A Comparison of /r/ Phoneme Production by Kindergarten Children in Stress-Varied Sentences

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Josephine Willison
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A COMPARISON OF /r/ PHONEME PRODUCTION BY KINDERGARTEN CHILDREN IN STRESS-VARIED SENTENCES

BY

JOSEPHINE WILLISON
B.A., Metropolitan State College, Denver, 1978

THESIS

Submitted in partial fulfillment of the requirements for the degree of Master of Arts: Communicative Disorders in the Graduate Studies Program of the College of Health at the University of Central Florida; Orlando, Florida

Spring Quarter
1981
TO MY MOTHER, ADELE WILLISON,
FOR HER ENDLESS LOVE AND FINANCIAL SUPPORT
DURING MY GRADUATE STUDIES
ACKNOWLEDGEMENTS

I wish to express my appreciation to the members of my committee, Dr. Doris P. Bradley, Dr. Charles D. Dziuban, and Dr. Raymond W. Buchanan, Jr. I wish to give special thanks to Dr. Bradley, who chaired my committee. She has been a source of continued guidance, insight, and encouragement.

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**APPENDIX A:** Mean Number of Correct Responses, T-Values, Degrees of Freedom, and Statistical Probabilities For Each Combination of Two Conditions Compared For Each Test Word (Rabbit, Carrot, and Car) . . . . 27

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Communication is an important element in the life of all human beings. Communication allows an individual to relate experiences, ideas, knowledge, and feelings to other individuals by means of speech, sign language, gestures, and writing. Communication is a process by which meanings are exchanged between individuals through a system of arbitrary symbols that have been agreed upon by the members of the community (Nicolosi, 1978).

Articulation may be viewed as one of several interrelated processes by which speech is produced, and speech may be viewed as one of several modalities through which language is utilized. An understanding of the relationship of articulation to speech and of speech to language is basic to developing an understanding of the nature of articulation and misarticulation. (McDonald, 1964, p. 66)

Defining Articulation

McDonald (1964) defines articulation as a process consisting of a series of overlapping, ballistic movements which place varying degrees of obstruction in the way of outgoing airstream and simultaneously modifies the size, shape, and coupling of resonating cavities. The audible phenomenon (phonemes) produced by these series of overlapping, ballistic movements are highly variable and their characteristics are influenced by the movement sequences (phonetic context) in which they appear. (p. 87)

Emerick and Hatten (1974) define articulation as "an incredibly
swift and complicated process whereby the lips, jaw, palate, and tongue modify or impede the breath stream to produce a repertoire of standard speech sounds" (p. 131).

Noll (cited in Emerick & Hatten, 1974) explained articulation as an individual performing a series of "valving movements with his oral apparatus (physiological activity) producing audible events (acoustic signals) which have a shared significance (perception) for a community of speakers" (p. 131).

**Defining Defective Articulation**

"Any factor or factors which interfere with the development of the highly specific, ballistic, overlapping series of movements of mature articulation will result in defective articulation" (McDonald, 1964, p. 102). Articulation disorders are often classified as either organic or functional. "An organic articulation disorder is one which can be traced to some anatomical anomaly or physiological malfunction and functional problems are those for which no organic basis is apparent" (McDonald, 1964, p. 103).

Individuals who have articulation disorders do not produce speech sounds in the usual, accepted manner. Their speech tends to call attention to itself, and is often very difficult to understand or is unintelligible (Curtis, 1967). These individuals "are handicapped because their speech deviates from the norms of our society, a society that depends on effective communication and demands it" (Van Riper, 1978, p. 156).

Winitz (1968) divides articulation learning into two separate
processes. One process involves the acquisition of phonemic production skills. The other process involves the association of acquired phonemes into integrated linguistic units. Winitz believes that the two separate processes may involve different principles of learning. Carrell (1968) makes a similar distinction. He divides defective articulation into phonemic errors and contextual errors. Phonemic errors occur when speech sound production does not develop correctly. Contextual errors occur when the ability to sequence sounds in a normal manner with normal prosody does not develop correctly.

Disturbances of speech sound production or misarticulations are the most common type of speech disorder. Powers (1971) reported that public school caseloads primarily consist of children with functional articulation disorders. Curtis (1967) states that articulation disorders make up three out of every four speech problems in the public schools.

Emerick and Hatten (1974) state that we must be concerned with four areas to thoroughly and differentially diagnose an individual's articulation: (a) What are the error sounds? (b) How does the client misarticulate? (c) Does his articulation vary and under what conditions does it vary? (d) Why does he misarticulate?

This study is most concerned with the third area. It is the purpose of this study to describe how suprasegmental features may vary defective sound production.

Defining Suprasegmental Features

Denes and Ladefoged (cited in Perkins, 1971) suggest that "no
one to one relationship exists between the articulation of phonemes and any single type of articulatory characteristic" (p. 256).

Segmental and suprasegmental features are considered articulatory characteristics. Suprasegmental features signal stress, intonation, and durational aspects of the utterance. Suprasegmental features are often viewed as "a part of prosody, which is contributed to by phonetic structure" (Nation & Aram, 1977, p. 74). Prosody can be defined as the melody of speech or vocal variety (Nation & Aram, 1977). Netsell (cited in Nation & Aram, 1977) operationally defines three prosodic features: intonation, stress, and rhythm. "Intonation is perceptually related to the fundamental frequency of the vocal fold vibration. Stress relates to syllabic emphasis and rhythm is the perception of the phonetic events over time" (p. 94).

Prosody seems to include at least two major dimensions, according to Nation and Aram (1977). Intonation and stress are included in the first dimension, while timing, rhythm, rate and fluency are included in the second dimension (Nation & Aram, 1977). This study is primarily concerned with the first dimension or the variations of stress and intonation on sound production.

Lehiste (1970) defines the suprasegmental parameters as intonation, stress, and quantity or duration. "Suprasegmental variations in these parameters extend over more than one phoneme" (Shadden, Asp, Tonkovich, & Mason, 1980, p. 390).

Lehiste (1970) reports that stressed syllables are usually longer in duration or quantity, higher in fundamental frequency or
pitch, and more intense than unstressed syllables.

Koike and Asp (1981) report that intonation seems to be "an inclusive term that refers to variations in pitch as a function of time" (p. 81). Koike and Asp (1981) report that other researchers use intonation to include inflection and pitch shift. Inflection identifies pitch change within a single phonation. Pitch shift identifies the pitch change "from the end of one phonation to the beginning of the next phonation" (Koike & Asp, 1981, p. 81).

Previous Research in the Area of Suprasegmental Features

"The lack of correspondence between a physiologic description of a sound and its perception in speech can be illustrated by assimilative influence (more recently called coarticulation) of one sound on almost any other sound" (Perkins, 1971, p. 257). "Coarticulation refers to the tendency of the articulators to assume a different position for a particular phone, depending on the phones that precede or follow it - a phenomenon that is very common in speech" (Wolfe & Goulding, 1973, p. 10).

"Recent studies of coarticulation have shown that nearly all sounds in a syllable influence each other physiologically, the influence coming from such factors as phonetic context, stress, rate, and morphemic boundaries" (Perkins, 1971, p. 257). Perkins (1971) states that other researchers see "this as evidence that higher linguistic processes control the articulation of phonemes" (p. 257).

Sheldon (1976) reported that children with inadequate articulation used lower overall intensity and reduced duration and that they had less variation in fundamental
frequency and intensity than children with adequate articulation. (Shadden et al., 1980, p. 391)

"Most studies of English agree that the vowels of words, short phrases, and sentences are differentiated by relative degrees of stress or loudness" (Lieberman, 1967, p. 145). Lieberman (1967) cited other researchers as stating that cyclical phonological rules assign a set of stress levels to the vowels of a word or phrase. Stress levels are assigned to a word, its syntactic function (noun or verb), and the constituent structure of a derived phrase marker. "The phonologic rules shift only the primary stress, but each time they assign primary stress to some vowel they lower the stress levels on all other vowels" (Lieberman, 1967, p. 146).

Production effects may modify the linguistic aspects of intonation like other phonologic aspects of the language (Lieberman, 1967). "In connected fluent speech where production effects are usually apparent, these features may be omitted or grossly distorted" (Lieberman, 1967, p. 170).

Prosody is examined in the overall utterance, rather than in specific instances or segments. The overall stress, intonation, and timing and rhythm patterns are examined, rather than a specific instance of stress, intonation or timing. "A specific instance provides little information about the nature of the prosody product" (Nation & Aram, 1977, p. 95). Prosody can be observed as a production phenomenon, or as a function of meaning (Nation & Aram, 1977).

Koike and Asp devised the Tennessee Test of Rhythm and Intonation Patterns (T-TRIP) to assess the suprasegmental patterns of young
children. The T-TRIP "is a three part suprasegmental test with 25 test items" (Koike & Asp, 1981, p. 81). The 25 test items consist of the nonsense syllable /ma/ which is spoken and recorded with different rhythm and intonation patterns. Each test item is presented twice and the child attempts to imitate the patterns heard. "The T-TRIP appears sensitive to differences between groups of different ages" (Koike & Asp, 1981, p. 81). Younger children generally score lower than older children on the test. Shadden et al. (1980) reported 86% accuracy on the T-TRIP with five year old children.

Shadden et al. (1980) studied the imitation of suprasegmental patterns by five year old children with adequate and inadequate articulation.

Ten five-year-old children with adequate articulation skills and 10 five-year-old children with inadequate articulation skills were administered the Templin and Darley Test of Articulation and the Test of Rhythm and Intonation Patterns (TRIP). Differences between the adequate and inadequate groups in terms of the mean percentage correct and the correlations between the TRIP and the Templin and Darley test scores within groups were statistically non-significant. (Shadden et al., 1980, p. 390)

Shadden states:

Neither the amount of time enrolled in therapy nor the initial severity and nature of the articulation disorder were controlled in this study. If enrollment in therapy is a critical factor affecting experimental results, the scatter of scores in the inadequate group and the overlap of individual scores with the adequate group may reflect varying amounts of therapy training, initial severity and nature of the articulation disorder, and relative success in learning skills and adapting to therapy situations. Thus the presence of a therapy effect would best be evaluated by comparing children with adequate articulation
to two groups of young children with inadequate articulation, one enrolled in therapy and one with no previous therapy. Such a comparison would provide information about the extent to which suprasegmental development is indirectly facilitated in therapy as well as further specify the nature of the relationship between suprasegmental and segmental development in children with inadequate articulation before therapy enrollment. Similarly, more extensive articulation testing in a variety of contexts and in spontaneous speech might provide a more adequate means of analysis of subgroup differences within the inadequate articulation population. (Shadden et al., 1980, p. 398)

**Articulation Testing**

Traditionally, articulation tests have focused on sounds in the initial, medial, and final positions of words. Articulation tests such as the Goldman-Fristoe Test of Articulation test sounds in the initial, medial, and final positions of words using pictures of common objects to elicit spontaneous speech. The Goldman-Fristoe Test of Articulation (1969) consists of 36 spiral-bound pictures and two stories which the child retells to provide for the evaluation of 23 single consonants and 12 consonant blends. A stimulability subtest is provided. "Percentile rank norms for ages 6 to 16+ are based on a National Speech and Hearing survey of 38,884 children" (Darley & Spriestersbach, 1978, p. 248).

There have been recent attempts in the literature to eliminate three-position (initial, medial and final) word testing in articulation assessment. McDonald (1964) has suggested that traditional three-position testing be relegated to a minor role in articulation assessment.

The characteristics of any sound are influenced by the sounds
that precede it and the sounds that follow it, or by its phonetic context. "The phonetic contexts which are observed in the traditional, word-oriented, three position test are not representative of the phonetic contexts which occur in connected speech" (McDonald, 1964, p. 114).

McDonald has therefore devised a test that allows for testing of 30 phonemes in multiple phonetic contexts.

The McDonald Deep Test of Articulation has a different format in that the test pictures and stimulus material are presented in pairs, the child being asked to link their names together without pausing. McDonald feels that a person tends to misarticulate certain sounds only in certain contexts, and that deep testing will reveal many instances in which a usually defective sound will be produced correctly. He therefore devised stimulus materials that would present any given sound so that it precedes or follows each of the other sounds. (Van Riper, 1978, p. 158)

From a clinical point of view, it is feasible and advisable to look for phonetic contexts in which the individual consistently articulates the sound correctly. "Such correct production may be 'nuggets of gold' to be used in speeding the establishment of correct habit patterns" (McDonald, 1964, p. 54) in therapy.

Children who deviate from normal phoneme acquisition are shown not to be making random errors but to be operating with somewhat different sets of rules; the rules a given child is using account for his particular set of errors. (Darley & Spriestersbach, 1978, p. 244)

All aspects of articulatory behavior are influenced by the phonological rules of the language and must be accounted for in articulation assessment. At the phonologic level, "segmental features include the sounds or phonemes of the language and their rules of
permissible order" (Nation & Aram, 1977, p. 95), while suprasegmental features include juncture, stress, and intonation.

STATEMENT OF THE PROBLEM

This study describes the production of an error phoneme by kindergarten children in three patterns of stress. The following research question is advanced:

1. Does production of the error phoneme /r/ change when patterns of stress change?

For the purpose of this study, the error phoneme /r/ is defined as: (a) a distorted /r/ (where the /r/ phoneme can be identified but is not totally accurate), (b) a substitution of the /w/ phoneme for the /r/ phoneme, or (c) an omission of the /r/ phoneme. A stressed word is defined as a word produced with an increase in pitch, an increase in intensity, and an increase in duration.

SIGNIFICANCE OF THE STUDY

It is assumed that segmental skills are independent of suprasegmental skills and the breakdown in performance in functional articulation disorders should be traced back only as far as the point of emergence of segmental phonemes. Consequently, diagnosis and treatment of articulation disorders focuses almost exclusively on the segmental (phonemic) elements of speech perception and production, with constant reference to the developmental sequence of emergence of segmental phonemes. (Shadden et al., 1980, p. 397)

Numerous speech diagnostic tests have been developed and standardized on the ages that most children acquire segmental phonemes (for example, Templin and Darley, 1960; Goldman and Fristoe, 1972). These segmental tests assess the number and type of mis-articulations, and they typically serve as a
reference for planning a therapy program, especially for children with mild articulation problems. However, children with severe communication problems may have unintelligible speech that is difficult, if not impossible, to evaluate solely via misarticulated phonemes. In these cases, errors of rhythm and intonation also affect the intelligibility of the child's speech. (Koike & Asp, 1981, p. 81)

Articulatory assessment of a child should provide the clinician with a description of all of the variables that together account for the sound production system of the client. Based on this review of the literature, it is obvious that additional data is needed in testing the effect of suprasegmental feature variation on sound production.

Asp (1975) stated that the level of suprasegmental development in a hearing-impaired child may determine the intelligibility level achieved by the child. Asp (1975) also reported that suprasegmental training during therapy improved speech sound production and speech intelligibility in deaf children.

Suprasegmentals may function in a similar manner in children with inadequate articulation. Thus, suprasegmental skill acquisition might serve not only to facilitate segmental development but also to improve intelligibility during the therapeutic process and facilitate more natural sounding speech production at the conclusion of a therapy program. (Shadden et al., 1980, p. 399)

Prosody is receiving greater attention in speech pathology. Emphasis is being given to prosodic disturbances as it relates to neurological, voice, and fluency disorders. Therapy programs emphasizing the training of the suprasegmental speech patterns have been developed for aphasic adults and children by Sparks and Holland (1976)
and Stark, Poppen, and May (1967).

The suprasegmental features of stress and intonation should be examined in articulation testing as well as in the therapy process. This study focuses on the testing.
CHAPTER II
METHODOLOGY

Subjects

The subjects were thirty-five kindergarten children in two public elementary schools in Brevard County, Florida. All subjects were currently enrolled in the school's speech-language program for a functional articulation disorder. All subjects were receiving therapy to correct the production of the /r/ phoneme. The subjects ranged in age from five years to six years six months. A hearing screening was administered to all of the subjects at 20 dB for the frequencies 500 to 8000 Hz. All of the subjects selected for the study had hearing within normal limits bilaterally and were performing at grade level according to their teachers. The amount and type of therapy that each subject had received varied. Each subject demonstrated awareness of stress by imitating the practice stimulus, "How are you?" Three subjects did not qualify for the experiment because they were unable to imitate the practice stimulus.

Test Site

All testing was conducted in speech-language therapy rooms at two public elementary schools in Brevard County. The layout of the two schools was the same with the same room used for the speech-language therapy room. The therapy rooms were 8 X 10 foot rooms off the school libraries. The rooms had one door for entering and
exiting. All visual stimuli were removed from the walls to eliminate distractions. All diagnostic and therapy materials were stored in a gray metal cabinet in the southwest corner of each room to eliminate distractions. There was a round table in the center of each room. Two chairs were placed at each table, one for the experimenter and one for the subject. The subject's chair was a small chair that was at a comfortable level for a child sitting at the table. The subject's chair was placed to the left of the experimenter's chair so that the experimenter and the subject had a good view of the Easel Kit. The tape recorders were placed in the center of the table in front of the subject. Two Bell and Howell tape recorders were on the table, along with the Easel Kit for the Sounds-in-Words Subtest of the Goldman-Fristoe Test of Articulation. The Easel Kit is the size of a three-ring notebook. The Easel Kit is a compact device used to display and store test materials. When opened, it forms an easel to use while presenting the thirty-five large and colorful pictures for the Sounds-in-Words Subtest of the Goldman-Fristoe Test of Articulation (Goldman & Fristoe, 1969). The experimenter determined that each test site was free of extraneous auditory distractions and adequately lighted to assure the subject's most optimal response. The air conditioners were not operating during the testing.

**Stimulus Materials**

The phoneme /r/ was chosen for study because it is frequently misarticulated, and clinicians report that it is a very difficult phoneme to correct (Aungst & Frick, 1964). Powers (1971) summarized
several studies that cited the /r/ phoneme as one of the ten sounds most frequently in error. Elbert, Shelton, and Arndt (1967) reported that articulation judges had higher agreement when judging the production of the /r/ phoneme than when judging the production of the /s/ and /z/ phonemes.

The Sounds-in-Words Subtest of the Goldman-Fristoe Test of Articulation was used to identify each subject's error sound. This subtest uses brightly colored pictures that the subjects are required to name. The pictures are of objects and activities that are familiar to children (Goldman & Fristoe, 1969). A picture of a rabbit is used to test the production of the /r/ phoneme in the initial position of words. A picture of a carrot is used to test the production of the /r/ phoneme in the medial position of words, and a picture of a car is used to test the production of the /r/ phoneme in the final position of words.

One three-word declarative sentence was prepared for each of the /r/ words (rabbit, carrot, and car) used in the Goldman-Fristoe Test of Articulation with the test word in the middle position. The three sentences were:

1. The rabbit hopped.
2. The carrot fell.
3. The car stopped.

A tape recording was prepared with the experimenter presenting the sentence containing each test word with stress placed on the first word of the sentence. The same sentence was repeated with
stress placed on the second word (test word) of the sentence. The same sentence was repeated with stress placed on the third word of the sentence. A ten-second pause was left between each test stimulus presentation to allow the subject adequate time to imitate the stimulus presented.

Procedure

One subject was tested at a time. One session was required per subject.

1. Each subject entered the room with the experimenter.
2. The experimenter asked each subject to be seated in the appropriate chair to the left of the experimenter.
3. The experimenter administered the Sounds-in-Words Subtest of the Goldman-Fristoe Test of Articulation to each subject. The experimenter followed the procedure for administering the Sounds-in-Words Subtest as outlined in the test manual for the Goldman-Fristoe Test of Articulation (Goldman & Fristoe, 1969).
4. The experimenter then gave each subject the following instructions: "I want you to say this sentence the same way I say it." The experimenter then presented the practice stimulus, "How are you?" with stress placed on the first word. The same instructions were then repeated for the second presentation of the practice stimulus with stress placed on the second word. The same instructions were repeated once again for the third presentation of the practice stimulus with stress placed on the third word. The practice stimulus was used to determine that the subjects could perceive the different
types of stress in each sentence and imitate them. Only subjects who were able to imitate the practice stimuli with the correct stress were used in this study.

5. The subjects who were able to imitate correctly the practice stimuli received the test stimuli. The experimenter gave each subject the following instructions, "Now you are going to hear some sentences on the tape recorder. I want you to repeat each sentence the same way that you hear it." The experimenter began the tape of the test stimuli. The test stimuli and the subjects' responses were recorded on the second tape recorder to be evaluated at a later time by three judges rating articulation.

The three judges rating articulation were speech-language clinicians in public schools in Brevard County, Florida. Prior to testing, each judge listened to the Mowrer /r/ and /3\'/ Discrimination Training Program. The purpose of the Mowrer /r/ and /3\'/ Discrimination Training Program was to train judges to classify /r/ sounds occurring in words as either correct or incorrect, and to count the occurrence of /r/ phonemes or /r/-distorted phonemes as they occur in words during connected speech. The judges scored their own responses as instructed on the Mowrer /r/ and /3\'/ Discrimination Training Program. Each judge agreed within 80% accuracy with the Mowrer /r/ and /3\'/ Discrimination Training Program. The tape recorded responses of all subjects in the present study were evaluated independently by the three judges. The judges were instructed to score either correct or incorrect each test word as it occurred in each of the three stress
varied sentences. Responses determined to be correct were scored as '0'. Responses determined to be incorrect were scored as '1'.

Data consisted of the ratings of /r/ production by three judges. The judges' ratings were combined, yielding the total number of responses judged to be correct for each test word in each stress condition. The mean score from the three judges for each test condition was computed and used in the analysis. Data were computed by the University of Vermont SPSS computer. Multiple T-tests were used to analyze the data.
CHAPTER III

RESULTS

The data were analyzed using multiple T-tests based on comparisons of mean scores. For each of the test words (rabbit, carrot, and car), the number of correct responses in each stress condition was compared to the number of correct responses in each of the other two stress conditions. Correct responses for the test word "rabbit" were analyzed in conditions 1, 2, and 3. Correct responses for the test word "carrot" were analyzed in conditions 4, 5, and 6. Correct responses for the test word "car" were analyzed in conditions 7, 8, and 9. Conditions 1, 4, and 7 had stress placed on the first word of the sentences. Conditions 2, 5, and 8 had stress placed on the second word (test word) of the sentences. Conditions 3, 6, and 9 had stress placed on the third word of the sentences. Appendix A shows comparisons of the mean number of correct responses, T-values, degrees of freedom, and statistical probabilities for each combination of two conditions compared for each test word (rabbit, carrot, and car).

Nine T-values were obtained. The .05 level of probability was accepted as significant with 34 degrees of freedom for all nine conditions.

1. A significant T-value of -3.38 was obtained when condition 1 was compared to condition 2.

2. A significant T-value of -2.58 was obtained when condition
1 was compared to condition 3.

3. A non-significant T-value of 1.44 was obtained when condition 2 was compared to condition 3.

4. A non-significant T-value of 1.50 was obtained when condition 4 was compared to condition 5.

5. A significant T-value of 2.86 was obtained when condition 4 was compared to condition 6.

6. A non-significant T-value of 1.44 was obtained when condition 5 was compared to condition 6.

7. A non-significant T-value of -1.66 was obtained when condition 7 was compared to condition 8.

8. A non-significant T-value of .57 was obtained when condition 7 was compared to condition 9.

9. A non-significant T-value of 1.87 was obtained when condition 8 was compared to condition 9.

These results indicated that changes in the production of the /r/ phoneme occurred when various words were combined with specific stress conditions. In some stress conditions, changes in the production of the /r/ phoneme did not occur.
CHAPTER IV
DISCUSSION

Changes of /r/ Production in Stress Conditions

A significant change in the production of the /r/ phoneme was noted when specific stress conditions were combined with various words. Sentences containing the test word "rabbit" yielded more responses judged to be correct when stress was placed on the word "rabbit" than when stress was placed on the word preceding "rabbit". More responses also were judged to be correct when stress was placed on the word following "rabbit" than when stress was placed on the word preceding "rabbit". The /r/ phoneme in the word "carrot" was judged more often to be correct when stress was placed on the word preceding "carrot" than when stress was placed on "carrot". No significant change in the number of correct responses was noted for the word "car" in any of the three stress conditions.

Traditionally, speech pathologists expect to see greater improvement in the production of a phoneme when the phoneme is in the initial position of a word than when it is in the medial or final position (Powers, 1971). The findings of this study support that expectation because two of the three comparisons of stress conditions for the word "rabbit" were determined to be significant. Type and amount of therapy were not controlled in this study. It is possible that therapy emphasized remediation of the /r/ phoneme in the
initial position for some or all of the subjects.

Speech pathologists expect to see greater improvement in the production of a phoneme when the phoneme is in the medial position of words than when it is in the final position of words (Powers, 1971). This study supports that expectation because one of the three comparisons of the stress conditions for the word "carrot" was determined to be significant.

Speech pathologists expect the production of the phoneme in the final position of words to be the most resistant to change (Powers, 1971). This study supports that expectation because none of the three comparisons of stress conditions for the word "car" were determined to be significant.

Implications for Assessment and Remediation

As has been previously discussed, stress raises fundamental frequency, increases duration, and increases intensity of the stressed word (Lehiste, 1970). These characteristics of stressed words produce a change in the physiologic, overlapping, ballistic movements of articulation (Perkins, 1971). It is feasible that these physiologic changes contribute to accurate production of a phoneme in a word that would otherwise be inaccurate. While the findings of this study are not conclusive, they do suggest that a speech pathologist should be aware of the possible influence of the suprasegmental features of stress and intonation in the assessment and remediation of articulation. Stress could be used as a diagnostic tool in determining whether a specific suprasegmental context facilitates correct
phoneme production. This information would be useful not only for diagnosis but also in designing an efficient and effective therapy program.

Implications for Future Research

The review of the literature indicated that several aspects of suprasegmental features probably influence phoneme production in articulation. Some possible areas of future research would include:

1. Investigation of the influence of stress on phoneme production with age as a variable.

2. Investigation to determine if error phonemes other than /r/ are affected by variations in stress.

3. Investigation of the effect of other suprasegmental features, such as rate, rhythm, and timing, on error sound production.

4. Investigation to determine if previous exposure to therapy and amount of time in therapy varies a speaker's change of phoneme production as a result of various patterns of stress.

5. Investigation to determine if speakers with multiple phonemic errors respond in the same manner to stress variations as speakers with single phoneme production errors.

6. Investigation to determine whether a therapy program which emphasizes stress and intonation - similar to Melodic Intonation Therapy (Sparks & Holland, 1976) - is more effective than traditional therapy in changing error phoneme production for speakers who can successfully imitate various stress patterns.

If research is conducted in the areas suggested, findings would
probably increase the efficiency and effectiveness of assessment and remediation of articulation disorders.
A review of the literature indicated that the suprasegmental features of stress and intonation should be examined in articulation testing. The purpose of the current study was to describe the production of the error phoneme /r/ in three patterns of stress. The /r/ phoneme was chosen for study because it is frequently misarticulated and clinicians report that it is a very difficult phoneme to correct.

The subjects were thirty-five kindergarten children with functional articulation disorders in two public elementary schools in Brevard County, Florida. One three-word declarative sentence was prepared for each of the /r/ words (rabbit, carrot, and car) used in the Goldman-Fristoe Test of Articulation with the test word in the middle position. The sentences were: (a) The rabbit hopped, (b) The carrot fell, and (c) The car stopped. Each sentence was presented with three patterns of stress. The subjects' responses were scored by three judges rating articulation. The judges' ratings were analyzed using multiple T-tests, comparing the mean number of correct responses in each stress condition with the mean number of correct responses in each of the other two stress conditions for each test word. Three comparisons were determined to be significant: (a) A significant T-value of -3.38 was obtained when stress placed on the word preceding "rabbit" was compared with stress placed on
"rabbit", (b) A significant T-value of -2.58 was obtained when stress placed on the word preceding "rabbit" was compared with stress placed on the word following "rabbit", and (c) A significant T-value of 2.86 was obtained when stress placed on the word preceding "carrot" was compared with stress placed on the word following "carrot".

The results of this study indicated that a change in the production of the /r/ phoneme was observed when specific stress conditions were combined with various words.

The implications of these findings suggest that speech pathologists should be aware of the possible influence of the suprasegmental features of stress and intonation in the assessment and remediation of articulation disorders.
APPENDIX A

MEAN NUMBER OF CORRECT RESPONSES, T-VALUES, DEGREES OF FREEDOM, AND STATISTICAL PROBABILITIES FOR EACH COMBINATION OF TWO CONDITIONS COMPARED FOR EACH TEST WORD (RABBIT, CARROT, AND CAR)
APPENDIX A

Mean Number of Correct Responses, T-Values, Degrees of Freedom, and Statistical Probabilities For Each Combination of Two Conditions Compared For Each Test Word (Rabbit, Carrot, and Car)

<table>
<thead>
<tr>
<th>Conditions</th>
<th>$\bar{X}$</th>
<th>T-Value</th>
<th>d.f.</th>
<th>2-Tail Probability</th>
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<tbody>
<tr>
<td><strong>RABBIT</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1</td>
<td>1.3143</td>
<td>-3.38</td>
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<td>34</td>
<td>0.160</td>
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<td></td>
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<td>34</td>
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<td>1.87</td>
<td>34</td>
<td>0.070</td>
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</tbody>
</table>
REFERENCES


Mowrer, D. E. Mowrer /r/ and /3r/ discrimination training program. Tempe, Arizona: IDEAS, n. d. (cassette tape, 60 min.)


