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To the Graduate Council:

I am submitting herewith a thesis written by Hillie Sue Davis Hill entitled "Stimulability of Defective Consonants." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Speech Pathology.

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STIMULABILITY OF DEFECTIVE CONSONANTS

A Thesis

Presented to

the Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

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by

Hillie Sue Davis Hill

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ABSTRACT

The purpose of this study was to determine if there are differences in the number of correct responses made by children with defective articulation when stimulated auditorilly and visually with specific consonants in different speech tasks. The subjects were twenty children, ten males and ten females, selected from the first and second grade classes of Knoxville and Knox County public and private schools. The stimulation test consisted of twenty-seven stimulus items designed to test the subject's response to stimulation of three consonants, /s/, /z/, and /θ/, in three speech tasks: isolated consonants, the same consonant in isolated VCV disyllables, and the same consonant in VCV disyllabic phrases. Each stimulus item was presented three times, for a total of eighty-one test items. The eighty-one test items were presented in random order.

From the results of this study, the following conclusions can be made:

1. There is no significant difference between males and females in their responses to auditory-visual stimulation of defective consonants, although females generally respond correctly to stimulation more often than males.

2. There are significant differences among the responses to auditory-visual stimulation of the consonants, /s/, /z/, and /θ/. Specifically, responses to stimulation of /θ/ are more often correct than responses to stimulation of /s/ or /z/.

3. There are no significant differences among the responses to auditory-visual stimulation as a function of vowel environment, for the vowels /i/, /æ/, /ɑ/, or /u/.

4. There are no significant differences among the responses to auditory-visual stimulation as a function of speech task, for these three tasks: isolated consonants, the same consonant in isolated VCV disyllables, and the same consonant in VCV disyllabic phrases.

5. The responses of males and females to stimulation of /θ/ in different vowel environments differ significantly. These same differences were not evident for /s/ and /z/.

6. There is great individual variability in the responses to auditory-visual stimulation of the consonants /s/, /z/, and /θ/.

7. Further research is indicated to provide more data on the responses of children with defective articulation to auditory-visual stimulation of defective consonants.

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CHAPTER I

INTRODUCTION

Stimulation of error sounds during articulation testing has been recognized as an integral part of the diagnostic process (Sommers et al., 1967; Van Riper and Irwin, 1958; Perkins, 1971; and Curtis, 1967). The purpose of stimulation is to determine the degree to which a subject is able to modify his production toward a standard production after being presented with a model to imitate by the clinician (Van Riper, 1972; Van Riper and Irwin, 1958; Milisen, 1971; Sommers et al., 1967; Perkins, 1971; and Curtis, 1967). Several investigators have sought to determine the prognostic value of stimulation (Sommers et al., 1967; Steer and Drexler, 1960; Barnes and Morris, 1967; Jacobs, Philips, and Harrison, 1970; Snow and Milisen, 1954b; Van Riper and Ericson, 1969; and Carter and Buck, 1958). However, few have investigated the differences in responses to stimulation according to speech task (Scott and Milisen, 1954b; and Carter and Buck, 1958), and a search of the literature has not revealed any who have evaluated the influence of the vowel environment on the stimulability of consonant sounds. The purpose of this study is to determine if differences exist in the responses made by children diagnosed as displaying functionally defective articulation patterns when stimulated auditorilly and visually with specific consonants in different speech tasks.

I. REVIEW OF LITERATURE

The term "stimulability" has been used to describe the ability of the subject to change toward normalcy his misarticulation of a sound following some type of stimulation by the examiner (Sommers et al., 1967; Curtis, 1967; Morris, 1973; Berry and Eisenson, 1956; and Perkins, 1971). The purposes for determining a subject's responsiveness to stimulation are: to determine which sounds might be easier to correct (Berry and Eisenson, 1956; Curtis, 1967; Perkins, 1971; and Milisen, 1954); to assess the adequacy of the speech mechanism for the production of that sound (Johnson, Darley, and Spriestersbach, 1963); to obtain information about the consistency of the error (Morris, 1973); and to determine the need for therapy (Perkins, 1971; Farquhar, 1961; and Van Riper and Irwin, 1958).

There are many variables which could influence the results of stimulation. Some of these are: method of presentation; speech task; phonetic environment; age; sex; severity of articulation error; and dentition.

Method of Presentation

As Morris (1973) has pointed out, the use of stimulation in a diagnostic session is essentially as a one-time therapy session. This dual use of stimulation, for therapy and for diagnosis, is one reason for the disagreement as to the best method of presentation of the model. Several authors have referred to stimulation as the presentation of a model for imitation (Van Riper and Irwin, 1958; Van Riper, 1969; Templin and Darley, 1969; Milisen, 1954 and 1971; and Darley, 1964); however,

their descriptions of the method of presentation differ.

For example, Darley (1964) does not mention the specific method of stimulus presentation he considers to be best. Wood (1971), Curtis (1967), and Kresheck and Socolofsky (1972) stress the importance only of the orally presented stimulus. Several other investigators have stressed the importance of having the subject both listen and watch as the stimulus is presented (Templin and Darley, 1969; Scott and Milisen, 1954a; and Smith and Ainsworth, 1967). In two independent studies comparing the methods of stimulus presentation, Scott and Milisen (1954a) and Smith and Ainsworth (1967) reported that the combination of visual and auditory stimulation was the most effective method for eliciting corrections of defectively produced sounds among preschool and school aged children. Berry and Eisenson (1960) and Milisen (1954) recommend intensive stimulation in which the child not only sees and hears the stimulus but also feels the stimulus as the therapist produces it. No explanation is offered by either as to how the child is able to feel the stimulus as it is produced by the therapist, but Milisen goes on to stress that some children are helped greatly by feeling the sound as the therapist produces it. Van Riper and Irwin (1958) describe different levels of stimulus presentation ranging from the single presentation of the stimulus for the subject to imitate to the repeated exaggerated presentations of the stimulus accompanied by comments on the manner and place of production to aid the subject in his attempt at production of the sound. Jacobs, Philips, and Harrison (1970) stress the importance of allowing the cleft-palate subject to observe both the "acoustic" and the placement aspects of a stimulus and that both these aspects should be considered when judging the response. They

point out that the cleft-palate subject who is able to alter the placement aspect of his production while maintaining an inadequate acoustic signal is very different from the one who cannot alter the placement of a sound. A weakness of their approach is that when the placement is not easily visible, both the subject and the examiner must infer the placement from their perception of the acoustic signal.

Another aspect of manner of presentation is the question of whether a response elicited by any specific manner of stimulation differs from that elicited by spontaneous presentation. Several investigators have tried to determine the effect of a single presentation of a stimulus item on the articulation scores of children (Templin, 1947; Snow and Milisen, 1954a, 1954b; Scott and Milisen, 1954a; Smith and Ainsworth, 1967; and Kresheck and Socolofsky, 1972). Of these investigations, Templin (1947) found no differences in the two methods of presentation. All the other investigations here cited reported that the imitative (i.e., stimulation) method of presentation of stimuli elicited significantly more correct responses than the spontaneous method. This difference was consistent for presentations for stimulation and for the use of either pictures or printed words for eliciting spontaneous responses. This difference was also observed for different levels of severity of articulation error pattern (Kresheck and Socolofsky, 1972).

Speech Task

Another variable which can influence the performance of the subject in responding to stimulation is the speech task. In diagnosis, the general procedure has been to present the sound first in isolation, then

in nonsense syllables, then in words, and sometimes in phrases (Curtis, 1967; Farquhar, 1961; Johnson, Darley, and Spriestersbach, 1963; Milisen, 1971; Scott and Milisen, 1954b; Van Riper and Ericson, 1969; and Elbert, Shelton, and Arndt, 1967). The assumption has been that isolation and nonsense syllables are easier because of less interference from previously learned patterns (Milisen, 1971; and Johnson, Darley, and Spriestersbach, 1963). There has been little experimental evidence to support this assumption.

Scott and Milisen (1954b) evaluated the differences in the responses to stimulation of the sounds /r/, /l/, /s/, /z/, /k/, /g/, /f/, and /v/ in isolation, nonsense syllables, and words and in the initial, medial, and final positions of nonsense syllables and words. They reported that isolation elicited more correct responses than nonsense syllables, and both elicited more correct responses than words. This was true for all the sounds tested except the /l/ which was more often correct in the initial and medial positions of nonsense syllables than in isolation or words. This difference in the data could be due in part to the difficulty in producing a consonantal /l/ in isolation. This same problem arises in the data on the /r/. The investigators did not differentiate between the consonantal and vocalic forms of this phone. They did not indicate how they controlled the production in isolation to insure that it was the consonantal /r/ being produced. They also did not indicate if any attempt was made, e.g., changing the stress patterns, to insure that the /r/ in the medial position of the nonsense syllable, preceded and followed by a vowel, was produced as a consonant. The /r/ in the final position of the nonsense syllable is a post-vocalic form and is more like a vowel

than a consonant (Buck, 1954; and Curtis and Hardy, 1959). The /k/ and /g/ also present problems in production as isolated phones. The difference in percentage correct between the isolated production and the initial position of nonsense syllables is not great and may reflect differences due to the change in the following vowel from the shwa to the /ɑ/.

When one eliminates these four sounds from the data, the isolated phone again appears to elicit more correct responses, followed by nonsense syllables and words. However, the vowel used in the nonsense syllables is a low back vowel and the four remaining sounds are frontal sounds. It may be that a high front vowel would elicit more correct productions than the low back vowel and than the phone produced in isolation. The phonetic environment of the words is not reported or controlled and may be a factor in the results on the word level of the stimulation test.

Scott and Milisen (1954b) also reported that the initial position elicits the most correct responses in both nonsense syllables and words. Since the vowel environment was the same for all positions of nonsense syllables and this difference was maintained for all sounds in the nonsense syllable test, it may be concluded that for these sounds in nonsense syllables formed by combining them with the vowel /ɑ/, the initial position elicits more correct responses to stimulation than the medial and final positions.

Phonetic Environment

There are little experimental data reported on the effect of different phonetic environments in the response to stimulation. Several

investigators have reported differences in responses to items on articulation tests (Spriestersbach and Curtis, 1951; Buck, 1954; and Curtis and Hardy, 1957); however, Siegel, Winitz, and Conkey (1963) reported no differences in articulation performance as a function of the word used. Templin (1947) found differences in only four phonemes when the words were presented by stimulation to preschool children. There was no reason given for using only ten phonemes for comparison, nor for the selection of the specific phones used. There is a need for a more carefully controlled comparison of specific environments to determine if any environments do affect specific phones differently.

Age

No one has investigated differences in responses to stimulation as a function of age, although there is experimental evidence to support the assumption that articulation proficiency increases with age (Morency, Wepman, and Weiner, 1967; Van Riper and Ericson, 1969; Roe and Milisen, 1942; and Saylor, 1949). Sommers et al. (1967), reported that age was a significant factor when considering amount of improvement over a school year, but they did not find an interaction of age with stimulability.

Sex

Another variable which has been assessed in research on articulation but not in research on stimulation responses is differences between the sexes. Studies on the maturation of articulation proficiency have reported a nonsignificant but consistent difference between the sexes, with the girls slightly more proficient than boys of the same age in terms of articulation performance (Roe and Milisen, 1942; Sayler, 1949; and

Templin, 1952). Smith and Ainsworth (1967) reported no significant differences between the sexes in performance on two types of stimulation tests using words as stimulus items. The trend recurs often enough in the literature, however, to warrant further investigation.

Severity of Articulation Error

The severity of the articulation error may also be an important variable related to the ability of the child to respond to stimulation. The few studies which discuss severity indicate that the responses to stimulation maintain the same pattern regardless of severity of articulation pattern (Kresheck and Socolofsky, 1972; Farquhar, 1961; and Sommers et al., 1967).

Dentition

The absence or malpositioning of teeth may also be an important variable related to the ability of the child to respond to stimulation. Although the literature is inconclusive, there appears to be a low correlation between missing or malpositioned teeth and misarticulation of frontal consonants, especially sibilants (Bankson and Byrne, 1962; Snow, 1961; and Powers, 1971). It is possible that a similar correlation exists between missing or malpositioned teeth and the ability of the child to respond to stimulation of frontal consonants. A search of the literature has not revealed any investigation of this possible correlation.

Uses of Stimulation

Two major uses have been made of the information gained from stimulation testing during the diagnostic session. The first, based on

the assumption that a stimulable sound is inconsistent and more readily remediable (Perkins, 1971; and Morris, 1973), is to determine the order of correction for the error sounds (Berry and Eisenson, 1956; Johnson, Darley, and Spriestersbach, 1963; Templin and Darley, 1969; and Milisen, 1954).

The second use of the information gained from stimulation during the diagnostic session, prognosis for therapy, arose from the ever increasing caseloads and percentages of primary grade articulation cases on these caseloads in the public schools (Bingham et al., 1969; Mills and Streit, 1954; Pronovost, 1966; and Pendergast, 1966), and the evidence that during these primary years, articulation is still maturing (Van Riper and Ericson, 1969; Dickson, 1962; Roe and Milisen, 1942; and Morency, Wepman, and Weiner, 1967). Sommers et al. (1961 and 1962), and Reid (1946) demonstrated that speech therapy was effective in reducing the caseload in later grades and improving articulation over the amount of improvement seen in matched controls. However, the number of children who did achieve adequate articulation proficiency without therapy presented a need for a method of discriminating between these children and those who would need extra help. Among the factors which have been found to have predictive value are response to stimulation (Sommers et al., 1967; Irwin, West, and Trombetta, 1966), and the number of errors in the final position of words and the number of errors on the consonants /f/, /l/, and /θ/ (Steer and Drexler, 1960). Several investigators have reported that the difference between the response on a spontaneous and stimulation test using the same phonemes had prognostic value, in that the greater the difference the greater the probability that the child would improve without

speech therapy (Snow and Milisen, 1954b; Farquhar, 1961; Carter and Buck, 1958; Irwin, West, and Trombetta, 1966; and Kisatsky, 1967). The importance of this difference between spontaneous and stimulation scores in prognosis for therapy has also been reported for children with cleft palates (Barnes and Morris, 1967; and Jacobs, Philips, and Harrison, 1970).

Both of these major uses should rely on information gained from the optimal conditions for stimulation and on an understanding of how various factors effect the response to stimulation. Although these variables have been considered separately to a limited degree, there has been little experimental interest in the interaction of several of the variables in the response to stimulation. Information on the individual variables involved and on their interaction is necessary for appropriate utilization of stimulation in diagnosis and therapy.

II. PURPOSE OF THE STUDY

The purpose of this study was to determine if there are differences in the number of correct responses by children with defective articulation when stimulated auditorilly and visually with specific consonants in different speech tasks. Specifically, the following questions were asked:

(1) Are there differences between males and females in their responses to auditory-visual stimulation of defective consonants?

(2) Are there differences among the responses to auditory-visual stimulation of the consonants /s/, /z/, and /θ/?

(3) Are there differences among the responses to auditory-visual stimulation of the consonants /s/, /z/, or /θ/ when the vowels /i/, /æ/, /ɑ/, and /u/ precede and follow them in symmetrical vowel-consonant-vowel (VCV) disyllables?

(4) Are there differences among the responses to auditory-visual stimulation of /s/, /z/, or /θ/ in isolation, the same consonant in isolated vowel-consonant-vowel (VCV) disyllables, and the same consonant in vowel-consonant-vowel disyllabic phrases?

CHAPTER II

METHODS AND PROCEDURES

I. SUBJECTS

Twenty subjects, ten males and ten females, were selected for this study. The subjects ranged in age from six to eight years, and were enrolled in the first and second grade classes of Knoxville and Knox County public and private schools.

Selection of subjects from the public schools was made by the investigator, with the cooperation of the speech clinician for that school, from the speech therapy rolls or waiting lists on the basis of performance on articulation tests given by the speech clinician. Selection of subjects from the private schools was made by the investigator on the basis of performance on a picture articulation test for the three consonants being investigated, /s/, /z/, and /θ/.

To be included in this study, each subject was required to meet the following criteria:

(1) Each subject was judged to have an error in his production of /s/, /z/, and /θ/ in the releasing position of words (McDonald, 1964).

(2) Each subject was judged to be of normal intelligence as indicated by appropriate grade placement for his age.

(3) Each subject was a member of the Caucasian race, as determined by the report of his speech clinician, his classroom teacher, and/or school records.

(4) Each child had normal hearing; that is, no loss greater than 25 dB (ISO) at 250, 500, 1000, 2000, and 4000 Hz in the better ear. The examiner presented pure tone tests using a portable audiometer (Belltone, Model 10D) through earphones (Telephonics, Model TDH-39) in a school room.

(5) Subjects with gross deviations of oral structure, as determined by a peripheral oral examination, or with obvious neuromuscular impairment were excluded from this study.

(6) Subjects who had received speech lessons for the correction of the sounds investigated in this study were excluded.

II. SPEECH TASKS

Three speech tasks were investigated: isolated consonants (Task 1), isolated VCV disyllables (Task 2), and VCV disyllabic phrases (Task 3). The vowels used in the disyllables and disyllabic phrases were /i/, /æ/, /ɑ/, and /u/. These were selected because they include high, low, front, and back vowels. The consonants investigated in this study were /s/, /z/, and /θ/. These consonants were selected because they are frequently misarticulated by children in this age group (Roe and Milisen, 1940; Morency, Wepman, and Weiner, 1967; and Templin, 1957). These consonants are also frequently misarticulated by older children (Roe and Milisen, 1940; and Sayler, 1949). In addition, the consonant /s/ was selected in order to compare it with its cognate, /z/. The /s/ has been reported to be less often defective than /z/ in this age group (Roe and Milisen, 1940; Morency, Wepman, and Weiner, 1967; and Templin, 1957). The consonant /s/ is also less frequently misarticulated by older

children (Roe and Milisen, 1940; and Sayler, 1949).

III. TESTS

A picture articulation test was administered to each subject immediately prior to the stimulation test to insure that the experimental consonants were defective in the releasing position of words.

The stimulation test (see Appendix A), consisted of twenty-seven stimulus items designed to test the subject's responses to stimulation of three consonants in three speech tasks: isolated consonants (Task 1), the same consonant in VCV disyllables (Task 2), and the same consonant in VCV disyllabic phrases (Task 3). Each stimulus was presented three times for a total of eighty-one test items. These eighty-one test items were presented in a different random order for each subject, with the exception that no two identical stimulus items followed each other.

The investigator presented the stimuli at 10 dB SPL (re: 0.0002 $dyne/cm^2$) above the ambient noise level of the room, as measured by a sound level meter (General Radio Company, Model 1555-A) at a distance of three feet. VCV disyllables and VCV disyllabic phrases were presented as spondees with the consonant in the releasing position of the second syllable of the spondee.

A training procedure preceded each stimulation test. The consonants /m/ and /t/ were presented in isolation, in isolated VCV disyllables, and in VCV disyllabic phrases similar to those used in the stimulation test. The subject was instructed to listen and watch the investigator as she produced each practice item three times. Following the third production, the investigator pointed to the subject and the subject produced the item

he had just seen and heard. When the subject had followed the instructions correctly for three consecutive practice items, the stimulation test was begun. All testing procedures were recorded on a high fidelity tape recorder (Sony, Model TC-255).

IV. JUDGING AND SCORING

The responses of each subject were judged as correct or incorrect by the investigator at the time of the testing. Two graduate students in speech pathology independently judged the responses of five subjects, randomly selected, at the time of the testing. One week after the initial testing procedure, these five subjects were retested and the responses were judged by the investigator and the same two judges.

CHAPTER III

RESULTS

The results were analyzed statistically in the following manner. Three separate analysis of variance designs (Lindquist Type VI), one for each consonant (/s/, /z/, /θ/), were used to evaluate differences between males and females, differences among vowels, and differences among speech tasks (isolated VCV disyllables and VCV disyllabic phrases). Differences among consonants in isolation were evaluated by three separate t-tests for related measures, one each for /s/-/z/, /s/-/θ/, and /z/-/θ/. Differences among consonants in Tasks 2 and 3 were evaluated by a two factor analysis of variance. Differences among speech tasks were evaluated by three separate two-factor (treatments-by-subjects) analysis of variance designs, one for each consonant (/s/, /z/, and /θ/).

I. RELIABILITY

The responses of five subjects, randomly selected, were scored independently by the investigator and two judges during two different testing sessions. These data were used in computing intra-judge and inter-judge reliability, using the formula:

$$\text{Percent Agreement} = \frac{A}{A + D}$$, where

A = number of agreements,

D = number of disagreements.

Intra-Judge Reliability

The mean intra-judge reliability for the investigator (Judge 1) was 91 percent. The mean intra-judge reliability for Judges 2 and 3 was 89 percent and 86 percent, respectively (see Appendix B). These indices of reliability are in agreement with those of Shriberg (1971), Wright (1954), and Irwin (1970).

Inter-Judge Reliability

The mean inter-judge reliability was 85 percent, 76 percent, and 74 percent for Judge 1 with Judge 2, Judge 1 with Judge 3, and Judge 2 with Judge 3, respectively (see Appendix B). These indices of reliability are in agreement with those of Henderson (1938), Shriberg (1971), Bankson and Byrne (1962), Wright (1954), and Irwin (1970).

II. DIFFERENCES BETWEEN MALES AND FEMALES

The twenty-seven stimulus items (see Appendix A) were repeated three times during the test, for a total of eighty-one test items. The criterion measure was the number of correct responses. The range of correct responses was 0 to 52, with a mean of 25.2, for the males, and 6 to 74, with a mean of 40.1, for the females.

Statistical Analysis

A three factor analysis of variance, Lindquist Type VI (1953), was used to analyze the data for each of the three consonants, /s/, /z/, and /θ/ (see Tables 1 through 3). For separate these analyses, the isolated VCV disyllables (Task 2) and VCV disyllabic phrases (Task 3) were evaluated. For all three separate analyses, the differences between

TABLE 1. Summary of analysis of variance for evaluating differences among vowels, among tasks (isolated VCV disyllables and VCV disyllabic phrases), and between groups with reference to /s/.

Source	SS	df	ms	F*	p**
Total	202.70	159			
Between Subjects (S)	140.32	19			
Groups (G)	13.81	1	13.81	1.96	NS
Error (b)	126.51	18	7.02		
Within Subjects (wS)	62.38	140			
Tasks (T)	0.16	1	0.16	0.42	NS
Vowels (V)	2.02	3	0.67	1.15	NS
G X T	0.50	1	0.50	1.31	NS
G X V	0.52	3	0.17	0.29	NS
T X V	0.97	3	0.32	0.92	NS
G X T X V	1.02	3	0.34	1.00	NS
$Error_1$ (w)	6.97	18	0.38		
$Error_2$ (w)	31.34	54	0.58		
$Error_3$ (w)	18.88	54	0.34		

*F ratios: ms_G / ms error (b); ms_T / ms $error_1$ (w); ms_V / ms $error_2$ (w); $ms_{G \times T}$ / ms $error_1$ (w); $ms_{G \times V}$ / ms $error_2$ (w); $ms_{T \times V}$ / ms $error_3$ (w); $ms_{G \times T \times V}$ / ms $error_3$ (w).

**Level of significance.

TABLE 2. Summary of analysis of variance for evaluating differences among vowels, among tasks (isolated VCV disyllables and VCV disyllabic phrases), and between groups with reference to /z/.

Source	SS	df	ms	F*	p**
Total	181.94	159	———	———	———
Between Subjects (S)	111.32	19	———	———	———
Groups (G)	5.26	1	5.26	0.89	NS
Error (b)	106.06	18	5.89	———	———
Within Subjects (wS)	70.63	140	———	———	———
Tasks (T)	0.56	1	0.56	0.16	NS
Vowels (V)	4.37	3	1.46	2.19	NS
G X T	0.51	1	0.51	1.44	NS
G X V	0.87	3	0.29	0.44	NS
T X V	2.07	3	0.69	1.98	NS
G X T X V	1.72	3	0.57	1.64	NS
$Error_1$ (w)	6.31	18	0.35	———	———
$Error_2$ (w)	35.89	54	0.67	———	———
$Error_3$ (w)	18.84	54	0.35	———	———

*F ratios: ms_G / ms error (b); ms_T / ms $error_1$ (w); ms_V / ms $error_2$ (w); $ms_{G \times T}$ / ms $error_1$ (w); $ms_{G \times V}$ / ms $error_2$ (w); $ms_{T \times V}$ / ms $error_3$ (w); $ms_{G \times T \times V}$ / ms $error_3$ (w).

**Level of significance.

TABLE 3. Summary of analysis of variance for evaluating differences among vowels, among tasks (isolated VCV disyllables and VCV disyllabic phrases), and between groups with reference to /θ/.

Source	SS	df	ms	F*	p**
Total	262.69	159			
Between Subjects (S)	190.07	19			
Groups (G)	23.26	1	23.26	2.51	NS
Error (b)	166.81	18	9.27		
Within Subjects (wS)	72.63	140			
Task (T)	6.01	1	6.01	3.42	NS
Vowel (V)	0.82	3	0.27	0.75	NS
G X T	2.76	1	2.76	1.57	NS
G X V	4.67	3	1.56	4.33	0.01
T X V	1.32	3	0.44	0.63	NS
G X T X V	2.17	3	0.72	1.03	NS
$Error_1$ (w)	31.61	18	1.76		
$Error_2$ (w)	19.64	54	0.36		
$Error_3$ (w)	3.64	54	0.07		

*F ratios: ms_G / ms error (b); ms_T / ms $error_1$ (w); ms_V / ms $error_2$ (w); $ms_{G\ X\ T}$ / ms $error_1$ (w); $ms_{G\ X\ V}$ / ms $error_2$ (w); $ms_{T\ X\ V}$ / ms $error_3$ (w); $ms_{G\ X\ T\ X\ V}$ / ms $error_3$ (w).

**Level of significance.

males and females were not significant at the 0.05 level. The interaction of group with vowel for the consonant /θ/ was significant at the 0.01 level (see Table 3).

Although not statistically significant, there were some differences in the responses of males and females which warranted consideration. The mean number of correct responses for /s/, /z/, and /θ/ for all tasks and vowels was 7.0, 6.9, and 11.3, respectively, for males. For females, the mean number of correct responses for /s/, /z/, and /θ/ was 12.4, 9.6, and 18.1, respectively. These means are presented in Figure 1. An analysis of this figure shows that for all consonants, the mean number of correct responses for females was greater than the mean number of correct responses for males. In addition, both males and females had a greater mean number of correct responses for /θ/ than for /s/ or /z/; however, while females had a greater mean number of correct responses for /s/ than for /z/, males had almost the same mean number of correct responses for /s/ as for /z/.

Figure 2 presents the percentage of correct responses for males and females for each consonant for each of the three speech tasks: isolated consonants (Task 1), isolated VCV disyllables (Task 2), and VCV disyllabic phrases (Task 3). The percentage of correct responses for isolated consonants was based on the number of correct responses out of three attempts, while the percentage of correct responses for isolated VCV disyllables and VCV disyllabic phrases was based on the number of correct responses out of twelve (three attempts for each of the four stimuli for each task). An analysis of Figure 2 reveals that males had a greater percentage of correct responses to stimulation of /z/ in

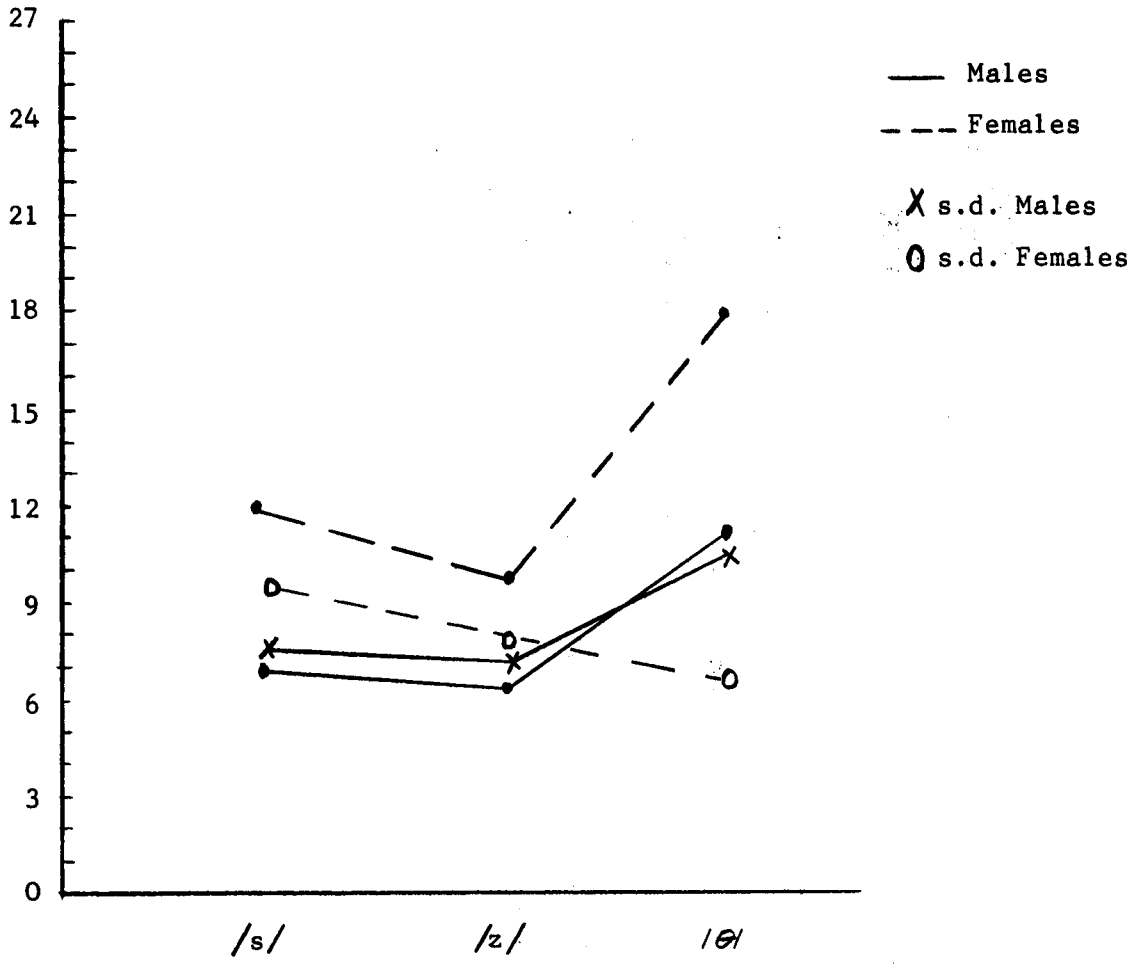


FIGURE 1. Mean number of correct responses and standard deviations for each consonant averaged over three speech tasks for males and females.

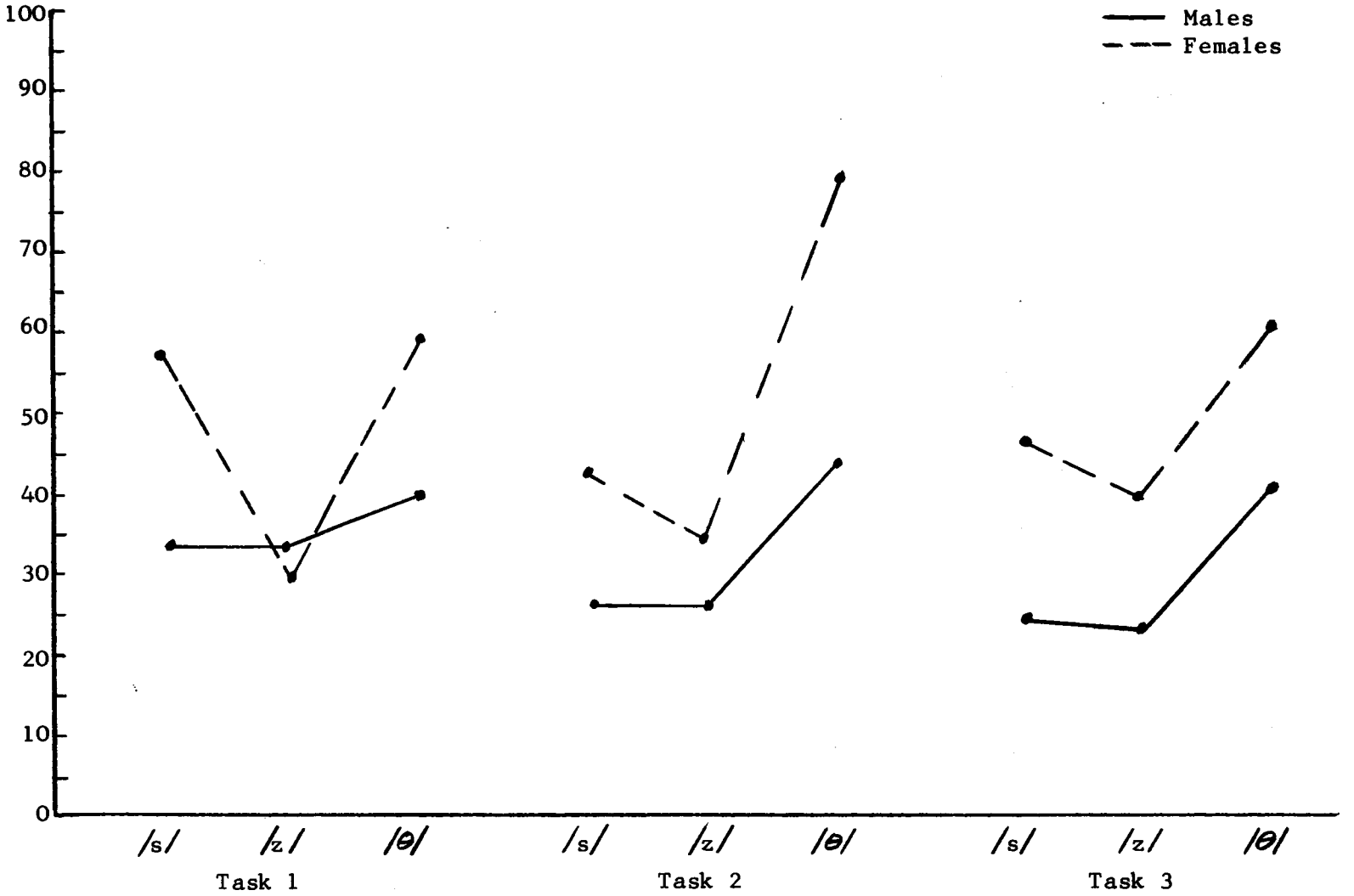


FIGURE 2. Percent of correct responses for males and females for each consonant for each of three speech tasks: Task 1, isolated consonants; Task 2, isolated VCV disyllables; and Task 3, VCV disyllabic phrases.

isolation than females. For Tasks 2 and 3 for /z/, and for all tasks for /s/ and /θ/, the females had a greater percentage of correct responses than males. For both males and females, the percentage of correct responses for /θ/ for all tasks was higher than the percentage of correct responses for /s/ or /z/. Although males had approximately the same percentage of correct responses for /s/ and /z/ for Tasks 1 and 3, the percentage of correct responses for /z/ in Task 2 was higher than the percentage of correct responses for /s/ in Task 2. Females had a higher percentage of correct responses for /s/ than for /z/ for all tasks.

Figure 3 illustrates the mean number of correct responses for males and females for each vowel for /s/, /z/, and /θ/. With the exception of /z/, in the context of /ɔ/ (see Figure 3b), females had a higher mean number of correct responses than males. In addition, the interaction of group with vowels for /θ/, which was significant at the 0.01 level, is evident in this figure (see Figure 3c). That is, males responded correctly more often in the context of /i/ and /ɑ/ than in the context of /ɔ/ and /u/. Females, responded correctly more often in the context of the back vowels, /ɑ/ and /u/. A further analysis of this figure reveals similar trends for /z/ (see Figure 3b). For /z/, the mean number of correct responses for the males was higher in the context of front vowels, /i/ and /æ/, than in the context of back vowels, /ɑ/ and /u/. The responses of females, however, were least often correct in the context of /ɔ/ than in the context of the other three vowels. The responses for both males and females for /s/ were higher in the context of the high vowels, /i/ and /u/, than in the context of the low vowels /ɔ/ and /ɑ/.

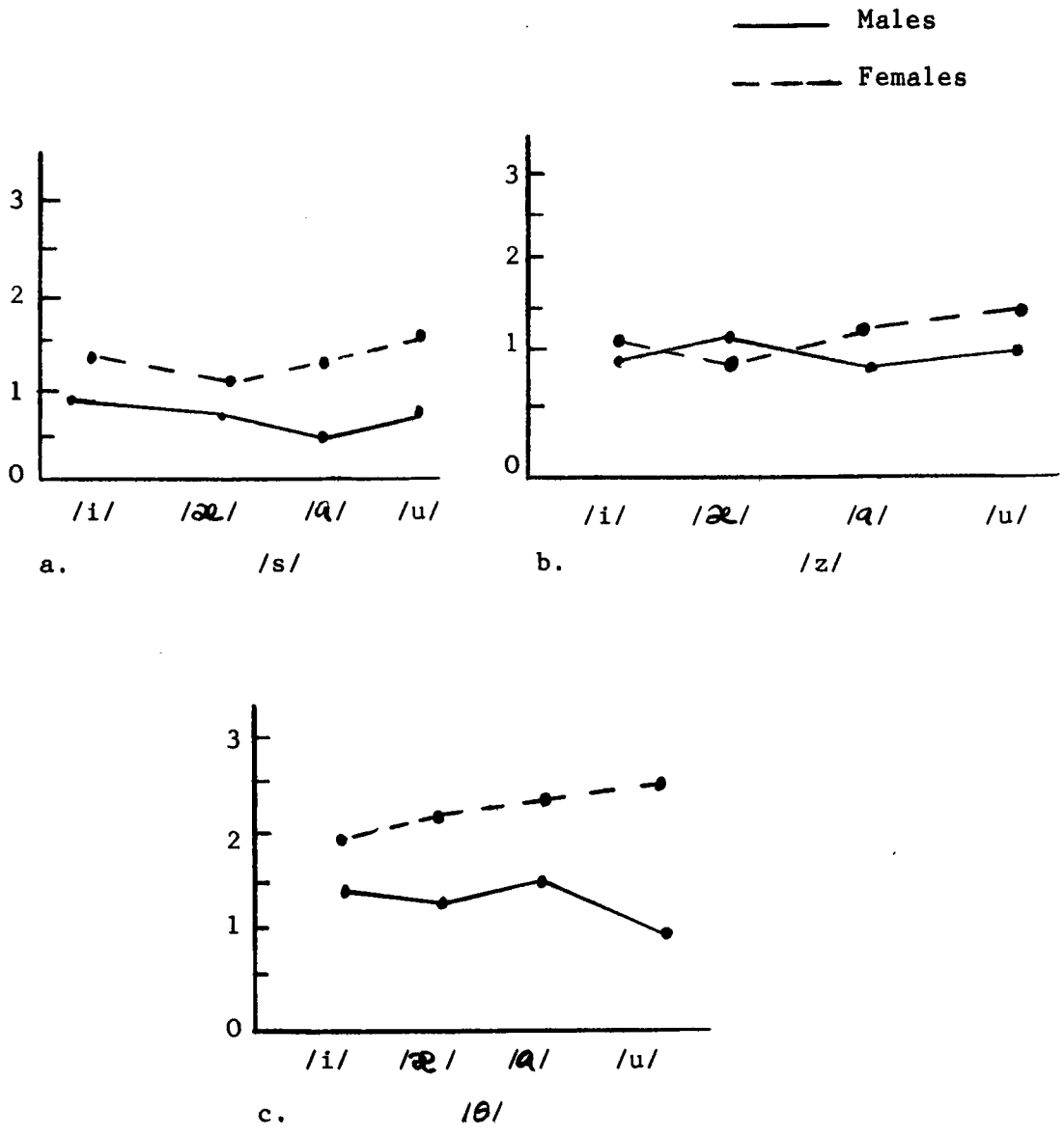


FIGURE 3. Mean number of correct responses for males and females for each vowel for each consonant averaged over two speech tasks: Task 2, isolated VCV disyllables; and Task 3, VCV disyllabic phrases.

Figure 4 presents the mean number of correct responses for males and females for each of the three consonants for Tasks 2 and 3 for each of the four vowels. The mean number of correct responses for females was higher for /θ/ for all vowels and for all tasks than the mean number of correct responses for /s/ or /z/. In addition, the mean number of correct responses for /s/ was higher than the mean number of correct responses for /z/. Males also had a higher mean number of correct responses for /θ/ for all vowels and all tasks, except for Task 3 in the context of /u/, where the mean number of correct responses was lower for /θ/ than for either /s/ or /z/. The mean number of correct responses for /s/ was generally lower than the mean number of correct responses for /z/.

Figure 5 presents the number of subjects who responded correctly to each stimulus item. An analysis of this figure reveals that, in general, more females responded correctly to the items than males. For example, ten females responded correctly at least once to /æ θæ/, while five males responded correctly at least once to /æ θæ/. There were some exceptions to this trend. The number of males and females responding correctly at least once to a stimulus item was the same for five of the items: /s/, /θ/, /usu/, /kisit/, and /bæzæk/. On one stimulus item, /z/, more males than females responded correctly at least once.

III. DIFFERENCES AMONG CONSONANTS

The nine stimulus items for each consonant (see Appendix A) were repeated three times during the test, for a total of twenty-seven test items per consonant. Since the differences between males and females was not significant, scores for all subjects were combined. The mean

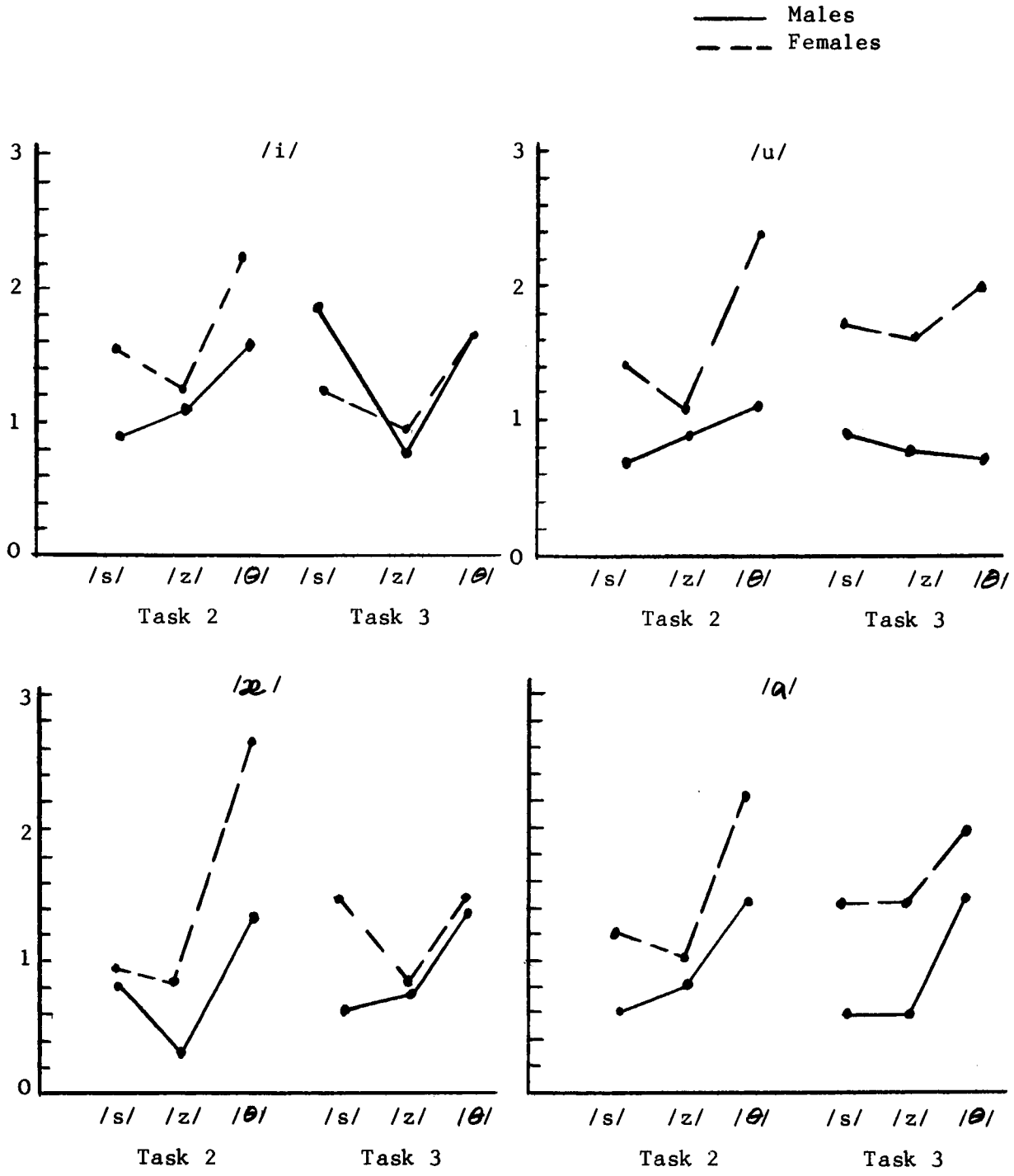


FIGURE 4. Mean number of correct responses for males and females for each consonant for each vowel for two speech tasks: Task 2, isolated VCV disyllables; and Task 3, VCV disyllabic phrases.

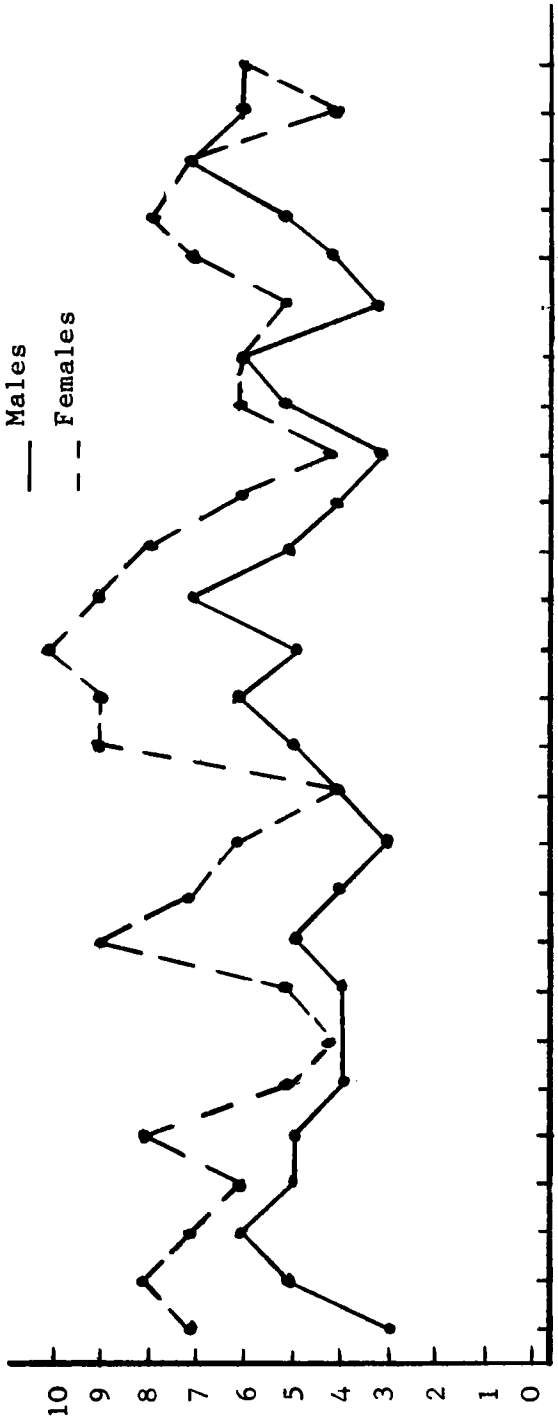


FIGURE 5. Number of males, out of 10, and number of females, out of 10, who responded with at least one correct production to stimulation of each of 27 stimulus items.

number of correct responses for /s/, /z/, and /θ/ was 9.7, 8.3, and 14.7, respectively.

Statistical Analysis

A t-test for related measures (Bruning and Kintz, 1968) was used to analyze differences among the three consonants in isolation (see Table 4). The difference between responses to stimulation of /s/ and /z/ in isolation and the differences between responses to stimulation of /s/ and /θ/ in isolation were not significant at the 0.05 level. The difference between responses to stimulation of /z/ and /θ/ in isolation is significant at the 0.01 level.

A two factor analysis of variance (Bruning and Kintz, 1968) was used to analyze the data for the three consonants and two tasks, isolated VCV disyllables and VCV disyllabic phrases (see Table 5). The differences among consonants was significant at the 0.005 level. These differences are graphically displayed in Figure 6. An analysis of this figure reveals that /θ/ was produced correctly more often than /s/ or /z/ for all tasks. The differences between /s/ and /z/ for Tasks 2 and 3 were not as great as the differences between /s/ and /θ/ or /z/ and /θ/ for these two tasks.

IV. DIFFERENCES AMONG VOWELS

There were a total of six test items (see Appendix A), for each vowel and consonant combination. The mean number of correct responses for /s/, /z/, and /θ/ was: 2.2, 2.0, and 3.3, respectively, for /i/; 1.9, 1.3, and 3.3, respectively, for /ɑ/; 1.0, 1.9, and 3.5,

TABLE 4. Summary of t-tests for related measures for evaluating differences between consonants with reference to response to auditory-visual stimulation of three consonants in isolation.

Consonant	X	SD	df	t	p*
/s/	1.35	1.30	19	1.98	NS
/z/	1.95	1.09			
/s/	1.35	1.30	19	0.46	NS
/θ/	1.50	1.19			
/z/	1.95	1.09	19	3.57	0.01
/θ/	1.50	1.19			

*Level of significance.

TABLE 5. Summary of analysis of variance for evaluating differences among consonants, and among tasks (isolated VCV disyllables and VCV disyllabic phrases).

Source	SS	df	ms	F*	p**
Total	2,168.59	59	———	———	———
Subjects (S)	1,209.09	19	———	———	———
Consonants (C)	192.27	2	96.13	6.06	0.005
Tasks (T)	4.41	1	4.41	2.07	NS
C X T	20.47	3	6.82	0.74	NS
Error (c)	602.73	38	15.86	———	———
Error (t)	40.43	19	2.13	———	———
Error (c x t)	348.80	38	9.18	———	———

*F ratios: ms_C / ms error (c); ms_T / ms error (t); $ms_{C \times T}$ / ms error (c x t).

**Level of significance.

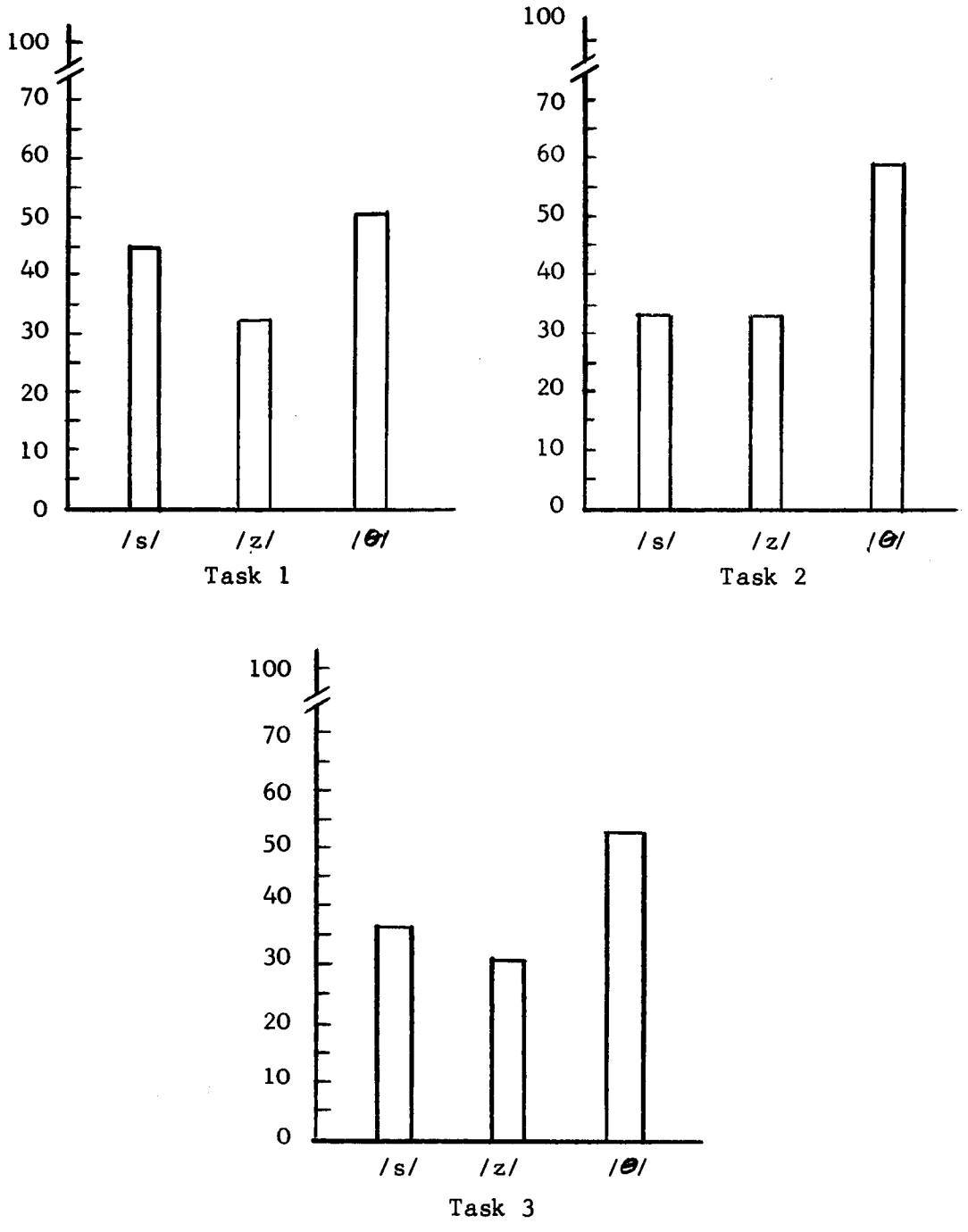


FIGURE 6. Percent of correct responses for all subjects for each consonant for each of three speech tasks: Task 1, isolated consonants; Task 2, isolated VCV disyllables; and Task 3, VCV disyllabic phrases.

respectively, for /ɑ/; and 2.4, 2.2, and 3.1, respectively, for /u/.

Statistical Analysis

A three factor analysis of variance, Lindquist Type VI (1953), was used to analyze the data for the vowels for each consonant (see Tables 1 through 3, pages 18, 19, and 20, respectively). For these separate analyses, the differences among vowels was not significant at the 0.05 level. There were no significant interactions for /s/ or /z/. An analysis of Figure 7 reveals that the differences among the vowels were not great for any of the consonants. The interaction of vowels and groups was significant for /θ/ at the 0.01 level. This interaction has been reported earlier (see Figure 3, page 25).

V. DIFFERENCES AMONG TASKS

When comparing the results for Task 1 (isolated consonants) with those for the other two tasks (isolated VCV disyllables and VCV disyllabic phrases), the number of correct responses were converted to percent correct, because Task 1 had three stimulus items, one for each consonant (total of nine test items), and Tasks 2 and 3 had eight stimulus items each (total of twelve test items each). The mean percent of correct responses for Tasks 1, 2, and 3 was,42, 43, and 38, respectively.

Statistical Analysis

A two factor analysis of variance (Bruning and Kintz, 1968) was used to analyze the data for the three tasks for each of the three consonants, /s/, /z/, and /θ/ (see Tables 6 through 8). For each of these

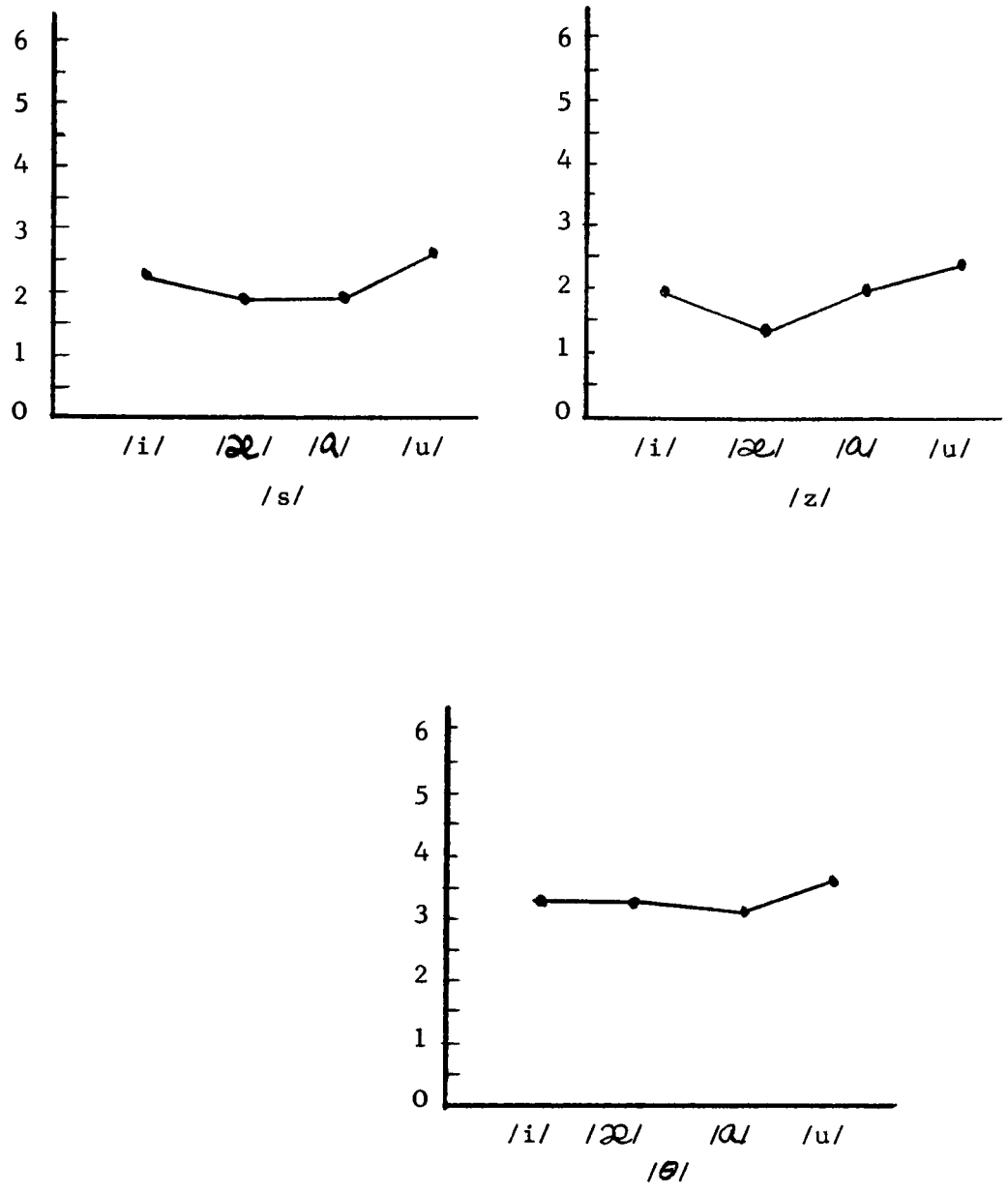


FIGURE 7. Number of correct responses averaged over subjects and tasks for each of four vowels and each of three consonants.

TABLE 6. Summary of analysis of variance for evaluating differences among three tasks (isolated consonants, isolated VCV disyllables, and VCV disyllabic phrases) with reference to /s/.

Source	SS	df	ms	F*	p**
Total	78,710.08	59	———	———	———
Subjects (S)	65,742.32	19	———	———	———
Treatments (T)	1,436.03	2	718.02	2.37	NS
Error	11,532.63	38	303.49	———	———

*F ratio: ms_T / ms error.

**Level of significance.

TABLE 7. Summary of analysis of variance for evaluating differences among three tasks (isolated consonants, isolated VCV disyllables, and VCV disyllabic phrases) with reference to /z/.

Source	SS	df	ms	F*	p**
Total	57,869.34	59	____	____	____
Subjects (S)	45,392.67	19	____	____	____
Treatments (T)	66.53	2	33.27	0.10	NS
Error	12,410.13	38	326.59	____	____

*F ratio: ms_T / ms error.

**Level of significance.

TABLE 8. Summary of analysis of variance for evaluating differences among three tasks (isolated consonants, isolated VCV disyllables, and VCV disyllabic phrases) with reference to /θ/.

Source	SS	df	ms	F*	p**
Total	92,100.93	59	____	____	____
Subjects (S)	81,193.60	19	____	____	____
Treatments (T)	1,328.03	2	664.02	2.39	NS
Error	10,579.30	38	278.40	____	____

*F ratio: ms_T / ms error.

**Level of significance.

three separate analyses, the differences among the three tasks were not significant. These results are displayed in Figure 8. This figure reveals no trends in the responses to stimulation of the different tasks.

VI. DIFFERENCES AMONG INDIVIDUALS

There was considerable variability among the responses of the individual subjects to stimulation (see Appendix C). For example, three of the subjects (Subjects No. 6, 12, and 13) responded correctly to less than ten of the twenty-seven items for /s/ and /z/, but to more than twenty of the twenty-seven /θ/ items. Subject No. 1 did not respond correctly to any of the eighty-one items. Subject No. 15 responded correctly to all but seven of the eighty-one items on the test.

Although considerable differences were evident among individual subjects in their consistency of response and in their specific patterns of response, three general patterns of responses can be identified. Figure 9 presents the mean number of correct responses and the ranges of correct responses for each of these patterns. The subject numbers of the subjects whose responses fit each pattern are included in parenthesis. An analysis of this figure reveals that the most common pattern involved a higher number of correct responses to stimulation of /θ/ and /s/ than to stimulation of /z/. Nine of the twenty subjects demonstrate this pattern of response. The second pattern of response, demonstrated by four of the twenty subjects, involves a higher number of correct responses to stimulation of /θ/ and /z/ than to stimulation of /s/.

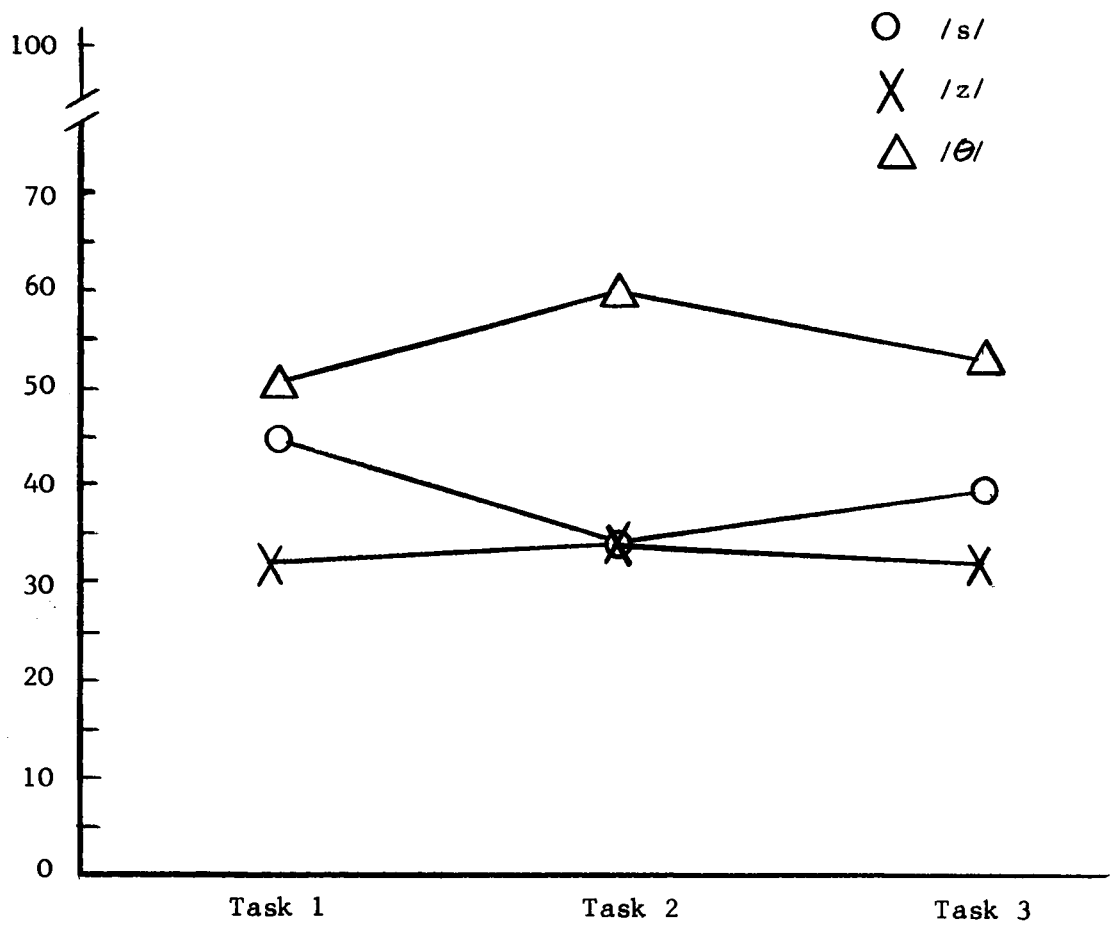


FIGURE 8. Percent of correct responses for each consonant, averaged for subjects and vowels, for each speech task: Task 1, isolated consonants; Task 2, isolated VCV disyllables; and Task 3, VCV disyllabic phrases.

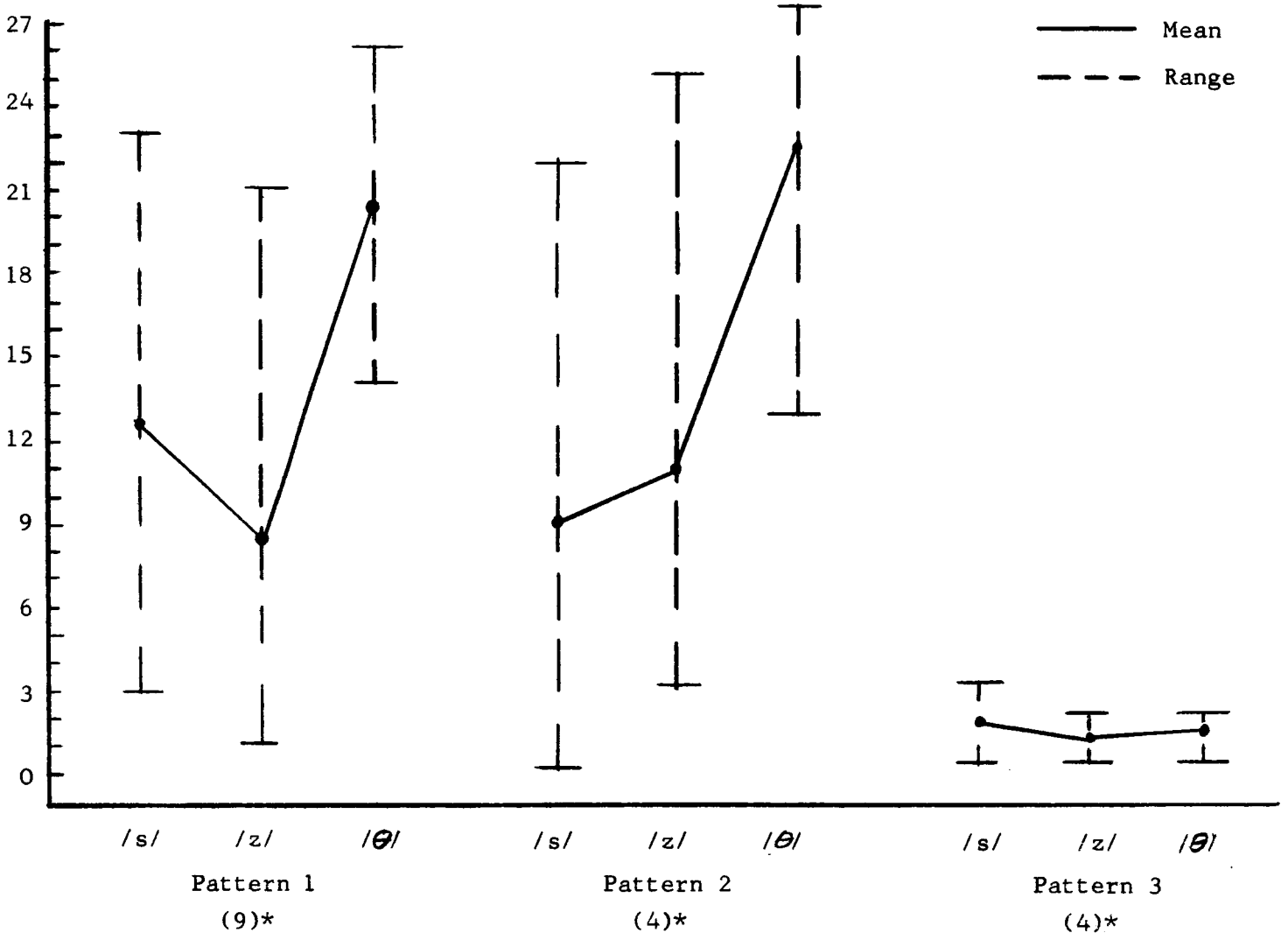


FIGURE 9. Three main patterns of response means, with ranges of response, for all subjects for three consonants averaged over speech tasks and vowels.

*Number of subjects represented by this pattern; the responses of three subjects did not fit any of the patterns.

The third pattern of response represents those subjects who essentially did not respond to stimulation of any of the three consonants. Four of the twenty subjects demonstrated this pattern and were considered non-stimulable for these consonants. The clinical impression of the conversational speech of these subjects was that of unintelligibility, unless the listener was aware of the idea the subject was trying to express.

The three remaining subjects were considered to demonstrate less common patterns of response. These response patterns may have been idiosynchratic or may have been patterns which would have been more prevalent in a different sample of subjects.

CHAPTER IV

DISCUSSION

I. DIFFERENCES BETWEEN MALES AND FEMALES

The results of this study indicate that there are no statistically significant differences between the responses of males and females to auditory-visual stimulation of the consonants /s/, /z/, and /θ/. This is in agreement with the findings of Smith and Ainsworth (1967) who reported no significant differences between males and females in their performances on two types of stimulation tests using words as stimulus items.

Although the difference is not statistically significant, females appear to respond correctly more often than males to auditory-visual stimulation of the consonants /s/, /z/, and /θ/. Smith and Ainsworth (1967) did not report a similar trend. A search of the literature has not revealed other investigators who have studied the differences between males and females in their responses to stimulation of misarticulated consonants.

A possible explanation for the trend in the results of this study may be related to the tendency, found in the research on maturation of articulation proficiency, for females to be slightly more proficient than males of the same age in terms of articulation performance. If auditory-visual stimulation facilitates the acquisition of consonants, one would expect a similar trend in the responses of males and females to stimulation.

II. DIFFERENCES AMONG CONSONANTS

The results of this study indicate that there are statistically significant differences among the responses of subjects to auditory-visual stimulation of three consonants, /s/, /z/, and /θ/. The responses of subjects to stimulation of /θ/ is better than the responses to stimulation of /z/ in isolation and than /s/ and /z/ in isolated VCV disyllables and VCV disyllabic phrases. Although not statistically significant, the responses of subjects to stimulation of /θ/ is better than their responses to stimulation of /s/ in isolation. A search of the literature has not revealed any investigation of differential responses of subjects to stimulation of these three consonants. Scott and Milisen (1954a, 1954b), however, compared /s/ and /z/ with the consonants /f/, /v/, /k/, /g/, /r/, and /l/. They did not report statistical significance, but rank ordered these consonants by percent correct response following stimulation as follows: /f/, /k/, /v/, /g/, /l/, /z/, /s/, /r/. They hypothesized that because /f/ and /v/ were readily visible sounds and /k/ and /g/ could easily be made more visible, these consonants were more easily imitated than the virtually non-visible consonants /s/ and /z/. Since /θ/ is a readily visible consonant, this explanation may also be applicable to the results of this study.

The use of an order-of-acquisition model for selecting consonants with which to begin therapy is not consistent with the use of an ability-to-change model. Roe and Milisen (1954) reported that /s/ is more often produced correctly by children this age than /θ/. Templin and Darley (1969) reported that /s/ is acquired by most children at an

earlier age than /θ/. The results of this study indicate that /θ/ is more readily imitated by most children in the first and second grades than is /s/. It may be that consideration of both order of acquisition data and ability to change data may be required in selecting consonants with which to begin therapy.

III. DIFFERENCES AMONG VOWELS

The results of this study indicate that the responses to stimulation of any of the three consonants, /s/, /z/, or /θ/, when preceded and followed by /i/ and the responses to stimulation of that same consonant when preceded and followed by /æ/ and the responses to stimulation of that same consonant when preceded and followed by /ɑ/ and the responses to stimulation of that same consonant when preceded and followed by /u/ are not statistically different. A search of the literature has not revealed any investigators who have studied the possible effects of phonetic environment on the response to stimulation.

These results could be compared to the results of studies of responses to articulation tests, if one accepts the assumption that phonetic environments which are not facilitory for stimulation would also not be facilitory for spontaneous responses. Siegel, Winitz, and Conkey (1963) reported no differences in responses to articulation tests as a function of the word used; however, several investigators (Spriestersbach and Curtis, 1951; Buck, 1954; Curtis and Hardy, 1957; and Templin, 1947) have reported differences in performance on articulation tests as a function of the word used as a stimulus item. All of these investigators, however, used as stimuli, words which could be easily pictured, and,

therefore, did not control for the specific effects of vowel environment.

Another explanation for these results may lie in the selection of the vowels to be investigated. For this study, the extremes of the vowel triangle were used. It may be that the use of other vowels would have produced different results. For example, it might be that the use of /ɛ/, a mid-front vowel, would yield significantly different results for /θ/ than those produced by the use of the vowels at the extremes of the vowel triangle.

The results of this study also indicate that males and females differ significantly in their responses to stimulation of /θ/ as a function of vowel context. That is, males responded correctly more often to stimulation of /θ/ in the context of /i/ and /ɑ/ than in the context of /ɚ/ and /u/. Females responded correctly more often to stimulation of /θ/ in the context of the back vowels, /ɑ/ and /u/, than in the context of the front vowels, /i/ and /ɚ/. These differences may reflect real differences or may be the result of chance.

IV. DIFFERENCES AMONG TASKS

The results of this study indicate that the responses to stimulation of any of the three consonants, /s/, /z/, or /θ/, in isolation (Task 1) and the responses to stimulation of the same consonant in isolated VCV disyllables (Task 2) and the responses to stimulation of the same consonant in VCV disyllabic phrases (Task 3) are not significantly different. Although there are differences among the responses to consonants in different tasks, there is no consistent pattern of

response observable among the tasks (see Figure 8, page 39).

These results are not in agreement with those of Scott and Milisen (1954b), who reported that more correct responses to stimulation were elicited when the consonant was presented in isolation than when the consonant was presented in nonsense syllables or words. One explanation for the differences may be differences in subjects. The present study used only subjects in the first and second grades, while Scott and Milisen included subjects who ranged from preschool to sixth grade.

Another possible explanation for the differences is that the procedures for the two studies differ and the methods of scoring differ. Scott and Milisen scored the best production out of three attempts, while in the present study, all attempts were scored. In addition, the number of stimulations presented the subjects in the Scott and Milisen study depended on the response of the subject for that item. In the present study, however, all subjects received the same number of stimulations for all stimulus items in the test.

The lack of significant differences among responses to stimulation of the consonant in isolation and responses to stimulation of the same consonant in the other two tasks in the present study is probably not related to the differences in the number of attempts possible for isolation and the number of attempts possible for the other two tasks. Scott and Milisen had similar differences in the total possible attempts for isolation and the total possible attempts for nonsense syllables and words.

V. SUGGESTIONS FOR FUTURE RESEARCH

The results of this study indicate the need for further research to provide more data on the responses of children with defective articulation to auditory-visual stimulation of defective consonants. Specifically, the following areas of investigation are indicated:

1. Since females respond correctly to stimulation of the consonants /s/, /z/, and /θ/ more often than males, further research is needed to determine if this trend is consistent for other consonants and other age groups.

2. A comparison of the responses of children to auditory-visual stimulation of consonants other than /s/, /z/, and /θ/.

3. A comparison of the responses of children to auditory-visual stimulation of vowel-consonant-vowel combinations other than those investigated in this study. Specifically, vowels other than /i/, /æ/, /ɑ/, and /u/ should be combined with the consonants /s/, /z/, and /θ/, and all vowels should be combined with other consonants.

4. The differences in the responses of individual subjects indicate the need for control of severity of articulation either by analyzing types of responses to articulation tests or by listener ratings of severity of articulation disorder on a spontaneous speech sample.

CHAPTER V

SUMMARY AND CONCLUSIONS

The purpose of this study was to determine if there are differences in the number of correct responses made by children with defective articulation when stimulated auditorilly and visually with specific consonants in different speech tasks. The subjects were twenty children, ten males and ten females, selected from the first and second grade classes of Knoxville and Knox County public and private schools. The stimulation test consisted of twenty-seven stimulus items designed to test the subject's response to stimulation of three consonants, /s/, /z/, and /θ/, in three speech tasks: isolated consonants, the same consonant in isolated VCV disyllables, and the same consonant in VCV disyllabic phrases. Each stimulus item was presented three times, for a total of eighty-one test items. The eighty-one test items were presented in random order.

From the results of this study, the following conclusions can be made:

1. There is no significant difference between males and females in their responses to auditory-visual stimulation of defective consonants, although females generally respond correctly to stimulation more often than males.

2. There are significant differences among the responses to auditory-visual stimulation of the consonants, /s/, /z/, and /θ/. Specifically, responses to stimulation of /θ/ are more often correct than responses to stimulation of /s/ or /z/.

3. There are no significant differences among the responses to auditory-visual stimulation as a function of vowel environment, for the vowels /i/, /æ/, /ɑ/, or /u/.

4. There are no significant differences among the responses to auditory-visual stimulation as a function of speech task, for these three tasks: isolated consonants, the same consonant in isolated VCV disyllables, and the same consonant in VCV disyllabic phrases.

5. The responses of males and females to stimulation of /θ/ in different vowel environments differ significantly. These same differences were not evident for /s/ and /z/.

6. There is great individual variability in the responses to auditory-visual stimulation of the consonants /s/, /z/, and /θ/.

7. Further research is indicated to provide more data on the responses of children with defective articulation to auditory-visual stimulation of defective consonants.

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APPENDICES

APPENDIX A

TABLE 9. Stimulus items.*

Task 1:	Isolated consonants		
	s	z	θ
Task 2:	Isolated VCV disyllables		
	isi	izi	iθi
	s	z	θ
	s	z	θ
	usu	uzu	uθu
Task 3:	VCV disyllabic phrases		
	ki sit	ki zil	ki θif
	b s t	b z k	b θ t
	p s t	p z r	p θ t
	blu sut	blu zu	blu θu

*Each item is repeated three times during the test, for a total of 81 test items.

APPENDIX B

TABLE 10. Reliability of judges.

	Judge 1	Judge 2	Judge 3
Judge 1	91	85	76
Judge 2	85	89	74
Judge 3	76	74	86

*Mean percent agreement.

APPENDIX C

TABLE 11. Number of correct responses, Part I.*

Subject	Isolation	Isolated VCV Disyllables				VCV Disyllabic Phrases				Total
	/s/	/i/	/ɛ/	/ɑ/	/u/	/i/	/ɛ/	/ɑ/	/u/	
1	0	0	0	0	0	0	0	0	0	0
2	2	3	2	0	1	3	3	1	3	18
3	0	1	0	0	0	0	0	0	0	1
4	1	0	0	0	0	0	0	0	0	1
5	1	2	3	2	2	1	2	2	2	17
6	2	0	0	0	1	0	0	0	1	4
7	3	2	1	2	2	2	0	2	1	15
8	1	1	2	2	1	2	1	1	0	11
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	1	0	0	0	2	3
11	2	1	1	0	0	0	0	1	2	7
12	0	1	1	0	0	0	0	0	1	3
13	0	3	0	0	2	0	1	0	2	8
14	3	2	1	2	3	3	2	2	2	20
15	3	3	2	3	1	3	3	3	1	22
16	3	2	2	3	3	3	3	3	3	25
17	3	2	1	3	3	3	3	2	3	23
18	3	1	1	1	2	0	2	2	2	14
19	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	1	2	3
Total	27	24	17	18	22	20	20	20	27	195

*No. 1 through No. 10 are males; No. 11 through No. 20 are females.

TABLE 12. Number of correct responses, Part II.*

Subject	Isolation	Isolated VCV Disyllables				VCV Disyllabic Phrases				Total
	/z/	/i/	/æ/	/ɑ/	/u/	/i/	/æ/	/ɑ/	/u/	
1	0	0	0	0	0	0	0	0	0	0
2	2	2	0	0	1	0	2	1	0	8
3	0	0	0	0	0	0	0	0	0	0
4	1	0	0	0	1	0	0	0	0	2
5	2	3	1	3	3	3	2	2	3	22
6	0	0	0	0	0	0	0	0	1	1
7	0	2	1	1	3	2	2	1	2	14
8	2	2	1	2	1	1	0	2	1	12
9	2	2	0	2	0	1	1	0	0	8
10	1	0	0	0	0	0	0	0	1	2
11	0	0	0	1	0	0	0	3	2	6
12	0	1	0	0	1	0	0	0	1	3
13	0	2	0	0	1	1	0	0	0	4
14	1	2	2	0	2	3	2	0	2	13
15	3	3	3	3	1	3	3	3	3	25
16	0	1	1	2	1	0	0	3	2	10
17	3	3	2	2	3	1	2	3	2	21
18	2	0	0	1	1	1	0	1	2	8
19	0	0	0	1	0	0	1	1	2	5
20	0	0	0	0	1	0	0	0	0	1
Total	19	23	11	18	20	16	15	20	24	165

*No. 1 through No. 10 are males; No. 11 through No. 20 are females.

TABLE 13. Number of correct responses, Part III.*

Subject	Isolation	Isolated VCV Disyllables				VCV Disyllabic Phrases				Total
	/θ/	/i/	/ɹ/	/ɑ/	/u/	/i/	/ɹ/	/ɑ/	/u/	
1	0	0	0	0	0	0	0	0	0	0
2	3	3	3	3	0	3	2	3	0	20
3	0	0	0	0	0	0	0	0	0	0
4	1	1	0	0	0	0	0	0	0	2
5	0	0	0	0	1	0	0	0	0	1
6	2	3	3	3	3	3	1	2	3	23
7	2	2	3	3	3	3	3	3	1	23
8	2	3	3	3	3	3	3	3	3	26
9	1	1	0	1	0	0	1	0	0	4
10	1	2	1	1	1	2	3	3	0	14
11	2	1	2	1	2	0	1	2	3	14
12	2	3	3	3	3	2	2	2	3	23
13	3	3	3	3	3	3	3	2	3	26
14	0	2	2	3	3	1	1	2	2	16
15	3	3	3	3	3	3	3	3	3	27
16	0	1	3	1	1	0	0	3	0	9
17	3	3	3	2	3	3	3	3	3	26
18	3	3	3	3	3	2	1	3	3	24
19	2	3	3	3	3	0	0	0	0	14
20	0	0	1	0	0	0	0	0	1	2
Total	30	37	39	36	35	28	27	34	28	306

*No. 1 through No. 10 are males; No. 11 through No. 20 are females.

VITA

Hillie Sue Davis Hill was born in Dothan, Alabama, on April 29, 1947. She attended elementary schools in Jacksonville, Florida, Anchorage, Alaska, and Langley Air Force Base, Virginia. She was graduated from Valdosta High School, Valdosta, Georgia, in 1965. The following September, she entered Georgia Southern College in Statesboro, Georgia, and in June, 1969, she received a Bachelor of Arts degree in English.

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