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EFFECT OF PHONETIC CONTEXT UPON INCIDENCE OF
CORRECT UTTERANCE OF THE [S] SOUND

Thesis for the Degree of M. A.
MICHIGAN STATE UNIVERSITY
Juanita West Muntyan
1963



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by

Juanita West Muntyan

AN ABSTRACT

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF ARTS

College of Communication Arts, Department of Speech

1963

Approved:
Hubert J. Ogden

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The purpose of this study was to identify observable relationships between the incidence of correct utterance of [s] in the speech of children who usually misarticulate this sound and the phonetic context in which it occurred.

The subjects were 53 kindergarten children between the ages of five and six years, considered by their teachers to be normal, who misarticulated the [s] sound. A test in which [s] appeared in sixteen different phonetic contexts was administered and the responses evaluated by three expert judges.

The results indicate that in the speech of children who usually misarticulate [s] more correct utterances occur when [s] terminates the syllable than when it initiates it. They further indicate a tendency for [s] to be articulated correctly more frequently when it is preceded by a back vowel than when it is preceded by a front vowel.

The conclusions which were drawn from this study suggest the need for differentiation among the articulation errors of children for purposes of research and therapy. They further suggest the need for additional studies in which the function of a consonant within its syllable determines the design of test materials.

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CHAPTER I

STATEMENT OF THE PROBLEM

Introduction

Non-organic articulatory defects of children have interested many researchers who have approached their study in a variety of ways. In Chapter II of this thesis reference will be made to studies in which children with non-organic articulatory defects have been compared with normal speaking children on the basis of sound discrimination ability, pitch discrimination ability, socio-economic status of the parents, rate of maturation, minor organic deviations, and listening ability to name only a few.

In the early literature of speech and hearing, one finds such classifications of speech defects as the following given by Walter B. Swift in 1919 in an article outlining procedure for beginning public school programs. "..... asking that the names and addresses be given for all the children in their classes who have speech defects together with a rough classification of these defects under the heads of stuttering, mispronunciations of a marked and habitual sort, and errors due to mental deficiency."¹

¹
Walter B. Swift, "How to Begin Speech Correction in the Public Schools," Quarterly Journal of Speech, 5 (1919), p. 239.

In 1956 Van Riper classified speech defects as, "...disorders of rhythm, articulation, phonation, and symbolization," pointing out that many other¹ classifications were possible, his being a classification of symptoms.

This refinement of classification resulted from the realization on the part of speech and hearing scientists that if progress in understanding speech defects was to be made, it would result from an orderly, systematic study of these defects.

For diagnostic, therapeutic, and research purposes it has been helpful to sub-classify articulation defects, according to their etiology, as organic articulatory defects and non-organic articulatory defects.

The mystery surrounding the etiology of non-organic articulatory defects has led to the belief held by such writers as Buck, Spriestersbach, and Curtis that there is need for still greater refinement of our classification^{2, 3} for research purposes. The present study is an attempt in that direction.

1

Charles Van Riper, Speech Correction: Principles and Methods (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1956), p. 57.

2

McKinsey Buck, "A Study of the Misarticulation of [R] in Children from Kindergarten through Third Grade" (unpublished Master's thesis, University of Iowa, 1948).

3

Duane Spriestersbach and James Curtis, "Misarticulations and Discrimination of Speech Sounds," Quarterly Journal of Speech, 37 (1951), pp. 483-491.

Statement of the Problem and Purpose of the Study

The problem which prompted this study is the lack of meaningful data concerning the cause of non-organic misarticulations of the [s] sound. The purpose was to study the articulation of the [s] sound in a variety of phonetic contexts, in the speech of kindergarten children who usually misarticulate the sound, in order to determine whether there were systematic relationships between the number of correct utterances of this sound and the particular phonetic context in which it appeared.

Spriestersbach and Curtis summarized data which indicated that there is a systematic relationship between phonetic context and greater frequency of correct utterance.¹ Curtis and Hardy stated,

If, indeed, this seemingly inconsistent articulatory behavior is actually systematic and lawful, it is desirable to determine not only the presence of such phenomena in the speech of children having articulatory defects, but also the factors which bring about the systematic occurrence of correct production.²

Hypothesis

The following hypothesis was proposed: The incidence of correct utterance of the [s] sound in the speech of children who usually misarticulate the sound is affected by the phonetic context in which it occurs.

1

Spriestersbach and Curtis, op. cit.

2

James F. Curtis and James C. Hardy, "A Phonetic Study of Misarticulation of [R] ," Journal of Speech and Hearing Research, 2 (September, 1959), p. 244.

Importance of the Study

It is a generally accepted fact by speech and hearing scientists that one of the most frequently misarticulated sounds is the [s] sound. Powers states that, "The [s] and [z] sounds are among the most frequently misarticulated of all the speech sounds."¹ A number of studies which will be referred to in Chapter II were directed toward this particular misarticulation. The fact that this sound is not only misarticulated by young children, but by adults as well, makes it one of interest to researchers. The further fact that the [s] and [z] sounds are frequently the only sound that a given individual misarticulates suggests the need for the sound-fractionation method of study in research.

The misarticulation of [s] may be a speech defect which is very different from the misarticulation of [r]. If this is true, it seems that the best way to learn more about each of these defects is to differentiate between them, as well as other phonemic errors, in our research.

Definition of Terms

Sound Fractionation.--The isolation of one speech sound for purposes of study.

Syllable.--The basic phonetic unit, the core of which is a vowel² initiated or terminated by a consonant.

¹
Lee E. Travis (ed.), Handbook of Speech Pathology (New York: Appleton-Century-Croft, Inc., 1957), p. 718.

²
R.H. Stetson, Motor Phonetics: A Study of Speech Movements in Action (2nd ed., Amsterdam: North Holland, 1951).

Prevocalic.--Before the vowel; initiating the syllable.

Postvocalic.--After the vowel; terminating the syllable.

[S] Plus Group.--Those children who displayed articulation errors in addition to the misarticulation of the [s] sound.

[S] Only Group.--Those children who displayed no articulation errors in addition to the misarticulation of the [s] sound.

Organization of the Thesis

Chapter I has contained the statement of the problem which led to this study. It has included an introduction to the topic, an outline of the purpose of the study, the hypothesis to be considered, the importance of the study, the definition of terms, and the organization of the thesis.

Chapter II will contain a review of the literature pertinent to the present research.

Chapter III will describe the subjects, equipment, and testing procedures used in this study.

Chapter IV will discuss the analysis and results of the study.

Chapter V will contain a summary of the study and the conclusions.

CHAPTER II

REVIEW OF THE LITERATURE

A review of the literature on articulation disorders which has appeared during the last two decades reveals relatively few studies devoted to the misarticulation of one particular sound. The classification, children with articulatory defects, is far more common than such classifications as, children who misarticulate [s], or children who misarticulate [r]. However, the use of the sound-fractionation technique is becoming more frequent as its value in research is realized. The review of the literature related to this study will be presented under the following headings:

1. Sound-fractionation studies.
2. Studies in phonetic context.
3. Studies in the importance of the syllable.
4. Studies of inconsistency or errors.
5. Studies of stimulation methods.

Sound-Fractionation Studies

In 1945 Nelson studied the misarticulation of [s] in combination with selected vowels and consonants. He reported that more of his subjects produced [s] correctly when it appeared in a blend than when it appeared¹ before a vowel.

¹
J.R. Nelson, "A Study of the Misarticulation of [S] in Combination with Selected Vowels and Consonants" (unpublished Master's thesis, University of Iowa, 1945).

Three years later Hale studied the misarticulation of [s] in children from kindergarten through third grade and reported that 73.3 percent of her subjects pronounced [s] correctly in some contexts while mispronouncing it in others.¹ During the same year Buck studied the misarticulation of [r] in children of the same age group. He reported that 94.5 percent of his subjects were inconsistent, pronouncing [r] correctly in some contexts, but not in others.² In both the Hale and the Nelson studies, however, phonetic context was interpreted to mean location of the test sound within the word. In 1950 Smith studying the frequency of the [r] substitution and the level of its most frequent occurrence, reported, "It was discovered that [r] is more difficult to produce in some positions than in others."³ In 1951 Perkins reporting on methods and materials for testing articulation of [s] and [z] suggested that the presence or absence of errors is related to the phonetic context.⁴

¹
Anita R. Hale, "A Study of the Misarticulation of the [S] in Children from Kindergarten through Third Grade " (unpublished Master's thesis, University of Iowa, 1948).

²
Buck, op. cit.

³
D.L. Smith, "The Frequency of the [R] Substitution and Level of Its Most Frequent Occurrence " (unpublished Master's thesis, Kent State University, 1950).

⁴
W.H. Perkins, "Methods and Materials for Testing Articulation of [S] and [Z] ", Quarterly Journal of Speech, 38 (1951), pp. 51-62.

In 1958 at the ASHA Convention a study by Curtis and Hardy on the misarticulation of [r] was reported. In this report the work of Buck was refined and extended. Perhaps the two most significant modifications of previous procedures were: (1) The [r] sound was classified with respect to its function within the syllable, rather than its position within the word; and (2) Curtis and Hardy attempted to give a precise identification to the errors made. Whereas Buck indicated that the [r] sound was either omitted, substituted, or distorted, Curtis and Hardy created a close phonetic¹ transcription to indicate what the substitutions and distortions were. Here, then, was an attempt to study in depth the misarticulation of one particular sound, or as we have chosen to call it in this research, sound fractionation. In 1961 a study by Burgess compared the acceptable articulation of [s] with the unacceptable articulation of this sound in respect to tongue posture and structural positions. She reported a number of observable differences in the tongue posture during the acceptable and unacceptable production of the [s]² sound. This study will be discussed in greater detail in Chapter IV. In the study of pitch discrimination and articulation by Sommers, Meyer, and Fenton there was not only an attempt to limit the sounds included in the study, but³ also the age range of the subjects was limited to the third grade. Everhart wrote,

¹
Curtis and Hardy, op. cit.

²
Eleanor H. Burgess, "Cephalometric Analysis of Tongue Posture and Structural Positions During Acceptable and Unacceptable Production of [S] Sound" (unpublished Master's thesis, Michigan State University, 1961).

³
Ronald K. Sommers, William J. Meyer, and Ann K. Fenton, "Pitch Discrimination and Articulation," Journal of Speech and Hearing Research, 4 (March, 1960), p. 27.

Current literature increasingly stresses the necessity of sound differential diagnosis in order to insure the ultimate success of a remedial program.¹

Phonetic Context

That the phonetic context of a sound affects its articulation is a fact accepted by speech and hearing scientists. Potter, Kopp, and Green state, ".....all sounds are changed to some extent by the sound that comes before² and after them."

House and Fairbanks studied the influence of consonant environment upon³ the secondary acoustical characteristics of vowels. Although their findings which had to do with duration, frequency, and relative power of voice have no direct relation to this study, the nature of their test material is of significance. They used 72 syllables consisting of a vowel preceded and followed by the same consonant. This is very similar to the phonetic structure of the stimulus words used in this study. Pearce investigated the influence of preceding phonemes on enunciation of certain test sounds and reported that,

1

Rodney W. Everhart, "Literature Survey of Growth and Development Factors in Articulatory Maturation," Journal of Speech and Hearing Disorders, 25 (February, 1960), p. 59.

2

Ralph K. Potter, George A. Kopp, and Harriet C. Green, Visible Speech (New York: D. Van Nostrand Co. Inc., 1947), p. 43.

3

H.S. House, and Grant Fairbanks, "The Influence of Consonant Environment Upon the Secondary Acoustical Characteristics of Vowels," Journal of Speech and Hearing Disorders, 19 (November, 1945), p. 534.

".....in running speech the incidence of inconsistent errors is influenced at least in part by preceding phonemes."¹ In the Curtis and Hardy study of the misarticulation of [r] , the phonetic context was shown to have significant influence upon the character of the [r] sound.² Wong and Fillman state, "It has long been observed that neighboring phonemes influence each other in systematic ways..."³ Bush reported on the effect of phonetic environment upon the acoustic distinctive features of certain English consonants.⁴ Sanders concluded that the preceding consonant measurably influenced the articulation of certain sounds.⁵ Van Riper and Irwin suggest that the phonetic context of any speech sound influences its formation. They state, "We also have the influence of assimilation. One sound is influenced by its neighbor."⁶

¹ Emma Jeanne Pearce, "An Investigation of the Influence of Preceding Phonemes on Enunciation of Certain Test Sounds" (unpublished Master's thesis, Texas Woman's University, 1961).

² Curtis and Hardy, op. cit.

³ William S-Y Wong and Charles S. Fillman, "Intrinsic Cues and Consonant Perception," Journal of Speech and Hearing Research, 4 (June, 1961), p. 130.

⁴ Clara N. Bush, "The Effect of Phonetic Environment Upon the Acoustic Distinctive Features of Certain English Consonants," ASHA, 12 (October, 1960), p. 386.

⁵ Edwina Miller Sanders, "A Study of the Need for Assessing Speech Adequacy by Checking Test Sounds in Various Specific Phonetic Contexts" (unpublished Master's thesis, Texas Woman's University, 1961).

⁶ Charles Van Riper and J.V. Irwin, Voice and Articulation (Englewood Cliffs, New Jersey: Prentice-Hall Inc., 1958), p. 77.

Importance of the Syllable

Stetson showed that the basic phonetic unit is the syllable, the core of which is a vowel with the consonant acting to initiate or terminate the vowel. He asserted that there was no logical connection between the way speech is produced physiologically and the break down of initial, medial, and final position used by most speech clinicians.¹ Keenan has made the following suggestion, "Discard the 'initial, medial, final' framework and reclassify consonants with more precision. The classification should be based, first,² upon the consonant's relationship to its syllable". In the study by Curtis and Hardy the position of the consonant within the syllable was the basis³ for classification of the various [r] phonemes. Barker wrote that in determining the proficiency of articulation, the position of a consonant within the syllable was a valid and reliable consideration.⁴

¹
R.H. Stetson, Motor Phonetics: A Study of Speech Movements in Action (2nd ed., Amsterdam: North Holland, 1951).

²
Joseph S. Keenen, "What is Medial Position?," Journal of Speech and Hearing Disorders, 26 (May, 1961), p. 173.

³
Curtis and Hardy, op. cit.

⁴
Janet O'Neil Barker, "A Numerical Measure of Articulation," Journal of Speech and Hearing Disorders, 25 (February, 1960), pp. 79-88.

Inconsistency of Errors

The concept that children with articulation defects are not consistent in their errors is not a new one. Van Riper wrote, "As we listen and analyze and record the errors, we do something else. We listen intently for words in which the sound usually mispronounced is made correctly." Van Riper and Irwin state, "Most articulation cases are inconsistent in their errors." Spriestersbach and Curtis summarized the findings of a number of studies by saying,

These and other studies appear to have established clearly that inconsistencies in speech production can hardly be attributed to chance. We must assume therefore that certain variables are operating in a systematic, lawful fashion.³

Buck found that 94.5 percent of his subjects were inconsistent. Amidon reported that only about one-third of the sounds were produced incorrectly in all three positions.

¹
Van Riper, op. cit.

²
Van Riper and Irwin, op. cit.

³
Duane Spriestersbach and James F. Curtis, "Misarticulations and Discrimination of Speech Sounds," Quarterly Journal of Speech, 37 (1951), p. 483.

⁴
Buck, op. cit.

⁵
Hilda F. Amidon, "A Statistical Study of Relationships Among Articulatory Errors Made by 100 First Grade Children" (unpublished Master's thesis, University of Iowa, 1941).

Stimulation Methods

Writers have differed in their opinions as to the importance of the type of stimulation used to elicit the desired responses from children being tested for articulation errors. Templin wrote, "In measuring the production of specific sounds similar results are obtained by spontaneous and imitative methods."¹ Snow and Milisen using two tests, one a picture test and the other oral presentation of test items, found that, "There was a consistent differential in favor of better responses to the oral test."² Humphrey and Milisen studied the ability to reproduce unfamiliar sounds which were presented orally. They concluded that those sounds which have "highly visible focal articulation points were most effective in producing correct responses."³ In other words, the most visible sounds were the most readily reproduced. Carter and Buck studying prognostic testing reported that the differential between children's spontaneous and imitative responses had prognostic value.⁴

¹

Mildred C. Templin, "Spontaneous Versus Imitated Verbalizations in Testing Articulation in Preschool Children," Journal of Speech and Hearing Disorders, 12 (May, 1947), p. 300.

²

Katherine Snow and Robert Milisen, "The Influence of Oral Versus Pictorial Presentation Upon Articulation Testing Results," Journal of Speech and Hearing Disorders, Monograph Supplement No. 4 (December, 1954), p. 35.

³

William Humphrey and Robert Milisen, "A Study of the Ability to Reproduce Unfamiliar Sounds Which Have Been Presented Orally," Journal of Speech and Hearing Disorders, Monograph Supplement No. 4 (December, 1954), p. 69.

⁴

E.T. Carter and M. Buck, "Prognostic Testing for Functional Articulation Disorders among Children in the First Grade," Journal of Speech and Hearing Disorders, 23 (February, 1958), pp. 124-133.

Siegel, Wintz, and Conkey reported that the imitative method of stimulation may result in better articulation performance than the spontaneous method, at least for some proportion of the items tested. However, they did not find this effect to be extensive. It was not observed for about 80 percent¹ of the cases.

The present study was designed to meet the following criteria:

1. Only those children who were considered to be physically, mentally, and emotionally normal, and who were within a twelve months age range were used as subjects.
2. The misarticulation of only one sound was studied.
3. The misarticulation of this sound was studied in 16 different phonetic contexts.
4. The sound's function within the syllable rather than its position within a word was the basis for the selection of stimulus material.
5. Focus was on the percent correct responses rather than total number of errors in articulation.
6. Spontaneous and imitative responses were compared.

In the research referred to in this chapter, each of the studies has met some of the above criteria, but in none of them has all of the criteria been met. It is the belief of the writer that if research on articulation defects is to yield meaningful data it must reduce the number of variables existant in most of the reported studies. At the present time, we have very little definite information concerning the non-organic speech disorders. If one is to deal effectively with these disorders, it is necessary that one learns

¹ Gerald M. Siegel, Harris Wintz, and Harlan Conkey, "The Influence of Testing Instrument on Articulatory Responses of Children," Journal of Speech and Hearing Disorders, 28 (February, 1963), pp. 67-76.

more about their causes and amenability. Unless one starts from the premise that non-organic articulation disorders constitute a homogeneous group, attempt must be made to identify possible subgroups and study them. This cannot be done as long as one chooses for subjects children with articulation disorders.

CHAPTER III

SUBJECTS, JUDGES, MATERIALS AND TESTING PROCEDURES

Subjects

The subjects studied were 53 kindergarten children between the ages of five and six years enrolled in the public schools of East Lansing, Michigan. Since the purpose was to study the misarticulation of the [s] sound in functional, or non-organic speech disorders, attempt was made to eliminate from the study group, all children with known organic deficiencies.

Hearing thresholds and I.Q. scores were not available, but by consultation with teachers and examination of health records, attempt was made to eliminate children who would be considered to be below normal in these two respects. It is realized that in the case of hearing, especially, this is not an adequate method of determining "normal", but because time and facilities did not permit the testing necessary to assess these scores, this method of eliminating improper subjects was adopted.

A further attempt was made to eliminate children from the study who had received, or were receiving at the time of the test, any kind of speech therapy, whether this therapy was a regular part of the child's school work or just a deliberate attempt on the part of a parent to change the child's speech patterns. Here again, it is recognized that this method leaves something to be desired since personal interviews were not held with all

parents, but rather the teachers were asked if in their opinion, the children were receiving any direct speech help.

Children who had deviant dental occlusions were not eliminated from the study. Since the cause and effect relationship between malocclusion and faulty articulation of [s] has not been unequivocally established, and since the interest was in the auditory cue alone in this study, it seemed appropriate to include this group.

In addition to the criteria set forth in the design of the study in Chapter I, the following specifications were adhered to in the selection of subjects.

1. They were enrolled in the kindergarten rooms of the public schools.
2. They were between the ages of five and six years.
3. They were not receiving, nor had they received in the past, any speech therapy.
4. They were described by their teachers as normal with respect to physical, mental, and emotional development.
5. They misarticulated the [s] sound.

Judges

Three judges, all experienced public school speech clinicians evaluated the children's responses. Since two of the judges were employed in the East Lansing Public Schools at the time of the study, it was necessary to plan the testing for those times when the clinicians were scheduled to be in the various buildings. This meant that at no one time could all three judges be present for the testing.

In order to establish inter-judge agreement, three practice sessions were scheduled. During these sessions the test was administered to first grade children currently enrolled in speech correction classes. All three judges were present at the three practice sessions. The writer administered the test while seated facing the subject. The other two judges sat to the left of the writer, but still facing the subject. When the evaluations were compared, agreement between the two judges not administering the test was found to be much higher than was the agreement between the writer and either of the other two judges. Since the writer had spent a great deal of time training herself to eliminate visual cues when making judgments as to the acceptability of children's articulation, it was decided to seat the other two judges where they could not see the faces of the subjects as they responded to the stimulus words on the test. During the next two sessions when this was done the agreement scores were considerably higher. Therefore, the scores given here are based on the last two practice sessions. During these two sessions, all three judges agreed on 87% of the responses evaluated.

The Test

The purpose of the test was to determine the effect of phonetic context upon the articulation of [s] . It was designed to test the articulation of [s] in the following contexts:

1. Prevocalic [s] . That is [s] in the initial position and followed by selected vowels.
2. Postvocalic [s] . That is [s] in the final position preceded by selected vowels.

Representative vowels were chosen on the basis of their position in the vowel triangle.¹ These vowels were: [ɪ], [ɛ], [æ], [a], [o], [u], [ɜ], [ʌ].

The following criteria were set up for the selection of the stimulus words:

1. They had to be familiar to the age group being tested.
2. They had to be words which could be either depicted or elicited through simple questions.
3. They had to be short.
4. For each of the eight vowels there had to be two stimulus words each for prevocalic [s] and postvocalic [s], making a total of 32 words.

Ideally, these words would have been one-syllable words. Practically, however, it was necessary to select some two-syllable words in order to meet the other criteria set up for the test.

In addition to the 32 words, 16 nonsense syllables, 8 combining the vowels with prevocalic [s] and 8 combining each vowel with postvocalic [s] were included in the test in order to compare the imitative with the spontaneous responses. The test hereafter will be referred to as The [S] Articulation Test.

¹
Daniel Jones, Pronunciation of English (London: Cambridge University Press, 1950), pp. 21-23.

Procedure

The subjects for this study were identified and selected by means of a screening test administered by the writer to each of the 455 kindergarten children enrolled in the eight public schools of East Lansing, Michigan. With the cooperation of the teachers, the test was administered in the kindergarten rooms and consisted of obtaining responses to the following questions:

1. What is your teacher's name?
2. Will you please count to ten?
3. What are these pictures? (spoon, glass, basket)

These responses provided us with six opportunities to evaluate the children's articulation of the [s] sound. If a child misarticulated two or more of the six items on the screening test, he was tentatively included in the study group. On the basis of this test, 61 children who misarticulated [s] were identified. Upon completion of each screening session, a conference with the teacher was arranged in order to determine whether or not each child selected met the other criteria set up for the choice of subjects for the study. At this time, also, the medical record of each tentative subject was checked in order to eliminate children with known physical defects. Eight children were eliminated from the original group by this procedure. Three of these were receiving some form of speech therapy, two had physical anomalies considered to be associated with the misarticulation, one had a diagnosed hearing loss, and two were considered by their teachers to be either mentally retarded or severely emotionally disturbed. This left a total of 53 children to whom The [S] Articulation Test was administered.

The writer then met with the two other judges to arrange a testing schedule to coincide with the times they were to be in the various schools. Since permission had been given to use their time in any given school only during the hours that they were scheduled to be there, it was impossible to do all of the testing when they could assist. For instance, in those schools where the speech correction was scheduled for mornings, the afternoon kindergartens had to be tested by the writer alone. This resulted in 26 subjects being tested with the writer as the only judge present. It is recognized that this constitutes a weakness in the study.

When The [S] Articulation Test was administered, the children were taken individually from their rooms to the most quiet available room, in most cases the room used for the speech correction classes, and seated facing the writer who administered all of the tests. The other judge sat with her back to the child, but very near to him, in order that the auditory cue would not be affected by the visual cue. It was thought that, due to the youth of the subjects, it was preferable for the tester to maintain eye contact with them in order to obtain maximum responses. However, every effort was made to avoid the influence of visual cues by using a technique in which the eye contact was momentarily interrupted as the child responded. The test form is included in Appendix A.

The stimulus material was presented in the following sequence. The prevocalic [s] words starting with "seed" were tested in the order in which they appear on the test sheet. Next the postvocalic words starting with

"piece" were tested in the order in which they appear. The nonsense syllables were presented in a left to right order rather than in the vertical order in which the words had been tested. This was done in an attempt to minimize the effect of learning upon the test results. It was felt that since the subject's responses to the words were spontaneous and since their articulation was in no way being challenged, the learning effect would be minimal. However, since the nonsense items were being presented orally by the tester there did seem to be the need to avoid presenting either all prevocalic or all postvocalic items consecutively, in order to minimize learning.

The first part of the test, the spontaneous responses to the words, was presented to the children in the form of a game in which they were asked to try to guess the one word that the tester wanted them to say. If the correct response was not forthcoming on the first attempt, succeeding attempts were made until it was elicited. Some of the words were elicited through the use of pictures, and some of them were responses to questions. When the nonsense syllables were presented, the tester instructed the children to repeat just exactly what they heard, explaining that some of them would sound like words, but others would not.

Upon completion of the test, the following information was recorded for each subject: the type of misarticulation--interdental lisp, lateral lisp, omission of [s] , and other errors; classification as to total number of articulatory errors [s] only, or [s] plus, if there were errors in addition to the [s] . This later information was obtained through the use of

the Templin-Darley Articulation Test for those subjects who had not displayed obvious additional errors during the administration of The [S] Articulation Test.

CHAPTER IV

RESULTS AND DISCUSSION

Results

The percent of correct utterances was computed for each of the vowels combined with prevocalic and postvocalic [s] . This data is shown in Table I. The data was analyzed using an analysis of variance technique described by Dixon and Massey as appropriate for classifications with two variables.¹ The summary of this analysis is shown in Table II. This analysis indicates that the difference between the percent of correct utterances of prevocalic and postvocalic [s] is significant at the .01 level of confidence. By referring to Table I it can be seen that this difference is in favor of the postvocalic position.

The prevocalic and postvocalic position was compared for each of the vowels using the formula for individual comparisons $d = t \sqrt{\frac{2MSw}{n}}$ as described by Lindquist.² Since a numerical difference equal to or greater than 5.91 is necessary for significance at the .01 level, Table I indicates that

1

Wilfred J. Dixon and Frank J. Massey Jr., Introduction to Statistical Analysis. (New York: McGraw-Hill Book Company, Inc., 1957), pp. 157-158.

2

E.F. Lindquist, Design and Analysis of Experiments in Psychology and Education. (Boston: Houghton Mifflin Company, 1956), pp. 93-94.

the percent of correct utterances of postvocalic [s] was significantly greater than that of prevocalic [s] in combination with four vowels, i.e. [ɛ], [ʌ], [ɜ], [ʌ]. The difference between prevocalic and postvocalic [s] combined with [o] was almost significant.

Discussion

There were no significant differences among the percents of correct utterance of [s] when it was combined in a prevocalic position with each of eight vowels.

There were no significant differences among the percents of correct utterance of [s] when it was combined in a postvocalic position with each of the eight vowels.

There were, however, significant differences at the .01 level of confidence between the percents of correct utterance for prevocalic and postvocalic [s] in combination with four of the vowels, i.e., [ɛ], [ʌ], [ɜ], [ʌ]. The difference between the percents of correct utterance between prevocalic and postvocalic [o] was almost significant.

When one seeks the explanation of findings such as these, the familiarity of the stimulus words must be taken into consideration. The words used to elicit responses are shown here, because it is the belief of the writer that these words did not differ sufficiently in familiarity to explain the differences in children's responses.

TABLE I

PERCENT OF CORRECT UTTERANCES OF PREVOCALIC [s] AND
POSTVOCALIC [s] WHEN COMBINED WITH EACH VOWEL

Vowel	Prevocalic [s] % Correct	Postvocalic [s] % Correct	Arithmetic Difference	Grand Mean
<u>i</u>	14.2	16.7	2.5	15.4
<u>E</u>	10.5	21.	10.5*	16.1
<u>æ</u>	16.	18.5	2.5	17.2
<u>a</u>	14.1	18.5	2.4	16.3
<u>o</u>	13.6	19.	5.4	16.3
<u>u</u>	13.6	24.	10.4*	18.8
<u>ʒ</u>	11.7	21.6	9.9*	16.6
<u>ʌ</u>	12.9	21.	8.1*	16.8
Grand Mean	13.3	20.1		

* Significant at .01 level of confidence.

TABLE II
ANALYSIS OF VARIANCE

Source	df	S.S.	M.S.	F
Position	1	187.69	187.69	48.13*
Vowels	7	54.44	7.78	1.99**
Residual	7	27.30	3.90	
Total	15			

* With $df = 1$ and 7 , an $F > 12.2$ required for significance at .01 level.

** With $df = 7$ and 7 , an $F > 6.99$ required for significance at .01 level.

TABLE III

RANK ORDER FOR TOTAL NUMBER OF JUDGMENTS OF CORRECT
 UTTERANCE OF [s] IN EACH PHONETIC CONTEXT BASED ON 162 OPPORTUNITIES

Vowel	Prevocalic [s]	Vowel	Postvocalic [s]
<u>æ</u>	26	<u>ʊ</u>	39
<u>ɑ</u>	23	<u>ʒ</u>	35
<u>i</u>	23	<u>ɛ</u>	34
<u>u</u>	22	<u>ʌ</u>	34
<u>o</u>	22	<u>ɔ</u>	31
<u>ʌ</u>	21	<u>ɑ</u>	30
<u>ʒ</u>	19	<u>æ</u>	30
<u>ɛ</u>	17	<u>i</u>	27

Prevocalic words

set
seven

soap
sew

suit
soup

circus
circle

suck
sun

Postvocalic words

yes
mess

close
dose

goose
moose

nurse
purse

us
bus

Considering the focus of articulation of these vowels, one might ask the question: Is the incidence of correct utterance of postvocalic [s] affected by the focus of articulation of the preceding vowel? The presence of the [ɛ] precludes a definite statement to this effect. However, it may be that there is a tendency for this to be the case, and the presence of the [ɛ] sound here is due to some other factor. This possibility is strengthened by the fact that the postvocalic [s] was articulated correctly most frequently when it was preceded by the back vowel [u] and least frequently when it was preceded by the front vowel [ɪ], (Table I).

Burgess reported that, "...during the unacceptable [s] sound production, the tip of the tongue was considerably farther forward in the mouth." She further stated that there was a significant difference between the relationship of the highest portion of the tongue to the palatal arch during

1

Burgess, op. cit.

acceptable and unacceptable production of [s] . The highest part of the tongue during acceptable production was the dorsum rather than the tip. If the height of the tip of the tongue is associated with unacceptable production of the [s] sound, there may be some relationship between this and the fact that the [s] was articulated accurately least frequently when it was preceded by [ɪ] which is a high front vowel.

Table I indicates that when the combined postvocalic group is compared with the combined prevocalic group, there is a significant difference at the .01 level in favor of the postvocalic group. This would tend to indicate that [s] is articulated accurately more frequently when it terminates the syllable than when it initiates it.

When the total number of evaluations for all of the stimulus words was compared with the total number of evaluations for all of the imitative responses to the nonsense syllables, it was found that there were significantly more accurate responses to the nonsense syllables than to the spontaneously elicited words. This would tend to support the findings of Snow and Milisen.¹ Part II of The [S] Articulation Test was administered for purposes of comparing the two methods of stimulation. Responses to this part of the test are not included in any of the other computations, but listed in Appendix C.

With the exception of eight children who did not meet the criteria set up for this study, the subjects represent the total number of children in a

¹

Snow and Milisen, op. cit.

kindergarten population of 455 who misarticulate the [s] sound. The fact that 60 percent of these children misarticulate no sound in addition to the [s] is significant for research as well as therapy.

While the boys in the study were divided quite evenly between the two articulation classifications set up for this study, there is a marked discrepancy between the number of girls in the two groups. Of the total number of 23 girls, 19 misarticulated only the [s] . Of the 53 children, 33 or about 60 percent of them, misarticulated only the [s] sound, and about 40 percent of them had articulation errors in addition to the [s] . This would suggest the existence of a subgroup whose articulation problem might be quite different from other non-organic articulation defects. It would appear that further study of this group is justifiable.

TABLE IV

CLASSIFICATION OF SUBJECTS ACCORDING TO ARTICULATION ERRORS

[S] Only--No Errors in Addition to [S]
 [S] Plus--Errors in Addition to [S]

Group	Boys	Girls	Total	%
[S] Only	14	19	13	60
[S] Plus	16	4	20	40
Total	30	23	53	

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

The misarticulation of the [s] sound is common, not only in the speech of children, but in the speech of adults as well. In this study 11 percent of the kindergarten population were found to misarticulate this sound. What is of greater significance for research, as well as for therapy, however, is the fact that of this group of children who misarticulated the [s] sound, 60 percent of them misarticulated no other sound in addition to the [s] sound. This would suggest the existence of a subgroup within the group usually referred to as non-organic articulatory defectives. If such a group exists, more meaningful data may be gathered from studying this group discretely.

The effect of the phonetic context upon the incidence of correct utterance of the [s] sound has been studied in order to determine existent relationships. Judgments of "acceptable" or "unacceptable" were made for 53 children responding to 32 stimulus words in which [s] appeared in 16 different phonetic contexts. The findings were subjected to statical treatment and the possible explanations for significant relationships set forth. Implications of these findings for research and therapy were suggested.

Conclusions

The study was conducted for the purpose of testing the hypothesis set forth in Chapter I which states that the incidence of correct utterance of the [s] sound in the speech of children who usually misarticulate this sound is affected by the phonetic context in which it occurs.

The findings of the study indicate that the hypothesis can be accepted and the following conclusions drawn:

1. The incidence of correct utterance of the [s] sound in the speech of children who usually misarticulate this sound is affected by the phonetic context in which it occurs.

2. In the speech of children who usually misarticulate [s], correct utterances occur most frequently when the [s] is in a postvocalic position.

3. In the speech of children who usually misarticulate [s] there is some indication that the [s] is articulated correctly more frequently when it is preceded by a back vowel than when it is preceded by a front vowel.

4. The results of the study indicate that within the classification non-organic articulation disorders there exists a subgroup worthy of further research.

5. The results of this study indicate the need for further research using a sound fractionation technique to identify additional subgroups.

Implications for Research

On the basis of the present findings the following questions might well be asked:

1. Would a larger sampling yield similar results?
2. Would there be significant differences in the findings if all of the subjects were evaluated by all of the judges?
3. Would a test using more stimulus words for each of the phonetic contexts yield findings different from those of the present study.
4. Is there a more reliable method of evaluating subject response than the use of expert judges?
5. Would meaningful data result from the use of a similar test administered to older subjects who could respond to printed words?
6. If there is a subgroup who misarticulate only the sound of [s] , would comparative studies for this group and other non-organic speech defectives yield meaningful data.
7. Would an additional break down within this subgroup into types of misarticulations of [s] be worthwhile?
8. Would longitudinal studies for the group who misarticulate [s] be valuable?

Implications for Therapy

If it is known that a child who usually misarticulates a particular sound is able to produce it correctly in a given phonetic context, this knowledge

provides the therapist with a starting point for re-education in the production of the sound.

If the back vowels are influential in the correct production of the postvocalic [s] , it would seem reasonable to plan therapy with this in mind.

If, as the findings of this study indicate, there is a significant difference in the incidence of correct utterance of the [s] sound when it terminates the syllable and when it initiates the syllable, it would seem advisable to plan therapy in such a way that this knowledge would be utilized. The majority of the teaching aid materials on the market today present beginning lessons in which the [s] appears in the initial, or initiating position. Some stress the teaching of [s] in combination with other consonants, but none, to the writer's knowledge suggest beginning therapy with material in which [s] terminates the syllable, or in which [s] is preceded by a back vowel.

If the existence of a subgroup who misarticulate only the [s] sound is a fact, this fact might change the nature of the therapy needs of this group.

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APPENDICES

APPENDIX A

THE [S] ARTICULATION TEST

Part I

[S] STIMULUS WORDS

NAME _____ SCHOOL _____ ROOM _____ SEX _____

[S] ONLY _____ INTERDENTAL _____ LATERAL _____ OTHER _____

[S] PLUS _____

PREVOCALIC [S]

SEED _____
SEAL _____SET _____
SEVEN _____SACK _____
SAND _____SOCK _____
SORRY _____SOAP _____
SEW _____SUIT _____
SOUP _____CIRCUS _____
CIRCLE _____SUCK _____
SUN _____

POSTVOCALIC [S]

PIECE _____
GEESE _____YES _____
MESS _____GAS _____
PASS _____MOSS _____
BOSS _____CLOSE _____
DOSE _____GOOSE _____
MOOSE _____NURSE _____
PURSE _____US _____
BUS _____

APPENDIX B

THE [S] ARTICULATION TEST

Part II

Nonsense Syllables

PREVOCALIC [S]

S i _____

S E _____

S æ _____

S a _____

S o _____

S u _____

S ʒ _____

S ʌ _____

POSTVOCALIC [S]

i S _____

E S _____

æ S _____

a S _____

o S _____

u S _____

ʒ S _____

ʌ S _____

APPENDIX C

RAW DATA*

PREVOCALIC [s]		NONSENSE	POSTVOCALIC [s]		NONSENSE
SEED	<u>9</u>	[sʔ] <u>9</u>	PIECE	<u>14</u>	[i s] <u>12</u>
SEAL	<u>14</u>		GEESE	<u>13</u>	
SET	<u>9</u>	[sɛ] <u>16</u>	YES	<u>17</u>	[ɛ s] <u>14</u>
SEVEN	<u>8</u>		MESS	<u>17</u>	
SACK	<u>7</u>	[sɔ] <u>15</u>	GAS	<u>16</u>	[ɔ s] <u>14</u>
SAND	<u>19</u>		PASS	<u>14</u>	
SOCK	<u>10</u>	[sɑ] <u>15</u>	MOSS	<u>15</u>	[ɑ s] <u>16</u>
SORRY	<u>13</u>		BOSS	<u>15</u>	
SOAP	<u>10</u>	[sɒ] <u>17</u>	CLOSE	<u>16</u>	[ɒ s] <u>18</u>
SEW	<u>12</u>		DOSE	<u>15</u>	
SUIT	<u>11</u>	[sʌ] <u>16</u>	GOOSE	<u>19</u>	[ʊ s] <u>16</u>
SOUP	<u>11</u>		MOOSE	<u>20</u>	
CIRCUS	<u>10</u>	[sɜ] <u>10</u>	NURSE	<u>18</u>	[ɜ s] <u>14</u>
CIRCLE	<u>9</u>		PURSE	<u>17</u>	
SUCK	<u>10</u>	[sʌ] <u>13</u>	US	<u>18</u>	[ʌ s] <u>16</u>
SUN	<u>11</u>		BUS	<u>16</u>	

*Number of utterances judged to be correct, based on a total of 81 evaluations of each item.

APPENDIX D

TECHNIQUE USED TO ELICITE RESPONSES

1. Seed This is a pumpkin (picture).
2. Seal This is a (picture).
3. Set This is a swing (picture).
4. Seven This is number (picture).
5. Sack Sometimes this is called a paper bag. Sometimes it is called a paper (picture).
6. Sand The children are digging in the (picture).
7. Sock This is a (picture).
8. Sorry When you hurt a friend you say, "I'm (what)."
9. Soap We wash with (picture).
10. Sew Mother uses the needle to (picture).
11. Suit The lady is wearing a swimming (picture).
12. Soup This is tomato (picture).
13. Circus These children are at the (picture).
14. Circle These children are holding hands and making a (picture).
15. Suck What does the baby have to do to make the milk come out of the bottle? (picture)
16. Sun This is the (picture).
17. Piece This is not a whole pie. It is just one (picture).
18. Geese These are wild (picture).
19. Yes When I shake my head this way it means "no". What does it mean when I shake it this way?
20. Mess The baby is making a terrible (picture).
21. Gas Father is getting (picture) for the car.
22. Pass At milk time your teacher asks a helper to, "Please (what) the milk."
23. Moss This is (object).
24. Boss When a child always tells you what to do, you may say, "Oh, your're not the (what)."

APPENDIX D--Continued

25. Close These houses are not far apart. They are very (picture) together.
26. Dose On Captain Kangaroo, Bunny Rabbit often gets a (what) of his own medicine.
27. Goose This is a (picture).
28. Moose This is a (picture).
29. Nurse This is a (picture).
30. Purse This is a (picture).
31. Us On TV you hear a man say, "Leave the driving to (what)."
32. Bus This is a (picture).

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