve-year old children. It should be noted that the attempted differentiation was not between children known to be organically impaired as compared to known non-organics, but between children in whom brain damage was only suspected and children with emotional disturbances without suspected brain damage. The suspected organic group scored significantly more poorly on the Bender than did the non-suspected group.

In a study by Peterson (1965) concerning the relationship between visual perception and articulation problems, it was found that those children with "poor" articulation performed "unsatisfactory" on a task of visual-motor perception (Minnesota Perçepto-Diagnostic Test). Those children with "good" articulation performed "satisfactory" on the visual-motor task. Retests one year later with the two groups of children resulted in even more dichotomous groupings.

Psychological Indicators of Organicity: Behavioral Characteristics of Brain-Damaged Children

Lack of behavioral control, both general and specific, is one of the most outstanding characteristics of brain-injured children (Wepman, 1963). As Strauss (1951) indicated, brain-injured children are often distracted by insignificant details of an individual stimulus or by other nonsignificant stimuli within a stimulus field. When this occurs, the child has difficulty in controlling specific and general behavior patterns in learning and/or interpersonal relationships. He becomes distractible, hyperactive, and his attention span for matters-at-hand shortens.

Although diagnosis of brain injury is based upon many factors, there are some recognizable signs that have been observed in brain-damaged individuals (Benton, 1962; Clements and Peters, 1962; Richardson, 1966; Zedler, 1966).

Benton (1962) describes some of the behavioral characteristics of children with brain damage: inconsistency in performance level, social and/or educational deficits, hyperactivity or impulsivity, visuoperceptive and/or visuo-motor disabilities, and deficiencies in ability to reason with both verbal and nonverbal materials.

Zedler (1966) investigated the proposition that children with suspected neurological damage could be identified and selected for medical, neurological, and psychological testing by a screening device developed from the Wechsler Intelligence Scale for Children and from observations of the subjects' behavior. A population of 113 academic underachievers was chosen to undergo the screening process. On the basis of the results of the screening process and evaluations made by a medical team, the following behavioral observations were considered to be significant in detecting children with a high risk of neurological impairment: open mouth (not mouth breathing); lateral deviation or protrusion of the tongue, especially when engaged in manual activities; nystagmus; lethargic facial expression; intermittent periods of stupor and alertness; inappropriate confusion or apprehension; substitution of speech sounds in words; speech slurred (usually omission of unstressed syllables); reversal or transposition of sounds and syllables; problems in naming;

errors in sentence structure; excessive use of words in attempting to communicate. Observations of the behavior of brain-damaged children have provided diagnostic cues which the careful observer might recognize in children with learning or behavior problems.

Summary of the Review

1. Children have acquired the majority of consonant phonemes in all word positions by the age of five.

2. Errors of omission occur relatively infrequently in the speech of five year-old children.

3. There is a recognizable clinical entity of children whose speech is characterized by the omission of most medial and final consonant phonemes, who appear to have normal intelligence and hearing, a stimulating environment, no emotional problems or peripheral nervous system damage.

4. Children with the omission pattern evidence other characteristics such as hyperactivity, short attention span, short auditory memory span, and case history factors that can be related to birth injury or early trauma, all of which suggest the possibility of central nervous system injury.

5. The Bender-Visual Motor Gestalt Test has proved to be an effective instrument in diagnosing organic involvement.

6. There are certain behavioral symptoms observed in individuals with known brain damage and in individuals with suspected brain damage. Among other factors, these include hyperactivity, short attention span, and short auditory memory span. These characteristics have been used to describe the children with the omission articulation syndrome.

7. It has been previously hypothesized that the children with the omission syndrome suffer from mild cerebral impairment.

On the basis of the information cited, the following hypotheses were formulated to further investigate the relationship between the omission articulation syndrome and possible neurological dysfunction:

1. Null Hypothesis: There is no significant difference between the means on the Bender-Gestalt Test of children who omit consonant phonemes, children who substitute and distort phonemes, and normal-speaking children.

Alternate Hypothesis: There is a significant difference between the means on the Bender-Gestalt Test of children who omit phonemes, children who substitute and distort phonemes, and normal-speaking children.

2. Null Hypothesis: There is no significant difference between the mean number of behavioral signs, characteristic of brain-injured individuals, of children who omit phonemes, children who substitute and distort phonemes, and normal-speaking children.

Alternate Hypothesis: There is a significant difference between the mean number of behavioral signs, characteristic of brain-injured individuals, of children who omit phonemes, children who substitute and distort phonemes, and normal-speaking children.

CHAPTER III

METHOD AND PROCEDURE

Selection of Subjects

A total of 30 subjects, ten in each group, served in this study. Children in the kindergarten, first and second grades from six small towns (Perry, Cushing, Cleveland, Guthrie, Drumright, and Yale) in the vicinity of Stillwater, Oklahoma were included. These towns were chosen because there was no speech therapist serving in these school systems. This eliminated the variable of altered speech patterns as a result of speech therapy. These towns were randomly ordered using a table of random digits (Runyon and Haber, 1967) and testing was carried out in the order in which the towns appeared. In addition, kindergarten children from the Stillwater public school system were included. Children in the first and second grades in the Stillwater public school system were omitted from this study because of an active speech therapy program for those grades.

All children with speech problems, as referred by the classroom teacher, in the kindergarten, first and second grade were screened. The children evidencing severe speech difficulty were further tested to determine the type and extent of their problems. Three groups of subjects were formed on the basis of their articulation patterns:

Group I: those subjects evidencing nine or more omissions of sounds that should normally be present in children of their chronological age, based upon Templin's normative data (1957).

Group II: those subjects evidencing nine or more substitutions and/or distortions, and five or less omissions of sounds that should normally be present in children of their chronological age, based upon Templin's normative data (1957).

Group III: normal-speaking children; i.e., no sound at or below the child's age level was misarticulated, according to Templin's normative data (1957).

(These groups will be referred to as Groups I, II, and III in the following chapters.) Since the number of individuals in Group III greatly exceeded those in Groups I and II, Group III subjects were selected for inclusion on a random basis according to Runyon and Haber's table of random digits (1967), so that the number of normal-speaking children from each school equalled the number of children in the omission group from each school.

Inclusion in this study was based upon the following criteria:

1. that hearing in the better ear be within normal limits, as assessed by an audiometric sweep check at 20 dB HL ISO 1964 at 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, and 4000 Hz;

2. that intelligence, as measured by the Peabody Picture Vocabulary Test (Form A) be within the normal range, considered to be 90 or above;

3. that structure and function of the oral mechanism be adequate for speech, as evaluated by a peripheral-oral examination.

Instrumentation

Articulation was assessed by the Speech Articulation Test for Young Children (revised edition) by Merlin J. Mecham (1959). A Beltone Model 9C portable audiometer was used to screen hearing. Intelligence was assessed through use of the Peabody Picture Vocabulary Test (Form A) (Dunn, 1959).

Two measures for assessing organicity were used. The Bender Visual Motor Gestalt Test (Bender, 1938) served as a measure of visual-motor perception. It was scored according to Koppitz's scoring system (1964, pp. 15-32). The second measure was a checklist of behavioral characteristics evidenced by children with minimal cerebral impairment as reported by Clements and Peters (1962) and Zedler (1966). This checklist was compiled by the author for the teacher's use (Appendix A).

Procedure

All testing was carried out by the author. The Speech Articulation Test for Young Children (Mecham, 1959) was administered to each child evidencing great speech difficulty during the screening process. Each child was then assigned to either Group I or Group II, based upon the type and extent of his articulation problem, as discussed earlier. Hearing, intelligence, and the peripheral-oral structure and function were examined. If the child failed to meet any one of these three criteria, as described earlier, he was omitted from the study.

Two performance measures were used to assess the possibility of neurological impairment. The Bender-Gestalt Test (Bender, 1938) was administered to each child according to the instructions by Koppitz

(1964, p. 15). Time for completion of the test was recorded. Each child was requested to write his name on the back of his Bender protocol, so that a "blind" scoring procedure could be employed. This procedure will be discussed in the next chapter.

Behavior checklists were given to the teachers of all the children included in this study. The teachers were instructed to respond to the behavioral characteristics listed. If a certain behavior characteristic had been noted as being present in that particular child's behavior pattern, the teacher was instructed to answer "yes." If the characteristic was noted as being absent, she was to answer "no." If she was unaware or unsure of the presence or absence of a particular characteristic, she was to answer D.K. (don't know). Self-addressed stamped envelopes were provided for convenient mailing to the examiner after completion of the checklist.

A list of all kindergarten, first, and second-grade children not included in either Groups I or II was compiled. An equal number of normal-speaking children was then randomly chosen from this list to match the number of children in the omission group found in each school. Articulation was assessed, and the subjects evidencing no articulatory errors at or below their age level were placed in Group III. The same three criteria (hearing, intelligence, structure and function of the oral mechanism) were imposed on these subjects for inclusion in the study. An identical testing procedure was followed with the Group III subjects as had been previously employed with Group I and Group II subjects.

CHAPTER IV

RESULTS

This chapter is concerned with the presentation of the results of the data accumulated in this study. Two hypotheses were formulated (Chapter II, p. 21) and tested. To facilitate analysis of the data, each hypothesis will be presented separately with the statistical procedures employed to test it. A discussion of the statistical methods used, presentation of the data, and the statistical computations employed in testing each hypothesis will reveal whether a particular hypothesis sould be rejected or not rejected.

The first hypothesis attempted to determine whether any differences in performance on the Bender-Gestalt Test existed between children who primarily omitted consonant phonemes, children who primarily substituted and distorted consonant phonemes, and children who produced consonant phonemes correctly. The following is the first such hypothesis considered in this investigation:

Null Hypothesis: There is no significant difference between the means on the Bender-Gestalt Test of children who omit consonant phonemes, children who substitute and distort phonemes, and normal-speaking children.

Alternate Hypothesis: There is a significant difference between the means on the Bender-Gestalt Test of children who omit phonemes, children who substitute and distort phonemes, and normal-speaking children.

In analyzing the Bender protocols, a "blind" scoring method was employed by this author. Each child's Bender protocol was numbered on the back of the paper. The protocol's from all three groups were shuffled together. Each subject's protocol was scored for errors according to the scoring system for young children developed by Elizabeth Koppitz (1964). The author had no knowledge of whose protocol she was scoring at the time. A score was obtained from which the mean normative score for that particular age group (Koppitz, 1964, p. 188) was subtracted.

A Kruskal-Wallis One-Way Analysis of Variance by Ranks was used in analyzing the data to test this hypothesis. The scores were ranked from low to high for the total experimental sample. Tables IV and V reveal the rankings and statistical computation for the Bender-Gestalt Scores.

TABLE IV

BENDER-GESTALT TEST SCORES OF CHILDREN WITH THREE TYPES OF SPEECH PATTERNS

Group I omission	Group II substitution-distortion	Group III normals
.2	5.6	2.3
3.6	- .7	3.2
3.2	7.2	5.2
5.6	11.2	-1.8
-1.8	- 1.4	5.2
.6	6.6	-1.7
7.2	- 1.4	-3.7
3.2	6.2	-2.4
1.2	- 5.8	3.2
-4.6	.6	6.2

TABLE V

BENDER-GESTALT TEST RANKS OF CHILDREN WITH THREE TYPES OF SPEECH PATTERNS

Group I omission	Group II substitution-distortion	Group III normals
11	23.5	15
20	10	17.5
17.5	28.5	21.5
23.5	30	5.5
5.5	8.5	21.5
12.5	27	7
28.5	8.5	3
17.5	25.5	4
14	1	17.5
2	12.5	25.5
$R_1 = 152.0$	$R_2 = 172.0$	$R_3 = 138.0$

$$H = \frac{12}{N(N+1)} \sum_{j=1}^{k} \frac{R_j^2}{n_j} - 3(N+1)$$ where $N = 30$, $n_1 = n_2 = n_3 = 10$, and $k = 3$

$$H'_{calc} = \frac{H}{1 - \frac{\Sigma Ti}{N^3 - N}}$$

$P(H' \geq .9041) = .62 \rightarrow$ Do not reject the null hypothesis of equal means.

The second hypothesis attempted to determine the significance of the number of behavioral characteristics present among the three groups of children. The following is the second hypothesis considered in this investigation:

Null Hypothesis: There is no significant difference between the mean number of behavioral signs, characteristic of brain-damaged individuals, of children who omit phonemes, children who substitute and distort phonemes and normal-speaking children.

Alternate Hypothesis: These is a significant difference between the mean number of behavioral signs, characteristic of brain-injured individuals, of children who omit phonemes, children who substitute and distort phonemes, and normal-speaking children.

The behavior checklist consisted of forty-nine items. The items listed were behaviors reported to be evidenced by brain-injured children; therefore, a "yes" answer to an item was considered a positive indicator of possible neurological damage. The number of "yes" responses for each child was counted.

The Kruskal-Wallis One-Way Analysis of Variance by Ranks was employed to determine whether or not any difference existed betseen the three groups of subjects in behavior manifestations. Tables VI and VII illustrate these findings.

TABLE VI

NUMBER OF BEHAVIORAL CHARACTERISTICS, INDICATIVE OF NEUROLOGICAL DAMAGE, OF CHILDREN WITH THREE TYPES OF SPEECH PATTERNS

Group I omission	Group II substitution-distortion	Group III normals
31	26	2
29	16	11
8	18	2
15	29	12
15	1	11
26	24	1
12	20	0
17	17	0
8	14	9
10	18	4

TABLE VII

RANKS OF THREE GROUPS OF CHILDREN IN BEHAVIORAL CHARACTERISTICS, INDICATIVE OF NEUROLOGICAL DAMAGE

Group I omission	Group II substitution-distortion	Group III normals
30	26.5	5.5
28.5	19	12.5
8.5	22.5	5.5
17.5	28.5	14.5
17.5	3.5	12.5
26.5	25	3.5
14.5	24	1.5
20.5	20.5	1.5
8.5	16	10
11	22.5	7

TABLE VII (Continued)

Group I omission	Group II substitution-distortion	Group III normals
R_1 = 183.0	R_2 = 208.0	R_3 = 74.0

$$H = \frac{12}{N(N+1)} \sum_{j=1}^{k} \frac{R_j^2}{n_j} - 3(N+1)$$

$$H'_{calc} = \frac{H}{1 - \frac{\Sigma Ti}{N^3 - N}}$$

$P(H' > 13.134) < .005 \rightarrow$ Reject null hypothesis of equal means.

To further explore the differences between the three groups, the Wilcoxon Rank Sum technique was used. Each group was compared to each of the other groups. The scores within pairs of groups were ranked from low to high. It should be emphasized that these were pairwise comparisons, rather than multiple-range comparisons. In comparing Groups I and II, a rank sum of 94.5 was obtained for Group I and 115.5 for Group II.

$P(R_{max} > 115.5) > .10 \rightarrow$ Do not reject the null hypothesis of difference between means.

Groups I and III obtained a rank sum of 143.5 and 66.5 respectively.

$P(R_{max} > 143.5) < .01 \rightarrow$ Reject the null hypothesis of equal means at any level $\geq .01$.

Groups II and III obtained a rank sum of 147.5 and 62.5 respectively.

$P(R_{max} > 147.5) < .01 \rightarrow$ Reject the null hypothesis of equal means at any level $\geq .01$.

In summary, there appears to be no significant difference between children who omit consonant sounds, children who substitute and distort consonant sounds and normal-speaking children in performance on the Bender-Gestalt Test. There does appear to be a significant difference in the mean number of behavioral signs between normal-speaking children and children with severe speech problems, including children from both the omission and substitution-distortion groups. However, there is no significant difference between the two groups of speech-defective children.

CHAPTER V

DISCUSSION

Restatement of the Problem

The purpose of this study was to investigate the relationship between the omission articulation pattern and possible neurological damage. The Bender-Gestalt Test and a checklist of behaviors reported to be evidenced by brain-injured children were used to assess possible neurological impairment. These measures were utilized to evaluate three groups of children selected from kindergarten, first, and second-grades:

1. children who primarily omitted consonant phonemes
2. children who primarily substituted and/or distorted consonant phonemes
3. normal-speaking children.

The following hypotheses were tested:

1. Null Hypothesis: There is no significant difference between the means on the Bender-Gestalt Test of children who omit consonant phonemes, children who substitute and distort phonemes, and normal-speaking children.

Alternate Hypothesis: There is a significant difference between the means on the Bender-Gestalt Test of children who omit phonemes, children who substitute and distort phonemes, and normal-speaking children.

2. Null Hypothesis: There is no significant difference between the

mean number of behavioral signs, characteristic of brain-injured individuals, of children who omit phonemes, children who substitute and distort phonemes, and normal-speaking children.

Alternate Hypothesis: There is a significant difference between the mean number of behavioral signs, characteristic of brain-injured individuals, of children who omit phonemes, children who substitute and distort phonemes, and normal-speaking children.

Recapitulation of Results

The following results were obtained:

1. The first null hypothesis was not rejected. There were no significant differences in performance on the Bender-Gestalt Test between the three groups of children.
2. The second null hypothesis was rejected. There was a significant difference in the mean number of behavioral signs between both speech defective groups of children and normal-speaking children; however, there was no significant difference between the two groups of speech-defective children.

Discussion and Interpretation

Analysis of the Bender-Gestalt Test data revealed that 80% of the omission group scored poorer than average for their age groups according to the norms established by Koppitz (1964). Only 60% of the substitution-distortion group and 60% of the normal group scored poorer than the established norms for their age groups. However, these differences in performance did not reach statistical significance.

In noting the children's signatures on the backs of their Bender protocols, two of the omission-group children wrote their names in mirror-writing. This behavior did not occur in either the substitution-distortion group or the normal group. This observation may imply that a task requiring visual-motor memory, as in name-writing, may be a more sensitive indicator of organicity than the Bender-Gestalt Test which required basically no memory. Since speech is primarily a process requiring memory, and since the child who omits sounds may indeed have some memory deficiencies, perhaps a memory task may be a more appropriate measure for differentiating these three groups. The findings by Silverstein (1967) and Scott (1967) of shortened memory span for digits with this group of children supports this speculation.

Pascal and Suttell (1951, pp. 62-66) point out that only if a brain lesion lies in an area or areas which affect an individual's ability to reproduce the Bender-Gestalt figures, can the Bender protocol indicate neurological impairment. If the omission-type child is neurologically impaired, perhaps the damage is in an area other than that required for visual-motor perception and cannot be evaluated through the use of the Bender-Gestalt Test. Koppitz (1964) states that "...it is not safe to assume that a good bender performance rules out the presence of brain injury" (p. 75).

The child with severe speech difficulty may attempt to compensate for his inadequate communication skills by developing his motor skills for self-expression. This speculation may account for the similarities between the three groups used in this study.

Although the three groups of subjects were not differentiated statistically on the Bender-Gestalt Test, several observations were made concerning the data. More omission subjects scored below the norms than did substitution-distortion subjects or normal subjects. Two of the omission-type subjects evidenced reversed writing of their names. Several speculations were made. The Bender-Gestalt Test may not be an adequate instrument for assessing neurological damage with this population. If neurological damage does exist in this speech-defective population, it may involve areas of the cortex to which the Bender-Gestalt Test is not sensitive. The child with severe speech problems may be compensating for his poor quality of verbal expression by utilizing his motor capacities for adequate expression, thus revealing Bender scores similar to the normal group studied. One cannot ignore the possibility that brain damage may not be present in the omission group. However, certain observational findings in this study do not warrant dismissal of the possibility of brain injury in this group of children. Further research in this area is needed to resolve this issue.

Analysis of the behavior checklist revealed a significant difference in the mean number of behavioral signs of normal-speaking children and children with severe speech problems (both Groups I and II); however, the difference between the two groups of speech-defective children did not reach significance. It appears that the speech-defective children, as a whole, evidenced significantly more behaviors associated with minimal cerebral impairment (Benton, 1962; Clements and Peters, 1962; Zedler, 1966), than did the normal speakers. This finding suggests the possibility that children with "severe" articulation problems may be neurologically impaired; however, it would be foolish to ignore an alternate possibility, i.e., severe speech problems may be contributing to deviant educational, emotional, and psychological behaviors.

The finding of no difference in behavioral characteristics between the omission and substitution-distortion groups may be explained by the possibility that teachers similarly perceive all children with severe speech problems. The classroom teacher is usually not trained to differentiate between severely deviant speech patterns. There may be a tendency to group the behavior of such children into one "odd" category. Thus both groups may be perceived as "Awkward or clumsy in fine muscle performance," "Cannot read at grade or age level," etc. as stated on the checklist. The child evidencing the omission pattern may in reality be experiencing neurological difficulties in all of his behavior, while the child with the substitution-distortion pattern may merely be perceived as experiencing these problems because of his speech difficulty. The teacher may generalize from the child's speech to all of his behavior, since much of her interaction with the child and estimation of his capabilities comes about in terms of speech.

The behavior checklist appeared to be a useful tool in describing behavioral symptoms which may contribute to the diagnosis of brain damage. Although the checklist did differentiate the normal speakers from the severe speech problems, a cause-effect relationship cannot be determined at this time. However, these results indicate the possibility of neurological impairment associated with severe speech problems, and certainly further investigation into this possibility is warranted.

Conclusions

The performance on the Bender-Gestalt Test of the three groups of subjects was not statistically different, although a greater percentage of omission-type children performed poorer than the norms, than did the other two groups. The information obtained from the Bender-Gestalt Test results is inconclusive; therefore, further study with children evidencing the omission pattern is suggested to determine the possible etiological factors involved.

The behavior checklist revealed a significant difference between Group III and both Groups I and II. This finding suggests the possibility that children with "severe" articulation-defects, regardless of type of errors made, may be neurologically impaired. In another sense, the behaviors exhibited by these children should be analyzed as possibly arising from the deviant communication problem. Children with a severe omission pattern or substitution-distortion pattern may lie at the high end of the continuum for minimal brain damage, as opposed to children with mild articulation problems.

Recommendations for Further Research

Several recommendations are in order for further research in this area. First, a replication of this study utilizing a larger sample of children would provide more adequate generalization of the results obtained. Second, a study utilizing a memory task, such as the Memory for Designs Test, or a task of auditory memory should be undertaken with the omission-type population. Third, the behavior checklist should be employed with children who have severe articulation difficulty as compared with those who have mild articulation difficulty.

Finally, to enhance diagnosis of possible causes underlying the omission articulation pattern, if they do exist, a test battery should be utilized with this population. Thus, many findings can be integrated to form a meaningful composite which should lead to successful diagnosis.

BIBLIOGRAPHY

Bender, L. A Visual Motor Gestalt Test and Its Clinical Use. New York: American Orthopsychiatric Association, 1938.

Benton, A. L. "Behavioral Indices of Brain Injury in School Children," Child Development, vol. 33 (1962), pp. 199-208.

Blaunstein, P. "A Study of the Relationship Between Defective Articulation and Neurological Involvement." Unpublished Master of Arts thesis at the University of Tennessee, December, 1967.

Chorost, S. B., G. Spivack, and M. Levine. "Rotations and EEG Abnormalities in Children," Journal of Consulting Psychology, vol. 23 (1959), p. 559.

Clements, S. D. and J. E. Peters. "Minimal Brain Dysfunctions in the School-age Child," Archives of General Psychiatry, vol. 6 (1962), pp. 17-29.

Dickson, S. "Differences Between Children Who Spontaneously Outgrow and Children Who Retain Functional Articulation Errors," Journal of Speech and Hearing Disorders, vol. 5, (1962), pp. 263-271.

Dunn, L. M. Peabody Picture Vocabulary Test. Minneapolis: American Guidance Service, 1959.

Getman, G. N. "The Visuomotor Complex in the Acquisition of Learning Skills" in Learning Disorders, vol. 1, ed. J. Hellmuth. Seattle: Seattle Seguin School, Inc., 1965, pp. 49-76.

Hanvik, L. "A Note on Rotation in the Bender Gestalt Test as Predicters of EEG Abnormalities in Children," Journal of Clinical Psychology, vol. 9 (1953), p. 399.

Haynes, J. R. and Sells, S. B. "Assessment of Organic Brain Damage by Psychological Tests," Psychological Bulletin, vol. 60 (1963), pp. 316-325.

Irwin, O. C. "Infant Speech: Consonant Sounds According to Manner of Articulation," Journal of Speech Disorders, vol. 12 (1947), pp. 402-404.

Irwin, O. C. "Infant Speech: Consonantal Position," Journal of Speech and Hearing Disorders, vol. 16 (1951), pp. 159-161.

Irwin, O. C. "Infant Speech: Consonantal Sounds According to Place of Articulation," Journal of Speech Disorders, vol. 12 (1947), pp. 397-401.

Irwin, R. B., J. F. West, and M. A. Trombetta. "Effectiveness of Speech Therapy for Second Grade Children with Misarticulations - Predictive Factors," Exceptional Children, vol. 32 (1966), pp. 471-479.

Jordan, E. P. "Articulation Test Measures and Listener Ratings of Articulation Defectiveness," Journal of Speech and Hearing Research, vol. 3 (1960), pp. 303-319.

Kirk, S. "A Behavioral Approach to Learning Disabilities," in Conference on Children with Minimal Brain Damage, eds. S. Kirk and W. Becker. Urbana: University of Illinois, 1963, pp. 40-53.

Koppitz, Elizabeth M. The Bender Gestalt Test for Young Children. New York: Grune and Stratton, 1964.

LeWinn, E. B. "Neurological Organization: The Basis for Learning," in Learning Disorders, vol. 2, ed. J. Hellmuth. Seattle: Seattle Seguin School, Inc., 1966, pp. 51-93.

Locke, J. L. "Questionable Assumptions Underlying Articulation Research," Journal of Speech and Hearing Disorders, vol. 33 (1968), pp. 112-116.

Mecham, M. J. Speech Articulation Test for Young Children (revised edition). Provo: Brigham Young University, 1959.

Menyuk, Paula. "Comparison of Grammar of Children with Functionally Deviant and Normal Speech," Journal of Speech and Hearing Research, vol. 7 (1964), pp. 109-121.

Metraux, R. W. "Speech Profiles of the Pre-school Child 18-24 Months," Journal of Speech and Hearing Disorders, vol. 15 (1950), pp. 37-53.

Miller, L. C., R. Loewenfeld, R. Linder, and J. Turner. "Reliability of Koppitz' Scoring System for the Bender Gestalt," Journal of Clinical Psychology, vol. 19 (1963), pp. 211-230.

Myklebust, H. R. "Learning Disorders - Psychoneurological Disturbances in Childhood," Rehabilitation Literature, (1964), pp. 354-360.

Myklebust, H. R. and B. Boshes. "Psychoneurological Learning Disorders in Children," Archives of Pediatrics, vol. 77 (1960), pp. 247-256.

Pascal, G. R. and B. J. Suttell. The Bender-Gestalt Test: Quantification and Validity for Adults. New York: Grune and Stratton, 1951.

Peterson, H. A. "A Study to Determine the Relationship Between Children's Articulation Skills and Visual Distortion," Speech Monographs, vol. 32 (1965), pp. 213-216.

Poole, Irene. "Genetic Development of Articulation of Consonant Sounds in Speech," Elementary English Review, vol. 11 (1934), pp. 159-161.

Powers, Margaret. "Functional Disorders of Articulation - Symptamotology and Etiology," in Handbook of Speech Pathology, ed. L. E. Travis. New York: Appleton-Century-Crofts, 1957, pp. 707-768.

Prins, T. D. "Analysis of Correlations Among Various Articulatory Deviations," Journal of Speech and Hearing Research, vol. 5 (1962a), pp. 152-160.

Prins, T. D. "Motor and Auditory Abilities in Different Groups of Children with Articulatory Deviations," Journal of Speech and Hearing Research, vol. 5 (1962b), pp. 161-168.

Quast, W. "The Bender-Gestalt: A Clinical Study of Children's Records," Journal of Consulting Psychology, vol. 25 (1961), pp. 405-408.

Renfrew, C. E. "Persistence of the Open Syllable in Defective Articulation," Journal of Speech and Hearing Disorders, vol. 31 (1966), 370-373.

Richardson, S. O. "Learning Disabilities: An Introduction," in International Approach to Learning Disabilities of Children and Youth, Third Annual International Conference. Tulsa: The Association for Children with Learning Disabilities, Inc., 1966, pp. 11-19.

Runyon, R. P. and A. Haber. Fundamentals of Behavioral Statistics. Reading, Massachusetts: Addison-Wesley Publishers, 1967.

Scott, Jane R. "The Relationship Among Two Patterns of Defective Articulation and Reading Readiness, Auditory Memory Span, and Intelligence," Unpublished Master of Arts thesis, University of Tennessee, June, 1967.

Shaw, M. C. and W. M. Cruickshank. "The Use of the Bender Gestalt Test with Epileptic Children," Journal of Clinical Psychology, vol. 12 (1956), pp. 192-193.

Siegel, S. Nonparametric Statistics for the Behavioral Sciences. New York: McGraw-Hill, 1956.

Silverstein, B. "A Defective Articulation Syndrome Characterized by Consonant Omissions." Paper presented at the American Speech and Hearing Association Convention, Chicago, November, 1967.

Silverstein, B. Personal communication. Denver, Colorado, November 17, 1968.

Snow, K. "A Detailed Analysis of Articulation Responses of 'Normal' First Grade Children," Journal of Speech and Hearing Research, vol. 6 (1963), pp. 277-290.

Strauss, A. A. "The Education of the Brain Injured Child," American Journal of Mental Deficiency, vol. 56 (1951), pp. 712-718.

Templin, M. C. Certain Language Skills in Children. Minneapolis: University of Minnesota Press, 1957.

Tolor, A. and H. C. Schulberg. An Evaluation of the Bender-Gestalt Test. Springfield: Charles C. Thomas, 1963.

Vandemark, A. A. and M. B. Mann. "Oral Language Skills of Children with Defective Articulation," Journal of Speech and Hearing Research, vol. 8 (1965), pp. 409-414.

Van Riper, C. Speech Correction: Principles and Methods. Englewood Cliffs: Prentice-Hall, 1963.

Webster's New World Dictionary of the American Language. Cleveland: World Publishing Company, 1968.

Wellman, B. L., I. M. Case, I. G. Mengert, and D. E. Bradbury. "Speech Sounds of Young Children," University of Iowa Studies in Child Welfare, vol. 5 (1936).

Wepman, J. "Cerebral Injury or Agenesis," in Conference on Children with Minimal Brain Impairment, ed. S. Kirk and W. Becker. Urbana: University of Illinois, 1963, pp. 1-12.

Wilcoxon, F., S. K. Katti, and R. A. Wilcox. Critical Values and Probability Levels for the Wilcoxon Rank Sum Test and the Wilcoxon Signed Rank Test. New York: American Cyanamid Company and the Florida State University, 1963.

Zedler, E. Y. "A Screening Scale for Children with High Risk of Neurological Impairment," in International Approach to Learning Disabilities of Children and Youth, Third Annual International Conference. Tulsa: The Association for Children with Learning Disabilities, Inc., 1966, pp. 20-28.

APPENDIX

CHECKLIST

________________________ is taking part in a study which is being conducted by a trained speech therapist to help us gain more information about the normal speech and speech difficulties of young children. Children with severe articulation problems and children with normal speech are being studied.

The following pages include a list of behavioral characteristics which have been found to be valuable in identifying children with certain learning disabilities. Based upon your knowledge and observations of the above-named child, please fill in the blanks.

If you have noticed the presence of a particular behavioral characteristic, please answer <u>YES</u>. If the behavioral characteristic is not a part of the child's behavior pattern, answer <u>NO</u>. If you are unsure, answer <u>D.K.</u> (don't know).

Thank you very much for your cooperation.

Sincerely,

Mrs. Evelyn Suib

CHECKLIST

I. Specific Learning Deficits:

______ Cannot read at grade or age level.

______ Mildly stressful situation brings out reading errors.

______ Spelling poor.

______ Reversal of letters or sounds in reading or spelling.

______ Difficulty with arithmetic.

______ Difficulty with abstractions and whole-part relationships.

______ Difficulty in mastering tasks dependent on good visual-motor coordination.

II. Perceptual-Motor Deficits:

______ Printing, writing and drawing poor.

______ Poor and erratic performance when copying geometric designs.

______ Attempts to compensate for the difficulty in copying geometric figures by task perseverance and/or innumerable and meticulous tiny strokes of the pencil.

______ Has difficulty in reproducing geometric designs with blocks.

______ Has difficulty with figure-ground discrimination.

______ Has difficulty with whole-part discrimination.

III. General Coordination Deficits:

______ Awkward or clumsy in fine muscle performance.

______ Awkward or clumsy in over-all coordination.

______ Sits with mouth open, but not mouth breathing.

______ Lateral deviation or protrusion of the tongue, especially when engaged in manual activities.

IV. Hyperactivity

______ Appears to be in constant motion.

______ Flits from one activity or object to another.

______ Restless and fidgety.

______ Voluble, uninhibited speech in the absence of outward hyperactivity.

______ Disorganized thinking in the absence of outward hyperactivity.

______ Moves, thinks and talks at a reduced rate.

______ Seems to understand, but cannot put his thoughts into words.

V. Impulsivity:

______ Cannot keep from touching and handling objects particularly in a strange or overstimulating environment.

______ Frequently speaks without checking himself.

______ Says insulting things.

______ Commits striking antisocial acts such as firesetting or stealing with little provocation.

VI. Emotional Lability:

______ High strung.

______ Irritable.

______ Aggressive.

______ Easily moved to tears.

______ Has quick changes from high temper to easy manageability and remorse.

______ Panicked by what to others is a minimally stressful situation.

______ Sweet tempered in spite of frustrating inability to read.

VII. Short Attention Span and/or Distractibility:

______ Unable to concentrate on one thing for very long.

______ Loses interest when abstract material is being presented.

______ Tends to become locked in a simple repetitious motor activity.

______ Preoccupied with one verbal topic.

______ Good attention span when interest is aroused, but when not so engaged, displays marked distractibility to meaningless stimuli.

______ Intermittent periods of stupor and alertness.

VIII. "Soft" Neurological Signs:

______ Transient deviation of the eye which the child cannot overcome.

______ Inability to tap on table with fingers flat, then turn hand over and do same.

______ Poor coordination of fingers.

______ Mixed or confused laterality in use of hand, foot, or eye.

______ Inability to distinguish left from right.

______ Speech defects.

______ Slow development of speech.

______ General awkwardness.

Clements, S. D. and J. E. Peters. "Minimal Brain Dysfunction in the School Age Child." Archives of General Psychiatry, vol. 6, 1962, pp. 17-29.

Zedler, E. Y. "A Screening Scale for Children with High Risk of Neurological Impairment." In International Approach to Learning Disabilities and Youth. Third Annual International Conference. Tulsa: Association for Children with Learning Disabilities, Inc., 1966, pp. 20-28.

VITA

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Master of Arts

Thesis: AN INVESTIGATION OF THE RELATIONSHIP BETWEEN THE OMISSION-ARTICULATION PATTERN AND NEUROLOGICAL IMPAIRMENT

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